

IAS

INSTITUTE FOR
ADVANCED STUDY



Report for the Academic Year
2017–2018

Cover: SHATEMA THREADCRAFT, Ralph E. and Doris M. Hansmann Member in the School of Social Science (right), gives a talk moderated by DIDIER FASSIN (left), James D. Wolfensohn Professor, on spectacular black death at *Ideas 2017-18*.

Opposite: Fuld Hall

COVER PHOTO: DAN KOMODA

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REPORT OF THE CHAIR

The Institute for Advanced Study's independence and excellence require the dedication of many benefactors, and in 2017–18, we celebrated the retirements of our venerable Vice Chairs Shelby White and Jim Simons, whose extraordinary service has enhanced the Institute beyond measure. I am immensely grateful and feel exceptionally privileged to have worked with both Shelby and Jim in shaping and guiding the Institute into the twenty-first century.

Shelby's acumen, loyalty, and invaluable contributions since her appointment to the Board in 2003 have been crucial to the Institute's continued success as a research institution of the highest standard. A former Member in the School of Mathematics who joined the Institute's Board in 2001, Jim has been one of our most generous patrons, having contributed nearly \$150 million to the Institute. Jim has an intimate understanding of how the Institute's extraordinarily focused yet freely inquisitive environment leads to advancement in unforeseeable ways.

In addition, we are indebted to Trustee Eric Schmidt and Wendy Schmidt for their \$2 million gift to launch, as of fall 2017, a three-year Program in Theoretical Machine Learning

led by Sanjeev Arora, Visiting Professor in the School of Mathematics.

The Board was delighted to welcome new Trustees Mark Heising, Founder and Managing Director of the San Francisco investment firm Medley Partners, and Dutch astronomer and chemist Ewine Fleur van Dishoeck, Professor of Molecular Astrophysics at the University of Leiden. Ewine succeeds Jeff Harvey, Enrico Fermi Distinguished Service Professor at the University of Chicago and a Trustee since 2013, whose service is greatly appreciated.

The Institute's commitment to the freedom of the mind and the acceleration of ideas, since its establishment in 1930, has facilitated foundational theories and ideas that turn into applications, innovation, and new tools and technologies. This long-view understanding and knowledge would not be possible without our Trustees, Faculty, Members, Staff, and donors for whose dedication I am most grateful.

Charles Simonyi
Chair of the Board

REPORT OF THE DIRECTOR

For nearly a century, the Institute for Advanced Study has served as a model and ideal for basic research, which is made publicly accessible and so benefits society as a whole, spreading widely beyond the circle of individuals who, over years and decades, introduce and develop the ideas.

Our Faculty, who select each year's Members from around the world, continued to be recognized in 2017–18 for their leadership and contributions to their fields. Jean Bourgain, IBM von Neumann Professor in the School of Mathematics, received the 2018 Steele Prize for Lifetime Achievement from the American Mathematical Society. Didier Fassin, James D. Wolfensohn Professor in the School of Social Science, was awarded the 2018 NOMIS Distinguished Scientist Award, the first social scientist to receive the honor. Juan Maldacena's pioneering research on the quantum physics of black holes was recognized with the 2018 Lorentz Medal by the Royal Netherlands Academy of Arts and Sciences and the Einstein Medal from the Albert Einstein Society in Bern. And Robert Langlands, Professor Emeritus in the School of Mathematics, received the highly prestigious 2018 Abel Prize by the Norwegian Academy of Science and Letters for his visionary program connecting representation theory to number theory.

We were delighted to announce the appointment of four new Professors, who will join the Faculty in the 2018–19 academic year. Myles Jackson, a historian of science, and Francesca Trivellato, a historian of the early modern period,

were appointed to the Faculty of the School of Historical Studies. Camillo De Lellis, a geometric analyst, and 2018 Fields Medalist Akshay Venkatesh, who works at the intersection of analytic number theory, algebraic number theory, and representation theory, were appointed to the Faculty of the School of Mathematics.

We express deep appreciation for the many exemplary and continued contributions of Robert MacPherson, Hermann Weyl Professor in the School of Mathematics, who transitions as of July 2018 to Professor Emeritus status, having served on the Faculty since 1994.

We were profoundly saddened by the death of Vladimir Voevodsky on September 30, 2017, at age 51. Vladimir joined the Institute as a Professor in the School of Mathematics in 2002, shortly before he was awarded a Fields Medal. A visionary whose work will continue to challenge and enrich the field in lasting ways, Vladimir is greatly missed by the Institute community and family, friends, and colleagues throughout the world.

The Institute's role—going against the grain, swimming as far upstream as we can, and being a forceful advocate and highest example for basic research—is more important than ever. It requires the support of each of us, and I deeply appreciate the many champions of our mission.

Robbert Dijkgraaf
Director and Leon Levy Professor



ALL PHOTOS DAN KOMODA

Top: CHARLES SIMONYI, Chair of the IAS Board of Trustees Above: ROBBERT DIJKGRAAF, Director and Leon Levy Professor

The Institute for Advanced Study

It was founding Director Abraham Flexner's belief that if the Institute "eschews the chase for the useful, the minds of its scholars will be liberated, they will be free to take advantage of surprises, and someday an unexpected discovery, apparently leading nowhere, will be found to be an indispensable link in a long and complex chain that may open new worlds in theory and practice."



FROM THE DEVELOPMENT of programmable computers and the uncovering of the deep symmetries of nature, to advances in societal understanding and historical practice, long and complex chains of knowledge have developed for nearly ninety years through research originating at the Institute for Advanced Study.

Albert Einstein was one of the first in a continuous line of distinguished Institute scientists and scholars who have produced a deeper understanding of the physical world and of humanity. Yet the Institute's remarkable history does not seem to weigh heavily on current scholars and scientists. Instead, the atmosphere focuses on the present, where every twist and hairpin bend changes our view. What do we know? What do we yet need to understand? How should we try to comprehend it?

Work at the Institute takes place across historical studies, mathematics, natural sciences, and social science. A permanent Faculty each year award fellowships to some two hundred visiting Members, from about one hundred universities and research institutions throughout the world. The Institute's reach has been multiplied many times over through the more than eight thousand Members who have influenced entire fields of study as well as the work and minds of colleagues and students. Thirty-three Nobel Laureates, forty-two of the sixty Fields Medalists, and seventeen of the nineteen Abel Prize Laureates, as well as many winners of the Wolf and MacArthur prizes, have been affiliated with the Institute.

At the Institute, everything is designed to encourage scholars to take their research to the next level. This includes creating and sustaining an

environment where Members live in an academic village of apartments, originally designed by Marcel Breuer in 1957, at the edge of the Institute's eight hundred acres of campus, woodland, and farmland. Members eat in the same dining hall, share common rooms and libraries, and carry out their work in an institutional setting where human scale has been carefully maintained to encourage the sharing of ideas, mutual understanding, and friendship.

Each year a new intellectual mix is created by the Members, ranging from young postdoctoral fellows to distinguished senior professors, who typically stay a year but may stay up to five years and return for subsequent visits throughout their careers. A period spent as a Member is often a life-changing experience. Young scholars meet the contemporaries who, with them, will be leading figures in their field in the future. Senior Members have the time and freedom to initiate new lines of research. Freed from teaching and administration, Members are afforded opportunities for discussing their work with scholars and scientists from other fields. Here they are given the time to take advantage of serendipitous encounters at lunch, teatime, or at After Hours Conversations, an interdisciplinary program to encourage wide-ranging conversations in an informal environment.

Throughout the year, the Institute hosts a broad array of concerts, lectures, and programs for the Institute community and the public. In addition, the Institute offers numerous and varied activities for Members, Visitors, and their families—from children's activities to play readings and jazz evenings.

Fundamental research at the Institute furthers our grasp of a world of diverse facts, structures, ideas, and cultures. This is due in large part to the precious freedom that Faculty and Members at the Institute experience—an independence enabled by the generosity of the Institute's founders and subsequent benefactors. We share the conviction of our founders that such unrestricted deep thinking will change this world but where and how is always a surprise.



ANDREA KANE



DAN KOMODA



DAN KOMODA



ANDREA KANE



A three-day conference on Shii Studies, organized in December by Professor SABINE SCHMIDTKE (center), convened international scholars to discuss past and present trends in Shii scholarship and future perspectives for research.

School of Historical Studies

The School of Historical Studies, established in 1949 with the merging of the School of Economics and Politics and the School of Humanistic Studies, actively promotes interdisciplinary research and cross-fertilization of ideas, thereby encouraging the creation of new historical enterprises.

THE SCHOOL OF HISTORICAL STUDIES bears no resemblance to a traditional academic history department, but rather supports all learning for which historical methods are appropriate. Its Faculty and Members embrace a historical approach to research throughout the humanistic disciplines, from socioeconomic developments, political theory, and modern international relations to the history of art, science, philosophy, music, and literature. In geographical terms, the School concentrates primarily on the history of Western, Near Eastern, and Far Eastern civilizations, with emphasis on Greek and Roman civilization, the history of Europe (medieval, early modern, and modern), the Islamic world, and East Asia. Support has been extended to the history of other regions, including Central Asia, India, and Africa.

The Faculty and Members of the School do not adhere to any one point of view but practice a range of methods of inquiry and scholarly styles, both traditional and innovative. Uniquely positioned to sponsor work that crosses conventional departmental and professional boundaries, the School actively promotes interdisciplinary research and cross-fertilization of ideas, thereby encouraging the creation of new historical enterprises.

Professor **Yve-Alain Bois**'s long-term project, the catalogue raisonné of the paintings, reliefs, and sculpture of Ellsworth Kelly, has taken most of his time in 2017–18 (he is hoping to finish the manuscript of the second volume by the end of 2018). As a result, the number of his publications was limited, consisting of two essays, each for an exhibition catalogue: one essay on the American sculptor Fred Sandback, the other on another American sculptor, Bob Grosvenor. Bois did, however, give several lectures and seminars. He gave two different lectures on Kelly, both in California (in February at the Claremont College and in March at Stanford

FACULTY

Yve-Alain Bois

Angelos Chaniotis

Nicola Di Cosmo

*Luce Foundation Professor
in East Asian Studies*

Patrick J. Geary

Andrew W. Mellon Professor

Jonathan Haslam

George F. Kennan Professor

Sabine Schmidtke

PROFESSORS EMERITI

Glen W. Bowersock

Caroline Walker Bynum

Giles Constable

Christian Habicht

Jonathan Israel

Irving Lavin

Peter Paret

Heinrich von Staden



Professor YVE ALAIN-BOIS (right) introduced Member CAROLINA MANGONE (left), a historian of Renaissance and Baroque art who gave a lunchtime colloquium on Michelangelo's unfinished sculptures.

University), discussing the large sculptures by the artist that these institutions had recently acquired. He gave a lecture on Matisse at the Nasher Sculpture Center in Dallas, which he gave again in Hangzhou, China, followed there by a graduate seminar. Also in China, he gave two other lectures (on Picasso and on non-composition) at the University of Nanjing, where he was awarded the honorary Chun-tu Hsueh Chair. He also participated in a workshop at Villa I Tatti, the Harvard University Center for Italian Renaissance Studies, in January (on “scholarly vitae”); a public dialogue with Harvard University Professor Benjamin Buchloh at the Dia Art Foundation in New York on the occasion of its exhibition of the recently deceased French artist François Morellet; and a public dialogue with curator Jean-Pierre Crique in the symposium “Monet and American Art” at the Musée d’Orsay in Paris. Additionally, Bois was a guest speaker in Professor Rosalind Krauss’s seminar at Columbia University, dedicated to the literary critic and philosopher Roland Barthes.

In June, he gave the keynote address in a symposium organized by the Camberwell College of Arts in London about his nearly twenty-year-old collection of essays, *Painting as Model*.

Throughout the spring and part of the summer, Bois worked with art historian Jérémie Koering on editing and translating an ensemble of texts by Meyer Schapiro and Hubert Damisch

(including their correspondence) on Luca Signorelli’s frescoes in Orvieto (and the famous case of Freud’s forgetting of the painter’s name), to be published in the journal *October* in fall 2018.

Bois’s seminar at IAS was remarkably productive this year. This was in part due to a rare concentration of fields, and also to the number of participants, who were all eager to take advantage of the situation. All the participants worked either in the field of medieval art (Cecily Hilsdale, Cynthia Hahn, Giulia Puma, and William Diebold), or in Italian Renaissance (Alexander Nagel, Carolina Mangone, and Jonathan Unglaub) with the exception of Vladimir Kulić (modern architecture); Catherine Clark (photography) and her husband, Brian Jacobson (cinema); and Professor Michael Koortbojian, a visitor from Princeton University (Greek and Roman art). The result of this rare convergence led to very rich exchanges. In fact, Mangone and Unglaub, who had each presented their own work (the former on Michelangelo’s “*non-finito*,” the latter on Andrea del Sarto’s *Madonna del Sacco*) gave a second, joint presentation on Guercino’s *Burial of Saint Petronilla*, a work on which they discovered, while here, they had a similar hypothesis. Many other such exchanges of high quality took place, notably concerning the methodological shortcomings of iconology, which was a topic of high interest to all the participants—but this

one is particularly memorable in that it will lead to a joint publication.

The main focus of Professor **Angelos Chaniotis**’s work remains the study of inscriptions and the information they provide for Greek social, cultural, and religious history. He co-edited *Supplementum Epigraphicum Graecum LXIII* (Brill, 2017) and worked on his book *Epigraphic Research at Aphrodisias, 1995–2015*. Thanks to generous grants provided by Annette Merle-Smith and the Charles and Lisa Simonyi Fund for Arts and Sciences, he started the digitization of squeezes of Greek inscriptions at IAS. In the first phase of this project, squeezes of Athenian inscriptions are being scanned and made accessible on the Institute’s website.

The “Epigraphic Friday” workshop, which Chaniotis has organized since 2013, attracted on March 16, 2018, more than fifty scholars and graduate students from American and European universities. The “Epigraphy Reading Group” at IAS (January–May 2018) was attended by graduate students from Princeton University; the City University of New York; Rutgers, the State University of New Jersey; and the Institute for the Study of the Ancient World at New York University. Subjects related to epigraphy but also numismatics, art history, archaeology, Jewish studies, and Roman law were treated by Members and Visitors in the Ancient Studies Seminar (October 2017–April 2018).

With the support of the Anneliese



ALL PHOTOS THOMAS CLARKE

Left: The annual Epigraphic Friday workshop, organized since 2013 by Professor ANGELOS CHANIOTIS (left), attracted more than fifty scholars and graduate students worldwide. *Right:* Member HARTWIN BRANDT analyzed how life, death, and emotions were memorialized, communicated, and perceived in literature and inscriptions of the Roman Empire.

Maier Research Award of the Alexander von Humboldt Foundation in Berlin, Chaniotis collaborated with graduate students and postdoctoral researchers from the University of Munich and the University of Freiburg in the study of inscriptions from Aphrodisias in Asia Minor and Yerosisos in Cyprus. In September 2017, he organized an excursion to Turkey of visits to important archaeological sites for graduate students and postdoctoral researchers from the University of Munich; the University of Oxford; Rutgers, the State University of New Jersey; and the Institute for the Study of the Ancient World at New York University. In July 2017, he organized the third Greek-Turkish Epigraphical Symposium in Thessaloniki.

Chaniotis gave twenty-five lectures in conferences, universities, museums, and cultural centers in Greece, Switzerland, the United Kingdom, and the U.S. Many of his lectures focused on his research on the history of emotions and his new research project on the transformations of night life from the fourth century B.C.E. to the fourth century C.E. In August 2017, he was the convener of a conference on this subject that took place at the Fondation Hardt in Geneva. The proceedings, *La nuit. Imaginaire et réalités nocturnes dans le monde gréco-romain*, which Chaniotis edited, were published in August 2018. In May 2018, he co-organized with the Greek architect and artist Nora Okka

“Spolia – 22 Transcripts,” an exhibition of multi-layer squeezes of ancient and medieval spolia built in a medieval church in Athens. The exhibition was on view in the Institute’s Simons Hall and the Historical Studies–Social Science Library from May–October 2018.

Chaniotis’s book *Age of Conquests: The Greek World from Alexander to Hadrian* was published by Profile Books and Harvard University Press in February 2018. Translations in Chinese, German, Greek, Italian, and Spanish are in preparation. The exhibition “A World of Emotions: Ancient Greece 700 B.C.–200 A.D.,” which Chaniotis curated together with Dr. Nikolaos Kaltsas in Athens and Professor Ioannis Mylonopoulos at Columbia University, was first presented at the Onassis Cultural Center New York from March 9 to June 24, 2017, and was on view at the Acropolis Museum in Athens from July 17 to November 19, 2017. On March 8, 2018, the exhibition received the Global Fine Art Awards’ 2017 Youniversal Award (the audience award). Finally, in March 2018, Chaniotis received an honorary degree from the Aristotle University of Thessaloniki in recognition of his contribution to the study of Greek history.

For **Nicola Di Cosmo**, Luce Foundation Professor in East Asian Studies, the main event of the year was the publication of the book, *Empires and Exchange*

in Eurasian Late Antiquity: Rome, China, Iran and the Steppe ca. 250–750, co-edited with former Member Michael Maas (Cambridge University Press, 2018). In twenty-six chapters, this volume attempts to redefine continental Eurasia as a unit of historical analysis from the Mediterranean to China at the time between antiquity and the Middle Ages. In particular, the book explores new forms of interaction—especially in the flow of material goods and international diplomacy—during a half-millennium that witnessed major transformations on both ends of Eurasia. While these transformations have been studied on a regional level before, here they are considered over a vast region that includes most of continental Eurasia, thereby expanding the reach of historical vision.

On another research front, Di Cosmo has been the corresponding author of two studies in which he and his co-authors explored the interplay between climatic and historical events. These are “Interplay of Environmental and Socio-political Factors in the Downfall of the Eastern Türk Empire in 630 C.E.,” published in *Climatic Change* in December 2017, and “Environmental Stress and Steppe Nomads: Rethinking the History of the Uyghur Empire (744–840) with Paleoclimate Data,” published in the *Journal of Interdisciplinary History* in Spring 2018.

Along the same lines, Di Cosmo convened in April 2018 the workshop “Climate, Archaeology, and History in the Eurasian Middle Ages,” as a follow-up to last year’s meeting on climate change in Eurasian late antiquity (from the fourth to eighth century). He is especially interested in a methodology that can be effectively adopted by historians to include paleoclimatic data in historical analysis. The main stimuli come from two unrelated questions. The first is the search for new sources of information on the history of Asian nomads, notoriously poor of written documents, and the second is the high resolution of many paleoclimatic data available today, which are suitable for short-term historical applications.

On other current research, Di Cosmo has been engaged in co-writing a book on the relations between the Republic of Venice and the Mongol empire in the thirteenth to fifteenth centuries. This study, which represents the completion of a long-term interest in the Italian colonies on the Black Sea, will be the first monograph on this topic in any language (aside from collections of documents), published first in Italian and later in English. Other works that have been completed but are still awaiting publication are a chapter for the *Cambridge World History of Violence* and a chapter for the *Cambridge History of the Mongol Empire*.

Finally, the East Asian Studies Seminar, which Di Cosmo has convened at IAS for the past fourteen years, included fourteen talks by Members and invited speakers in 2017–18.

Patrick J. Geary, Andrew W. Mellon Professor, continues his research into population movements at the end of antiquity in collaboration with his international team of archaeologists, geneticists, and historians. Having identified unsuspected structures in sixth-century populations in Italy and Hungary, the team is now looking both back into the fifth century—along the Danubian frontier—and forward into the eighth century—in Italy—in order to better understand historical change in populations over the centuries. Geary is engaged in efforts to disentangle genetic studies from racist essentialist discourse that is increasingly misinterpreting the results of genetic history, and also in efforts to emphasize the differences between population movements in the so-called Migration Period and the current migration crisis in Europe and America. He has spoken on these issues at Harvard University, Universität Heidelberg, Université Paris-Sorbonne, at the annual meeting of the American Historical Society in January, as well as at conferences in Milan and Spoleto.

In March, Geary served as a mentor in the Intercontinental Academia seminar “Laws: Rigidity and Dynamics” held at

Nanyang Technological University in Singapore. The seminar convened nineteen early-career scientists, engineers, social scientists, and humanists from six continents, along with eleven mentors—including two Nobel prize winners and senior scientists and scholars from around the world—to debate whether there exist commonalities in the different ways that the natural sciences, social sciences, and the humanities apply common terminology of laws, principles, theories, etc. A subset of the group will convene in fall 2018 at IAS to continue their discussions.

Peking University Press published a selection of Geary’s essays translated into Chinese with the title *历史记忆与书写* (“History, Memory, and Writing”). Geary was also elected Corresponding Member of the German Archaeological Institute.

Jonathan Haslam, George F. Kennan Professor, has been researching and writing on the origins of the Second World War, to be published by Princeton University Press in 2019.

The focus is largely, though not exclusively, on Europe. For this purpose, declassified documents from the archives of European foreign ministries have been exploited, including documents from Britain, France, Italy, Germany, Sweden, Spain, the Vatican, and the Soviet Union, plus those in the United States. The spread of research in diplomatic archives is thus wider than usual.

Where this work also differs from previous accounts, however, is that it does not focus wholly on diplomatic interaction with an admixture of economic history.

It takes seriously the impact of ideology as a primary factor in both the emergence of fascism and in the failure of the democratic powers to deter aggression from the fascist powers.

The emergence of fascism was not merely the outcome of an unsatisfactory peace on the part of Italy and failure in war on the part of Germany. The malaise amidst the European intelligentsia preceding the war played a critical part in what followed the war and re-emerged with a vengeance with the October Revolution of 1917 and the fascist victory in Italy five years later.



DAN KOMODA

NICOLA DI COSMO (right), Luce Foundation Professor in East Asian Studies, gives an After Hours conversation on “Venice, Genoa, and the Prisoner’s Dilemma.”



Left: WILL HANLEY, Elizabeth and J. Richardson Dilworth Fellow, examined the rules governing how personal names were used in serial historical records of the modern Middle East. *Right:* EUGENIA LEAN, Starr Foundation East Asian Studies Endowment Fund Member, examined how modern China has navigated global industrial capitalism.

German fascism is often seen as exceptional in its racial focus. But this was true only until 1937. And Hitler's conception of the threat to Germany as an organism incorporated Bolshevism and anti-Semitism in equal measure.

Thus any attempt to understand the rise of fascism has to understand anti-Bolshevism, which did not emerge from thin air. Moscow, in the form of the Communist International (Comintern), brazenly challenged the capitalist order and the colonial order overseas.

The diplomatic archives of Europe reflect this overriding concern. But to get to grips with the interaction between Bolshevism and anti-Bolshevism has therefore required extensive research in the archives of Comintern.

Thus the research takes us from bottom to top, from the ground forces of social unrest mobilized by Moscow to the state of alarm in the governments of Europe.

The consequences were tragic for all. The appeasers of Hitler in London were not pacifists. Their overriding fear was that Europe would be overrun by Bolshevism in the event of war. And when war broke out in September 1939, U.S. ambassador Joseph Kennedy reported the view of foreign secretary Lord Halifax that "if this war continued it would mean Bolshevism all over Europe."

In 2017–18, Professor **Sabine Schmidtke** continued to focus on the Zaydi tradition of Yemen and Northern Iran. Schmidtke gave several lectures on the subject, and the partnership with the

Hill Museum & Manuscript Library at St. John's University in Collegeville, Minnesota, continued to flourish and to build up a repository that will eventually host digital surrogates of most manuscripts pertaining to the Zaydi literary tradition. In addition to digital surrogates of the holdings of three private libraries from Yemen, the collection of Yemeni manuscripts held by the Biblioteca dell'Accademia dei Lincei e Corsiniana in Rome was uploaded to the vHMML Reading Room, and a Memorandum of Understanding was signed with Leiden University Library to include its holdings of Zaydi and Yemeni manuscripts in the project. Moreover, funding for the continuation of the Zaydi Manuscript Tradition (ZMT) project was granted by the National Endowment for the Humanities (2018–2021), the Middle East Center at the University of Pennsylvania, a gift by Sherwin Seligsohn (through the School of Historical Studies), and a gift by Charles Simonyi—this in addition to Schmidtke's personal funds. Schmidtke published several articles on the subject and completed a monograph on one of the private libraries processed for inclusion in the ZMT, *Traditional Yemeni Scholarship amidst Political Turmoil and War: Muḥammad b. Muḥammad b. Ismā'īl b. al-Muṭahhar al-Manṣūr (1915–2016) and His Personal Library* (Cordoba University Press, 2018). In the field of Islamic intellectual history, she published (with Hassan Farhang Ansari, Long-term Member in the School of Historical

Studies) the monograph *Studies in Medieval Islamic Intellectual Traditions* (Lockwood Press, 2017). She also worked on two additional issues of her journal, *Intellectual History of the Islamicate World*, "Writing in My Own Script: Allographic and Garshunographic Systems in Late Antiquity" (co-edited with George A. Kiraz, Member in the School), and "The Arabic Literary Genizah" (co-edited with Geoffrey Khan and Sarah Stroumsa), to be published in September 2019 and April 2020, respectively.

In the field of the Arabic Bible, Schmidtke is currently preparing, with Camilla Adang, a monograph, "Muslim Receptions and Perceptions of the Bible: Texts and Studies" (to be published by Lockwood Press in 2019). In the field of Shii Studies, Schmidtke completed (with Ansari) the second volume of the new peer-reviewed journal, *Shii Studies Review* (published by Brill, Leiden), as well as the volume *Materials for the Intellectual History of Imāmī Shī'ism in the Safavid Period: A Facsimile Edition of Ms New York Public Library, Arabic Manuscripts Collections, Volume 51985A* (Gorgias Press, 2018). Moreover, Schmidtke published an edited volume, *Studying the Near and Middle East at the Institute for Advanced Study, Princeton, 1935–2018* (Gorgias Press, 2018), which opens with a historical sketch of the study of the Near and Middle East at the Institute, discussing luminaries such as Ernst Herzfeld, Henri Seyrig, Ernst Kantorowicz, Otto Neugebauer, Marshall



Agnes Gund and Daniel Shapiro Member TIMOTHY BROOK (rear, center) gives an Early Modern History Seminar on “The Fire (Trading in the World).”

Clagett, Clifford Geertz, Bernard Lewis, Glen Bowersock, Oleg Grabar, and Patricia Crone and their respective impact on the field. The second part of the volume, “Fruits of Scholarship,” consists of essays and short studies by IAS scholars, past and present—Faculty, Members, and Visitors; mathematicians, social scientists, and historians—who are engaged in one way or another with the Near and Middle East in their scholarship. Their contributions cover fields such as the ancient Near East and early Islamic history, the Bible and the Qur’an, Islamic intellectual history within and beyond denominational history, Arabic and other Semitic languages and literatures, Islamic religious and legal practices, law and society, the Islamic West, the Ottoman world, Iranian studies, the modern Middle East, and Islam in the West.

Over the course of the year, Schmidtke organized a number of major events. Firstly, Schmidtke (in collaboration with Adang, Sonja Brentjes, and Maribel Fierro) organized “The Majlis Revisited: Inter- and Intra-religious and cross-cultural disputations in the Islamicate World,” an international conference that took place April 12–14, 2018, at Casa Árabe in Córdoba, Spain, and was co-sponsored by the Institute for Advanced Study. Secondly, Schmidtke organized (in collaboration with Guy G. Stroumsa) the Third Advanced School in the Humanities, “Literary Genres and Their Changing

Functions Among Jews, Christians, and Muslims in Late Antiquity and the Middle Ages,” which took place May 14–15, 2018, and which was jointly sponsored by IAS and the Israel Institute for Advanced Studies at the Hebrew University of Jerusalem. While the 2017 event was hosted on the IAS campus in Princeton, the 2018 Advanced School was convened in Jerusalem. Thirdly, Schmidtke convened (in collaboration with Kiraz) a two-day conference, “Dots, Marginalia, and Peritexts in Middle Eastern Manuscripts,” which took place June 28–29, 2018, at IAS.

In the framework of the Shii Studies Research Program (SSRP) (funded by the Carnegie Corporation of New York), Schmidtke convened (with Ansari) “Shii Studies: The State of the Art,” a conference that took place December 7–9, 2017, and was co-funded by the Dr. S. T. Lee Fund for Historical Studies; as well as “The Zaydi Manuscript Tradition: A Summer School” (June 6–9, 2018). Also in the SSRP framework, she hosted over the course of the year twelve international scholars specializing in Shii studies as short-term visitors. In addition, Schmidtke was elected Fellow of the Israel Academy of Sciences and Humanities (The Humanities and Social Sciences Fund) for 2018, and was in 2018 appointed a Polonsky Visiting Scholar of the Polonsky Academy at the Van Leer Jerusalem Institute.

Schmidtke also spent much of her time at the Institute with a large and

diverse group of Members studying subjects related to the Near and Middle East, though not necessarily to Islam. The group was highly international, with Members from the United Kingdom, Palestine, Germany, Oman, Iran, the United States, and Switzerland. Over the course of the year, these Members met regularly in a lively biweekly seminar, which was also frequented by Members from the School of Social Science, Princeton University graduate students and faculty, former IAS Members, and occasional visitors. In addition to a panel discussion on “The Bible in its Near Eastern Contexts (Ancient, Medieval, Modern): Philological Perspectives on the Pentateuch, Syriac, Samaritan, and Arabic Bibles” (with Kiraz, Konrad Schmid, and Stefan Schorch), the main subjects studied by the group and presented in the seminars related to Islamic law (Ansari); Syriac Studies (Kiraz); early Islamic history, historiography, and astrology (Antoine Borrut); the Arabic Bible (Sebastian Günther); an ontology of names and digital humanities (Will Hanley); and twentieth-century Syria (Kevin Martin)—this in addition to a number of lectures presented by short-term visitors (including Jan Thiele, Mohammed Abattouy, and Anna Izdebska).

Professor Emeritus **Glen Bowersock** prepared for publication the paper he delivered at Brent Shaw’s retirement conference on “Muhammad’s Rivals: Prophets in Late Antique Arabia.” He has monitored ongoing translations of his book, *The Crucible of Islam*, into French, German, and Greek. He has also been arranging for online access to approximately five thousand digitized but unidentified photographs from the Fonds Louis Robert in Paris. In conversation with Member John Eldevik about St. Thomas in India, Bowersock discussed the work of former Member Nathanael Andrade, who had worked at IAS on Thomas in India.

The unexpected deaths of Robert Silvers, editor of the *New York Review of Books*, and Alan Cameron, a former IAS Member who was the Charles Anthon Professor Emeritus of Latin and Literature at Columbia University, led Bowersock to prepare commemorative notices for both.

He spoke at the New York memorial for Cameron at the end of October. His memorial of this great scholar will appear next year in the *Proceedings of the American Philosophical Society*. Bowersock was also able to assist a Turkish journalist in writing a biography of the renowned archaeologist Kenan Erim, excavator of Aphrodisias and a close friend.

Bowersock has been discussing with the numismatist David Hendin several new coins from the kingdom of the Nabataeans (in contemporary Jordan), with special reference to a mutilated new piece from Kerak that shows the emperor Augustus and the Nabataean King Aretas IV precisely in 2 B.C.E., according to a date on the coin itself. This discovery was satisfying in confirming an argument Bowersock had made several decades ago about relations between the Roman imperial government and the Nabataeans.

In the *New York Review of Books*, Bowersock reviewed a general book on the Qur'an. This is now reprinted in a volume, edited by his colleague Professor Sabine Schmidtke, on the rich tradition of Near Eastern Studies at IAS. Bowersock also published in the *New York Review of Books* an article about a new work on the Phoenicians—who and where they were. The American Numismatic Society elected Bowersock an Honorary Life Fellow. At the beginning of May, Bowersock went to Paris to discuss his work at the Fonds Louis Robert and to attend the installation of former IAS Member Christopher Jones in the Académie des Inscriptions et Belles-Lettres.

Professor Emerita **Caroline Walker Bynum** spent the last year working on a book of essays to be titled “Dissimilar Similitudes,” which is a series of case studies of devotional objects from the later Middle Ages. The lengthy introduction explores the question of how earthly objects can be understood to refer to and transport worshippers to the otherness of heaven. The essays focus on several groups of such objects: some from North German convents, some at sites in the Holy Land, others now in the Metropolitan Museum of Art in New York City. Although the relatively rare writings of medieval theologians discussed how the

here-and-now might be like and unlike heaven, the argument of this book is that the objects themselves indicate and elucidate the paradoxical nature of same and other, earth and heaven, time and eternity. Also in 2017–18, Bynum’s 1995 prize-winning book *The Resurrection of the Body in Western Christianity, 200–1336* (Columbia University Press, 2017) was republished in an expanded edition with a new introduction and epilogue. In summer 2018, the journal *Common Knowledge* published a set of essays titled “In the Humanities Classroom,” which Bynum commissioned and edited. This symposium follows on an earlier collection of essays that appeared in winter 2017 in *Common Knowledge*, also commissioned, introduced, and edited by Bynum. At a time when the national conversation often devalues the humanities in favor of the STEM subjects, the goal of these essays is to show to a wide audience of non-specialists how transformative humanities teaching can be.

Professor Emeritus **Giles Constable** published “Women and Religious Life in the Twelfth Century” in the journal *Studi Medievali*. Forough Publications published a Persian language edition of *Sacrilege and Redemption in Renaissance Florence: The Case of Anotonio Rinaldeschi*, originally published in 2005 by Constable and former Member William J. Connell. Additionally, Constable was named a Chevalier de la Légion d’honneur of France.

During the academic session 2017–18, Professor Emeritus **Jonathan Israel** devoted most of his time and effort to completing the final part of his Oxford University Press series of volumes on the Enlightenment, the first part of which, *Radical Enlightenment*, appeared in 2001, the second and third volumes in 2006 and 2011. This last part deals mainly with the trans-Atlantic revolutionary era 1775–1830 and focuses on the role of late Enlightenment ideologues and big project-planners like Franklin, Jefferson, Paine, Mirabeau, Condorcet, Volney, Bentham, Filangieri, Sismondi, Comte, von Humboldt, and others in drawing up the great declarations, legislative programs, and basic principles not just of the American and French, but also the many other important revolutions

of the period, such as those in Belgium, Switzerland, Italy, Spain, and Spanish America. A central theme in all these revolutionary upheavals was the unresolved battle between aristocratic and democratic forms of republicanism; another was how and how far to limit the role of religious authority in politics, education, and the legal sphere.

Since 2001, what has gradually become a fairly major historiographical controversy over the validity or non-validity of Israel’s “Radical Enlightenment thesis” has developed with numerous—sometimes quite heated—interventions appearing in various countries both for and against. During late 2017, two collections of essays were published surveying the arguments on both sides, both of which contain long essays by Israel summarizing his “Radical Enlightenment thesis” and positioning it in relation to the wider debate. These collections are *Reassessing the Radical Enlightenment* (Routledge, 2017) and *Les Lumières radicales et le politique. Études critiques sur les travaux de Jonathan Israel* (Honoré Champion, 2017).

A second, lesser project, also nearing completion, is a small book—based on the two public Stroum Lectures in Jewish Studies that Israel gave at the University of

FACULTY & EMERITI HONORS

Yve-Alain Bois was conferred Nanjing University’s title of Chun-tu Hsueh Chair Professor.

Glen Bowersock was elected an Honorary Life Fellow of the American Numismatic Society.

Caroline Walker Bynum was elected a Fellow of the British Academy.

Angelos Chaniotis was conferred the Aristotle University of Thessaloniki’s title of Doctor Honoris Causa.

Giles Constable was named a Chevalier de la Légion d’honneur of France.

Patrick J. Geary was elected a Corresponding Member of the German Archaeological Institute.

Sabine Schmidtke was elected a Fellow of the Israel Academy of Sciences and Humanities.

Washington in Seattle in May 2017—dealing with what is seen as a tradition of revolutionary thought seeking to transform broad aspects of society and politics pervading the writings of a series of Jewish intellectuals, from Spinoza, through eighteenth-century revolutionaries such as Lucius Junius Frey, and then on to Ludwig Börne, Heinrich Heine, Moses Hess, and Karl Marx. It is not generally recognized, but is argued in this book, that Spinoza was a central preoccupation of each of these figures, including the young Marx whilst the latter was a democratic radical—until his turn to economic theory and socialism in 1844, when he dramatically changed direction.

On November 7, 2017, Israel delivered the annual lecture in memory of Martin Buber at the Israel Academy of Sciences and Humanities in Jerusalem, on the topic of Jewish emancipation in the era 1780–1860, arguing that it is possible to identify a particular tendency within the Enlightenment that promoted the project of Jewish emancipation, while more moderate tendencies within the Enlightenment tended to obstruct the process. Also during this year Israel delivered key note and other public lectures at conferences in Sydney, Melbourne, San Francisco, Berkeley, Copenhagen, Lund, Munich, Valparaiso, the David Library of the American Revolution in Washington Crossing, Leeuwarden, Seville, and Dublin.

In addition to his newest book, *The Expanding Blaze* (Princeton University Press), which came out in the autumn

of 2017, Israel published a number of articles during the year on Enlightenment topics, including essays on Spinoza and Rousseau.

Professor Emeritus **Irving Lavin** spent time rethinking ideas and issues that have been developed over his more than sixty-year career. Because of Lavin's work on the Roman artist Gian Lorenzo Bernini, his ninetieth birthday was celebrated in December 2017 with a gift of a unique brown ink and wash drawing by Bernini's workshop, dating about 1670, from Charles Scribner III to the Princeton University Art Museum. This occasion led to the publication, "Bernini and the Figura Serpentinata: a Drawing Recently Given to the Princeton University Art Museum by Charles Scribner III in Honor of Irving Lavin," in *Francisco Jarauta en las fronteras de Babel* (eds. P. Jarauta and P. Medina, Madrid, 2017, pp. 235–252). Other publications for this period include "Socrates Modern," in *I Filosofi antichi nell'arte italiana del seicento: stile, iconografia, contesti* (eds. S. Albi and F. Lofano, Rome, 2017, pp. 9–14); "Caravaggio Magister and the Beatles," in *About Art Online* (with M.A. Lavin, 2018; see www.ias.edu/lavin-caravaggio-beatles); "Bernini's Bust of Prospero Farinacci," in *Artibus et Historiae* no. 77 (2018, pp. 255–290); and "The Silence of Bernini's David," in *The Silence of Images: Theory and Process of Artistic Invention* (eds. C. Cieri Via, et al., Vatican City Press, forthcoming). Work continues on volumes four and five (Pindar Press,

London) of Lavin's published works on subjects other than Bernini.

In 2017–18, Professor Emeritus **Peter Paret** continued his exploration of German cultural and military history at the beginning of the nineteenth century. A long essay, "The Function of History in Clausewitz's Understanding of War," will appear in the October 2018 issue of *The Journal of Military History*. The article was translated into German, expanded, and with another methodological study by the German historian Hans Delbrück (1848–1929) will appear in December with an introductory essay and edited by Paret under the title *Krieg, Geschichte, Theorie* (Miles-Verlag, 2018). A greatly expanded German edition of his volume of essays *Clausewitz in seiner Zeit* was published by Königshausen & Neumann, Würzburg, and the talk he gave in Chicago in December 2017, "War and Its Historians" on receiving the Pritzker Literature Award for Lifetime Achievement in Military Writing, will be published in the Pritzker Military Museum & Library's annual report. Princeton University Press brought out a new edition of *The Cognitive Challenge of War: Prussia 1806*, which originally appeared in 2009, and announced that *Makers of Modern Strategy*, the collection of thirty-two essays that Paret edited in 1986, and to which he contributed three essays, as a replacement for the volume that originated at IAS in 1939, is now being translated into modern Chinese, the fourteenth language in which the work will appear.

2017–18 MEMBERS AND VISITORS

f First Term ♦ *s* Second Term ♦ *m* Long-term Member ♦ *v* Visitor

Abdulrahman al-Salmi

Early Islamic Theology and History ♦ Ministry of Endowments and Religious Affairs, Oman ♦ *s*
Patricia Crone Member

Hassan Farhang Ansari

Islamic Law and Theology ♦ Institute for Advanced Study ♦ *m*
Funding provided by Carnegie Corporation of New York

Celia Applegate

Music History ♦ Vanderbilt University
Edward T. Cone Member in Music Studies

Ilias Arnaoutoglou

Ancient Greek Legal History ♦ Academy of Athens ♦ *s*
Funding provided by the Patrons' Endowment Fund

Nicholas Baker

Cultural History of Renaissance Italy ♦ Macquarie University ♦ *s*

Elisheva Baumgarten

Medieval History ♦ Hebrew University of Jerusalem
George William Cottrell, Jr. Member

Betsy Beasley

History of Capitalism and International Relations ♦ Harvard University
AMIAS Member

David Blackburn

Modern German History ♦ Vanderbilt University
Funding provided by The Andrew W. Mellon Foundation

Hartwin Brandt

Ancient History ♦ Otto-Friedrich-Universität Bamberg
Funding provided by the Herodotus Fund

Stefan Brink

Medieval History ♦ University of Aberdeen ♦ *f*

Timothy Brook

Chinese History ♦ The University of British Columbia
Agnes Gund and Daniel Shapiro Member

Fabienne Burkhalter

Ancient Greek History, Papyrology ♦ Université Lille 3 ♦ *f*
Funding provided by the Fund for Historical Studies

Guillaume Calafat

Early Modern Mediterranean Legal and Maritime History ♦ Université Paris 1 Panthéon-Sorbonne
Funding provided by the Herodotus Fund

Catherine Clark

Modern European History and International Relations ♦ Massachusetts Institute of Technology
The Andrew W. Mellon Foundation Fellowships for Assistant Professors

Kathleen Coleman

Latin Literature and Roman Social History ♦ Harvard University
Elinor Lunder Founders' Circle Member

Constance Cook

Ancient China ♦ Lehigh University
Funding provided by the Hetty Goldman Membership Fund

William Diebold

Art History ♦ Reed College ♦ s

John Eldevik

Medieval Social and Religious History ♦ Hamilton College ♦ s

Alison Games

Early Modern Global History ♦ Georgetown University
Hans Kohn Member

Valerie Garver

Early Medieval History ♦ Northern Illinois University ♦ f

Sebastian Günther

Classical Islam and Arabic Studies ♦ Georg-August-Universität Göttingen
Willis F. Doney Member

Cynthia Hahn

Medieval Art History ♦ Hunter College, The City University of New York
Funding provided by the Fund for Historical Studies

Omar Hamdan

The Arabic Bible ♦ Eberhard Karls Universität Tübingen ♦ s
Martin L. and Sarah F. Leibowitz Member

Will Hanley

Legal History, Digital History ♦ Florida State University ♦ f
Elizabeth and J. Richardson Dilworth Fellow

Marta Hanson

Late Imperial China, History of Medicine ♦ Johns Hopkins University
Elizabeth and J. Richardson Dilworth Fellow

William Hedberg

Japanese Literature and Translation Studies ♦ Arizona State University
The Andrew W. Mellon Foundation Fellowships for Assistant Professors

Geoffrey Herman

History of Jews in Antiquity ♦ The Hebrew University of Jerusalem ♦ s
Funding provided by the Fund for Historical Studies

Cecily Hilsdale

Byzantine and Medieval Art ♦ McGill University
Funding provided by the Fund for Historical Studies

Minoru Inaba

Medieval History of China and Central Asia ♦ Kyoto University
Roger E. Covey Member in East Asian Studies

Adam Izdebski

Medieval Environmental History ♦ Jagiellonian University in Krakow
Funding provided by the Herodotus Fund

Kwangmin Kim

Late Imperial China ♦ University of Colorado ♦ s

George Kiraz

Ottoman History of Religious Minorities, Syriac Studies ♦ Beth Mardutho: The Syriac Institute
Funding provided by the Fund for Historical Studies

Jamie Kreiner

Early Medieval History ♦ University of Georgia
The Andrew W. Mellon Foundation Fellowships for Assistant Professors

Vladimir Kulić

Modern Architectural History ♦ Florida Atlantic University ♦ f
Funding provided by the Fund for Historical Studies

Eugenia Lean

History of Modern China ♦ Columbia University
The Starr Foundation East Asian Studies Endowment Fund Member ♦ f

Polly Low

Ancient Greek History ♦ The University of Manchester ♦ f
Funding provided by the Herodotus Fund

Weijing Lu

Chinese History ♦ University of California, San Diego
The Starr Foundation East Asian Studies Endowment Fund Member

Wilferd Madelung

Islamic Studies ♦ University of Oxford ♦ v, s

Carolina Mangone

Renaissance and Baroque Art ♦ Princeton University
The Andrew W. Mellon Foundation Fellowships for Assistant Professors

Kevin Martin

Cultural History of Modern Syria ♦ Indiana University
Willis F. Doney Member

Eduard Mühle

East European History ♦ Westfälische Wilhelms-Universität Münster ♦ f
Funding provided by The Gladys Kriebel Delmas Foundation

Alexander Nagel

Renaissance Art ♦ New York University ♦ f
William D. Loughlin Member; additional funding provided by the Patrons' Endowment Fund

Carlos Noreña

Roman History ♦ University of California, Berkeley ♦ s

Marek Olbrycht

Ancient History, Archaeology, Iranian Studies ♦ University of Rzeszów
Gerda Henkel Stiftung Member

Vladimir Pechatnov

History of Soviet-American Relations ♦ Moscow State Institute of International Relations ♦ f
Funding provided by the Fund for Historical Studies

Jörg Peltzer

Medieval Political, Social, and Legal History ♦ Universität Heidelberg
John Rassweiler Founders' Circle Member

David Gilman Romano

Classical Archaeology ♦ The University of Arizona ♦ s
Funding provided by The Andrew W. Mellon Foundation

Erin Rowe

Religious Culture of the Early Modern Catholic World ♦ Johns Hopkins University
Edwin C. and Elizabeth A. Whitehead Fellow

Jonathan Sachs

Early Modern British Culture ♦ Concordia University, Montreal

Jutta Schickore

History of Science ♦ Indiana University
Funding provided by the Fund for Historical Studies

Konrad Schmid

Hebrew Bible ♦ Universität Zürich ♦ f

Stefan Schorch

Samaritan Studies ♦ Martin-Luther-Universität Halle-Wittenberg
Funding provided by the Patrons' Endowment Fund

Silvia Sebastiani

Early Modern History ♦ École des Hautes Études en Sciences Sociales, Paris
Friends of the Institute for Advanced Study Member; additional funding provided by the Hetty Goldman Membership Fund

Jonathan Unglaub

Renaissance and Baroque Art ♦ Brandeis University
Felix Gilbert Member; additional funding provided by the Herodotus Fund

Karina Urbach

Modern International Relations and Jewish Family History ♦ University of London ♦ v

Frederik Vervae

Roman History ♦ The University of Melbourne ♦ s

Rory Yeomans

Comparative European Fascism ♦ Institute for Advanced Study ♦ s
Willis F. Doney Member

Ying Zhang

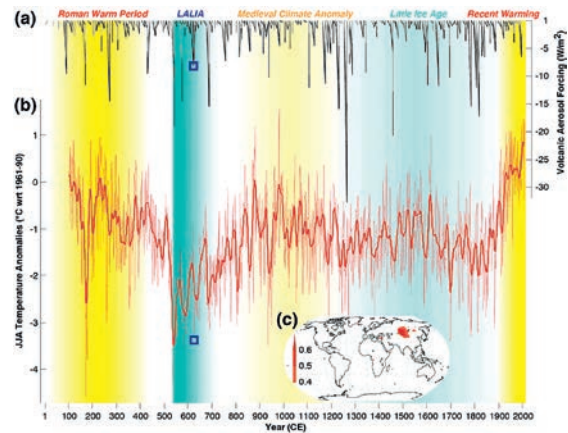
Early Modern China ♦ The Ohio State University



A theological work by al-Sāhib b. ‘Abbād, who promoted the teaching of Mu‘tazilī theology throughout Būyid territories and beyond

SABINE SCHMIDTKE ON MU‘TAZILISM IN ISLAM AND JUDAISM

The earliest attested Jewish compendium of Mu‘tazilite thought is the Kit‘b al-Ni‘ma, *The Book of Blessing*, of the Karaite Levi ben Yefet (in Arabic Abū Sa‘īd Lāwī b. Hasan al-Basrī) (late tenth to early eleventh century), the son of the prominent Karaite Bible exegete and legal scholar Yefet ben Eli ha-Levi (whose Arabic name was Abū ‘Alī Hasan b. ‘Alī al-Lāwī al-Basrī) (d. after 1006). Levi wrote the book at the request of his father as a vindication of Judaism on the basis of Mu‘tazilite rational theology, but unlike his father, who disapproved of Islamic Mu‘tazilite theology, Levi adopted the doctrines of the Mu‘tazila and implicitly recognized Muhammad as a friend of God endowed with prophethood, though ranking below Moses. Further evidence as to when (and why) Jewish thinkers began to adopt Mu‘tazilite thinking can be gleaned from the extant Jewish copies of Mu‘tazilite works of Muslim representatives of the movement, as preserved in the various Genizah collections, most specifically the Abraham Firkovich collection in St. Petersburg. Although a full inventory of the relevant collections and its Mu‘tazilite materials is still a major desideratum, it seems that the writings of the Bāyid vizier and patron of the Mu‘tazila, al-Sāhib b. ‘Abbād (938–95), who was himself an adherent of the movement, constitute the earliest Muslim Mu‘tazilite works, copies of which can be traced in the various Jewish collections. Read more at www.ias.edu/schmidtke-islam-judaism.



Climatic reconstructions from Di Cosmo et al., “Interplay of Environmental and Socio-Political Factors in the Downfall of the Eastern Türk Empire in 630 C.E.”

NICOLA DI COSMO ON HISTORY, CLIMATE, AND THE NEW PAST

Climate is neither nature nor environment. Climate is not even the weather. Climate is connected with and produced by the Earth’s system, affected by the solar system, and its variations transform ecologies: dry to wet, cold to warm, and vice versa, in different degrees of intensity and duration. Until recently, climate variability was caused only by a series of interacting natural forces that determined the length of seasons, the amount of rainfall, and the temperature of the atmosphere at different latitudes. Human beings had to face the consequences of this variability, enjoying balmy days while preparing for poor ones, feasts and famines punctuating the life cycles of humanity. How could this constant interaction between humans and nature not be part of history? Read more at www.ias.edu/di-cosmo-new-past.

KEVIN W. MARTIN ON THE BEGINNINGS OF AUTHORITARIAN CULTURE IN THE ARAB WORLD

As recent events have demonstrated, one of the most significant phenomena of the Arab World’s modern history is the persistence and resilience of undemocratic government. Syria has enjoyed the dubious distinction of leadership in this respect, its experience foreshadowing and/or exemplifying that of its neighbors. The pattern was established in 1949, when Syria experienced three coups d’état that installed a succession of military rulers. All of these coups were planned and executed by Army Colonel Adib al-Shishakli, who today is largely forgotten in Syria, and remains an obscure figure to all but a narrow circle of historians and political scientists outside the country. This is a considerable oversight, for after seizing power on his own behalf in December 1949, al-Shishakli effectively ruled Syria for much of the next five years, during which he wrought long-term changes in Syria’s political culture and initiated a host of policies and practices subsequently adopted by Egypt’s Gamal Abdul Nasser, Syria’s Hafez al-Assad, Iraq’s Saddam Hussein, and other authoritarian rulers throughout the region. Read more at www.ias.edu/martin-authoritarian-beginnings.



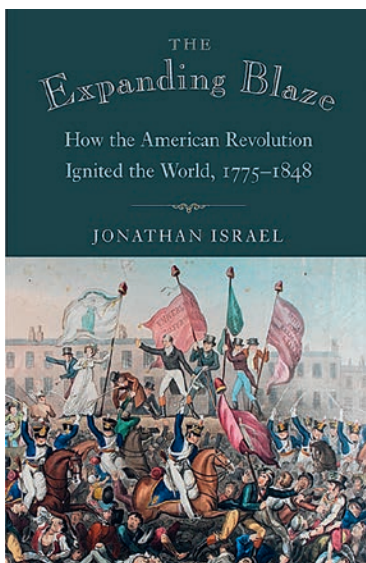
The al-Shishakli regime’s appropriation of American political culture is exemplified in the above caricature, which accompanied the state-sponsored article “Luminous Pages from the Life of a Leader.”

KATHLEEN COLEMAN ON A CHILD PRODIGY IN ANCIENT ROME

Who was Quintus Sulpicius Maximus? His funerary monument contains forty-three lines, the only poem currently known to be written by an ancient Roman child. Why is it important to study a single monument for a Roman prodigy who died nearly 2,000 years ago? Watch Coleman's lecture from *Ideas 2017–18* at www.ias.edu/coleman-child-prodigy.



DAN KOMODA



JONATHAN ISRAEL'S *THE EXPANDING BLAZE*

The American Revolution created a new form of republic explicitly built on the principle of “liberty.” Yet the United States that emerged in 1787 was predominantly undemocratic and by and large not geared to promoting the welfare of society as a whole. The Revolution contained two divergent tendencies within it, rooted respectively in moderate and radical Enlightenment, and this inevitably generated a conflict of attitudes, values, and institutions that could not easily be resolved. On the one hand there was the powerful Lockean legacy. But Locke had justified a revolution, the Glorious Revolution of 1688, led by an aristocracy on the basis of everyone's right to the pursuit of “life, liberty, and property,” assigning property a decisive role in the possession and organization of power and authority. Read more at www.ias.edu/israel-expanding-blaze.



Leonardo da Vinci, Deluge Drawings. Windsor, Royal Library

ROYAL COLLECTION TRUST / © HER MAJESTY QUEEN ELIZABETH II 2018

IRVING LAVIN ON LEONARDO DA VINCI'S WATERY CHAOS

Within the vast range and depth of Leonardo's perceptual and intellectual ken, recorded in innumerable drawings and verbal observations in his great legacy of notebooks and study sheets, it is abundantly clear that water preoccupied him much more than any of the many other subjects to which he turned his attention. The sheer volume of his studies of water, hundreds of drawings and notes, exceeds by far that of his work on any other single theme. Leonardo was truly enthralled, not to say obsessed by water—so much so that this fact in itself calls for explanation. Read more at www.ias.edu/lavin-leonardo-chaos.



Distinguished Visiting Professor AKSHAY VENKATESH led a special program on locally symmetric spaces. Locally symmetric spaces are the home of the Langlands program—a set of overarching and interconnected conjectures connecting representation theory to number theory, first proposed in 1967 by Professor Emeritus Robert Langlands.

School of Mathematics

The School of Mathematics, established in 1933, was the first School at the Institute for Advanced Study. Several central themes in mathematics of the twentieth and twenty-first centuries owe their major impetus to discoveries that have taken place in the School, which today is an international center for research on mathematics and computer science.

DURING THE ACADEMIC YEAR 2017–18, the School of Mathematics conducted a special program on locally symmetric spaces, led by Distinguished Visiting Professor **Akshay Venkatesh** of Stanford University.

Examples of locally symmetric spaces, which are highly symmetric objects, are the hyperbolic geometries investigated by Luigi Bianchi in the nineteenth century and a six-dimensional space parameterizing all possible three-dimensional lattices up to rotation.

Locally symmetric spaces are the home of the Langlands program—a set of overarching and interconnected conjectures connecting representation theory to number theory, first proposed in 1967 by Robert Langlands, now Professor Emeritus in the School of Mathematics. These spaces have become a crossroads for many different strands of mathematical thought. The special program placed particular focus on two of these areas:

Analysis on locally symmetric spaces. The motivation to study this comes both from the Langlands program and from analytic number theory. The techniques are drawn from representation theory and analysis on manifolds, among other fields.

Topology of locally symmetric spaces. Here the subject is guided again by a conjecture of Langlands that relates the cohomology of locally symmetric spaces to algebraic varieties. Understanding subtler features of this conjecture was a central theme of the program.

Core Program Activities

There was an introductory short course of six hours, given by Members Laurent Clozel and Joachim Schwermer. This series, aimed at an audience with some familiarity with automorphic forms, gave a quick introduction to the cohomology of locally symmetric spaces.

Research short courses (each a series of two-hour lectures) were given by Venkatesh and Members Alexander Goncharov, Erez Lapid, Simon Marshall, Yiannis Sakellaridis, and Romyar Sharifi.

A theme that ran through the lectures of Goncharov, Sharifi, and

FACULTY

Jean Bourgain

IBM von Neumann Professor

Helmut Hofer

Robert MacPherson

Hermann Weyl Professor

Peter Sarnak

Richard Taylor

Robert and Luisa Fernholz Professor

Avi Wigderson

Herbert H. Maass Professor

Vladimir Voevodsky

deceased September 30, 2017

PROFESSORS EMERITI

Enrico Bombieri

Pierre Deligne

Phillip A. Griffiths

Robert P. Langlands

Thomas Spencer

Venkatesh was an emerging connection between the theory of mixed motives and the theory of automorphic forms, particularly its topological manifestations. All three hinted at an underlying structure that is only partly visible at present.

The lectures of Marshall, Sakellaridis, and Lapid all related to the theory of periods of automorphic forms, and belonged to the analysis side of the program.

During the second term, there was a “Working Group on Microlocal Analysis and Automorphic Forms.” This was a series of lectures or discussions (several by more junior Members) on ideas at the interface of the mentioned topics. This working group seemed to successfully integrate participants of disparate seniority and backgrounds.

There were two workshops associated with the program, each with eighteen research talks: *Motives, Cohomology, and Galois Representations around the Langlands Program*, November 6–10, 2017, organized by Frank Calegari and Akshay Venkatesh; and *Representation Theory and Analysis on Locally Symmetric Spaces*, March 5–28, 2018, organized by Lapid, Sakellaridis, and Venkatesh.

There was a great deal of interaction

FACULTY & EMERITI HONORS

Jean Bourgain was awarded the Steele Prize for Lifetime Achievement by the American Mathematical Society for the breadth of his contributions made in the advancement of mathematics.

Robert Langlands was awarded the 2018 Abel Prize by the Norwegian Academy of Science and Letters for his visionary program connecting representation theory to number theory.

Robert MacPherson was awarded an honorary doctorate of science from the University of Chicago.

Peter Sarnak was awarded an honorary doctorate from King’s College London in recognition of his far-reaching vision that has opened up many new fields of research in mathematics.

Richard Taylor was elected a Member of the American Philosophical Society.

between the program participants and the number theory group at Princeton University. This occurred both through the weekly number theory seminar and yet another “Working Seminar.”

There were several important results announced at the program. Marshall announced a new subconvexity result with Member Ruixiang Zhang that applies in arbitrarily high rank, and Sakellaridis announced in his lecture a new unified approach to relative functoriality, in the spirit of *Beyond Endoscopy*, that should apply in all rank one cases.

The scientific activities at IAS in the area of geometry and dynamics, organized by Professor **Helmut Hofer** and several Members, covered as usual a broad area focusing on questions in symplectic dynamics, enumerative geometry, manifolds with G_2 -holonomy, Fukaya categories, and work on virtual moduli cycles. Manifolds with G_2 -holonomy are interesting seven-dimensional spaces which are also of importance in string theory. These occur in families of spaces having different geometric properties. These families are examples of so-called moduli spaces and an important question is the dimension of these moduli spaces, i.e., how many parameters does one need to describe these families locally. Member Gao Chen produced a singular compact manifold with G_2 -holonomy, which can be desingularized in three different ways obtaining three families of different dimensions that collapse into the same singular object. This is the first example of such a change of dimension phenomenon. Chen’s results hint to an extremely rich combinatorial structure governing the geometry of G_2 -manifolds.

Member Matthias Schwarz made substantial progress on a new type of question in symplectic dynamics called the “symplectic recurrence problem.” Classical Poincaré recurrence in physics states that certain systems will return, after a sufficiently long but finite time, very close to their initial state. This recurrence phenomenon is a consequence of a finite measure (or volume) being preserved by the dynamics. In the case of a symplectic dynamical system, the volume

conservation is a mere consequence of symplectic invariance. Hence, it is natural to ask whether Poincaré recurrence should allow for a correspondingly stronger formulation when using the stronger assumption of the invariance of the symplectic structure. The work of Schwarz strongly indicates that recurrence of symplectic systems is much stronger than volume-based recurrence. In both problems, moduli spaces play an important role. Indeed, modern symplectic geometry relies heavily on the study of moduli spaces. Usually the moduli spaces in symplectic geometry are very singular and have to be improved through clever perturbation schemes. The type of allowable perturbation scheme usually restricts the amount of recoverable information. Member Dingyu Yang, jointly with Guangbo Xu of Princeton University, made great progress on a longer standing problem in which one needs to recover more information than guaranteed by the usual perturbation schemes. At the heart of their approach lies a more sophisticated approach to perturbations, which might open up the way to the study of more singular objects and the use of other mathematical tools, i.e., perverse sheaves. Member Nate Bottman’s work is concerned with Fukaya categories (an algebraic way to record invariants coming from moduli spaces) and the open question about the functoriality of such constructions. These questions are very difficult and involve analysis, topology, and combinatorics. Member Sara Tukachinsky’s work is concerned with so-called open Gromov-Witten theory, which is much less understood than Gromov-Witten theory. Here research touches on questions concerning what kind of invariants can be constructed and what mathematical/geometrical information they encode.

During April 2018, Hofer was a Research Professor at the Mathematical Science Research Institute, Berkeley, participating in the program “Enumerative Geometry Beyond Numbers.” He gave a series of lectures on polyfold theory, a theory that he has developed with former Members Krzysztof Wysocki and Eduard Zehnder.

Professor Emeritus **Phillip A. Griffiths** continued work on a major mathematical research project relating to Hodge theory and moduli, in collaboration with Mark Green and former IAS Members Colleen Robles and Radu Laza. As Distinguished Scholar at the University of Miami for the winter term, and during a visit to Moscow, Griffiths gave short courses on “What is Complex Analytic Geometry?”

Transforming Postsecondary Education in Mathematics (www.tpsemath.org), a national initiative led by Griffiths and supported this past year by Carnegie Corporation of New York and the National Science Foundation, focused its efforts on rethinking curricular pathways in math for students with varying career goals. A conference in honor of Griffiths’s eightieth birthday was held at the University of Miami in March, where speakers included Edward Witten, Charles Simonyi Professor in the School of Natural Sciences, and a number of former IAS Members.

Other School Activities

The School hosted an Emerging Topics Working Group focused on quantum chaos, in particular recent developments featuring the fractal uncertainty principle, October 9–13, 2017. Quantum chaos studies the behavior of eigenfunctions and waves on manifolds which have chaotic geodesic flows, including the following two questions: 1) on a compact manifold, how do eigenfunctions of the Laplacian concentrate at high frequency (in terms of limiting *semiclassical measures*)? 2) on a noncompact manifold, do high-frequency solutions to the wave equation decay exponentially fast (i.e., is there an *essential spectral gap*)?

An important tool is the *geometric optics approximation*: at high frequencies and for bounded time solutions to the wave equation propagate along geodesics. It is part of a general theory called *microlocal analysis*. One challenge in quantum chaos is to extend geometric optics approximation to large times and use it together with the chaotic nature of the geodesic flow to obtain results on long-time wave dynamics and eigenfunction statistics. For strongly chaotic



THOMAS CLARKE

Member SARA TUKACHINSKY’s work is concerned with open Gromov-Witten theory and questions concerning what kind of invariants can be constructed and what mathematical/geometrical information they encode.

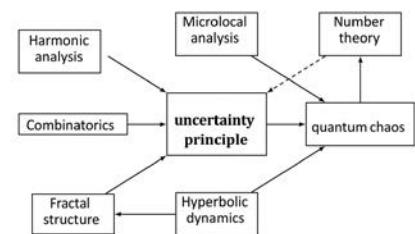
(hyperbolic) systems, the classical trajectories (geodesics) diverge from each other exponentially fast under a small perturbation and geometric optics approximation is valid for time which is logarithmic in frequency.

In 2015, Semyon Dyatlov and Joshua Zahl proposed a new approach to the essential spectral gap question, reducing it to showing a *fractal uncertainty principle* (FUP). Roughly speaking, FUP states that no function can be localized near a fractal set in both position and frequency (Fourier) space. Dyatlov–Zahl proved FUP for sets of dimension close to $\frac{1}{2}$; in 2016, Dyatlov and Long Jin proved FUP for a class of Cantor sets.

At the end of 2016, **Jean Bourgain**, IBM von Neumann Professor, and Dyatlov proved a general FUP, holding for any porous subset of the real line. This result has already seen several important applications to quantum chaos. In particular, together with the work of Dyatlov–Zahl (or a recent much shorter version by Dyatlov and Maciej Zworski), it implies that every convex co-compact hyperbolic surface has an essential spectral gap. In 2017, Dyatlov and Jin used the general FUP to show that every semiclassical measure on a compact hyperbolic surface has full support; in particular, eigenfunctions of the Laplacian are bounded below (independently of the eigenvalue) on any nonempty open set. Also in 2017, Bourgain and Dyatlov proved Fourier

decay for hyperbolic limit sets, which in particular gave a stronger version of FUP for sets of dimension $\leq \frac{1}{2}$.

The FUP approach goes beyond the time for which geometric optics approximation is valid, and proofs of FUP have relied on harmonic analysis, fractal geometry, and combinatorics, bringing new techniques to quantum chaos. There is also hope to use number theory to show stronger versions of FUP in special cases; moreover, some results in quantum chaos (specifically spectral gaps for arithmetic surfaces) have applications to diophantine problems in number theory. The relation of these fields in context of FUP can be described by the following diagram:



The goal of the workshop was to bring together experts from these fields to better understand the different parts of the above diagram and work on several open problems.

The workshop was organized by Jean Bourgain (IAS) and Semyon Dyatlov (Massachusetts Institute of Technology/University of California, Berkeley/Clay Mathematics Institute). The participants were Alexis Drouot (Columbia

University); Alex Gamburd (The Graduate Center, City University of New York); Long Jin (Purdue University); Alex Kontorovich (Rutgers University/IAS); Elon Lindenstrauss (The Hebrew University of Jerusalem); Alexandr Logunov (IAS); Michael Magee (Durham University); Frédéric Naud (Université d'Avignon); Stéphane Nonnenmacher (Université Paris-Sud); Professor **Peter Sarnak** (IAS); Mikhail Sodin (Tel Aviv University); Ruixiang Zhang (IAS); and Steve Zelditch (Northwestern University).

The first day of the workshop consisted of two colloquium style lectures: an introduction to quantum chaos (Nonnenmacher) and an overview of applications of FUP (Dyatlov). The next several days had two or three lectures each: on FUP and its applications (Dyatlov, Jin, Zhang), Dolgopyat's method (Naud), geometry of limit sets (Magee), long-time wave propagation (Nonnenmacher), and the sum-product theorem (Lindenstrauss). These talks were open to the general public and most of them are available as video lectures on the IAS website. There were several informal presentations, including FUP for Cantor sets (Dyatlov), the Beurling–Malliavin theorem (Sodin), and quantum cat map (Nonnenmacher), as well as many open-format discussions.

This workshop was a rare occasion when experts from several different fields could meet and exchange knowledge. For instance, experts on harmonic

analysis, combinatorics, and number theory learned about the microlocal techniques used in the passage from FUP to results in quantum chaos. At the same time, experts in microlocal analysis and quantum chaos learned about the tools from harmonic analysis and combinatorics that are used in the proof of FUP.

Many open problems were discussed. One for which progress seems most likely is adapting recent results (which were in the setting of hyperbolic surfaces) to more general surfaces with hyperbolic geodesic flows. One of the main issues in this setting is that the stable/unstable foliations are not smooth. It appears that some of the proofs in the paper of Bourgain–Dyatlov can be revisited and combined with hyperbolic parametrix to yield an FUP adapted to such nonsmooth foliations. This would yield statements that only need hyperbolic dynamics of the geodesic flow, not relying on constant curvature.

Another Emerging Topics Working Group was held April 9–13, 2018, on geometric and variational methods in the Arnold diffusion problem, and related topics.

The Arnold diffusion problem is concerned with the phenomena of global instability in nearly integrable Hamiltonian systems. It originated with a conjecture by Vladimir Arnold in 1964, that “generic” integrable systems subjected to arbitrarily small, “generic” perturbations, have “diffusing orbits” that travel some distance independent of the size of the perturbation. A related problem, posed

by Boris Chirikov in 1979, is concerned with describing the stochastic process exhibited by diffusing orbits. A fundamental role in pursuing Arnold's conjecture, and in providing many ideas and inspiration, was played by former Member John Mather.

The last several years have witnessed significant progress on the Arnold diffusion problem, and the emergence of new geometric approaches, as well as approaches at the confluence of geometric and variational methods.

This workshop was focused on a particular combination of such techniques. A first focal point was on the methods based on normally hyperbolic invariant manifolds, scattering maps, and shadowing lemmas that were developed in works by Amadeu Delshams, former Members Marian Gidea and Rafael de la Llave, and Tere Seara, in order to prove diffusion in the so-called “a priori unstable” case of the Arnold diffusion problem. A second focal point was on a method to obtain diffusing orbits by combining classical hyperbolic methods with Mather's theory, developed in works by Patrick Bernard, and former Members Vadim Kaloshin and Ke Zhang, in the “a priori stable” case, for two-and-a-half degrees of freedom Hamiltonian systems. A third focal point was on the construction of compact invariant cylinders with boundary, located near simple or double resonances, and the construction of diffusing orbits along these cylinders, by intertwining scattering dynamics and

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THE INSTITUTE FOR ADVANCED STUDY was deeply saddened by the passing of Vladimir Voevodsky, Professor in the School of Mathematics, at age 51 on September 30, 2017.

Voevodsky was a truly extraordinary and original mathematician who made remarkable advances in algebraic geometry, and whose most recent work concerned rewriting the foundations of mathematics to make them suitable for computer proof verification. Born in Moscow on June 4, 1966, Voevodsky was awarded the Fields Medal in 2002 at age thirty-six, shortly after his appointment as Professor in the School of Mathematics. He had spent the prior three years (1998–2001) as a Long-term Member.

“Vladimir had the courage to think about the hardest and most fundamental problems in mathematics,” said Richard Taylor, Robert and Luisa Fernholz Professor in the School of Mathematics. “He would look for the right conceptualization, in the belief that then the difficulties would become surmountable. Very few mathematicians have succeeded in pulling off such an approach, but Vladimir succeeded magnificently, particularly in his construction of the derived category of mixed motives and his use of it to prove the Milnor and Bloch–Kato conjectures in K-theory.”



ANDREA KANE

twist dynamics, developed by Jean-Pierre Marco and Gidea, in the “a priori stable” case, for three-degrees-of-freedom Hamiltonian systems. All these advances were discussed at the workshop, which contributed to a better understanding of the different components of these works.

Another topic that was actively discussed is an approach of proving stochastic Arnold diffusion, developed by Marcel Guardia, Kaloshin, and Zhang, for certain classes of a priori unstable systems. This approach not only provides existence of diffusing orbits, but also shows that in a certain time scale small fluctuations accumulate to a stochastic diffusion process. This gives a partial justification for the name of the phenomenon: Arnold diffusion. Stochastic Arnold diffusion also is being investigated by Gidea and Maciej Capinski, in the context of the planar elliptic restricted three-body problem, through a computer-assisted proof.

The methods mentioned above are of interest not only for the purpose of overcoming the Arnold diffusion problem, but also from the point of view of applications. Indeed, one informal way to describe this problem is that “small perturbations can accumulate to large effects.” The range of applications include space mission design—when one would like to exploit instability to produce efficient trajectories—and the dynamics in particle accelerators and plasma confinement—when one would like to prevent instability to disintegrate the system.

The workshop was organized by Vadim Kaloshin (University of Maryland) and Marian Gidea (Yeshiva University). The participants were Marie-Claude Arnaud (Université d’Avignon); Abed Bounemoura (CNRS and CERE-MADE, Université Paris-Dauphine); Amadeu Delshams (Universitat Politècnica de Catalunya); Jaques Féjoz (Université Paris-Dauphine and Observatoire de Paris); Marcel Guardia (Universitat Politècnica de Catalunya); Rafael de la Llave (Georgia Institute of Technology); Jean-Pierre Marco (University Pierre and Marie Curie); Tere Seara (Universitat Politècnica de Catalunya); Ke Zhang (University of Toronto); Professor Emeritus **Thomas Spencer** (IAS);



DAN KOMODA

AVI WIGDERSON, Herbert H. Maass Professor, gives an After Hours talk on artificial intelligence.

Lai-Sang Young (Courant Institute of Mathematical Sciences); Javier Gómez Serrano (Princeton University); Edward Belbruno (Princeton University and Yeshiva University); and Pablo Roldan (Yeshiva University).

There were three colloquium-style lectures, on the state of the art on the Arnold Diffusion problem, as well as on future directions, by Marco, de la Llave, and Zhang. Also, there were five seminar-style lectures focused on specific techniques, applications, and related topics, by Delshams, Seara, Gidea, Guardia, and Arnaud. All talks were open to the general public and are available as video lectures on the IAS website. Ample time was devoted to collaborative work, on pursuing ongoing projects, as well as on launching new research ideas.

The workshop can be viewed as a first step towards making connections between several works, and building new bridges between various approaches. The participants also started to look at several new problems, in which they anticipate to make advancements. Some specific research directions include:

- Existence of diffusion in the case when the unperturbed Hamiltonian is not convex;

- Describing the stochastic process underlying Arnold diffusion, in general systems as well as in concrete examples (e.g., from celestial mechanics);

- Robust transitivity in large classes of nearly integrable Hamiltonian systems;

- Existence of diffusion in system with weak dissipation.

It is anticipated that many of the research problems started at the IAS will be continued during the Mathematical Sciences Research Institute program on “Hamiltonian Systems, From Topology to Applications through Analysis,” to be held in fall 2018, which will be attended by many of the workshop participants. They also plan to write a joint paper that surveys the state of the art of the Arnold diffusion problem through the lens of geometric-variational approaches, providing a clear picture on what has been done so far, and what needs further work.

A three-year program in Theoretical Machine Learning began in fall 2017, led by Visiting Professor Sanjeev Arora and supported by a \$2 million grant from Eric and Wendy Schmidt. A natural extension of existing activities in the Computer Science and Discrete Mathematics group headed by **Avi Wigderson**, Herbert H. Maass Professor, the program aims to establish a theoretical understanding of machine learning and fundamental principles related to how algorithms behave in machines, how they learn, and why they are able to make desired predictions and decisions. Activities in 2017–18 included three public lectures: “Machines: How Do They Learn and Where Are They Headed?” by Arora and Richard Zemel, Visitor in the School and a Professor of Computer Science at the University of Toronto, on October 27, 2017; “Deep Learning and Cognition” by Christopher Manning, Thomas M. Siebel Professor in

Machine Learning and Professor of Linguistics and of Computer Science at Stanford University, on November 15, 2017; and “How Could Machines Learn as Efficiently as Animals and Humans?” by Yann LeCun, Director of Facebook AI Research and Silver Professor of Computer Science at New York University, on December 12, 2017.

The School held additional lecture series in 2017–18. Sergiu Klainerman of Princeton University gave the Hermann Weyl Survey Lectures “On the Mathematical Theory of Black Holes,” October 16–18, 2017. Former Member Oded Regev of New York University gave the Ruth and Irving Adler Expository Lecture on “Lattices: From Geometry to Cryptography,” November 29, 2017. Former Member Simon Donaldson of the Simons Center for Geometry and Physics at Stony Brook University gave the Marston Morse Lecture Series on “Exceptional Holonomy and Related Geometric Structures,” April 3–6, 2018.

The School also hosted a workshop on Optimization, Complexity, and Invariant Theory. This workshop, held June 4–8, 2018, explored connections between complexity and optimization with algebra and analysis, which have emerged from the works on operator scaling. Topics included optimization, invariant theory, computational complexity, and quantum information theory. The speakers were Peter



DAN KONODA

The Theoretical Machine Learning Lecture Series, organized by IAS Visiting Professor Sanjeev Arora, included talks by Arora and Visitor Richard Zemel on “Machines: How Do They Learn and Where Are They Headed?”; Yann LeCun (pictured above), Facebook’s Chief Artificial Intelligence Scientist and Founder of the Facebook AI Research lab, on “How Could Machines Learn as Efficiently as Animals and Humans?”; and Christopher Manning, Thomas M. Siebel Professor in Machine Learning and Professor of Linguistics and of Computer Science at Stanford University, on “Deep Learning and Cognition.”

Buergisser (Technical University of Berlin); Matthias Christandl (University of Copenhagen); Harm Derksen (University of Michigan); Ankit Garg (Microsoft Research New England); Leonid Gurvits (The City College of New York); Gábor Ivanyos (Institute for Computer Science and Control, Hungarian Academy of Sciences); Lap Chi Lau (University of Waterloo); James R. Lee (University of Washington); Yuanzhi Li (Princeton University); Visu Makam (University of Michigan); Roy Meshulam (Technion–Israel Institute of Technology); Ketan D. Mulmuley (The University of Chicago); Rafael Oliveira (University of Toronto);

K. V. Subrahmanyam (Chennai Mathematical Institute); Nisheeth Vishnoi (Ecole Polytechnique Fédérale de Lausanne); Michael Walter (University of Amsterdam); and Herbert H. Maass Professor Avi Wigderson (IAS).

The School continued its Summer Collaborators program, with the Faculty selecting small groups of mathematicians (between two and five people) who could benefit from IAS resources to further their collaborative research projects. Six groups were invited to visit IAS at various periods of two to four weeks throughout the summer, receiving travel funds, per diem, local housing, office space, and access to campus resources.

2017–18 MEMBERS AND VISITORS

f First Term ♦ *s* Second Term ♦ *v* Visitor ♦ *vp* Visiting Professor ♦ *dvp* Distinguished Visiting Professor ♦ *vf* Veblen Fellow ♦ *vri* Veblen Research Instructorship ♦ *vnf* von Neumann Fellowship ♦ *j* Joint Member School of Natural Sciences

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Funding provided by the National Science Foundation

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Funding provided by Eric and Wendy Schmidt

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Theoretical Machine Learning + Institute for Advanced Study
Funding provided by Eric and Wendy Schmidt

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Funding provided by the National Science Foundation

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Funding provided by the National Science Foundation

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Computing Open Gromov–Witten Theory ♦ Institute for Advanced Study
Funding provided by the National Science Foundation

Behnam Neyshabur

Optimization, Generalization in Deep Learning ♦ Institute for Advanced Study
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Funding provided by the Charles Simonyi Endowment

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Funding provided by the Charles Simonyi Endowment and the National Science Foundation

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Funding provided by the National Science Foundation

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Funding provided by the Charles Simonyi Endowment

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Funding provided by the National Science Foundation

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Funding provided by the Charles Simonyi Endowment

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Helen Wong

Quantum Topology, Applications of Topology ♦ Carleton College ♦ *vnf*
Funding provided by The Ambrose Monell Foundation and the National Science Foundation

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Funding provided by the National Science Foundation

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Funding provided by the National Science Foundation

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Harmonic Analysis on Euclidean Spaces, General Locally Symmetric Spaces ♦ Institute for Advanced Study
Funding provided by the National Science Foundation and the James D. Wolfensohn Fund

Rong Zhou

Geometry of Shimura Varieties ♦ Institute for Advanced Study
Funding provided by the National Science Foundation

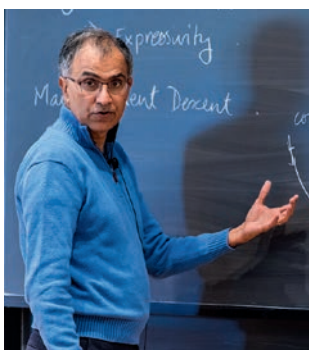
Michal Zydor

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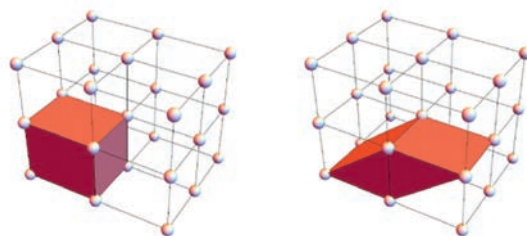
SANJEEV ARORA ON ESTABLISHING A THEORETICAL UNDERSTANDING OF MACHINE LEARNING

“It’s kind of like physics in its formative stages—Newton asking what makes the apple fall down,” says Sanjeev Arora, Visiting Professor in the School of Mathematics, trying to explain the current scientific excitement about machine learning. “Thousands of years went by before science realized it was even a question worth asking. An analogous question in machine learning is ‘What makes a bunch of pixels a picture of a pedestrian?’ Machines are approaching human capabilities in such tasks, but we lack basic mathematical understanding of how and why they work.”

The core idea of machine learning, according to Arora, involves training a machine to search for patterns in data and improve from experience and interaction. This is very analogous to classic curve-fitting, a mathematical technique known for centuries. Training involves algorithms, the theoretical foundations of which are of great interest in mathematics. Read more about the three-year program in theoretical machine learning that Arora has been leading since 2017, supported by a \$2 million grant from Eric and Wendy Schmidt, at www.ias.edu/arora-machine-learning.



DAN KOMODA



AKSHAY VENKATESH ON THE TOPOLOGY OF LOCALLY SYMMETRIC SPACES

In 2017–18, I led a special program about analysis and topology on locally symmetric spaces as a Distinguished Visiting Professor in the School of Mathematics. Locally symmetric spaces are the home of the Langlands program—a set of overarching and interconnected conjectures connecting representation theory to number theory, first proposed in 1967 by Robert Langlands, now Professor Emeritus in the School of Mathematics. These spaces have become a crossroads for many different strands of mathematical thought, and the special program placed particular focus on two of these areas: *analysis* on locally symmetric spaces and *topology* of locally symmetric spaces. The program was broad and represented several parallel intellectual directions. For coherence, I will focus on just one theme, which suggests that the relationship between the topology of locally symmetric spaces and the arithmetic of algebraic varieties is much richer than expected. Read more at www.ias.edu/venkatesh-locally-symmetric-spaces.



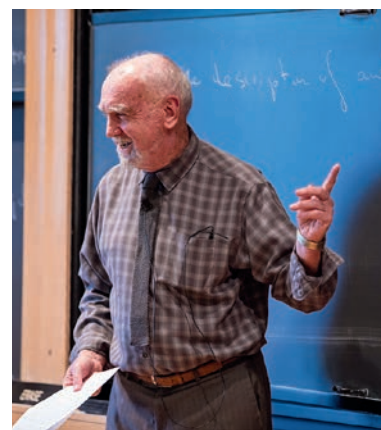
CLIFF MOORE

ROBBERT DIJKGRAAF ON ABEL LAUREATE ROBERT LANGLANDS

Robert Langlands was celebrated in Oslo and around the world on May 22, 2018, when H.M. King Harald V presented the 81-year-old mathematician with this year’s Abel Prize, awarded by the Norwegian Academy of Science and Letters and known as the Nobel Prize in mathematics.

Langlands, who works in Einstein’s former office, has been a Professor at the Institute for Advanced Study for more than forty-five years. He discovered in the late 1960s a deep connection between two completely different parts of mathematics: on the one hand, numbers and their relations, on the other hand, geometrical patterns and their symmetries. You could say that he discovered an Escher print in arithmetic.

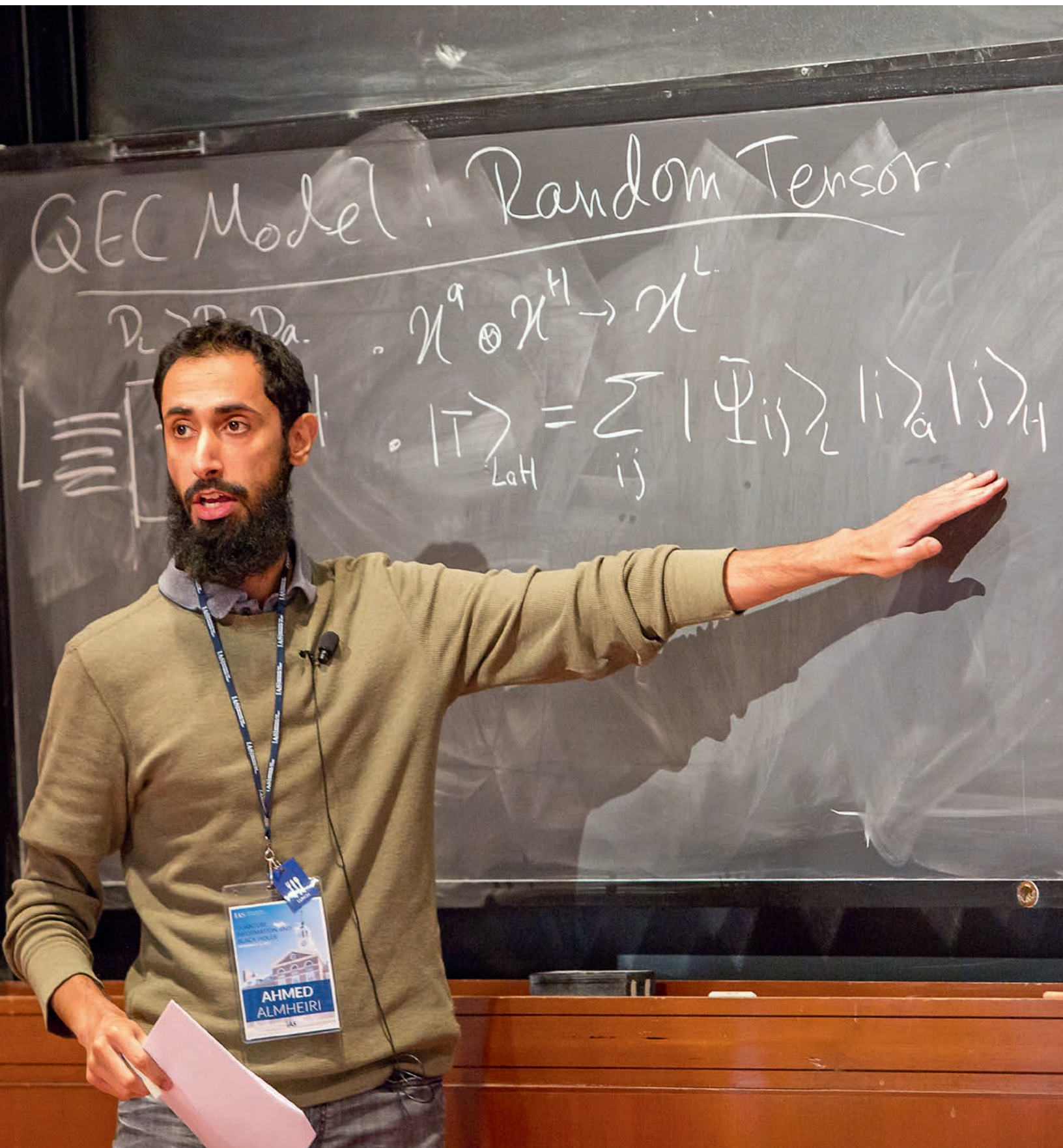
It is difficult to convey the enormous impact of his revolutionary idea. Langlands showed how the same formula can originate from two entirely different worlds of thought. To employ another metaphor: it is as if two chefs cooking with two entirely different recipes, ingredients, and methods of preparation, produce exactly the same dish. Read more at www.ias.edu/dijkgraaf-rosetta-stone.



DAN KOMODA

REMEMBERING VLADIMIR VOEVODSKY

On Sunday, October 8, 2017, IAS hosted a gathering in remembrance of Professor Vladimir Voevodsky. Friends, family, and the Institute community convened to celebrate the mathematician’s life and legacy. Watch Voevodsky’s collaborators and friends give remarks at www.ias.edu/remembering-vladimir-voevodsky.



QEC Model: Random Tensor

$D_L > D_R$

- $X^a \otimes X^H \rightarrow X^L$

- $|T\rangle_{LaH} = \sum_{ij} |\Psi_{ij}\rangle_L |i\rangle_a |j\rangle_H$

Member AHMED ALMHEIRI, seen here speaking on “Quantum Error Correction and the Black Hole Interior,” studies the connections between quantum information theory, quantum field theory, and quantum gravity.



School of Natural Sciences

The School of Natural Sciences, established in 1966, supports research in broad areas of astrophysics, systems biology, and theoretical physics. Areas of current interest include investigating the origin and composition of the universe; conducting research at the interface of molecular biology and the physical sciences; and elementary particle physics, string theory, quantum theory, and quantum gravity.

EACH YEAR THE SCHOOL OF NATURAL SCIENCES appoints about fifty Members, the majority of them postdoctoral fellows, who are typically at the Institute for three years, some for up to five years. Collaboration is encouraged among Members who work in the School's many scientific areas—from molecular biology to mathematical physics.

From its earliest days, the Institute has been a leading center for fundamental physics, contributing substantially to many of its central themes, which now interrelate with astrophysics and biology. Areas of current interest in theoretical physics include elementary particle physics, string theory, quantum theory, and quantum gravity, and their relationship to geometry, theoretical and observational astrophysics, and cosmology.

Research in the School's astrophysics group encompasses astronomical systems from nearby planets to distant galaxies, from black holes to the dark matter and dark energy that dominate the evolution of the universe. There is a growing cross-fertilization between astrophysics and elementary particle physics, and the work of many Members and Faculty is at the boundary between these two disciplines. Members in the astrophysics research group employ an array of tools from theoretical physics, large-scale computer simulations, and ground- and space-based observational studies to investigate the origin and composition of the universe, and to use the universe as a laboratory to study fundamental physics. At the Simons Center for Systems Biology, the tools of modern physics and mathematics are being applied to biological investigation, on varying scales, from molecular to organismic, and in some cases focusing on understanding disease processes.

The School's collaborative and pioneering approach to the sciences, which extends to the Institute's School of Mathematics, Princeton University, and the larger scientific community, continues to transform research in these fields and to open opportunities for powerful and important discoveries.

FACULTY

Nima Arkani-Hamed

Stanislas Leibler

Juan Maldacena

Carl P. Feinberg Professor

Nathan Seiberg

Scott Tremaine

Richard Black Professor

Edward Witten

Charles Simonyi Professor

Matias Zaldarriaga

PROFESSORS EMERITI

Stephen L. Adler

Freeman J. Dyson

Peter Goddard

Peter Goldreich

Arnold J. Levine

Astrophysics

Statistical mechanics was developed in the nineteenth century by Maxwell, Boltzmann, and others, and has been widely applied to describe the behavior of systems such as gases and fluids. Applying these methods to systems with weak long-range forces, such as ionized plasmas or stellar systems—where the dominant forces are electromagnetic or gravitational—has proved to be much more difficult. Over the past year, a group of researchers at IAS including Richard Black Professor **Scott Tremaine**, Member Jihad Touma, and Members Ben Bar-Or and Jean-Baptiste Fouvy, has focused on this problem. Their results include a general formulation of the diffusion equation in stellar systems that generalizes and illuminates the classical Landau and Balescu–Lenard approaches and the first direct determination of the diffusion coefficients for resonant relaxation. They have also determined the diffusion coefficients in a dark-matter halo composed of hypothetical axion-like particles having macroscopic de Broglie wavelengths (“fuzzy dark matter”), and have demonstrated that stellar systems surrounding massive black holes can exhibit first-order and continuous phase transitions between a disordered or spherical configuration and an ordered configuration in which the long axes of the stellar orbits are aligned. Their results suggest a much richer variety of dynamical behavior than has so far been expected in the dense star clusters found at the centers of most galaxies.

The needle on a compass points north because the Earth has a magnetic field. Our Milky Way galaxy also has a magnetic field that permeates interstellar space, although it is only a few parts per million as strong as the Earth’s. The structure and origin of the galactic magnetic field are poorly understood. However, interstellar space is also full of dust, and these dust grains, like so many tiny compass needles, align with the ambient magnetic field, and emit polarized radiation that encodes the local magnetic field orientation. Member Susan Clark is using this polarized dust emission, among other data, to investigate the magnetic properties

of interstellar space. Clark is also pioneering new ways to observe the magnetic field through its influence on interstellar gas. Using observations of emission from atomic hydrogen gas, Clark recently discovered that the structure of this gas encodes the degree to which the magnetic field is “tangled,” or disordered, along the line of sight. This work is not only a new way to study the galactic magnetic field, but also a novel tool for separating galactic polarization from polarization in the residual radiation from the Big Bang. Clark is building new maps of the galactic polarization field, clearing the way for new discoveries in the polarization of the universe’s oldest light.

Maureen and John Hendricks Visiting Professor **Rashid Sunyaev** continues his part-time position as Chief Scientist of the Space Research Institute of the Russian Academy of Sciences. In this capacity his main focus is the “Spectrum-Roentgen-Gamma” (SRG) spacecraft, a joint project of Germany and Russia that is scheduled to be launched in spring 2019 from Baikonur in Kazakhstan. The spacecraft is equipped with German and Russian x-ray telescopes, called eROSITA and ART-XC, and will conduct a four-year survey that is expected to discover more than three million supermassive black holes in active galactic nuclei, and all massive clusters of galaxies in the observable universe. Sunyaev will lead the scientific analysis and operation planning for the Russian share of the survey data.

Since the first direct detection of gravitational waves by the Laser Interferometer Gravitational-Wave Observatory (LIGO) in late 2015, the astrophysics related to gravitational wave sources has occupied many of the Members at IAS. In 2018, LIGO observed the first binary neutron



ANDREA KANE

Research by Richard Black Professor **SCOTT TREMAINE** (right), seen here with an astrophysics workshop participant, and colleagues suggests a much richer variety of dynamical behavior than has so far been expected in the dense star clusters found at the centers of most galaxies.

star merger (GW170817), which was followed up by an extensive campaign of electromagnetic observations to elucidate the properties of the subsequent explosion.

During the past year, Professor **Matias Zaldarriaga** and Javier Roulet derived properties of the populations of binary black holes that can be inferred from the merger events LIGO has collected so far. Members Barack Zackay, Liang Dai, and Tejaswi Venumadhav Nerella introduced a new and vastly more efficient way to infer the parameters of merging neutron star and black hole sources from gravitational wave data and applied it to GW170817. Dai and Member David Radice used the combination of electromagnetic observations and gravitational waves measured for GW170817 together with data from numerical simulations to put the best constraints on the tidal deformability of neutron stars to date. Radice used state-of-the-art numerical relativity simulations to systematically study the expectations for the mass ejection, electromagnetic counterparts, and nucleosynthesis expected in a binary neutron star merger.

LIGO is about to start its third season of observations and many new events are expected in the coming years.

Systems Biology

Using theoretical approaches originating in physics, Professor **Stanislas Leibler** and Members working at the Simons Center



ALL PHOTOS DAN KOMODA

Left: Hubble Fellow SUSAN CLARK (right), seen here with Bezos Member MARCEL SCHMITTFULL (left), has been using polarized dust emission, among other data, to investigate the magnetic properties of interstellar space and pioneering new ways to observe the galactic magnetic field through its influence on interstellar gas. *Right:* Professor MATIAS ZALDARRIAGA speaks on gravitational waves from colliding neutron stars and light from heavy elements.

for Systems Biology are looking for general mechanisms that could operate across different length and time scales and across different organizational levels of biological systems.

In cellular systems, interactions that determine the dynamics of protein assembly are neither homogeneous (as in the assembly of simple physical systems such as crystals) nor completely random (as in the assembly of vitreous materials); rather they are specific, with their specificity determined through evolution. Together with Member Pablo Sartori, Leibler continued his work on the so-called “multifarious assembly” of cellular proteins. Using a simple equilibrium model, they found that the constraint of reliable assembly implies that in order for many different protein complexes to coexist, they must have a heterogeneous composition, and use only a small fraction of the proteome. An analysis of publicly available datasets confirmed these predictions. It would be important now to consider the effects of non-equilibrium phenomena present in the cell.

Together with Long-term Member BingKan Xue, Leibler developed a theoretical framework to describe alternative adaptation strategies of populations living in varying environments. This approach is based on environment-to-phenotype mapping, rather than traditionally used genotype-to-phenotype mapping. It manages to bring together different strategies used by organisms living in

different environmental conditions into a single unifying picture.

In the academic year 2017–18, Professor Emeritus **Arnold J. Levine** collaborated with Research Associate Dmitry Krotov, former Member and Visitor Benjamin Greenbaum, and former Janssen Fellow Marta Łuksza to apply algorithms—developed by Krotov and former Visiting Professor John J. Hopfield using dense associative memories for pattern recognition as part of a neural networks project—to genomics and cancer (see “Dense Associative Memory for Pattern Recognition” in *Advances in Neural Information Processing Systems*, 2016). This deep learning collaboration followed work done by Łuksza, Greenbaum, Levine, and others to develop a neoantigen fitness model to predict tumor response to checkpoint blockade immunotherapy (see “A Neoantigen Fitness Model Predicts Tumour Response to Checkpoint Blockade Immunotherapy” in *Nature*, 2017). The immunogenicity of neoantigens, which are peptides presented on the surface of cancer cells, is believed to be associated with the similarity of their sequence and the sequences of common pathogens. In the study with Krotov, neural network-based algorithms were used to extract frequently occurring sequence motifs from the sequences of common pathogens available in the Immune Epitope Database, revealing that neural networks discover known biochemical aspects of

these sequences, such as the preponderance of hydrophobic residues in the second and ninth positions of the 9-mer sequences. Additionally, aspects of the sequences that involve correlations between simultaneous mutations at multiple positions along the 9-mer were discovered. The algorithms make it possible to compress the entire data set of pathogens into a few clusters in such a way that sequences within a cluster are more similar to each other than sequences from different clusters.

Together with former Member Chang Chan, Levine has been studying the genetic modifiers to tumor penetrance in a model of Li-Fraumeni mice with R172H p53 mutation in diverse genetic backgrounds. They have found that genetic background can alter the incidence rate of tumor types such as lymphomas, liposarcomas, and angiosarcomas. They sequenced a number of tumors from these mice models and identified different sets of mutations selected in different tumor types, including loss of heterozygosity (LOH) of the sex imprinted locus IGF2/H19 with loss of maternal chromosomes in osteosarcomas. The most common mechanism for loss of wildtype p53 is through copy neutral LOH, which occurs in almost all sarcomas and half of lymphomas. Although the earliest occurring lymphomas were found in the thymus and were of T-cell origin, the majority of lymphomas were of B-cell origin.



DAN KOMODA

CLAY CORDOVA (right), Marvin L. Goldberger Long-term Member, gives a talk moderated by EDWARD WITTEN (left), Charles Simonyi Professor, on topology and physics at *Ideas 2017–18*. Watch the video at www.ias.edu/cordova-topology-physics.

Theoretical Physics

Much of Professor **Nima Arkani-Hamed**'s work has revolved around the discovery of new mathematical structures in combinatorics and “positive geometry” that appear to have deep connections with the very basic physics governing the interplay of quantum mechanics and spacetime. 2018 saw an extension of these ideas in a number of new directions.

The connection between positive geometry and physics was first seen in the context of the particle scattering processes, where a generalization of polygons and polytopes known as the “amplituhedron” was seen to govern the amplitudes of a close supersymmetric cousin of the theory of strong interactions. While this object was introduced about five years ago, the exploration of its geometric and physical content is still in its infancy. Arkani-Hamed took a new step in this direction by fully characterizing an infinite class of “facets” of the amplituhedron that correspond to a canonical set of so-called “deepest cuts” of the scattering amplitudes, which probe the most complicated Feynman diagrams that contribute to the amplitude. A reformulation of the amplituhedron based on earlier 2017 work, in terms of combinatorial geometry directly in the physical space of particle trajectories, played a crucial role in understanding this geometry and determining the cut,

providing the first non-trivial results on scattering amplitudes valid for arbitrarily many particles and accounting for quantum “loop” effects to all orders of approximation.

Much of the progress in the understanding of scattering amplitudes over the past few decades has been driven by what can be called the “on-shell, bootstrap” philosophy, where amplitudes are determined by their symmetries and singularity properties, rather than by following unitary evolution in spacetime a la Feynman diagrams. It is likely that the deepest application of this philosophy should manifest in a new approach to cosmology, and Arkani-Hamed took a first step in this direction of “cosmological collider physics” together with Maldacena back in 2015. Arkani-Hamed returned to this question more systematically in 2018, giving a complete characterization for the non-trivial “cosmological correlations” associated with the simplest interactions of particles of arbitrary mass and spin coupled during inflation. Conceptually, it is fascinating to see how apparently intrinsically time-dependent phenomena—like particle production during inflation—can be reproduced from purely “boundary” considerations at future infinity, and the results are also useful as physically correct templates for comparing to experimental probes of

cosmological “non-gaussianities” in the coming decades.

Continuing with the theme of cosmology, in fall 2017, Arkani-Hamed extended the connection between “positive geometries” and physics to cosmology with the introduction of “cosmological polytopes,” which are a rough analog of the amplituhedron, for giving a combinatorial/geometric characterization of the wave function of the universe in a class of toy cosmologies with interacting scalar fields. In the last year, Arkani-Hamed used these objects to pose and answer a fascinating question about cosmology. The concepts of Lorentz invariance of local (flat space) physics, and unitarity of time evolution for particle scattering, are famously rigid and robust, admitting no obvious consistent theoretical deformations, and confirmed to incredible accuracy by experiments. But neither of these notions seem to appear directly in describing the spatial correlation functions at future infinity characterizing the observables in cosmology. How then can we see them from a possible *ab-initio* theory for the late-time wave function of the universe? Quite beautifully, the combinatorics and geometry of a particular “scattering facet” of the cosmological polytope straightforwardly leads to the emergence of Lorentz invariance and unitarity for particle scattering.

Finally, 2018 saw the emergence of two new and unexpected appearances of “positive geometries” in the context of effective field theories and conformal field theories. Over a decade ago, Arkani-Hamed pointed out new constraints on low-energy effective field theories, ultimately arising from causality and the positivity of probabilities, which forced certain low-energy interactions to have “positive” amplitudes. Given the surprising appearance of positivity elsewhere in the physics of scattering amplitudes, Arkani-Hamed decided to look again at the old positivity properties from this new perspective. Surprisingly, the old positivity properties turn out to be the tip of a large iceberg, and indeed there is yet another positive geometry—the “EFThe-dron”—that gives an infinite number of non-linear constraints on low-energy amplitudes in any theory, and in particular, for the scattering of electrons, photons, and gravitons in the real world. Finally, these observations about effective field theories strongly suggested looking for a similar hidden positivity in conformal field theories. Indeed, it has long been clear that the wonderful successes of the “conformal bootstrap” program are related to some geometric objects associated with “conformal blocks.” Together with Member Shu-Heng Shao and others, Arkani-Hamed discovered that already the simplest conformal theories enjoy the same hidden total positivity properties as seen in the previous examples. This turns the conformal bootstrap program into a well-defined and quite beautiful combinatorial/geometric problem, making it possible to make a number of new exact statements about conformal field theories.

In the past year, Carl P. Feinberg Professor **Juan Maldacena** has been particularly interested in traversable wormhole configurations. General relativity plus ordinary quantum matter do not allow traversable wormholes leading to travel faster than light. Classical physics does not even allow long traversable wormholes, where it takes longer to go through the wormhole than via the ambient space. However, including quantum effects, one can have such configuration, as Maldacena showed in

a paper with Alexey Milekhin and Fedor Popov, both Princeton University students. The configuration looks similar to a pair of near extremal magnetically charged black holes. But instead of a horizon, they are joined via a traversable wormhole. The solution can exist according to the ordinary physics of the Standard Model when the black holes are very small and very close to each other, at a distance comparable to the ones that the Large Hadron Collider is exploring now. This was based on previous work with Xiaoliang Qi, Junior Visiting Professor at IAS, where similar solutions were shown to exist for simple models of two-dimensional gravity. These solutions arise when interactions between special quantum systems generate the right pattern of entanglement (a subtle form of quantum correlation). These quantum systems are simple enough that they might be produced in a condensed matter physics laboratory in the near future. The low energy physics that emerges, including the spectrum, reflects some symmetries that are also present in the case of geometric wormholes.

All the examples of dualities between quantum mechanical systems and gravity theories that come from string theory involve gauge theories. In the quantum mechanical case, one can imagine relaxing the gauge constraints and ask whether the corresponding theories also have a gravity dual. The conclusion of an investigation with Milekhin shows that they do. Simple non-invariant states correspond to minor deformations near the boundary of the corresponding geometry, but the bulk of the geometry is the same as for the gauge invariant states.

With Clay Cordova, a long-term Member at IAS, as well as with Gustavo J. Turiaci, a Princeton University student, Maldacena described a way to put bounds on the interactions between an operator and two energy momentum tensors. This was done by noticing that such interactions would generate an interference pattern in the energy depositions of a hypothetical collider physics experiment. By demanding that the total energy is positive, one obtains the desired bound.

Professor **Nathan Seiberg** continued his explorations of quantum field theory—a framework combining quantum theory with Einstein’s special theory of relativity. Quantum field theory is important in many branches of physics including particle physics, string theory, condensed matter physics, and cosmology, and it leads to many insights in mathematics. There is no doubt that we are still very far from a clear and complete understanding of it.

Even though our real world has three spatial dimensions, there is enormous interest in studying quantum field theory in other dimensions. The theory in one and two spatial dimensions is important also in the study of wires and thin surfaces, or boundaries of materials in condensed matter physics. It is also important in describing the evolution of strings, which are one-dimensional objects.

In the past year, Seiberg continued his explorations of quantum field theory in two and three spatial dimensions.

With former Member Zohar Komargodski he revisited an old problem of studying the behavior of a theory like that of the strong force, but in two spatial dimensions. They proposed that the long-distance behavior of that theory depends crucially on the number of flavors and colors and also on another integer, a Chern–Simons coupling of the gluons. For some range of these three integers the long-distance behavior had been known for a while. They proposed a specific novel scenario for the other values. Although this was merely a conjecture, it passed a large number of nontrivial consistency checks. Later,

FACULTY & EMERITI HONORS

Freeman Dyson was awarded the Robert Heinlein Memorial Award from the National Space Society.

Juan Maldacena was awarded the Lorentz Medal from the Royal Netherlands Academy of Sciences, and the Albert Einstein Medal from the Albert Einstein Society.

Matias Zaldarriaga was elected a Member of the National Academy of Sciences.



DANI KOMODA

Left to Right: Physicist Johanna Erdmenger, Charles Simonyi Professor EDWARD WITTEN, physicist Beate Heinemann, Carl P. Feinberg Professor JUAN MALDACENA, Professor NIMA ARKANI-HAMED, and physicist Kyle Cranmer

together with Jaume Gomis, they presented related scenarios for other theories, including supersymmetric theories. As with the previous conjectures, these suggested phases satisfy many consistency conditions and resolve many puzzles.

Further insight into these conjectures and new applications of them were considered with former Member Davide Gaiotto and Komargodski. They showed that the suggested phases and the phase transitions between them that had been suggested for theories in two spatial dimensions arise on domain walls and interfaces in three spatial dimensions. This understanding provided a concrete description of the theory on these domain walls and interfaces and gave more evidence for the suggested scenarios.

In order to subject this understanding to further scrutiny, similar theories based on other gauge groups were also analyzed. Specifically, the behavior of variants of the theories based on orthogonal gauge groups were analyzed with Long-term Member Clay Cordova and Po-Shen Hsin. These theories presented new subtleties and their understanding had surprising consequences. Among them are new peculiar properties of time-reversal symmetry in two spatial dimensions. It turned out that these peculiar properties are ubiquitous and occur in many examples.

This set of papers raised a number of interesting questions. One of them was

a puzzle about the allowed values of the parameters of a popular theory in two spatial dimensions (the $O(3)$ sigma model). Former Member Daniel Freed, Komargodski, and Seiberg clarified that the model is consistent only for certain values of these parameters, thus resolving many confusions.

Finally, Seiberg, along with former Members Yuji Tachikawa and Kazuya Yonekura, considered an anomaly in the action of duality. Such an anomaly had been studied earlier by Professor Edward Witten. The new understanding related several distinct anomalies and allowed the authors to resolve an apparent discrepancy between previous analyses of the space of super-conformal field theories.

In 2017–18, Charles Simonyi Professor **Edward Witten** made several new observations about “anomalies” in quantum field theory. Anomalies were discovered by Stephen Adler and others around 1970 and play an important role in the transition from classical to quantum physics. With Xiao-Gang Wen and Member Juven Wang, Witten discovered a new “global” anomaly in $SU(2)$ gauge theory, and more recently reinterpreted in terms of anomalies a construction originally due to Ashoke Sen of non-supersymmetric D-branes in string theory.

With Kevin Costello and Masahito Yamazaki, Witten continued his work

on the relation between “integrability”—roughly, the ability to actually solve the equations governing a many-body system—and gauge theory. This relationship, introduced by Costello a few years ago generalizes in an unexpected way the relationship between knot theory, conformal field theory, and Chern–Simons gauge theory that Witten discovered thirty years ago.

Because of a variety of old and new results on entropy in black hole theory, quantum field theory, and holography, there has been much interest in recent years in computing entanglement entropy in string theory. However, for technical reasons, few computations have been available. Witten recently showed how a version of the “replica trick” can be used to compute entanglement entropy in open string theory.

With IAS Director and Leon Levy Professor Robbert Dijkgraaf, Witten wrote a paper interpreting in physical language several constructions related to two-dimensional gravity that were discovered by mathematicians in recent years. This article included a tribute to the work of the brilliant Iranian mathematician and Fields Medalist, Maryam Mirzakhani, former Member in the School of Mathematics.

In 2018, Witten lectured at the summer program Prospects in Theoretical Physics at IAS. His lectures have been published online (www.ias.edu/witten-pitp-2018) to provide accessible introductions to a number of topics including quantum information theory and black hole theory.

Professor Emeritus **Stephen L. Adler** continued activities in three areas of research interest: particle physics, gravitation, and quantum foundations. In the latter, he calculated the rate of bulk heating through coupling to phonons induced by the noise postulated in state vector reduction models, showing that a frequency cutoff in the noise power spectrum can lead to a sharply reduced heating rate. This calculation became the appendix in a paper that Adler coauthored with the low temperature experimental physicist Andrea Vinante, which reconciled various bounds on the

noise coupling with the preliminary detection of a noise signal in a cantilever experiment, and which suggested new bulk heating experiments to place improved bounds.

In particle physics, Adler continued a detailed study of the possibility of using gauged Rarita–Schwinger spin-3/2 fields as ingredients in grand unification theories. In a collaboration with Marc Henneaux and Pablo Pais, he showed that the fully gauge invariant extension of the usual spin-3/2 theory that he introduced in earlier work still has problems, which are shifted from the sector containing the original fields to the auxiliary field sector introduced in the extension. In a later paper, Adler studied a model containing a spin-3/2 fermion field directly coupled to a spin-1/2 field, in a manner motivated by the $SU(8)$ theory that he has been interested in for several years. This model eliminates the weak field singularity found in the usual gauged spin-3/2 theory, and permits calculation of the perturbation theory triangle anomaly.

In current work, Adler is analyzing the free field structure of the coupled model in detail, as a preliminary to an exploration of whether the model when gauged can spontaneously break chiral symmetry and generate a mass for the spin-3/2 field. Adler made an extended winter trip to Korea, China, and Singapore at which he gave talks on the three research areas in which he is active, including a colloquium on collapse models, and a review of the status of gauging Rarita–Schwinger fields at the Julian Schwinger Centennial Conference in Singapore.

During the year 2017–18, Professor Emeritus **Freeman Dyson** surveyed the literature concerning biological evolution. Dyson's interest in this subject began long ago, through personal contacts with biologists Motoo Kimura and Ursula Goodenough, who were regarded as heretics by the community of orthodox biologists because their ideas about speciation go counter to conventional wisdom. The result of this survey may or may not be a publishable review article.

The main subject of the inquiry is the beetle paradox, originally formulated

by Charles Darwin. Darwin asked the question, why did the Creator have such an inordinate fondness for beetles? Darwin understood that there is a mismatch between the real world, with its amazing richness of diverse species—many of them obviously burdened with superfluous flowers and feathers—and the theoretical world of Darwinian evolution, in which only the fittest should

survive. Naively, we should expect Darwinian evolution to result in a world with a much smaller number of species, each selected by superior fitness to be a winner in the game of survival. All through his life, Darwin was puzzled by the abundance of weird and wonderful species that look like losers but still survive.

A key to the beetle paradox was provided by Motoo Kimura with his neutral theory of evolution. While Darwin knew nothing of the work of Mendel, Kimura knew from Mendel that inheritance is transmitted in discrete units that Mendel called genes. Kimura worked out the mathematics of speciation in large and small populations. In large populations, inheritance is effectively continuous, and speciation is dominated by Darwinian selection. In small populations, inheritance is effectively discrete, and speciation is dominated by random jumps without selection. In the world of nature, small, genetically isolated populations provide the most favorable environment for formation and extinction of species. That is why we see a high abundance of diverse species in nature. At the ragged edges of small populations, where random jumps prevail, speciation is driven by Kimura's neutral theory. Of course, Darwin's theory is still true away from the edges, where selection has time to operate on big populations.

A third participant in this debate is Ursula Goodenough, who discovered that, in a large sample of sexually



Professor Emeritus FREEMAN DYSON reads from *Maker of Patterns* during a celebration of his book in April. Watch Dyson read several of his personal letters, written to his family about major advances in twentieth-century science, followed by a discussion with Institute Director and Leon Levy Professor Robbert Dijkgraaf, at www.ias.edu/dyson-maker-patterns.

DAN KOMODA

reproducing species, the genes concerned with mating systems mutate more rapidly than other genes. The faster mutation of mating systems causes speciation to be more rapid. At the cost of lower fertility for individuals, Nature increases the probability of rare events in which matched pairs of Adam-and-Eve mutants become the progenitors of new species. This unexpected discovery by Goodenough enhances the effect of the Kimura neutral theory, further accelerating speciation and enriching the natural ecology.

Dyson's purpose in surveying the literature concerning evolution is to find out how much of it is fact and how much is fantasy.

Dyson's other main activity this year was the compilation of a book, *Maker of Patterns* (Liveright, 2018). The book consists of personal letters written by Dyson to his parents and sister from 1941 to 1978, describing events weekly as they appeared at the time, with annotations and comments added later to explain the context. The letters are history without hindsight. They are a record of Dyson's personal life, the community of scientists in which he was immersed, and the public affairs that he witnessed, undistorted by later memory and interpretation. The title, *Maker of Patterns*, is borrowed from G. H. Hardy—Dyson's friend and teacher at Cambridge University—who in *A Mathematician's Apology* used these words to describe his trade.

2017–18 MEMBERS AND VISITORS

f First Term ♦ *s* Second Term ♦ *m* Long-term Member ♦ *v* Visitor ♦ *dvp* Distinguished Visiting Professor ♦ *jvp* Junior Visiting Professor ♦ *ra* Research Associate ♦
j Joint Member School of Mathematics

Ahmed Almheiri

Quantum Field Theory ♦ Institute for Advanced Study

Valentin Assassi

Astrophysics ♦ Institute for Advanced Study
Martin A. and Helen Chooljian Founders' Circle Member

Ben Bar-Or

Astrophysics ♦ Institute for Advanced Study
Schmidt Fellow; supported by Eric and Wendy Schmidt

J. Richard Bond

Astrophysics, Cosmology ♦ Canadian Institute for Theoretical Astrophysics, University of Toronto ♦ *s*
Funding provided by the Raymond and Beverly Sackler Foundation Fund

Horacio Casini

Quantum Field Theory ♦ Centro Atómico Bariloche, Argentina ♦ *v, f*

Susan E. Clark

Astrophysics ♦ Institute for Advanced Study
Space Telescope Science Institute Hubble Fellow

Matthew Coleman

Astrophysics ♦ Institute for Advanced Study
Funding provided by the National Science Foundation and NASA

Clay Cordova

Theoretical Physics ♦ Institute for Advanced Study ♦ *m*
Marvin L. Goldberger Member; additional funding provided by the U.S. Department of Energy

Bartłomiej Stanislaw Czech

Theoretical Physics ♦ Stanford University
Funding provided by the National Science Foundation

Liang Dai

Cosmology ♦ Institute for Advanced Study
NASA Einstein Fellowship Program

Michael Dine

Theoretical Particle Physics ♦ University of California, Santa Cruz ♦ *s*
Funding provided by the National Science Foundation

Jean-Baptiste Fouvy

Astrophysics ♦ Institute for Advanced Study
Space Telescope Science Institute Hubble Fellow

Yvonne Geyer

Particle Physics ♦ Institute for Advanced Study
Roger Dashen Member; additional funding provided by the National Science Foundation

Vera Gluscevic

Cosmology, Astrophysics ♦ Institute for Advanced Study
Schmidt Fellow; supported by Eric and Wendy Schmidt

Alexander Goncharov

Arithmetic Algebraic Geometry, Lie Groups, Representations ♦ Yale University ♦ *j, f*

Guy Gur-Ari

Theoretical Physics ♦ Institute for Advanced Study
Funding provided by the National Science Foundation

Adrian Hamers

Astrophysics ♦ Institute for Advanced Study
The Peter Svennilson Membership

James Colin Hill

Cosmology ♦ Institute for Advanced Study and Columbia University
Friends of the Institute for Advanced Study Member

Anna Karlsson

Theoretical Physics ♦ Institute for Advanced Study
Funding provided by the Swedish Research Council

Alexander A. Kaurov

Astrophysics, Cosmology ♦ Institute for Advanced Study
Schmidt Fellow; supported by Eric and Wendy Schmidt

Shota Komatsu

Quantum Field Theory ♦ Institute for Advanced Study
Funding provided by the U.S. Department of Energy

Dmitry Krotov

Biology ♦ Institute for Advanced Study ♦ *ra*

Paul Langacker

Particle Physics ♦ Institute for Advanced Study ♦ *v*

Doug Lin

Astronomy, Astrophysics ♦ Lick Observatory ♦ *f*
IBM Einstein Fellow

Jennifer Lin

Particle Physics ♦ Institute for Advanced Study
William D. Loughlin Member; additional funding provided by the U.S. Department of Energy

Matthew Low

Particle Physics ♦ Institute for Advanced Study
Funding provided by the U.S. Department of Energy

Raghu Mahajan

Quantum Field Theory ♦ Princeton University ♦ *v*

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Astrophysics ♦ Institute for Advanced Study
Funding provided by the National Science Foundation and NASA

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Funding provided by the National Science Foundation and the Paul Dirac Fund

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Funding provided by the U.S. Department of Energy and the Adler Family Fund

Thomas Rudelius

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Cosmology ♦ Institute for Advanced Study
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Funding provided by the Simons Foundation

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Maureen and John Hendricks Visiting Professor

Yuan-Sen Ting

Cosmology ♦ Institute for Advanced Study and Harvard University
Martin A. and Helen Chooljian Member

Jihad Touma

Applied Mathematics, Astrophysical Dynamics ♦ American University of Beirut ♦ *f*

Ken Van Tilburg

Particle Physics ♦ Institute for Advanced Study
AMLAS Member

Tomer Volansky

Particle Physics ♦ Tel Aviv University
Funding provided by The Ambrose Monell Foundation

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Juven Chun-Fan Wang

Theoretical Physics ♦ Institute for Advanced Study
Funding provided by the Corning Glass Works Foundation Fellowship Fund and the National Science Foundation

BingKan Xue

Biology ♦ Institute for Advanced Study ♦ *m*
Eric and Wendy Schmidt Member in Biology

Ellis Ye Yuan

Theoretical Physics ♦ Institute for Advanced Study
Funding provided by the U.S. Department of Energy

Barak Zackay

Astrophysics ♦ Institute for Advanced Study
Infosys Member



EDWARD WITTEN ON THE NATURE OF REALITY

Among the brilliant theorists cloistered in the quiet woodside campus of the Institute for Advanced Study in Princeton, New Jersey, Edward Witten stands out as a kind of high priest. The sole physicist ever to win

the Fields Medal, mathematics' premier prize, Witten is also known for discovering M-theory, the leading candidate for a unified physical "theory of everything." A genius's genius, Witten is tall and rectangular, with hazy eyes and an air of being only one-quarter tuned in to reality until someone draws him back from more abstract thoughts. Read more of a *Quanta Magazine* interview with Witten by IAS Director's Visitor Natalie Wolchover at www.ias.edu/witten-quanta-physicist.



Ahmed Almheiri signs the Institute Register, a multi-volume collection of signatures from visiting scholars, starting with Albert Einstein in 1933.

AHMED ALMHEIRI ON THE BLACK HOLE FIREWALL PARADOX

The best way to understand something is to first start out confused. The prime example for where there is a lot of confusion is to understand what happens when you add quantum mechanics with gravity in the context of black holes. Stephen Hawking showed that when you do that, you get the information problem. We tried to address that, and we got the firewall paradox. Read more at www.ias.edu/almheiri-firewall-paradox.

JUAN MALDACENA ON BLACK HOLES, QUANTUM INFORMATION, AND SPACETIME

The goal is to understand how quantum information travels through spacetime. In fact, we think that the geometry of spacetime itself is reflecting properties of this quantum information. Ultimately, we want to understand a black hole as a system that obeys the rules of quantum mechanics, and how those rules are consistent with the rules of gravity. They seem to be very different, and there are some paradoxes that haven't been resolved yet. We are trying to understand how the view of black holes as a quantum computer is consistent and compatible with the view of black holes that comes from Einstein's theory of general relativity. Read more at www.ias.edu/maldacena-quantum-info.



MARTA ŁUKSZA ON PREDICTING RESPONSE TO IMMUNOTHERAPY

We attempted to model how the immune system recognizes a tumor and how that affects a tumor's evolution under therapy, in simple mathematical terms. Currently, in limited available datasets, we are able to predict which patients are likely to have a positive outcome to therapy. By capturing the most fundamental properties, we also gain valuable insight into paths for improving current treatments. Read more about the first mathematical model to predict how a cancer patient will respond to immunotherapy developed by former Janssen Fellow Marta Łuksza, former Member Benjamin Greenbaum, Professor Emeritus Arnold Levine, and collaborators at www.ias.edu/simons-immunotherapy-model.



VERA GLUSCEVIC ON DARK MATTER

When I was a graduate student at Caltech, Annika Peter, a senior postdoc at the time, made a descriptive comparison between the universe and a cupcake: "The dough that makes up most of it, that's the dark energy. The icing is dark matter. And the sprinkles on top—that's all the ordinary matter that we know and love." At the Institute, I study the dark matter "icing" that keeps together all the stars and galaxies with its gravity, but does little else—it does not seem to emit or absorb light, nor do its constituents seem to collide much with ordinary particles. Specifically, I design and apply new ways to probe this mysterious substance, using a combination of theoretical and analysis tools, and data from a variety of observations and measurements. Read more at www.ias.edu/gluscevic-dark-matter.



Member CHITRALEKHA DHAMIJA (left) and James D. Wolfensohn Professor DIDIER FASSIN (right) during a discussion of readings on “Decolonizing the Social Sciences,” part of the “The Social Sciences in a Changing World” theme for 2017–18



School of Social Science

Founded in 1973, the School of Social Science is devoted to a multidisciplinary and international approach to the analysis of societies, social change, and social problems. Every year a theme is chosen to provide coherence to the collective work undertaken, although other areas of research are also welcome. For 2017–2018, the theme was “The Social Sciences in a Changing World.” In total, twenty-five members and eleven visitors participated in the activities of the School.

OVER THE PAST CENTURY AND A HALF, social scientists have conducted research on a multiplicity of topics and societies, including the worlds of science and technology, but similar investigation into their own disciplines had been relatively limited until recent years. Indeed, the social studies of science, broadly speaking, have been primarily focused on the natural sciences, be they physical or biological. In the past decade, however, social scientists have begun to examine various aspects of the social sciences, including their politics and practices, their epistemologies and methods, their institutionalization and professionalization, their national development and colonial expansion, their heterogeneous globalization and local contestations, and their public presence and role in society. Strikingly, this trend has been concomitant with a reconfiguration of the landscape in which the social sciences are inscribed, a reshaping of their borders with neighboring fields, and a contestation of some of their foundations. In particular, they have come under increasing pressure from cognitive and evolutionary sciences as well as method-driven and big data approaches, which formulate new claims to understand society, while their funding, political support, and social credibility have been threatened in many countries. It is therefore an interesting and challenging time to engage in what is in fact a “social science of the social sciences.” The examination of the stakes of this reflexive moment was coordinated jointly by **Didier Fassin**, James D. Wolfensohn Professor, and Visiting Professor **George Steinmetz**, Charles Tilly Collegiate Professor of Sociology at the University of Michigan, Ann Arbor.

Are the social sciences one discipline or a fragmented domain of research? Is there a unified universal paradigm or do national specificities exist? Does private or public funding influence their development, or do they remain independent of external determinations? How do they relate with competing approaches to the world, be they scientific or not? What

FACULTY

Didier Fassin

James D. Wolfensohn Professor

PROFESSORS EMERITI

Joan Wallach Scott

Michael Walzer



Left: Deutsche Bank Member NICHOLAS GUILHOT, a historian of political thought, participates in a social science seminar. *Right:* Visitor YVONNE CHIU studies authoritarianism in East Asia, particularly as it relates to censorship, material accumulation, and anomie.

interactions are there between their evolution and the transformations of contemporary societies? Based on the collaboration of an international group of scholars from across the social sciences and humanities, including history, sociology, anthropology, philosophy, economics, political theory, and political science, this ambitious project thus explored a broad variety of topics which have in common to enlighten not only the work of social scientists

FACULTY & EMERITI HONORS

Didier Fassin received the NOMIS Distinguished Scientist 2018 Award, which is presented to exceptional scholars, supporting them in their exploration of unconventional academic paths and therefore inciting new directions in science. He is the first social scientist to be granted this award, which will enable him to develop an international research program titled “Crisis: A Global Inquiry into the Contemporary Moment.”

The University of Edinburgh awarded **Joan Wallach Scott** an Honorary Doctorate of Science in recognition of her distinguished contribution to critical history, gender studies, and academic freedom.

but also, and perhaps even more crucially, the way we understand our societies and the challenges they face. The program was based on discussions of readings as well as invitation of guest speakers. An edited volume gathering the most significant contributions to the theme is in preparation.

Besides his involvement in this program, **Didier Fassin** worked on two books based on two series of lectures, which are being translated into German, Italian, Spanish, and Chinese.

The Tanner Lectures on Human Values gave birth to *The Will to Punish* (Oxford University Press, 2018), including comments by David W. Garland, Rebecca M. McLennan, and Bruce Western. The essay takes for its starting point the contemporary punitive moment, with its unprecedented increase in the carceral population worldwide, but proposes to go beyond it by asking three fundamental questions: What is punishment? Why do we punish? Who gets punished? The definition, justification, and distribution of retribution have been mostly discussed by moral philosophers and legal scholars who have provided normative answers. The social sciences offer a different set of responses by confronting what ought to be with what actually is, based on empirical observations on the police,

the justice system, and the correctional apparatus. This critical approach leads to a radical reformulation of the theory of punishment. Parts of the research were presented at the University of Pennsylvania and at the Conference for the Tenth Anniversary of the Ombudsman for Prisons in the French Senate.

The Adorno Lectures were published as *Life: A Critical User's Manual* (Polity, 2018). The argument is that, whereas the social sciences and humanities have abandoned for more than a century the project to think of life in its dual dimension—that is, the living and the lived, or the biological and the biographical—it is possible and even necessary to combine them. Three analytical tools reinterpreted from philosophical works are proposed to that end: forms of life, ethics of life, and politics of life. In light of ethnographies conducted over more than two decades on three continents on humanitarian programs and law enforcement, asylum seekers and undocumented migrants, AIDS patients and orphans, as well as of historical and sociological sources, the essay unveils the troubling tensions in the way contemporary societies treat human beings. This research was presented as *Lezione Magistralis* at the University of Bologna.

The long-term program on morality

was the object of an extensive presentation in the context of the Henri Janne Chair to which Fassin was appointed at the Free University of Brussels and of a specific discussion of resentment for the inaugural Raphael Lemkin Lecture at Rutgers, the State University of New Jersey. The reflection conducted on the public presence of social science served as the theme of a lecture given at the Max Planck Institute for Social Anthropology and a lecture delivered at the Collège de France on global health. In preparation of the new research program related to the NOMIS Distinguished Scientist Award, the theme of “crisis” was the matter of a graduate course at Princeton University and of a one-week doctoral seminar at the École des Hautes Études en Sciences Sociales in Paris. Finally, Fassin was invited as a Visiting Professor to present his work at the University of Electronic Science and Technology of China in Chengdu, the Tongji University in Shanghai, and the Normal University in Beijing.

Apart from this research, a film series titled “From the Banned Countries” was organized with Marcia Tucker, Historical Studies and Social Science librarian. It presented outstanding documentaries from the six countries that were initially subject to an immigration ban imposed by the Trump

administration. Each screening, which was open to the larger Princeton community, was followed by a discussion with a scholar benefiting from an expertise on the history and current situation of the country.

In addition to helping Professor Fassin run the theme seminar and coediting a volume with him, Visiting Professor **George Steinmetz** continued his research into the history, sociology, and philosophy of the social sciences. Steinmetz’s research in 2017–18 focused on completing his book “Colonial Sociology: Sociologists in the British and French Empires and the Founding of an Academic Discipline, 1940s–1960s.” This grew out of his previous work, which showed that precolonial representations of non-Europeans guided the European administration of colonized subjects. These representations were heterogeneous, however. Therefore, colonizers had to select particular ideas as guides for their policymaking. Ongoing struggles between different groups of administrators inside the colonial state determined which ideas were turned into “native policy.”

These findings—the impact on policy of precolonial images and struggles among colonial officials—led to new research questions. The fact that

ethnographic representations shaped policy led Steinmetz to examine the determinants of those representations. Steinmetz explored parallel questions in *The Politics of Method in the Human Sciences* (Duke University Press, 2005) and *Sociology and Empire* (Duke University Press, 2013). The forthcoming book examines the production of social science in British, French, and Belgian colonies between 1930 and decolonization. Nearly half of the sociologists in these European countries worked in the colonies. The central concepts and methodologies of postwar French and British sociology were invented in the colonies and then exported back to the metropolises. This included Pierre Bourdieu’s central theories of “social fields” and “habitus.” “Colonized” sociologists co-created these sociological constructs.

Steinmetz conducted other studies in the history of social science, publishing articles on American sociology and colonialism, the shifting relations between historians and sociologists in twentieth-century Germany and France, and (with Member Johan Heilbron), on Pierre Bourdieu.

Steinmetz also pursued his research on the philosophy of social science, writing on the concepts of contingency, crisis, and historicism, as part of a future book on “critical historical socio-analysis.” He brought a group of specialists to IAS to launch a book series, “Post-Positivist Social Science,” with the University of Chicago Press. He coedited a volume with Timothy Rutzou, *Critical Realism, History, and Philosophy in the Social Sciences*, which appeared in 2018.

As Chair of the Comparative and Historical Sociology section of the American Sociological Association, Steinmetz organized a series of panels at the 2017 and 2018 annual meetings, developed a blog on “Critical Historical Sociology,” and wrote a series of short articles for the section’s newsletter. He organized a daylong conference at the University of Pennsylvania on “The Crisis of History and the History of Crisis,” which took place in August 2018.



DAN KOMODA

Visiting Professor GEORGE STEINMETZ (left) conducted a study in the history of social science focused on Pierre Bourdieu with Member JOHAN HEILBRON (right).

Steinmetz lectured at Princeton University, the London School of Economics and Political Science, the Hamburg Institute for Social Research, and the Royal Netherlands Academy of Arts and Sciences. He gave several lectures and seminars at IAS on topics such as “What is the Difference Between the Social Sciences, Natural Sciences, and the Humanities?” “Using Bourdieu for the Historical Sociology of the Social Sciences,” and “How and Why Do We Write the History of the Social Sciences?”

During 2017–18, Professor Emerita **Joan Wallach Scott** began work on a new project, tentatively titled “The Judgment of History.” Taking up the

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A SCHOLAR AT RISK was supported by the School of Social Science with the Institute of International Education Scholar Rescue Fund for the third consecutive year. Gubad Ibadoghlu, a political economist who is a researcher at Azerbaijan State University and the chairman of the Movement for Democracy and Welfare in Azerbaijan, worked on a comparative study of extractive industries in South Caucasus and Central Asia, analyzing how the politics of natural resources hindered democratic processes in the region.

question of what it means to say “history will be the judge,” Scott will examine some key moments during which that judgment was meant to be enacted. The project involves reading a good deal in theories and philosophies of history, as well as about the way moralism functions in our ideas of law and justice. It includes a look at actual attempts to put this notion of history’s judgment into effect in the course of the twentieth century.

In addition to this research, Scott gave a number of talks related to her new book, *Sex and Secularism* (Princeton University Press, 2017), and to the publication of the thirtieth anniversary edition of her *Gender and the Politics of History*. She also edited a series of her essays on academic freedom, coming out in 2019 under the title *Knowledge, Power, and Academic Freedom* (Columbia University Press). She received an honorary degree from the University of Edinburgh, and she lectured at a number of universities in the United States, and at the Université de Paris 8 as well as in Edinburgh. Scott gave keynote addresses at conferences on gender in Bogotá, Colombia, and Quito, Ecuador.

Professor Emeritus **Michael Walzer** spent the academic year 2017–18 working on some old topics and some new ones. He wrote a lecture on the

tension between freedom and equality for meetings in Italy and France. Walzer was invited by the editors of *Foreign Affairs* to write about whistle-blowing, and he worked on that for some time, benefiting greatly from lunch conversations with Members in the School. The piece was published as “Just and Unjust Leaks”—not his title. Walzer also began work on the rules of engagement for police officers (contrasted with the rules for soldiers, on which he has written over many years), and this work will continue into 2018–19. This is a subject of interest to others in the School—and of interest generally, given the “militarization” of the police in many communities across the United States. Finally, Walzer has continued to work on *The Jewish Political Tradition*. The third volume in that series, on *Community*, came out in May 2018 (Yale University Press), and Walzer and colleagues hope to finish the fourth and last volume in the next three years. Walzer met regularly with several Members to talk about religion and politics, though that was far from the School’s theme for the year. His book *A Foreign Policy for the Left* was published by Yale University Press in January 2018—a political, not an academic book, although several of the chapters originally appeared in academic journals.



Left: Friends Member JACOB S. T. DLAMINI (left) studies the social and political history of conservation in Africa. Right: Professor Emerita JOAN WALLACH SCOTT (left) and Member AYŞE PARLA (right) participate in a panel discussion, “A Refuge for Scholars: Contemporary Challenges in Historical Perspective.”



ALL PHOTOS DAN KOMODA

Members KRISTOFFER KROPP (left), BREGJE VAN EEKELEN (center), SARA FARRIS (right), and MIRIAM KINGSBERG KADIA (far right) participate in a lunchtime seminar titled “A Field of European Social Science?”

2017–18 MEMBERS AND VISITORS

f First Term ♦ s Second Term ♦ v Visitor ♦ vp Visiting Professor

Ayten Alkan

Urban Studies, Critical Animal Studies ♦ Institute for Advanced Study

Johanna K. Bockman

Sociology ♦ George Mason University ♦ v

Yvonne Chiu

Political Science ♦ Institute for Advanced Study ♦ v

Charly Coleman

Intellectual and Cultural History; Eighteenth-century France ♦ Columbia University
Deutsche Bank Member

Peter Coviello

American Literature, Queer Studies, Political Theology ♦ University of Illinois at Chicago

Alice Crary

Philosophy ♦ The New School for Social Research

Anne-Claire Defossez

Sociology ♦ Institute for Advanced Study ♦ v

Chitralekha Dhamija

Anthropology ♦ Jawaharlal Nehru University

Paul DiMaggio

Sociology ♦ New York University
Princeton Foundation for Peace & Learning Founders' Circle Member

Jacob S. T. Dlamini

Social and Political History of Conservation in Africa ♦ Princeton University
Friends of the Institute for Advanced Study Member

Bregje van Eekelen

Anthropology, History ♦ Erasmus University Rotterdam

Jean-Louis Fabiani

Historical Sociology of the Social Sciences ♦ Central European University
Funding provided by the Florence Gould Foundation Fund

Sara Farris

Sociology ♦ Goldsmiths, University of London ♦ v

Nicolas Guilhot

History of Political Thought ♦ CNRS, Center for International Research in the Humanities and Social Sciences
Deutsche Bank Member

Johan Heilbron

Sociology ♦ Centre Européen de Sociologie et de Science Politique, Université Paris 1
Louise and John Steffens Founders' Circle Member

Julia C. Hell

European Historical Cultural Studies ♦ University of Michigan, Ann Arbor ♦ v

Gubad Ibadoghlu

Economics, Political Sociology ♦ The Economic Research Centre of Azerbaijan ♦ v
Funding provided by the Institute of International Education Scholar Rescue Fund

Miriam Kingsberg Kadia

History of Modern Japan, Global History, History of Knowledge ♦ University of Colorado, Boulder

Kristoffer Kropp

Sociology ♦ Roskilde University

Nicolas Langlitz

Anthropology, History of Science ♦ The New School for Social Research
Deborah Lunder and Alan Ezekowitz Founders' Circle Member

Tomaž Mastnak

History of Social and Political Thought ♦ Research Centre of the Slovenian Academy of Sciences and Arts ♦ v

John Lardas Modern

Religious Studies ♦ Franklin & Marshall College

Álvaro Morcillo-Laiz

International Relations, Political Sociology, History of Social Sciences ♦ Centro de Investigación y Docencia Económicas, Mexico City
Wolfensohn Family Member

Paulina Ochoa Espejo

Political Theory ♦ Haverford College

Ayşe Parla

Anthropology ♦ Sabanci University ♦ v

Silvia Pasquetti

Sociology ♦ Newcastle University

Amín Pérez

Sociology ♦ École des Hautes Études en Sciences Sociales, Paris

Lawrence Rosen

Anthropology ♦ Princeton University ♦ v

Janick Marina Schaufelbuehl

History of International Relations ♦ Université de Lausanne
Roger W. Ferguson, Jr., and Annette L. Nazareth Member

Mehdi Shadmehr

Political Economy of Authoritarian Regimes, Revolution and Regime Change, Repression and Censorship, Leadership, and Ideology ♦ University of Calgary
Richard B. Fisher Member

Carel E. Smith

Law and Philosophy ♦ Universiteit Leiden ♦ v

George Steinmetz

History, Philosophy, and Sociology of the Social and Human Sciences ♦ University of Michigan, Ann Arbor ♦ vp

Peter D. Thomas

Political Philosophy, History of Political Thought ♦ Brunel University

Shatema Threadcraft

Political Science ♦ Dartmouth College
Ralph E. and Doris M. Hansmann Member

Everett Yuehong Zhang

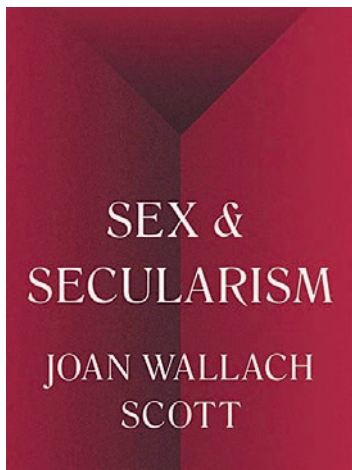
Anthropology ♦ Institute for Advanced Study ♦ v

Andrew Zimmerman

Transnational History ♦ The George Washington University
AMIAS Member

Agata Zysiak

Historical Sociology ♦ University of Łódź, Poland

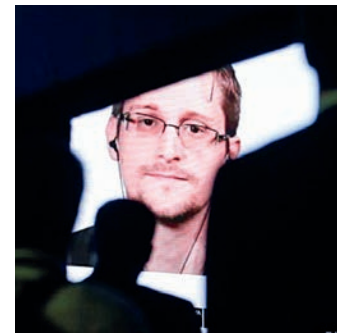


JOAN WALLACH SCOTT ON *SEX AND SECULARISM*

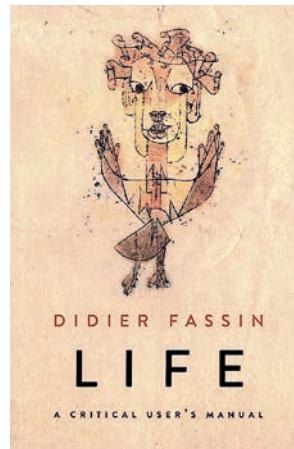
Attention to secularism has again entered popular discourse as part of the “clash of civilizations” rhetoric. Of course, there is a long history of academic study of secularization, the processes by which European states are said to have brought organized religion under their control, introduced bureaucratic management and technical calculation into their governing operations, and justified their sovereignty in terms of republican or democratic theory, that is, as representatives of the mandate of those considered citizens, not as the embodiment of God’s will. Secularism has been taken to be synonymous with these processes; the historical triumph of enlightenment over religion. But in its recent usage, it has had a simpler referent as the positive alternative, not to all religion but to Islam. In this discourse secularism guarantees freedom and gender equality while Islam is synonymous with oppression. Read more at www.ias.edu/scott-sex-secularism.

MICHAEL WALZER ON “JUST AND UNJUST LEAKS”

All governments, all political parties, and all politicians keep secrets and tell lies. Some lie more than others, and those differences are important, but the practice is general. And some lies and secrets may be justified, whereas others may not. Citizens, therefore, need to know the difference between just and unjust secrets and between just and unjust deception before they can decide when it may be justifiable for someone to reveal the secrets or expose the lies—when leaking confidential information, releasing classified documents, or blowing the whistle on misconduct may be in the public interest or, better, in the interest of democratic government. Read more of Walzer’s article in *Foreign Affairs* at www.ias.edu/walzer-leaks.



ROBERT MARCHANTE/REUTERS



The book’s cover image, *Angelus Novus*, was painted by Paul Klee in 1920. Walter Benjamin, who wrote profound reflections on life, and found in *Angelus* an inspiration for several of his own works, owned the painting until his tragic death fleeing the Nazi regime.

DIDIER FASSIN ON *LIFE*

How can one think of life in its dual expression—matter and experience, the living and the lived? Philosophers and, more recently, social scientists have offered multiple answers to this question, often privileging one expression or the other—the biological or the biographical. But can one conceive of them together and thus reconcile naturalist and humanist approaches? It is possible to do so by mobilizing three concepts: forms of life, ethics of life, and politics of life. In *Life: A Critical User’s Manual*, Didier Fassin explores the pieces of this anthropological composition, which, once assembled like in Georges Perec’s jigsaw puzzle, reveals a perplexing image: that of unequal lives. Read more at www.ias.edu/fassin-life.



GEORGE STEINMETZ ON WRITING THE HISTORY OF THE SOCIAL SCIENCES

Why should we write the history and sociology of the social sciences? Some have suggested that putting science under the sociological microscope is self-indulgent and dangerously relativist. Others murmur that only those who can’t do science study science. Ernst Wilhelm Eschmann, a Nazi sociologist, wrote in 1934 that a science that makes itself into its object of study, that studies “its relations and boundaries with other sciences, its epistemology, methods, and history,” represents “the symptom of a profound sickness of an entire culture,” a “pathology of scientificity.”

Few nowadays would be inclined to agree with a Nazi scientist. Yet these criticisms should not go unanswered, especially in an age when scholars are insistently called upon to demonstrate the usefulness of their work. The historical sociology of social science *is* useful. It is a necessary part of all social science. Read more at www.ias.edu/steinmetz-history-social-sciences.



SARA FARRIS ON #METOO

#MeToo has been such a big catalyst for what looks every day more like the emergence of a new feminist movement, because it speaks to women across the class, race, and sexuality divides. The movement points to the fact that sexual harassment and violence in many ways functions as a “great equalizer” among women because the overwhelming majority of us have experienced it in some form, regardless of our backgrounds. Read more of Farris’s article in *Al Jazeera* at www.ias.edu/farris-metoo.



DAN KOMODA

SHATEMA THREADCRAFT ON SPECTACULAR BLACK DEATH

How might a politics centered on spectacular black death marginalize the concerns of black women? Shatema Threadcraft, Ralph E. and Doris M. Hansmann Member in the School of Social Science, explored this question during *Ideas 2017–18* with James D. Wolfensohn Professor Didier Fassin. Watch more at www.ias.edu/threadcraft-black-death.

OFFICERS IN A GROUP CALLED “DOUBLEDOMES” PASS WRITTEN IDEAS AROUND



LIFE MAGAZINE

In the June 11, 1956 issue of *Life* magazine, members of the U.S. Navy are seen participating in programs designed to stimulate creative thinking.

BREGJE VAN EEKELN ON DISCIPLINE AND CREATIVITY

How did creativity arise as an object of scientific inquiry?

On April 6, 1960, Institute for Advanced Study Director Robert Oppenheimer received a letter from psychologist John E. Drevdahl, requesting his support in setting up a study among IAS Members to assess the factors that made them creative.... While it is easy to relate to

Drevdahl’s intuition that the military and industry were not the most suitable places to capture creative thinking, it was in those very places that creativity theories and techniques were flourishing in the United States at the time.

My research project on the social history of creativity shows that in the decade preceding the correspondence, processes to garner new ideas and techniques to think “beyond” existing bodies of knowledge became an object of professional interest in a contact zone of industry, the military, and academia. Read more at www.ias.edu/van-eekelel-discipline-creativity.



The Crossing choir performing in Wolfensohn Hall



Special Programs and Outreach

The Institute for Advanced Study is committed to the idea that science and learning transcend all geographic boundaries and scholastic disciplines, and that scholars and scientists are members of one commonwealth of the mind. It engages with the greater Princeton community through public lectures, concerts, and events, and extends its influence beyond academia through innovative programs designed to inspire and educate.

BEYOND THE WORK THAT TAKES PLACE in the four Schools, the Institute's scope is broadened and enhanced by its special programs, which contribute much to the vitality of the Institute.

The Program in Interdisciplinary Studies, directed by Professor Piet Hut, explores ways of viewing the world that span a range of disciplines from computational astrophysics, geology, and paleontology to artificial intelligence, cognitive psychology, and philosophy.

The Director's Visitor program enables the Director to invite scholars from a variety of fields, including areas not represented within the four Schools, to participate in the range of intellectual and social activities at the Institute.

The Artist-in-Residence Program was established in 1994 to create a musical presence within the Institute community, and to have in residence a person whose work could be experienced and appreciated by scholars from all disciplines. Artists-in-Residence have included Robert Taub, Jon Magnussen, Paul Moravec, Derek Bermel, Sebastian Currier, and, as of 2016, David Lang.

The Institute also engages in outreach beyond its local community. Since 1994, the IAS/Park City Mathematics Institute has integrated mathematics educators, researchers, and students through innovative programs. The Program for Women and Mathematics, sponsored jointly with Princeton University, provides substantive mathematics content as well as practical encouragement for women to pursue careers in the field of mathematics.

The School of Natural Sciences sponsors Prospects in Theoretical Physics, a two-week residential summer program held at the Institute for exceptionally promising graduate students and postdoctoral scholars.

The Summer Program in Social Science, led by Professor Didier Fassin, is an interdisciplinary initiative for early-career scholars from Africa, the Middle East, and Latin America, which aims to enrich and expand the realm of social sciences through the confrontation of different intellectual traditions and perspectives.

A Digital Scholarship@IAS initiative was formed in 2016 to accelerate the pace of research across disciplines and geographic locations by offering Faculty and Members new tools and technologies to gather and process large amounts of data, visualize the results, and make the data and results openly available.

SPECIAL PROGRAMS

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OUTREACH

[IAS/Park City Mathematics Institute](#)

[Program for Women and Mathematics](#)

[Prospects in Theoretical Physics](#)

[Summer Program in Social Science](#)

[Digital Scholarship@IAS](#)

SPECIAL PROGRAMS

PROGRAM IN INTERDISCIPLINARY STUDIES



LEFT, THOMAS CLARKE; MIDDLE, AMY RAMSEY

The main focus of Professor **Piet Hut**, head of the Institute's Program in Interdisciplinary Studies, has been a study of the origins of novelty throughout the history of the universe, specifically the origins and nature of cognition.

The three greatest forms of novelty have been the origin of the universe itself, in the Big Bang; the origin of life on Earth and likely elsewhere in the universe; and the origin of consciousness. Of these three, the first one stands out as having provided the cosmic stage on which everything else plays out, while the last one provided the means of describing the stage and the plays that are performed on it.

The second one, the origin of life, played a central role in enabling the third one, in that the origin of life is also the origin of making choices: the very first living cell needed to distinguish food from non-food in order to function, grow, and multiply. Therefore, the origin of life was at the same time the origin of cognition, albeit in a very elementary form. One could also say that it is the origin of awareness. In some sense a living cell is aware of what it needs from its surroundings, in ways that, say, clouds or rivers or volcanoes are not.

Hut embarked on a book project on the origins of novelty, tentatively titled "The Innovation Circle: Emergent Order in Cognition and in the World," in collaboration with Eric Smith, a physicist at the Earth-Life Science Institute in Tokyo, a research center that Hut and colleagues founded six years ago. Another book project, tentatively titled "Open Mind, Open World," arose from a long-term collaboration between Hut and Dan Zahavi, a philosopher of phenomenology at the University of Copenhagen.

As the head of the Program in Interdisciplinary Studies, Hut has led the After Hours Conversations series of regular "bar talks," in which speakers from each of the four Schools give ten-minute talks, followed by informal discussions, a popular program that he started ten years ago with Professor Emerita Caroline Walker Bynum.

Hut and his visitors hold (literally) round-table lunches during most of the first and second term, in the Simons Hall dining hall. Anyone is welcome to join these lunches, where the main topics are related to cognition, as discussed from many different angles, with rich contributions from visitors of all four Schools at IAS.

Left: A main focus of Professor PIET HUT (far right), has been a study of the origins of novelty throughout the history of the universe, specifically the origins and nature of cognition. *Center:* From left to right, Visitors OHAD NACHTOMY, OLAF WITKOWSKI, and YUKO ISHIHARA. *Right:* The Meta Institute for Computational Astrophysics, cofounded by Piet Hut in Second Life, the first professional scientific organization based in a virtual world

2017–18 VISITORS

f First Term ♦ *s* Second Term

Henderson (Jim) Cleaves

Chemistry ♦ Carnegie Institution for Science

Yentl Dudink

Social Sciences ♦ Vrije Universiteit Amsterdam ♦ *s*

Ayako Fukui

Harmonic Analysis ♦ ARAYA Brain Imaging

Yuko Ishihara

Philosophy ♦ Earth-Life Science Institute, Tokyo Institute of Technology

Barnaby Marsh

Evolutionary Dynamics ♦ Harvard University

Ohad Nachtomy

History of Philosophy and Science ♦ Bar-Ilan University

Michael Th. Rassias

Mathematical Analysis, Analytic Number Theory ♦ Universität Zürich ♦ *f*

Peter Rood

Complex Systems, Philosophy ♦ YHouse, Inc. ♦ *f*

Michael Solomon

Bioethics ♦ Institute for Advanced Study

Arpita Tripathi

International Development, Philanthropy in Developing Countries, India ♦ YHouse, Inc.

Edwin L. Turner

Astrophysics ♦ Princeton University

Olaf Witkowski

Complex Systems, Artificial Life ♦ Earth-Life Science Institute, Tokyo Institute of Technology

ARTIST-IN-RESIDENCE PROGRAM



ALL PHOTOS ANDREA KANE

Left: Artist-in-Residence DAVID LANG (left) and composer Caroline Shaw (right) take questions from the audience in a post-concert discussion.
Right: The Crossing choir performing in Wolfensohn Hall

In his second season as IAS Artist-in-Residence, Pulitzer Prize–winning composer **David Lang** curated the 2017–18 Edward T. Cone Concert Series, the second year in a three-year series titled “The Pattern Makers.” This season opened with a performance by pianist Stephen Drury of Frederic Rzewski’s *The People United Will Never Be Defeated*. A concert by professional choir The Crossing followed, featuring performances of Ted Hearne’s *Consent*, Caroline Shaw’s *To the Hands*, and Lang’s *the national anthems*. At the beginning of 2018, pianist Vicky Chow performed composer Tristan Perich’s *Surface Image*, surrounded by a wall of forty tiny speakers whose elemental electronic sounds complemented the piano’s oceanic tones. Ensemble Signal concluded the program with a string orchestra performance highlighting Michael Gordon’s *Weather* and Julia Wolfe’s *Cruel Sister*.

In October, Lang gave a Friends Public Lecture on “The Pattern Makers: Season 2,” in which he gave a taste of the programming for the year, previewing how each performance would employ patterns to accomplish different musical goals. View the lecture in its entirety at www.ias.edu/patternmakers-season-2.

In December, Lang premiered *symphony for a broken orchestra*, a new piece written as part of an initiative of the same name to rehabilitate Philadelphia’s public-school music programs by repairing over one thousand damaged instruments previously languishing in storage. Read more about Lang’s involvement at www.ias.edu/lang-broken-orchestra.

DIRECTOR’S VISITORS

During the summer of 2018, **Graham Farmelo**, Fellow at Churchill College, University of Cambridge, completed the writing of his book “The Universe Speaks in Numbers,” about the relationship between fundamental physics and pure mathematics, from Newton to the present. The book, to be published by Faber & Faber in May 2019, will feature the contributions of several of the leading theoreticians who have been based at IAS and several of its mathematicians.

Michael Pembroke, Justice of the Supreme Court of New South Wales, Australia, finalized the concluding section of his book about the new world order ushered in by the Korean War. Published by OneWorld Press and released in the United States in August 2018, *Korea: Where the American Century Began* has been short-listed for the New South Wales Premier’s History Awards and the Queensland Literary Awards, and long-listed for the 2018 Mark and Evette Moran NIB Literary Award.

Natalie Wolchover, a senior writer and editor at *Quanta Magazine*, researched and conducted interviews for three articles during her month at the Institute: a piece about traversable wormholes, another about physicists’ efforts to classify all possible phases of matter, and a profile/Q&A of Edward Witten. She also developed a deeper understanding of many current issues in physics.



Left: “The Universe Speaks in Numbers: How Modern Math Reveals Nature’s Deepest Secrets” by Director’s Visitor Graham Farmelo, forthcoming from Faber & Faber in May 2019, features contributions of several leading theoreticians who have been based at IAS and several IAS mathematicians.
Right: Director’s Visitor Michael Pembroke finalized the concluding section of *Korea: Where the American Century Began* (OneWorld, 2018), which has been short- and long-listed for several literary and history awards.

OUTREACH

IAS/PARK CITY MATHEMATICS INSTITUTE



ALL PHOTOS DAVID TITENSOR

The 2018 IAS/Park City Mathematics Institute program focused on the field of harmonic analysis and its interactions with geometric measure theory and partial differential equations.

The IAS/Park City Mathematics Institute (PCMI) is an intensive three-week summer program held annually in Park City, Utah. It includes several parallel sets of activities for different groups across the entire mathematical community. Established in 1991 through a grant from the National Science Foundation, PCMI has been an outreach program of the Institute for Advanced Study since 1994. PCMI is currently funded by major grants from the National Science Foundation and Math for America, as well as grants from private foundations and individuals. Rafe Mazzeo (Stanford University) is the PCMI director.

The component programs of PCMI include a workshop for mathematics researchers, eight mini-courses for graduate students, two lecture series for undergraduate students, a program for faculty from predominantly undergraduate institutions, a faculty workshop on equity and mathematics education, and a teacher leadership program for K–12 school teachers. Together these programs have over 330 participants. PCMI is a very successful effort toward vertical integration, with participants from different groups interacting with each other both scientifically and socially.

Each year, a different research theme is chosen, and a set of organizers who are specialists in the topic shape the program. The theme for PCMI 2018, “Harmonic Analysis,” focused primarily on the interactions of that field with geometric measure theory and partial differential equations, and it brought together mathematicians working in many exciting areas of recent research in harmonic analysis. The organizers for the program were Carlos Kenig (The University of Chicago), Fanghua Lin (Courant Institute of Mathematical Sciences, New York University), Svitlana Mayboroda (University of Minnesota), and Tatiana Toro (University of Washington).

In the Undergraduate Faculty Program, Alex Iosevich (University of Rochester) led an exploration of finite point configurations, both in Euclidean space and in vector spaces over finite fields, giving the faculty participants the tools needed to work on open problems in this topic in their own research and with their students. The participants in the Undergraduate Summer School attended a lecture series by Eyvindur Palsson (Virginia Polytechnic Institute and State University) and Ricardo Sáenz (University of Colima). Most undergraduates also took part in the Experimental Math Lab, a new activity in which undergraduate participants formed teams and—with mentoring by senior researchers—investigated open-ended questions and presented their results during the final week of PCMI.

Gerunda Hughes (Howard University) and Deena Khalil (Howard University) led the one-week Workshop on Equity and Mathematics Education, in which faculty participants explored perspectives on the definition of equity, how it is manifested (or not) in education, and its relationship to diversity, inclusion, social justice, and broadening participation in mathematics education. Participants shared their own work related to equity in mathematics, including course development, research, teaching, and assessment.

The Teacher Leadership Program included fifty-seven teachers from across the country who came together for a collaborative professional development experience in which they learned new mathematics, reflected on best pedagogical practices, and created new materials for their own classrooms and others’. During the summer session, the participating teachers planned for a set of academic year outreach activities designed to extend the impact of this program. These activities include a series of workshops to be held at several sites around the country during the 2018–19 school year, and an online lesson study group.

The research theme for PCMI 2019 is “Quantum Field Theory and Manifold Invariants,” organized by Dan Freed (University of Texas), Sergei Gukov (California Institute of Technology), Ciprian Manolescu (University of California, Los Angeles), Constantin Teleman (University of California, Berkeley), and Ulrike Tillmann (University of Oxford). To learn more about the IAS/Park City Mathematics Institute—including information about the application process—visit www.ias.edu/pcmi.

PROGRAM FOR WOMEN AND MATHEMATICS



The twenty-fifth annual IAS Women and Mathematics Program focused on the mathematics of modern cryptography and included lectures on post-quantum cryptography, lattice-based algorithms, and elliptic curve cryptography.

The twenty-fifth annual Women and Mathematics Program, “Mathematics of Modern Cryptography,” was held May 19–25, 2018 at the Institute for Advanced Study. Program activities were sponsored by IAS, Princeton University, the National Science Foundation, and a grant from Lisa Simonyi. Program organizers were Dusa McDuff (Barnard College), Margaret Readdy (University of Kentucky), and Sun-Yung Alice Chang (Princeton University).

Toni Bluher (National Security Agency) gave four lectures on “Mathematics of Cryptography,” and Kristin Lauter (Microsoft Research) gave four lectures on “Mathematics of Post-Quantum Cryptography.” Emily Willson (National Security Agency) and Sorina Ionica (Université de Picardie) served as teaching assistants. Thirty-one undergraduates, thirty-three graduates, and twelve postdoctoral and faculty mathematicians from thirty universities attended the program.

Research seminars were given by Kelsey Horan, “A Fast Quantum Algorithm for Solving Multivariate Quadratic Equations”; Angela Robinson, “The Tractability of the Discrete Logarithm Problem in S_n and Hybrid Encryption in the Quantum Random Oracle Model”; Elizabeth Wilcox, “The Chermak–Delgado Lattice of a Finite Group”; Ha Tran, “Well-known Ideal Lattices From Cyclotomic Fields”; Fattaneh Bayatbabolghani, “Enforcing Input Correctness via Certification in Garbled Circuit Evaluation”; F. Betül Durak, “Breaking the Format-Preserving Encryption Standard Over Small Domains”; and Soodeh Dadras, “Security of Control Systems in Autonomous Vehicle Platooning.” A colloquium was given by Jill Pipher (Brown University) on “NTRU Lattice-based Algorithms: History and Modern Developments.”

The evening Women-in-Science Seminar series included a question-and-answer session moderated by Lillian Pierce (Duke University; von Neumann Fellow, School of Mathematics); a chat with Jill Pipher (Brown University); and a career panel given by Toni Bluher (National Security Agency), Jessica Fintzen (Member, School of Mathematics), Kristin Lauter (Microsoft Research), Helen Wong (von Neumann Fellow, School of Mathematics), and Helen Xing (Cubist). Margaret Readdy (University of Kentucky) moderated an introduction to the Women and Mathematics Ambassador Program and shared results from its first year.

On May 23, sixty participants visited Princeton University to hear talks by Princeton faculty Oanh Nguyen, Ana Menezes, and Yueh-Ju Lin. Alyson Deines (Center for Communications Research, La Jolla) gave one computer workshop lecture using SAGE on “Elliptic Curve Cryptography” in a computer lab of the Lewis Library. Linda Cook (Princeton University) was Deines’s teaching assistant. In addition, the program engaged in an outreach event on May 23, 2018. Several program participants visited Littlebrook Elementary School, an afterschool program in Princeton, to teach “Codes and Secrets” (e.g., Caesar, substitution, Morse code, pigpen) and simple error-correcting codes using a lie detector.

Thanks to a generous grant from Charles and Lisa Simonyi, the IAS Women and Mathematics Program just concluded its first year of the WAM Ambassador Program to build support and outreach networks across the country. The WAM participants listened to one representative from each of the funded groups and were able to ask questions regarding organizing similar activities in their own region. The funded activities included research talks, symposia, panels, conferences, reading groups, workshops, and local outreach, at locations across the country. The Ambassador Program will fund up to three postdoctoral or advanced graduate ambassadorships and up to six graduate ambassadors each year.

On May 26, the twenty-fifth Women and Mathematics Program concluded with a dinner honoring cofounders Karen Uhlenbeck and Chuu-Lian Terng. For their foresight and commitment, speakers for the two Women and Mathematics lectures have been named in their honor, with the titles of Uhlenbeck Lecturer and Terng Lecturer.

PROSPECTS IN THEORETICAL PHYSICS

Prospects in Theoretical Physics (PiTP) is an intensive two-week summer program geared specifically to graduate students and postdoctoral scholars considering a career in theoretical physics or astrophysics. It encourages the participation of women, minorities, and students from smaller institutions that do not have extensive programs in theoretical physics or astrophysics.

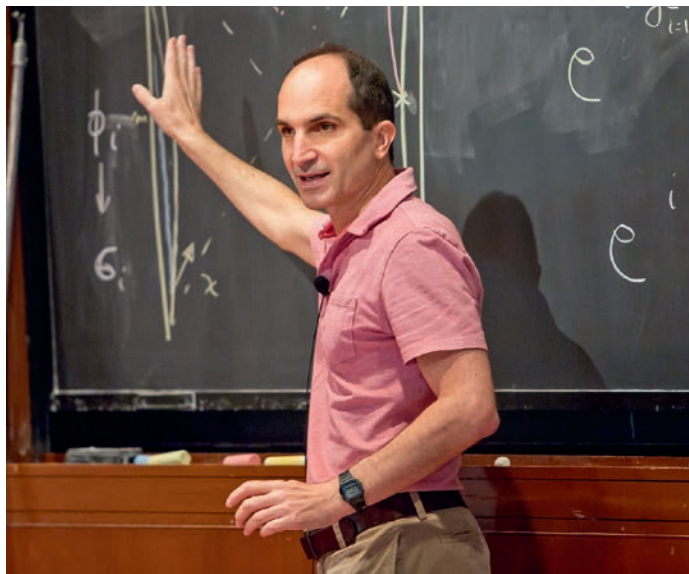
First held at the Institute in 2002, PiTP has covered topics ranging from cosmology to the Large Hadron Collider, to string theory, to computation and biology, to insights into quantum matter, and to computational plasma astrophysics. Representatives from both the Institute for Advanced Study and Princeton University are among the program's organizers and lecturers.

“From Qubits to Spacetime” was the theme of PiTP 2018, which was held July 16–27 on the Institute campus. Topics included entanglement entropy in quantum field theory and gravity; black hole entropy and its quantum corrections; the black hole information paradox; complexity, tensor networks, and quantum error correction; chaos and black holes; general relativity horizon and singularity theorems; and simple models for near extremal black holes.

Roughly 160 participants were officially enrolled in the program, and its lectures attracted many students, postdoctoral researchers, and professors from nearby institutions.

The 2018 Prospects in Theoretical Physics program included lectures by Ahmed Almheiri (IAS), Atish Dabholkar (International Centre for Theoretical Physics, Trieste), Thomas Faulkner (University of Illinois at Urbana-Champaign), Daniel Harlow (Massachusetts Institute of Technology), Matthew Headrick (Brandeis University), Carl P. Feinberg Professor Juan Maldacena (IAS), Douglas Stanford (IAS), Leonard Susskind (Stanford University), Aron Wall (Stanford Institute for Theoretical Physics), and Charles Simonyi Professor Edward Witten (IAS).

PiTP 2018 “From Qubits to Spacetime” convened roughly 160 participants, including Carl P. Feinberg Professor JUAN MALDACENA (top), Member YING ZHAO (middle, center), and former Member ARON WALL (bottom). The program covered topics ranging from the connections between quantum information and the structure of spacetime to how quantum effects can be included in black hole thermodynamics.



ANDREA KANE



ANDREA KANE



DAN KOMODA

SUMMER PROGRAM IN SOCIAL SCIENCE

Organized by the School of Social Science and developed by Didier Fassin, James D. Wolfensohn Professor, the Summer Program in Social Science entered a new phase with three two-year cycles funded by the Mellon Foundation starting in June 2018. It is conducted in collaboration with Professor Sarah Nuttall of the Wits Institute for Social and Economic Research at the University of the Witwatersrand in Johannesburg and Professor Mara Viveros of the Escuela de Estudios de Género and Centro de Estudios at the Universidad Nacional de Colombia in Bogotá. The program began with a two-week session in Princeton, to be followed by one week mid-2019 at one of the two collaborating institutions in South Africa and Colombia, with continuous communication facilitated among the scholars throughout the two-year period.



ALL PHOTOS ANDREA KANE

The Summer Program in Social Science draws together early-career scholars from countries in Africa, the Middle East, and Latin America to enrich and expand the realm of the social sciences, to facilitate dialogue between disciplines, and to strengthen international networks.

Designed to draw together twenty early-career scholars from countries in Africa, the Middle East, and Latin America, the program aims to enrich and expand the realm of the social sciences through the confrontation of different intellectual traditions and perspectives; to facilitate and enhance the dialogue between various scientific disciplines and communities; and to strengthen international networks across continents. Special attention is paid to local contexts of production and global modalities of circulation of knowledge, and the participants are invited to exchange their research experiences with their constraints, challenges, and expectations.

The scholars invited to participate have gone through a selection process. Their disciplines are history, anthropology, sociology, geography, economics, law, political science, and literary studies. Their research topics include, among others, the care of disabled persons in Brazil, the discourse on indigenous people in Argentina, the transportation infrastructure in Colombia, the resistance to extractive industries in Latin America, the everyday life under an authoritarian regime in Angola, the violence of mafias in Nigeria, the public life of secret societies in Cameroon, the social life of mining communities in Zimbabwe, the experience of Palestinian women imprisoned in Israel, the resilience of the population during the Syrian crisis in Lebanon, the Arab uprising seen from the perspective of farmers in Egypt, the ethics and politics of Sufi shrines in Pakistan, and the humanitarian approach to migrant working children in Mexico and India. Members of the School as well as scholars from Princeton University participate in the mentoring.

The program began in 2015 with a three-year pilot initiative organized by the Institute in collaboration with the École des Hautes Études en Sciences Sociales in Paris and the Swedish Collegium for Advanced Study in Uppsala. It led to a collective volume in preparation, tentatively titled “Writing the Social Sciences in Different Worlds.”



Top: In June 2018, the Summer Program convened nineteen participants at the Institute for Advanced Study. Their research topics included, among others, the care of disabled persons in Brazil, the discourse on indigenous people in Argentina, and the violence of mafias in Nigeria. *Above:* Professor Emerita JOAN WALLACH SCOTT (left) and James D. Wolfensohn Professor DIDIER FASSIN (right) invited participants to exchange their research experiences with their constraints, challenges, and expectations.



THOMAS CLARKE

Left: The DigitalScholarship@IAS website, which contains tools and resources for digital scholarship Right: GEORGE KIRAZ, Member in the School of Historical Studies, spoke about computing lexica and dictionaries as part of the Digital Scholarship conversation series.

Supporting scholars working in the field of Digital Scholarship remained a priority this past academic year. As of the 2017–18 academic year, IAS Computing includes a full-time resource (María Mercedes Tuya) for supporting digital scholarship projects and overseeing campus-wide efforts. Broad direction for these efforts continues to be provided by the Digital Scholarship Working Group (Jeff Berliner, Emma Moore, Marcia Tucker, María Mercedes Tuya, and Professor Sabine Schmidtke). To support these goals, this past year, IAS became an institutional member of the ORCID consortium (see <https://orcid.org>) and the New Jersey Digital Humanities Consortium (see <https://blogs.shu.edu/njdhc>).

For the second year, a series of focused talks were held on campus as part of the Digital Scholarship Conversations series (see sidebar). In 2017–18, four speakers participated in talks on a wide array of topics ranging from specific applications of digital scholarship to broad policy and institutional awareness.

Supported by funding from the Carnegie Corporation of New York, the National Endowment of the Humanities, the Middle East Center at the University of Pennsylvania, and the Charles and Lisa Simonyi Fund for Arts and Sciences, and in partnership with the Hill Museum and Manuscript Library, Professor Sabine Schmidtke’s “Zaydi Manuscript Tradition: A Digital Portal” project continued to grow. The repository now hosts 1,389 manuscripts available to the public through open access. It is planned that by 2020, some ten thousand to fifteen thousand manuscripts (mainly from Yemen, but also from European and North American libraries and other places in the Middle East) will be uploaded to the repository and the portal (see www.ias.edu/digital-scholarship-zaydi-manuscript-tradition).

Supported by funding from Annette Merle Smith and from the Charles and Lisa Simonyi Fund for Arts and Sciences, the effort to digitize the Institute’s unique collection of squeezes of ancient Greek inscriptions, led by Professor Angelos Chaniotis, is now underway. The project currently seeks additional funding via a Council on Library and Information Resources grant now in the final round of competition. In April, Aaron Hershkowitz joined the effort as the Squeeze Digitization Project Coordinator. To date, 5,593 squeezes have been scanned, of which 411 have been uploaded with attendant metadata to the *Krateros: Squeezes of Greek Inscriptions at the IAS* collection in Albert (see www.ias.edu/krateros), where they are available open access.

Albert, the Digital Repository of IAS, was launched in September. Its goal is to provide open access to the scholarly work of the Institute’s Faculty, Emeriti, and Long-term Members. To date, the repository hosts over four hundred documents, and now serves as the home of the Shelby White and Leon Levy Archives Digital Collections, as well as the aforementioned *Krateros* collection. Plans for further development include the integration of an embedded image viewer into the platform, the automatic import of existing papers from key online repositories, and most importantly, growth in the number of Faculty whose collections are housed in Albert (see <https://albert.ias.edu>).

The DigitalScholarship@IAS website remains a key resource for IAS scholars working in the field. The webpage, which is continuously curated, contains a powerful toolbox for digital scholarship; resources for historians, social scientists, and natural scientists; information on events in this field at IAS and neighboring institutions; and digital scholarship projects at the Institute.

DIGITAL SCHOLARSHIP CONVERSATIONS, 2017–18

October 19

Digital Scholarship Conversations + Open Access, Copyright Law, and Licensing in Scholarship + **Kyle K. Courtney**, Esq., Harvard University

October 20

Digital Scholarship Conversations + Open Access, Publishing, and Scholarship: The Future? + **Kyle K. Courtney** Esq., Harvard University

November 17

Digital Scholarship Conversations + Digital Islamic Law: Prospects and Pitfalls + **Intisar A. Rabb**, Harvard Law School; and **Sharon Tai**, Harvard Law School

March 30

Digital Scholarship Conversations + Computing Lexica & Dictionaries + **George A. Kiraz**, Beth Mardutho: The Syriac Institute; Member, School of Historical Studies

RECORD OF EVENTS

School of Historical Studies

September 26

Medieval Studies Seminar ♦ *First Term Introductions* ♦ **Patrick J. Geary**, Andrew W. Mellon Professor, School of Historical Studies

September 27

Modern International Relations Seminar ♦ *Informal Group Discussion*

October 4

Early Modern History Seminar ♦ *“Black Like Me”: African Catholicism and White Hostility* ♦ **Erin Rowe**, Johns Hopkins University; Member, School of Historical Studies

Modern International Relations Seminar ♦ *Informal Group Discussion*

October 5

Lunchtime Colloquia Series ♦ *First Term Introductions* ♦ **Angelos Chaniotis**, Professor, School of Historical Studies

October 10

Ancient Studies Seminar ♦ *The Ostraca of Maresha* ♦ **Avner Ecker**, The Hebrew University of Jerusalem

October 11

Modern International Relations Seminar ♦ *Seeing Red: France and the People's Republic of China, 1949–2005* ♦ **Catherine Clark**, Massachusetts Institute of Technology; Member, School of Historical Studies

October 12

Lunchtime Colloquia Series ♦ *Understanding Is Within One's Grasp (liaoran zaiwo 瞭然在握): The Healer's Body-as-Technology in Classical Chinese Medicine* ♦ **Marta Hanson**, Johns Hopkins University; Member, School of Historical Studies

October 16

East Asian Studies Seminar ♦ *Wukong's Itinerary to India* ♦ **Minoru Inaba**, Kyoto University; Member, School of Historical Studies

October 17

Near Eastern Studies at the Institute for Advanced Studies Lecture Series ♦ *The Corpus of the Arabic Science of Weights: Textual Tradition, Theoretical Scope, and Significance in the History of Mechanics* ♦ **Mohammed Abattouy**, Mohammed V University

October 18

Art History Seminar ♦ *A Pope for a Pope: Michelangelo's Non-finito and Baronio's Christian Antiquarianism* ♦ **Carolina Mangone**, Princeton University; Member, School of Historical Studies

Modern International Relations Seminar ♦ *Expert Capital: Houston and the Making of a Service Empire* ♦ **Betsy Beasley**, Harvard University; Member, School of Historical Studies

Early Modern History Seminar ♦ *Eighteenth-Century Slow Time: Seven Propositions* ♦

Jonathan Sachs, Concordia University, Montreal; Member, School of Historical Studies

October 19

Lunchtime Colloquia Series ♦ *How Marco Polo Got Home* ♦ **Timothy Brook**, The University of British Columbia; Member, School of Historical Studies

October 24

Ancient Studies Seminar ♦ *The Reform of the Monetary System and the Control of the Monetary Exchange in Egypt in the Second Century B.C.* ♦ **Fabienne Burkhalter**, Université Lille 3; Member, School of Historical Studies

Medieval Studies Seminar ♦ *Byzantium and Big History: Climate, Environment, and Society in the Premodern World* ♦ **Adam Izdebski**, Jagiellonian University, Krakow; Member, School of Historical Studies

October 25

Near Eastern Studies Seminar ♦ *“Unconventional” Kalām Texts: Examples from the Zaydī Literature* ♦ **Jan Thiele**, Consejo Superior de Investigaciones Científicas.

October 26

Lunchtime Colloquia Series ♦ *Medieval Nordic Laws—When? Why? How?* ♦ **Stefan Brink**, University of Aberdeen; Member, School of Historical Studies

October 30

Art History Seminar ♦ *Metaphors of Love and Birth in Andrea del Sarto's “Madonna del Sacco”* ♦ **Jonathan Unglaub**, Brandeis University; Member, School of Historical Studies

East Asian Studies Seminar ♦ *Narrating the Concept of the Great State* ♦ **Timothy Brook**, The University of British Columbia; Member, School of Historical Studies

November 1

Early Modern History Seminar ♦ *The Invention of the Amboyna Massacre* ♦ **Alison Games**, Georgetown University; Member, School of Historical Studies

Modern International Relations Seminar ♦ *Business Groups and the United States' Support for European Integration, 1946 to 1986* ♦ **Janick Marina Schaufelbuehl**, Université de Lausanne; Member, School of Social Science

November 2

Lunchtime Colloquia Series ♦ *Q. Sulpicius Maximus, Poet, Eleven Years Old* ♦ **Kathleen Coleman**, Harvard University; Member, School of Historical Studies

November 6

East Asian Studies Seminar ♦ *Making Confinement Confucian: Imprisoned Officials and Their Families* ♦ **Ying Zhang**, The Ohio State University; Member, School of Historical Studies

Art History Seminar ♦ *Pictorial Replication* ♦ **Michael Koortbojian**, Princeton University

November 7

Medieval Studies Seminar ♦ *Images of Sacred Blackness* ♦ **Erin Rowe**, Johns Hopkins University; Member, School of Historical Studies

November 8

Modern International Relations Seminar ♦ *Informal Group Discussion*

November 9

Lunchtime Colloquia Series ♦ *Problematizing the Political Prisoner: The Case of Ming China (1368–1644)* ♦ **Ying Zhang**, The Ohio State University; Member, School of Historical Studies

November 13

Art History Seminar ♦ *The Byzantine Idiom in Medieval Spain Just Before and Just After the Medieval Conquest* ♦ **Cecily Hilsdale**, McGill University; Member, School of Historical Studies

East Asian Studies Seminar ♦ *Men of One Age: Japanese Fieldworkers in the Transwar World* ♦ **Miriam Kingsberg Kadia**, University of Colorado; Member, School of Social Science

November 14

Ancient Studies Seminar ♦ *Constantine's Arch and His Military Image at Rome* ♦ **Michael Koortbojian**, Princeton University

Medieval Studies Seminar ♦ *Comparing Princely Rank in Late Medieval Europe: Why and How?* ♦ **Jörg Peltzer**, Universität Heidelberg; Member, School of Historical Studies

November 15

Early Modern History Seminar ♦ *The Fire (Trading in the World)* ♦ **Timothy Brook**, The University of British Columbia; Member, School of Historical Studies

Near Eastern Studies Seminar ♦ *The Bible in its Near Eastern Contexts (Ancient, Medieval, Modern): Philological Perspectives on the Pentateuch, Syriac, Samaritan, and Arabic Bible. A Panel Discussion* ♦

Sabine Schmidtke, Professor, School of Historical Studies; **George Kiraz**, Beth Mardutho: The Syriac Institute; Member, School of Historical Studies; **Konrad Schmid**, Universität Zürich; Member, School of Historical Studies; **Stefan Schorch**, Martin-Luther-Universität Halle-Wittenberg; Member, School of Historical Studies

November 16

Lunchtime Colloquia Series ♦ *The Dot Between Philology and Numerical Notation* ♦ **George Kiraz**, Beth Mardutho: The Syriac Institute; Member, School of Historical Studies

November 20

Art History Seminar ♦ *The Thing I Have Loved the Best: Significant Jewels* ♦ **Cynthia Hahn**, Hunter College, The City University of New York; Member, School of Historical Studies

November 21

Ancient Studies Seminar ♦ *Rotten Limbs and Runny Noses: Modern Reflections on Ancient Geriatrics* ♦ **Hartwin Brandt**, Otto-Friedrich-Universität of Bamberg; Member, School of Historical Studies

Medieval Studies Seminar ♦ *Low Status Cloth and Dress in the Carolingian World* ♦ **Valerie Garver**, Northern Illinois University; Member, School of Historical Studies

November 22

Near Eastern Studies Seminar ♦ *The Perception of Slavs/Saqaliba in Arabic Sources of the Ninth to Twelfth Centuries* ♦ **Eduard Mühle**, Westfälische Wilhelms-Universität Münster; Member, School of Historical Studies

November 27

East Asian Studies Seminar ♦ *Upending Convention: "Lettered" Experimentation and New Technologies in Turn-of-the-Century Hangzhou* ♦ **Eugenia Lean**, Columbia University; Member, School of Historical Studies

November 28

Medieval Studies Seminar ♦ *Integration and Persistence in Post-migration Longobard Society: Textual and Genomic Evidence* ♦ **Patrick J. Geary**, Andrew W. Mellon Professor, School of Historical Studies

November 29

Early Modern History Seminar ♦ *Preamble and Introduction, "Understanding Is Within One's Grasp (liaoran zaiwo 瞭然在握): The Healer's Body-as-Technology in Classical Chinese Medicine"* ♦ **Marta Hanson**, Johns Hopkins University; Member, School of Historical Studies

Near Eastern Studies Seminar ♦ *A Names Ontology for Middle East History* ♦ **Will Hanley**, Florida State University; Member, School of Historical Studies

November 30

Lunchtime Colloquia Series ♦ *Toward a Social History of Jewish Marriage in Medieval Northern Europe* ♦ **Elisheva Baumgarten**, The Hebrew University of Jerusalem; Member, School of Historical Studies

December 4

East Asian Studies Seminar ♦ *Assembling Communities of Culinary and Mortuary Practice—Rethinking Zhou Contact with Their Western Neighbors (1046–771 B.C.E.)* ♦ **Yitzchak Jaffe**, New York University

December 5

Medieval Studies Seminar ♦ *The Notion of Slavic Unity during the Middle Ages* ♦ **Eduard Mühle**, Westfälische Wilhelms-Universität Münster; Member, School of Historical Studies

December 6

Near Eastern Studies Seminar ♦ *Isaiah, a Biblical Prophet and His Message in Islamic Tradition* ♦ **Sebastian Günther**, Georg-August-Universität Göttingen; Member, School of Historical Studies

Modern International Relations Seminar ♦ *Informal Group Discussion*

December 7

Lunchtime Colloquia Series ♦ *Spaces of Non-alignment* ♦ **Vladimir Kulić**, Florida Atlantic University; Member, School of Historical Studies

S.T. Lee Lecture ♦ *The Visual Culture of Iranian Twelver Shiism in the Qajar Period* ♦ **Ulrich Marzolph**, Akademie der Wissenschaften zu Göttingen

December 7–9

Shii Studies: The State of the Art International Conference ♦ *Opening Remarks* ♦ **Sabine Schmidtke**, Professor, School of Historical Studies ♦ *A Medieval Nusayri Shaykh's Disputations and the Study of the Nusayris in Western Academia* ♦ **Mushegh Asatryan**, University of Calgary ♦ *The Past, Present, and Future of Druze Studies* ♦ **Samer Traboulsi**, University of North Carolina at Asheville ♦ *Pir Sabzali and the Missing Sources of Ismaili History* ♦ **Shafique N. Virani**, University of Toronto ♦ *Documentary Sources on Ismatism in Badakhshan: Genealogical History and the Construction of Confessional Identity in Badakhshan* ♦ **Jo-Ann Gross**, The College of New Jersey ♦ *Occultist Imamophilia in Timurid-Safavid Iran* ♦ **Matthew Melvin-Koushki**, University of South Carolina ♦ *The Uniqueness of the Fatimid State* ♦ **Yaacov Lev**, Bar-Ilan University ♦ *Islamic Reform in Contemporary Iran: The Shiite Legacy* ♦ **Soroush Dabbagh**, University of Toronto ♦ *Between the Lines: Reading the History of Papers from Early Manuscripts in the Glaser Collection Held in Berlin* ♦ **Anne Regourd**, University of Copenhagen ♦ *Imamic Governance and Sharī'a Justice in Twentieth-Century Yemen* ♦ **Brinkley**

Messick, Columbia University ♦ *From Kūfā to Yemen to Baghdad: The Evolution of Zaydī Dialectics on the Imamate* ♦ **Nebil A. Husayn**, University of Miami ♦ *The Parting of Ways Between 'Alid Shi'ism and 'Abbāsīd Shi'ism in the Wake of the 'Abbāsīd Revolution: A Reexamination* ♦ **Deborah Tor**, University of Notre Dame ♦ *New Evidence for the History of Iranian Jewry and Imāmī-Jewish Relations from Shī'ī Manuscript Repositories in Iran* ♦ **Dennis Halfit**, Ben-Gurion University of the Negev ♦ *Jewish-Shii Studies: Past Contributions and Future Prospects* ♦ **Ehud Krinis**, Ben-Gurion University of the Negev ♦ *Levy Billig (1897–1936): An Understudied Episode in the History of Shī'ī Studies* ♦ **Roy Vilozny**, University of Haifa ♦ *Al-Mā'mūn's Translators: Sectarian Genealogies of the Graeco-Arabic Translation Movement* ♦ **Amin Ehteshami**, University of California, Berkeley ♦ *Historicization of Shi'ism and Shi'itization of History: Forty Years of Imami Studies from Henry Corbin to Mohammad Ali Amir-Moezzi* ♦ **Mathieu Terrier**, Centre National de la Recherche Scientifique, Paris ♦ *The Contemporary Shī'a Seminary in Iran: Opponents and Adherents of Philosophy and Sufism* ♦ **Seyed Amir Hossein Asghari**, Indiana University ♦ *Dating Versions of the Karbalā' Story* ♦ **Torsten Hylén**, Dalarna University ♦ *"The Disciples of al-Shaykh": Imāmī Legal Scholarship after al-Ṭūsī (d. 460/1067)* ♦ **Ali Rida Rizek**, Georg-August-Universität Göttingen ♦ *The ijāza of al-'Allāma al-Hillī to the Banū Zuhra: Sources for the History of the School of Hilla* ♦ **Aun Hasan Ali**, University of Colorado ♦ *Notes on the Life and Legacy of al-Shahīd al-Thānī, Zayn al-Dīn al-'Āmilī* ♦ **Devin Stewart**, Emory University ♦ *How Do We Deal with Imamic Hadith? The Case of the Historical Development in the Imams' Statements of Khums* ♦ **Edmund Hayes**, Universiteit Leiden ♦ *Early Shī'ī Law: Limitations and Possibilities of Current Scholarship* ♦ **Robert Gleave**, University of Exeter ♦ *The Problem of Additions in the Manuscript Tradition of the Ikhwān al-Ṣafā'* ♦ **Carmela Baffioni**, Institute for Ismaili Studies, London ♦ *Fatimid Ritual: From Mamluk to Modern Scholarship* ♦ **Daniella Talmon-Heller**, Ben-Gurion University of the Negev ♦ *Ismā'īlism as Shī'ism: The Construction of a Historical Category of Analysis* ♦ **Rodrigo Adem**, Harvard University ♦ *Shī'ism as Epic in the 'Alī Nāmāh* ♦ **George Warner**, SOAS, University of London ♦ *The Origins, Usage, and Indeterminacy of Sectarian Labels: "Batris" and "Rafidis" as Case Studies* ♦ **Michael Dann**, University of Illinois at Urbana-Champaign ♦ *Early Shī'ī Discourse on Religious Leadership: Penitence, Revolution, and Eschatology after Imam Ḥusayn* ♦ **Mohammad Sagha**, The University of Chicago ♦ *Mu'tazilism Ignored, Espoused, and Negotiated: Imami Interpretations of the Covenant Verse* ♦ **Hussein Abdulsater**, University of Notre Dame ♦ *Shiite Anti-Sunni Polemics and the Sunni Tafsiir Tradition* ♦ **Walid Saleh**, University of Toronto ♦ *Questioning Center and Periphery in Modern Shi'ism* ♦ **Simon Wolfgang Fuchs**, Albert-Ludwigs-Universität Freiburg

December 11

Art History Seminar ♦ *Architecture of Non-alignment in Post-war Yugoslavia* ♦ **Vladimir Kulić**, Florida Atlantic University; Member, School of Historical Studies

December 12

Ancient Studies Seminar ♦ *How God Became a Lawgiver: The Torah's Place in the History of Ancient Near Eastern Law* ♦ **Konrad Schmid**, Universität Zürich; Member, School of Historical Studies

Medieval Studies Seminar ♦ *Scandinavia and Its Neighbours, A.D. 700–1100: An Attempt of a Synthesis* ♦ **Stefan Brink**, University of Aberdeen; Member, School of Historical Studies

December 14

Lunchtime Colloquia Series ♦ *Apes, Slaves, and Global Markets: Boundaries of Humanity in Enlightenment Debates* ♦ **Silvia Sebastiani**, École des Hautes Études en Sciences Sociales, Paris; Member, School of Historical Studies

December 15

Early Modern History Seminar ♦ *Literati Men, Talented Women, and the Practice of Polygamy* ♦ **Weijing Lu**, University of California, San Diego; Member, School of Historical Studies

December 18

Art History Seminar ♦ *The Orientation of Renaissance Art* ♦ **Alexander Nagel**, New York University; Member, School of Historical Studies

December 21

Lunchtime Colloquia Series ♦ *Painting as Miraculous Birth: Raphael's Sistine Madonna* ♦ **Jonathan Unglaub**, Brandeis University; Member, School of Historical Studies

January 16

Medieval Studies Seminar ♦ *Second Term Introductions* ♦ **Patrick J. Geary**, Andrew W. Mellon Professor, School of Historical Studies

January 18

Lunchtime Colloquia Series ♦ *Second Term Introductions* ♦ **Angelos Chaniotis**, Professor, School of Historical Studies

January 22

East Asian Studies Seminar ♦ *The Role of China in Japanese Literary Historiography of the Meiji Period (1868–1912)* ♦ **William Hedberg**, Arizona State University; Member, School of Historical Studies

January 23

Medieval Studies Seminar ♦ *Representation of and Responsibility for the Realm: A Cause for Social Differentiation in Late Medieval England and the Empire?* ♦ **Jörg Peltzer**, Universität Heidelberg; Member, School of Historical Studies

January 24

Modern International Relations Seminar ♦ *Informal Group Discussion*

January 25

Lunchtime Colloquia Series ♦ *Looking Within: Early Modern Jewelry as Devotion, Power, and Identity* ♦ **Cynthia Hahn**, Hunter College, The City University of New York; Member, School of Historical Studies

January 29

East Asian Studies Seminar ♦ *Asian Borderlands and Millenarianism, 1850–1900* ♦ **Kwangmin Kim**, University of Colorado; Member, School of Historical Studies

January 30

Medieval Studies Seminar ♦ *A Living Law and the Living Landscapes: The Byzantine Rural Code (Nomos Georgikos) and Its Textual History* ♦ **Adam Izdebski**, Jagiellonian University, Krakow; Member, School of Historical Studies

January 31

Early Modern History Seminar ♦ *Encountering the Future in Games of Chance* ♦ **Nicholas Baker**, Macquarie University; Member, School of Historical Studies

February 1

Lunchtime Colloquia Series ♦ *Divination and the Body in Ancient China* ♦ **Constance Cook**, Lehigh University; Member, School of Historical Studies

February 5

East Asian Studies Seminar ♦ *Feelings and the Logic of Space in the Lineage Novel of Late Chosŏn Korea (1392–1910)* ♦ **Ksenia Chizhova**, Princeton University

February 6

Medieval Studies Seminar ♦ *The Legend of Prester John* ♦ **John Eldevik**, Hamilton College; Member, School of Historical Studies

February 7

Modern International Relations Seminar ♦ *Informal Group Discussion*

February 8

Lunchtime Colloquia Series ♦ *Provincializing Ecologies: Environmental Change and the End of Antiquity* ♦ **Adam Izdebski**, Jagiellonian University, Krakow; Member, School of Historical Studies

February 13

Ancient Studies Seminar ♦ *Andragoras—A Seleukid Governor in Iran* ♦ **Marek Olbrycht**, University of Rzeszów; Member, School of Historical Studies

February 13–14

Genomics and Archaeology Workshop ♦ *Analyses of Genomic, Archaeological, and Isotopic Data from Pannonia and Italy* ♦ **Krishna Veeramah**, Stony Brook University, The State University of New York; and **Patrick J. Geary**, Andrew W. Mellon Professor, School of Historical Studies ♦ *Panel—Response and Reactions* ♦ **Falko Daim**, Römisch-Germanisches Zentralmuseum, Mainz; and **Philipp von Rummel**, Deutsches Archäologisches Institut, Berlin ♦ *Further Response and Reactions* ♦ **Walter Pohl**, Österreichische Akademie der Wissenschaften; and **Frans Theuws**, Universiteit Leiden ♦ *How Might Genomics Be Integrated into the Ongoing Research Projects of the Panelists in Different Regions of Eurasia and North Africa?* ♦ **Falko Daim**, Römisch-Germanisches Zentralmuseum, Mainz; **Philipp von Rummel**, Deutsches Archäologisches Institut, Berlin; **Walter Pohl**, Österreichische Akademie der Wissenschaften; and **Frans Theuws**, Universiteit Leiden

February 14

Early Modern History Seminar ♦ *What Law Is It There? Corsican Transregional Families, Trials, and Legal Knowledge in the Western Mediterranean (1590–1630)* ♦ **Guillaume Calafat**, Université Paris 1 Pantheon-Sorbonne; Member, School of Historical Studies

Modern International Relations Seminar ♦ *Informal Group Discussion*

February 15

Lunchtime Colloquia Series ♦ *From Paris to Beijing and Back Again, 1973–1974* ♦ **Catherine Clark**, Massachusetts Institute of Technology; Member, School of Historical Studies

February 19

Art History Seminar ♦ *Nativities, Central Italy, 1250–1450: Between Historia and Imago, the Rise of an Intercession Image?* ♦ **Giulia Puma**, Université de Nice Sophia Antipolis

February 20

Ancient Studies Seminar ♦ *A Rose Garden in Paradise: The Talmud and Manichaeism in a Sasanian Context* ♦ **Geoffrey Herman**, The Hebrew University of Jerusalem; Member, School of Historical Studies

Medieval Studies Seminar ♦ *Medieval Jewish Epitaphs* ♦ **Elisheva Baumgarten**, The Hebrew University of Jerusalem; Member, School of Historical Studies

February 21

Modern International Relations Seminar ♦ *Informal Group Discussion*

February 22

Lunchtime Colloquia Series ♦ *Imperfect Michelangelo* ♦ **Carolina Mangone**, Princeton University; Member, School of Historical Studies

February 26

Art History Seminar ♦ *Marcel Breuer's Work at the IAS* ♦ **John Davies**, John Davies Design

East Asian Studies Seminar ♦ *Ritual Healing: The Body-as-Technology in Mid-Seventh-Century Tang China* ♦ **Marta Hanson**, Johns Hopkins University; Member, School of Historical Studies

February 27

Ancient Studies Seminar ♦ *Roman Archaeology and the Politics of Power: Varro, Emperor Caesar, and the Spolia Opima* ♦ **Frederik Vervaet**, The University of Melbourne; Member, School of Historical Studies

Medieval Studies Seminar ♦ *Symptomatic Subjects: Bodies, Signs, and Narratives in Late Medieval England* ♦ **Julie Orlemanski**, The University of Chicago

February 28

Near Eastern Studies Seminar ♦ *The Syriac Community in the Late Ottoman Period: Digging in the Archives of Mardin* ♦ **George Kiraz**, Beth Mardutho: The Syriac Institute; Member, School of Historical Studies

Modern International Relations Seminar ♦ *Informal Group Discussion*

March 1

Lunchtime Colloquia Series ♦ *Recent Excavation and Research at the Sanctuary of Zeus at Mt. Lykaion, Arcadia* ♦ **David Gilman Romano**, The University of Arizona; Member, School of Historical Studies

March 5

Art History Seminar ♦ *The Medieval and the Age of Technological Reproducibility: The Central Role of the Gothic in Weimar-Era Debates on Original and Copy* ♦ **William Diebold**, Reed College; Member, School of Historical Studies

East Asian Studies Seminar ♦ *Mao Zedong Between Caopi and Yuan Shikai: Another Look at Twentieth-Century Chinese History* ♦ **Zvi Ben-Dor Benite**, New York University

March 6

Medieval Studies Seminar ♦ *Ex Oriente: Isaak und der Weisse Elefant* ♦ **William Diebold**, Reed College; Member, School of Historical Studies

March 8

Lunchtime Colloquia Series ♦ *Fascist Departures: Travel Writing and Transnational Encounters on the Periphery of Hitler's New Europe* ♦ **Rory Yeomans**, Member, School of Historical Studies

March 12

East Asian Studies Seminar ♦ *Marriage and Intimacy in Late Imperial China* ♦ **Weijing Lu**, University of California, San Diego; Member, School of Historical Studies

March 13

Ancient Studies Seminar ♦ *Thinking with Monsters: On the Societal Productivity of Ancient Greek Monsters* ♦ **Henry Heitmann-Gordon**, Ludwig-Maximilians-Universität München

Medieval Studies Seminar ♦ *A Singular and Plural Beast* ♦ **Jamie Kreiner**, University of Georgia; Member, School of Historical Studies

March 14

Early Modern History Seminar ♦ *Building the Marital Bond* ♦ **Weijing Lu**, University of California, San Diego; Member, School of Historical Studies

March 15

Lunchtime Colloquia Series ♦ *Learning and Spirituality Without Prophets and Scriptures, as Seen by the Medieval Muslim Scholar Ibn Tufayl* ♦ **Sebastian Günther**, Georg-August-Universität Göttingen; Member, School of Historical Studies

March 16

Epigraphic Friday ♦ *Epigraphy Between Philology and Technology* ♦ **Christopher Jones**, Harvard University ♦ *New Epigraphic Evidence from the Sanctuary of Zeus on Mount Lykaion* ♦ **Kyle Mahoney**, Sewanee: The University of the South ♦ *What Was the Xenike Lusis?* ♦ **Elizabeth Meyer**, University of Virginia ♦ *An Isolympian and Isopythian Festival in a Hellenistic Inscription from Messene* ♦ **Nino Luraghi**, Princeton University ♦ *Heracles Hoplophylax, Iudaioi, and a Palm Grove: A Fresh Look at I. Smyrna 697* ♦ **Martin Hallmannsecker**, University of Oxford ♦ *Naukleroi in Roman Miletus* ♦ **Ilias Arnautoglou**, Academy of Athens; Member, School of Historical Studies ♦ *The Photographs and Squeezes in the Louis Robert Archive* ♦ **Glen W. Bowersock**, Professor Emeritus, School of Historical Studies ♦ *Grammar and Ideology on Roman Imperial Milestones* ♦ **Carlos Noreña**, University of California, Berkeley; Member, School of Historical Studies ♦ *Remarks on Greek Inscriptions from Parthian Susa* ♦ **Marek Olbrycht**, University of Rzeszów; Member, School of Historical Studies ♦ *Herakles, Melqart, and the "Middle Ground": What Inscriptions Can Tell* ♦ **Marco Santini**, Princeton University ♦ *Constantine the Great and the Octagonal Church in Syrian Antioch* ♦ **Hartwin Brandt**, Otto-Friedrich-Universität Bamberg; Member, School of Historical Studies ♦ *Greek Inscriptions in the Poetry of Cavafy* ♦ **Angelos Chaniotis**, Professor, School of Historical Studies

March 20

Art History Seminar ♦ *Cartier-Bresson's Work in China* ♦ **Catherine Clark**, Massachusetts Institute of Technology; Member, School of Historical Studies

Ancient Studies Seminar ♦ *Law and the Imperial Imaginary in Republican Rome* ♦ **Carlos Noreña**, University of California, Berkeley; Member, School of Historical Studies

March 21

Near Eastern Studies Seminar ♦ *How to Translate Arcane Knowledge: Devising an Arabic Rendition of a Pythagorean Terminus Technicus* ♦ **Anna Izdebska**, Jagiellonian University, Krakow

March 22

Lunchtime Colloquia Series ♦ *We Have Discovered America! The United States in the Syrian Imagination, 1946–1963* ♦ **Kevin Martin**, Indiana University; Member, School of Historical Studies

March 27

Ancient Studies Seminar ♦ *Mt. Lykaion as the Arcadian Birthplace of Zeus* ♦ **David Gilman Romano**, The University of Arizona; Member, School of Historical Studies

East Asian Studies Seminar ♦ *The Expanding Boundaries of Slavery in Tang China* ♦ **Don Wyatt**, Middlebury College

March 28

Early Modern History Seminar ♦ *Boundaries of Humanity: Orangutans, Slaves, and Global Markets in Enlightenment Debates* ♦ **Silvia Sebastiani**, École des Hautes Études en Sciences Sociales, Paris; Member, School of Historical Studies

Near Eastern Studies Seminar ♦ *"We Have Discovered America": The U.S. in the Syrian Imagination, 1946–1963* ♦ **Kevin Martin**, Indiana University; Member, School of Historical Studies

Medieval Studies Seminar ♦ *Reliquaries and Memory* ♦ **Cynthia Hahn**, Hunter College, The City University of New York; Member, School of Historical Studies

Modern International Relations Seminar ♦ *Informal Group Discussion*

March 29

Lunchtime Colloquia Series ♦ *The Invention and Legacies of the Amboyna Massacre* ♦ **Alison Games**, Georgetown University; Member, School of Historical Studies

April 2

Art History Seminar ♦ *French State Propaganda Film for Gas Industry and Yves Klein's Tableaux-feu* ♦ **Brian Jacobson**, University of Toronto

East Asian Studies Seminar ♦ *Divination and the Body in Ancient China* ♦ **Constance Cook**, Lehigh University; Member, School of Historical Studies

April 4

Modern International Relations Seminar ♦ *Informal Group Discussion*

April 3

Ancient Studies Seminar ♦ *The Representation of Space in Graeco-Roman Relief Sculpture* ♦ **Michael Koortbojian**, Princeton University.

April 5

Lunchtime Colloquia Series ♦ *The German Atlantic: Recovering an Invisible World* ♦ **David Blackburn**, Vanderbilt University; Member, School of Historical Studies

April 9

Art History Seminar ♦ *Work in Progress on Joint Project on Guercino's Saint Petronilla* ♦ **Jonathan Unglaub**, Brandeis University; Member, School of Historical Studies; and **Carolina Mangone**, Princeton University; Member, School of Historical Studies

April 11

Modern International Relations Seminar ♦ *Informal Group Discussion*

April 12

Lunchtime Colloquia Series ♦ *Mass Deportations, Slave Wars, and the Augustan Pax Servilis* ♦ **Frederik Vervaeke**, The University of Melbourne; Member, School of Historical Studies

April 28–30

Workshop: Climate, Archaeology, and History in the Eurasian Middle Ages ♦ *Evidence for Medieval Volcanic Eruptions and Their Climatic Impacts* ♦ **Clive Oppenheimer**, University of Cambridge ♦ *East Asia Hydroclimate Estimates of 8th–13th-Century Ocean Temperatures* ♦ **Gabriel Vecchi**, Princeton University ♦ *Climate Models for Historical Applications: A General Introduction* ♦ **Jane Baldwin**, Princeton University ♦ *Hunnic Movements and Strategies: A Response to Climatic Fluctuations?* ♦ **Susanne Hakenbeck**, University of Cambridge ♦ *Seismic Events and Climate in the Archaeological Records of The Uyghur Khaganate: the Case of Por-Bajin* ♦ **Irina Arzhantseva**, Institute of Ethnology and Anthropology Russian Academy of Science ♦ *Why Not Karakorum? A New Look at an Old City* ♦ **Jan Bemann**, Universität Bonn ♦ *In the Service of the Khan? Artisans of Karakorum in the Light of Archaeological and Written Sources* ♦ **Susanne Reichert**, Universität Bonn ♦ *Climate and Empire in the Early Medieval Carpathian Basin: Huns, Avars, and Magyars* ♦ **Johannes Preiser-Kapeller**, Österreichische Akademie der Wissenschaften ♦ *Water and Climate Factors in the Early Medieval Culture Changes on the Lower Syr-Darya* ♦ **Heinrich Härke**, Eberhard Karls Universität Tübingen ♦

Nile Variability and Egyptian Civilization ♦

Joseph Manning, Yale University ♦ *Cultural and Social Change in the First Millennium B.C. With or Without Climate Change* ♦ **Ursula Brosseder**, Universität Bonn ♦ *Climate Push and Pull: A Hidden Driver of Geopolitical Cycle in China* ♦ **Qing Pei**, Education University of Hong Kong ♦ *Consilience in the Understanding of the Past: Building Connections Between Paleoclimatology, Palynology, and Economic History* ♦ **Adam Izdebski**, Jagiellonian University, Krakow ♦ *The Contribution of Climate Science to History: Questions, Fallacies, and Prospects* ♦ **Nicola Di Cosmo**, Luce Foundation Professor of East Asian History, School of Historical Studies

May 2

Early Modern History Seminar ♦ *The "Explanation of the Fingers and Palms"* ♦ **Marta Hanson**, Johns Hopkins University; Member, School of Historical Studies

May 15

Early Modern History Seminar ♦ *Henry Robinson's Mediterranean Experience (1604–1673): Tuscany, Trade, and Toleration in Seventeenth-Century England* ♦ **Guillaume Calafat**, Université Paris 1 Pantheon-Sorbonne; Member, School of Historical Studies

May 30

Early Modern History Seminar ♦ *The History of Women and the Science of Man in the Scottish Enlightenment* ♦ **Silvia Sebastiani**, École des Hautes Études en Sciences Sociales, Paris; Member, School of Historical Studies

June 4

Early Modern History Seminar ♦ *The Execution of Franz Ferdinand Engelsberger* ♦ **Yaacov Deutsch**, David Yellin College of Education, Jerusalem

June 6–9

Shii Studies Research Program Conference: The Zaydi Manuscript Tradition ♦ *Imam al-Mu'ayyad Yahyā b. Ḥamza's (d. 1348) Decree Legitimizing Confiscating and Selling Certain Types of Waqf* ♦ **Eirik Hovden**, University of Bergen ♦ *The Origins of the Adhān: Reports from the Family of 'Alī* ♦ **Nebil Husayn**, University of Miami ♦ *Practices of Zaydi Power in Medieval and Modern Yemen* ♦ **Daniel Mahoney**, Universität Wien ♦ *Kitāb al-Asās li-'Aqā'id al-Akyās* ♦ **Michael Payne**, Brown University ♦ *Negotiating Historicity of Qāḍī Nu'mān's (d. 363/974) Sources: Examining "Kitāb al-īḍāh" through a Zaydi Collection*, "Kutub Muḥammad b. Sallām b. Sayyār al-Kūfī" ♦ **Kumail Rajani**, University of Exeter ♦ *Wilfred Madelung's "Der Imam al-Qāsim b. Ibrāhīm und die Glaubenslehre der Zaiditen"* ♦ **Ekaterina Pukhovaia**, Princeton University ♦ *Daylamī Dynastic Structures, Military-Factional Politics, and the Zaydī Imāmate of the South Caspian* ♦ **Mohammad Sagha**, The University of Chicago ♦ *Notes on the History of Urūl al-Fiḡh and al-Qāḍī al-Nu'mān's Ikhtilāf usūl*

al-madhābīb ♦ **Devin Stewart**, Emory University ♦ *Takmilatu Majmu' al Hadi ilal Haqq* ♦ **Nuran Uoek**, Ankara University and Princeton University ♦ *Zaydism in Iran and Yemen* ♦ **Ali Zaherinezhad**, Universität Hamburg

June 28–29

Dots, Marginalia, and Peritexts in Middle Eastern Manuscripts Workshop ♦ *Paratextual Material in the Mansur Collection* ♦ **Sabine Schmidtke**, Professor, School of Historical Studies ♦ *The ijazat among the Zaydies: the Case of Majmu' al-ijazat by Ahmad al-Miswari* ♦ **Hassan Farhang Ansari**, Long-term Member, School of Historical Studies ♦ *The Masora as a Paratext* ♦ **Elvira Martín Contreras**, Centro de Ciencias Humanas y Sociales ♦ *Inscriptions and Scribbles on Margins of Hebrew Manuscripts from the Maghreb* ♦ **Yael Barouch**, The Hebrew University of Jerusalem ♦ *Chapter Divisions and the Transmission History of the MSS of the Tosefta* ♦ **Binyamin Katzoff**, The Hebrew University of Jerusalem ♦ *Hagiopolite Lectionary Rubrics in Arabic Gospels* ♦ **Robert Turnbull** ♦ *The Significance of Variae Lectiones and their Sigla in Hadith Collections* ♦ **Ali Zaherinezhad**, Universität Hamburg ♦ *Toward a Reading History of al-Jahiz's "Kitab al-Hayawan"* ♦ **Jeannie Miller**, University of Toronto ♦ *Peritextual Encoding of Metatron* ♦ **Aryeh M. Krawczyk**, The Emanuel Ringelblum Jewish Historical Institute ♦ *Ornithomorphic Imagery and Rinceaux in P. Cotsen-Princeton I* ♦ **Alyssa Cady**, Princeton University ♦ *Astrology in the Mamlūk Sultanate* ♦ **Fien De Block**, Ghent University ♦ *Dot Wars* ♦ **Jonathan Loopstra**, University of Northwestern, St. Paul ♦ *Syriac Transmission Eusebian Apparatus* ♦ **Jeremiah Coogan**, University of Notre Dame ♦ *Syriac Manuscript Peritexts and the Chaldaean Schism of 1552* ♦ **Lucy Parker**, University of Oxford ♦ *Some Notes on Muḥammad Pārsā's (d. 822/1420) Library* ♦ **Akram Habibulla**, Indiana University ♦ *Peritext as Textual Genealogy: Case Studies from Ottoman Manuscripts* ♦ **Aslihan Gürbüzel**, McGill University ♦ *Popular Heroic Stories . . . Ottoman* ♦ **Elif Sezer Aydınli**, Istanbul Şehir University ♦ *Word Division in West Semitic* ♦ **Aaron Koller**, Yeshiva University ♦ *Peritextual Indicators of Use and Transmission in Ancient Egyptian Funerary Texts* ♦ **Niv Allon**, Metropolitan Museum of Art ♦ *Reading Between the Lines: Interpreting Glosses in Sumerian Royal Hymns* ♦ **Szilvia Jáka-Sövegjártó**, Universität Heidelberg ♦ *The Language of Paper* ♦ **Meredith Quinn**, Harvard University ♦ *Dotology: Towards a Typology* ♦ **George Kiraz**, Beth Mardutho: The Syriac Institute; Member, School of Historical Studies

School of Mathematics

September 14

Working Group on Algebraic Number Theory

Joint IAS/Princeton University Number Theory Seminar ♦ *2ⁿ-Selmer Groups, 2ⁿ-Class Groups, and Goldfeld's Conjecture* ♦ **Alex Smith**, Harvard University

September 18

Computer Science/Discrete Mathematics Seminar I ♦ *Rigorous RG: A Provably Efficient and Possibly Practical Algorithm for Simulating 1D Quantum Systems* ♦ **Umesh Vazirani**, University of California, Berkeley

September 21

Working Group on Algebraic Number Theory

Joint IAS/Princeton University Number Theory Seminar ♦ *Cohomology of p-adic Stein Spaces* ♦ **Wiesława Nizioł**, École Normale Supérieure de Lyon; Member, School of Mathematics

September 26

Short Talks by Postdoctoral Members ♦ *Chromatic Homotopy Theory* ♦ **Irina Bobkova**, Member, School of Mathematics ♦ *Computing Maps between Fukaya Categories via Morse Trees* ♦ **Nathaniel Bottman**, Member, School of Mathematics ♦ *Homotopy Type Theory: Working Invariantly in Homotopy Theory* ♦ **Guillaume Brunerie**, Member, School of Mathematics ♦ *A Converse to a Theorem of Gross-Zagier, Kolyvagin, and Rubin* ♦ **Ashay Burungale**, Université Paris 13; Member, School of Mathematics ♦ *Towards Optimal Ramsey Graphs and Randomness Extractors* ♦ **Eshan Chattopadhyay**, Member, School of Mathematics ♦ *Period Map: Past, Present, and the Future* ♦ **Gao Chen**, Member, School of Mathematics

Computer Science/Discrete Mathematics Seminar II ♦ *Lifting Theorems in Communication Complexity and Applications* ♦ **Toniann Pitassi**, University of Toronto; Visiting Professor, School of Mathematics

September 27

Short Talks by Postdoctoral Members ♦ *Moduli Interpretations for Noncongruence Modular Curves* ♦ **William Yun Chen**, Member, School of Mathematics ♦ *Analysis and Design of Convolutional Networks via Hierarchical Tensor Decompositions* ♦ **Nadav Cohen**, Member, School of Mathematics ♦ *Diophantine Analysis and Special Sets* ♦ **Vesselin Dimitrov**, Member, School of Mathematics ♦ *Topological Structure of the Spectrum for Ergodic Schrödinger Operators* ♦ **Rui Han**, Member, School of Mathematics ♦ *Representations of p-adic Groups* ♦ **Jessica Fintzen**, Member, School of Mathematics

September 28

Working Group on Algebraic Number Theory

Joint IAS/Princeton University Number Theory Seminar ♦ *Kloosterman Sums and Siegel Zeros* ♦ **James Maynard**, Member, School of Mathematics

September 29

Short Talks by Postdoctoral Members ♦ *Mechanized Reasoning in Mathematics* ♦ **Kuen-Bang Favonia Hou**, Member, School of Mathematics ♦ *Liquid Crystals and Interacting Dimer Models* ♦ **Ian Jauslin**, Member, School of Mathematics ♦ *Joint Equidistribution of CM Points* ♦ **Ilya Khayutin**, Princeton University; Veblen Research Instructor, School of Mathematics ♦ *Some Problems Related to Partial Sums of Fourier Integrals* ♦ **Jongchon Kim**, University of Wisconsin–Madison; Member, School of Mathematics ♦ *Categorical Actions in Geometry and Representation Theory* ♦ **Clemens Koppensteiner**, Member, School of Mathematics ♦ *The Quantum Best Separable State Problem and Classical Connections* ♦ **Pravesh Kothari**, Princeton University; Member, School of Mathematics

October 2

Computer Science/Discrete Mathematics Seminar I ♦ *Crossing the Logarithmic Barrier for Dynamic Boolean Data Structure Lower Bounds* ♦ **Omri Weinstein**, Columbia University

Seminar on Theoretical Machine Learning ♦ *Hyperparameter Optimization: A Spectral Approach* ♦ **Elad Hazan**, Princeton University

Short Talks by Postdoctoral Members ♦ *Weights of Mod p Automorphic Forms* ♦ **Bao V. Le Hung**, Member, School of Mathematics ♦ *Multivariate Trace Inequalities* ♦ **Marius Christopher Lemm**, California Institute of Technology; Member, School of Mathematics ♦ *A[∞] Structures as a Language for Open Gromov–Witten Theory* ♦ **Sara Tukachinsky**, Member, School of Mathematics ♦ *p-adic L-Functions and Iwasawa Main Conjectures* ♦ **Zheng Liu**, Member, School of Mathematics ♦ *Zeros of Laplace Eigenfunctions and Propagation of Smallness* ♦ **Aleksandr Logunov**, Member, School of Mathematics ♦ *The Distribution of Primes and Zeros of Riemann's Zeta Function* ♦ **James Maynard**, Member, School of Mathematics

October 3

Locally Symmetric Spaces Seminar ♦ *Motivic Correlators and Locally Symmetric Spaces* ♦ **Alexander Goncharov**, Yale University; Member, School of Mathematics

Computer Science/Discrete Mathematics Seminar II ♦ *Elementary Open Problems in Algebra (with Consequences in Computational Complexity)* ♦ **Avi Wigderson**, Herbert H. Maass Professor, School of Mathematics

October 4

Short Talks by Postdoctoral Members ♦ *On Weak Epsilon Nets and the Radon Number* ♦ **Shay Moran**, University of California, San

Diego; Member, School of Mathematics ♦ *From Representations of the Symmetric Group to Branched Covers of the Disk* ♦ **Amitai Netser Zernik**, Member, School of Mathematics ♦ *The Mystery of Over-Parametrization in Neural Networks* ♦ **Behnam Neyshabur**, Member, School of Mathematics ♦ *Twisted Integral Orbit Parametrizations* ♦ **Aaron Pollack**, Member, School of Mathematics ♦ *Algebraic Groups in Positive Characteristic* ♦ **Srimathy Srinivasan**, Member, School of Mathematics ♦ *Geometry of the Smallest 1-Form Laplacian Eigenvalue on Hyperbolic Manifolds* ♦ **Michael Lipnowski**, Member, School of Mathematics

October 5

Working Group on Algebraic Number Theory

Joint IAS/Princeton University Number Theory Seminar ♦ *Unlikely Intersections for Algebraic Curves in Positive Characteristic* ♦ **David W. Masser**, Universität Basel; Visitor, School of Mathematics

October 6

Mathematical Conversations ♦ *Cohomology and Cryptography* ♦ **Akshay Venkatesh**, Stanford University; Distinguished Visiting Professor, School of Mathematics

Short Talks by Postdoctoral Members ♦ *The Local Multiplicity Problem for the Ginzburg–Rallis Model and the Generalized Shalika Model* ♦ **Chen Wan**, Member, School of Mathematics ♦ *Formulas Related to Zastava Spaces* ♦ **Jonathan Peiyu Wang**, Member, School of Mathematics ♦ *Finer Virtual Structure for Moduli Spaces of Holomorphic Curves* ♦ **Dingyu Yang**, Member, School of Mathematics ♦ *Geometry of Shimura Varieties* ♦ **Rong Zhou**, Member, School of Mathematics ♦ *The Relative Trace Formula Approach to the Global Gan–Gross–Prasad Conjecture for Unitary Groups* ♦ **Michał Zydor**, Member, School of Mathematics ♦ *The Geometry and Topology of Minimal Surfaces in \mathbb{R}^3 of Finite Total Curvature* ♦ **Otis Chodosh**, Veblen Research Instructor, School of Mathematics

October 7

Workshop on Topology: Identifying Order in Complex Systems ♦ *Discrete Conformal Geometry of Polyhedral Surfaces and Its Applications* ♦ **Feng Luo**, Rutgers, The State University of New Jersey ♦ *On Morse Index Estimates for Minimal Surfaces* ♦ **Davi Maximo**, University of Pennsylvania ♦ *Fast Predictive Models for Image Registration* ♦ **Marc Niethammer**, The University of North Carolina at Chapel Hill ♦ *Personalized Cancer Therapy Using Molecular Landscape Topology and Thermodynamics* ♦ **Edward Rietman**, University of Massachusetts ♦ *Consistent Manifold Representation for Topological Data Analysis* ♦ **Tim Sauer**, George Mason University

October 9

Princeton/IAS Symplectic Geometry Seminar ♦ *Wrapped Floer Theory and Homological Mirror Symmetry for Toric Calabi–Yau Manifolds* ♦ **Yoel Groman**, Columbia University

Computer Science/Discrete Mathematics Seminar I ♦ *Barriers for Rank Methods in Arithmetic Complexity* ♦ **Rafael Oliveira**, University of Toronto

Emerging Topics Working Group ♦ *An Introduction to Quantum Chaos* ♦ **Stéphane Nonnemacher**, Université Paris-Sud 11 ♦ *Fractal Uncertainty Principle and Its Applications* ♦ **Semyon Dyatlov**, Massachusetts Institute of Technology

Members' Seminar ♦ *Analysis and Topology on Locally Symmetric Spaces* ♦ **Akshay Venkatesh**, Stanford University; Distinguished Visiting Professor, School of Mathematics

October 10

Locally Symmetric Spaces Seminar ♦ *Cohomology of Arithmetic Groups and Automorphic Forms: An Introduction* ♦ **Laurent Clozel**, Université Paris-Sud 11; Member, School of Mathematics ♦ *Transfer Operators for (Relative) Functoriality “Beyond Endoscopy” I* ♦ **Yiannis Sakellaridis**, Rutgers, The State University of New Jersey; von Neumann Fellow, School of Mathematics

Emerging Topics Working Group ♦ *Semiclassical Analysis, Chaotic Dynamics, and Fractal Uncertainty Principle* ♦ **Semyon Dyatlov**, Massachusetts Institute of Technology ♦ *Proof of Fractal Uncertainty Principle* ♦ **Ruixiang Zhang**, Member, School of Mathematics ♦ *Control of Eigenfunctions on Hyperbolic Surfaces* ♦ **Long Jin**, Purdue University

Computer Science/Discrete Mathematics Seminar II ♦ *Structural Aspects of the Null–Cone Problem in Invariant Theory* ♦ **Ankit Garg**, Microsoft Research New England

October 11

Emerging Topics Working Group ♦ *An Introduction to Dolgopyat’s Method* ♦ **Frédéric Naud**, Université d’Avignon ♦ *Fractal Uncertainty Principle: Improving over the Volume Bound* ♦ **Semyon Dyatlov**, Massachusetts Institute of Technology ♦ *Limit Sets in Higher Dimensions* ♦ **Michael Magee**, Durham University

October 12

Working Group on Algebraic Number Theory

Emerging Topics Working Group ♦ *Long Time Propagation of Waves and the Hyperbolic Parametrix* ♦ **Stéphane Nonnemacher**, Université Paris-Sud 11 ♦ *An Introduction to Dolgopyat’s Method (continued)* ♦ **Frédéric Naud**, Université d’Avignon

Joint IAS/Princeton University Number Theory Seminar ♦ *On Residues of Eisenstein Series—through a Cohomological Lens* ♦ **Joachim Schwermer**, Universität Wien; Member, School of Mathematics

October 13

Emerging Topics Working Group ♦ *Fourier Decay for Limit Sets* ♦ **Semyon Dyatlov**, Massachusetts Institute of Technology ♦ *The Sum-Product Theorem* ♦ **Elon Lindenstrauss**, The Hebrew University of Jerusalem

October 16

Princeton/IAS Symplectic Geometry Seminar ♦ *Compactification of Moduli Spaces of J-Holomorphic Maps Relative to SNC Divisors* ♦ **Mohammad Tehrani**, Stony Brook University, The State University of New York

Seminar on Theoretical Machine Learning ♦ *Keeping IT Cool: Machine Learning for Data Center Cooling* ♦ **Nevena Lazić**, Google

Hermann Weyl Lectures ♦ *On the Mathematical Theory of Black Holes I* ♦ **Sergiu Klainerman**, Princeton University

October 17

Locally Symmetric Spaces Seminar ♦ *Cohomology of Arithmetic Groups and Automorphic Forms: An Introduction (continued)* ♦ **Laurent Clozel**, Université Paris-Sud 11; Member, School of Mathematics ♦ *Transfer Operators for (Relative) Functoriality “Beyond Endoscopy” II* ♦ **Yiannis Sakellaridis**, Rutgers, The State University of New Jersey; von Neumann Fellow, School of Mathematics

Hermann Weyl Lectures ♦ *On the Mathematical Theory of Black Holes II* ♦ **Sergiu Klainerman**, Princeton University

October 18

Mathematical Conversations ♦ *Spectral Gaps Without Frustration* ♦ **Marius Christopher Lemm**, California Institute of Technology; Member, School of Mathematics

Hermann Weyl Lectures ♦ *On the Mathematical Theory of Black Holes III* ♦ **Sergiu Klainerman**, Princeton University

October 19

Working Group on Algebraic Number Theory

Joint IAS/Princeton University Number Theory Seminar ♦ *The Arithmetic Intersection Conjecture* ♦ **Michael Rapoport**, University of Maryland and Universität Bonn

October 23

Princeton/IAS Symplectic Geometry Seminar ♦ *Wrapped Fukaya Categories and Functors* ♦ **Yuan Gao**, Stony Brook University, The State University of New York

Computer Science/Discrete Mathematics Seminar I ♦ *A Nearly Optimal Lower Bound on the Approximate Degree of AC^0* ♦ **Mark Bun**, Princeton University

Members' Seminar ♦ *Geometry and Arithmetic of Sphere Packings* ♦ **Alex Kontorovich**, Rutgers, The State University of New Jersey; von Neumann Fellow, School of Mathematics

October 24

Locally Symmetric Spaces Seminar ♦ *Cohomology of Arithmetic Groups and Eisenstein Series—an Introduction* ♦ **Joachim Schwermer**, Universität Wien; Member, School of Mathematics ♦ *Motivic Correlators and Locally Symmetric Spaces II* ♦ **Alexander Goncharov**, Yale University; Member, School of Mathematics

Joint IAS/Princeton University Number Theory Seminar ♦ *Elliptic Curves of Rank Two and Generalised Kato Classes* ♦ **Francesc Castella**, Princeton University

Computer Science/Discrete Mathematics Seminar II ♦ *On the Strength of Comparison Queries* ♦ **Shay Moran**, University of California, San Diego; Member, School of Mathematics

October 25

Mathematical Conversations ♦ *How Deep Is Your Proof?* ♦ **Toniann Pitassi**, University of Toronto; Visiting Professor, School of Mathematics

Analysis Seminar ♦ *Nematic Liquid Crystal Phase in a System of Interacting Dimers* ♦ **Ian Jauslin**, Member, School of Mathematics

October 26

Working Group on Algebraic Number Theory

Joint IAS/Princeton University Number Theory Seminar ♦ *A Converse Theorem of Gross–Zagier and Kolyvagin: CM Case* ♦ **Ye Tian**, Chinese Academy of Sciences, Beijing

Analysis Seminar ♦ *Quasi-periodic Solutions to Nonlinear PDEs* ♦ **Wei-Min Wang**, Université Paris-Sud 11

October 30

Princeton/IAS Symplectic Geometry Seminar ♦ *Weinstein Manifolds through Skeletal Topology* ♦ **Laura Starkston**, Stanford University

Computer Science/Discrete Mathematics Seminar I ♦ *Fooling Intersections of Low-Weight Halfspaces* ♦ **Rocco Servedio**, Columbia University

Members' Seminar ♦ *High Density Phases of Hard-Core Lattice Particle Systems* ♦ **Ian Jauslin**, Member, School of Mathematics

October 31

Locally Symmetric Spaces Seminar ♦ *Cohomology of Arithmetic Groups and Eisenstein Series— an Introduction (continued)* ♦ **Joachim Schwermer**, Universität Wien; Member, School of Mathematics ♦ *Motivic Correlators and Locally Symmetric Spaces III* ♦ **Alexander Goncharov**, Yale University; Member, School of Mathematics

Joint IAS/Princeton University Number Theory Seminar ♦ *Nonlinear Descent on Moduli of Local Systems* ♦ **Junho Peter Whang**, Princeton University

Computer Science/Discrete Mathematics Seminar II ♦ *Cap-Sets in $(F_q)^n$ and Related Problems* ♦ **Zeev Dvir**, Princeton University; von Neumann Fellow, School of Mathematics

November 1

Mathematical Conversations ♦ *The Three Pillars of Statistical Machine Learning: Then and Now* ♦ **Nadav Cohen**, Member, School of Mathematics

Analysis Seminar ♦ *Structure Theorems for Intertwining Wave Operators* ♦ **Wilhelm Schlag**, The University of Chicago; Visiting Professor, School of Mathematics

November 2

Joint IAS/Princeton University Number Theory Seminar ♦ *On the Notion of Genus for Division Algebras and Algebraic Groups* ♦ **Andrei S. Rapinchuk**, University of Virginia; Member, School of Mathematics

Analysis Seminar ♦ *Two-Bubble Dynamics for the Equivariant Wave Maps Equation* ♦ **Jacek Jendrej**, The University of Chicago

November 3

Special Seminar ♦ *Introduction to the Works of Takuro Mochizuki* ♦ **Pierre Deligne**, Professor Emeritus, School of Mathematics

November 6

Princeton/IAS Symplectic Geometry Seminar ♦ *Morse–Bott Cohomology from Homological Perturbation* ♦ **Zhengyi Zhou**, University of California, Berkeley

Computer Science/Discrete Mathematics Seminar I ♦ *Language Edit Distance, $(\min, +)$ -matrix Multiplication, and Beyond* ♦ **Barna Saha**, University of Massachusetts

Workshop on Motives, Galois Representations, and Cohomology around the Langlands Program ♦ *Functoriality and Algebraic Cycles* ♦ **Kartik Prasanna**, University of Michigan ♦ *p -adic Etale Cohomology of p -adic Symmetric Spaces* ♦ **Pierre Colmez**, Université Pierre et Marie Curie; Member, School of Mathematics ♦ *The Mod p Derived Spherical Hecke Algebra: Structure and Applications* ♦ **Niccolò Ronchetti**,

Stanford University ♦ *Algorithms for the Topology of Arithmetic Groups and Hecke Actions* ♦ **Michael Lipnowski**, Member, School of Mathematics

Seminar on Theoretical Machine Learning ♦ *Naturalizing a Programming Language* ♦ **Sida Wang**, Visitor, School of Mathematics

November 7

Workshop on Motives, Galois Representations, and Cohomology around the Langlands Program ♦ *Higher Hida Theory* ♦ **Vincent Pilloni**, Centre National de la Recherche Scientifique, Paris ♦ *Modularity Lifting Theorems for Non-regular Symplectic Representations* ♦ **George Boxer**, The University of Chicago ♦ *Potential Automorphy of Some Compatible Systems over CM Fields* ♦ **Patrick Allen**, University of Illinois at Urbana–Champaign; Member, School of Mathematics ♦ *Automorphy of Mod 3 Representations over CM Fields* ♦ **Chandrashekar Khare**, University of California, Los Angeles

Computer Science/Discrete Mathematics Seminar II ♦ *Pseudorandom Generators for Unordered Branching Programs* ♦ **Eshan Chattopadhyay**, Member, School of Mathematics

November 8

Workshop on Motives, Galois Representations, and Cohomology around the Langlands Program ♦ *Topological and Arithmetic Intersection Numbers Attached to Real Quadratic Cycles* ♦ **Henri Darmon**, McGill University ♦ *An Euler System for Genus 2 Siegel Modular Forms* ♦ **David Loeffler**, University of Warwick ♦ *A Derived Hecke Algebra in the Context of the Mod p Langlands Program* ♦ **Rachel Ollivier**, The University of British Columbia ♦ *Computations in the Topology of Locally Symmetric Spaces* ♦ **Mark McConnell**, Princeton University

Analysis Seminar ♦ *Time Quasi-periodic Gravity Water Waves in Finite Depth* ♦ **Massimiliano Berti**, Scuola Internazionale Superiore di Studi Avanzati, Trieste, Italy

November 9

Workshop on Motives, Galois Representations, and Cohomology around the Langlands Program ♦ *Pseudorepresentations and the Eisenstein Ideal* ♦ **Preston Wake**, University of California, Los Angeles ♦ *Higher Eisenstein Elements in Weight 2 and Prime Level* ♦ **Emmanuel Lecouturier**, Institut de Mathématiques de Jussieu–Paris Rive Gauche ♦ *Exceptional Splitting of Reductions of Abelian Surfaces with Real Multiplication* ♦ **Yunqing Tang**, Princeton University ♦ *Models for Galois Deformation Rings* ♦ **Brandon Levin**, The University of Chicago

November 10

Workshop on Motives, Galois Representations, and Cohomology around the Langlands Program ♦ *Solvable Descent for Cuspidal*

Automorphic Representations of $GL(n)$ ♦ **Laurent Clozel**, Université Paris-Sud 11; Member, School of Mathematics ♦ *Zagier’s Conjecture on $\zeta_F(4)$* ♦ **Alexander Goncharov**, Yale University; Member, School of Mathematics

November 13

Princeton/IAS Symplectic Geometry Seminar ♦ *Odd Sphere Bundles and Symplectic Manifolds* ♦ **Li-Sheng Tseng**, University of California, Irvine

Computer Science/Discrete Mathematics Seminar I ♦ *Learning Models: Connections between Boosting, Hard-Core Distributions, Dense Models, GAN, and Regularity I* ♦ **Russell Impagliazzo**, University of California, San Diego

Seminar on Theoretical Machine Learning ♦ *Towards a Better Understanding of Neural Networks: Learning Dynamics, Interpretability, and RL Generalization* ♦ **Maithra Raghu**, Cornell University

Members’ Seminar ♦ *Decomposition Theorem for Semi-simple Algebraic Holonomic D -Modules* ♦ **Takuro Mochizuki**, Kyoto University

November 14

Locally Symmetric Spaces Seminar ♦ *A Remark on Cohomology of Locally Symmetric Spaces* ♦ **Joseph Bernstein**, Tel Aviv University; Member, School of Mathematics ♦ *Automorphic Forms and Motivic Cohomology I* ♦ **Akshay Venkatesh**, Stanford University; Distinguished Visiting Professor, School of Mathematics

Computer Science/Discrete Mathematics Seminar II ♦ *Learning Models: Connections between Boosting, Hard-Core Distributions, Dense Models, GAN, and Regularity II* ♦ **Russell Impagliazzo**, University of California, San Diego

November 15

Special Seminar ♦ *Wild Harmonic Bundles and Related Topics I* ♦ **Takuro Mochizuki**, Kyoto University

Analysis Seminar ♦ *Thin Monodromy and Lyapunov Exponents, via Hodge Theory* ♦ **Simion Filip**, Harvard University

November 16

Working Group on Algebraic Number Theory

November 17

Special Seminar ♦ *Wild Harmonic Bundles and Related Topics II* ♦ **Takuro Mochizuki**, Kyoto University

November 20

Special Seminar ♦ *How to Modify the Langlands Dual Group* ♦ **Joseph Bernstein**, Tel Aviv University; Member, School of Mathematics

Members' Seminar ♦ *Representations of Kauffman Bracket Skein Algebras of a Surface* ♦ **Helen Wong**, Carleton College; von Neumann Fellow, School of Mathematics

November 21

Locally Symmetric Spaces Seminar ♦ *Automorphic Forms and Motivic Cohomology II* ♦ **Akshay Venkatesh**, Stanford University; Distinguished Visiting Professor, School of Mathematics

Joint IAS/Princeton University Number Theory Seminar ♦ *Joint Equidistribution of CM Points* ♦ **Ilya Khayutin**, Princeton University; Veblen Research Instructor, School of Mathematics

Computer Science/Discrete Mathematics Seminar II ♦ *A Practical Guide to Deep Learning* ♦ **Richard Zemel**, University of Toronto; Visitor, School of Mathematics

November 27

Princeton/IAS Symplectic Geometry Seminar ♦ *Open Gopakumar–Vafa Conjecture for Rational Elliptic Surfaces* ♦ **Yu-Shen Lin**, Harvard University

Computer Science/Discrete Mathematics Seminar I ♦ *Locally Testable and Locally Correctable Codes Approaching the Gilbert–Varshamov Bound* ♦ **Shubhangi Saraf**, Rutgers, The State University of New Jersey

Seminar on Theoretical Machine Learning ♦ *Beyond Log-Concavity: Provable Guarantees for Sampling Multi-Modal Distributions Using Simulated Tempering Langevin Monte Carlo* ♦ **Holden Lee**, Princeton University

Members' Seminar ♦ *Everything You Wanted to Know about Machine Learning but Didn't Know Whom to Ask* ♦ **Sanjeev Arora**, Princeton University; Visiting Professor, School of Mathematics

November 28

Locally Symmetric Spaces Seminar ♦ *Automorphic Forms and Motivic Cohomology III* ♦ **Akshay Venkatesh**, Stanford University; Distinguished Visiting Professor, School of Mathematics

Joint IAS/Princeton University Number Theory Seminar ♦ *Shimura Curves and New abc Bounds* ♦ **Hector Pasten**, Harvard University

Computer Science/Discrete Mathematics Seminar II ♦ *Geometric Complexity Theory from a Combinatorial Viewpoint* ♦ **Greta Panova**, University of Pennsylvania; von Neumann Fellow, School of Mathematics

November 29

Ruth and Irving Adler Expository Lecture in Mathematics ♦ *Lattices: From Geometry to Cryptography* ♦ **Oded Regev**, New York University

Mathematical Conversations ♦ *Approximate Prime Numbers* ♦ **James Maynard**, Member, School of Mathematics

Analysis Seminar ♦ *Nonuniqueness of Weak Solutions to the Navier–Stokes Equation* ♦ **Tristan Buckmaster**, Princeton University

November 30

Working Group on Algebraic Number Theory

Joint IAS/Princeton University Number Theory Seminar ♦ *Locally Symmetric Spaces: p -adic Aspects* ♦ **Laurent Fargues**, Institut de Mathématiques de Jussieu–Paris Rive Gauche

December 4

Princeton/IAS Symplectic Geometry Seminar ♦ *Open Gromov–Witten Theory of $(\mathbb{C}P^1, \mathbb{R}P^1)$ in All Genera and Gromov–Witten Hurwitz Correspondence* ♦ **Amitai Netser Zernik**, Member, School of Mathematics

Computer Science/Discrete Mathematics Seminar I ♦ *General Strong Polarization* ♦ **Madhu Sudan**, Harvard University

Joint IAS/Princeton University Number Theory Seminar ♦ *Torsion for Abelian Varieties of Type III and New Cases of the Mumford–Tate Conjecture* ♦ **Victoria Cantoral Farfan**, The Abdus Salam International Centre for Theoretical Physics, Trieste, Italy

Members' Seminar ♦ *Algebraic Combinatorics: Applications to Statistical Mechanics and Complexity Theory* ♦ **Greta Panova**, University of Pennsylvania; von Neumann Fellow, School of Mathematics

December 5

Locally Symmetric Spaces Seminar ♦ *Motivic Correlators and Locally Symmetric Spaces IV* ♦ **Alexander Goncharov**, Yale University; Member, School of Mathematics

Joint IAS/Princeton University Number Theory Seminar ♦ *Automorphy for Coherent Cohomology of Shimura Varieties* ♦ **Jun Su**, Princeton University

Computer Science/Discrete Mathematics Seminar II ♦ *Short Proofs Are Hard to Find (Joint Work with Toni Pitassi and Hao Wei)* ♦ **Ian Mertz**, University of Toronto

December 6

Analysis Seminar ♦ *Spectral Gaps without Frustration* ♦ **Marius Christopher Lemm**, California Institute of Technology; Member, School of Mathematics

December 7

Working Group on Algebraic Number Theory

Joint IAS/Princeton University Number Theory Seminar ♦ *From Counting Markoff Triples to Apollonian Packings; a Path via Elliptic K3 Surfaces and Their Ample Cones* ♦ **Arthur Baragar**, University of Nevada, Las Vegas

December 8

Mathematical Conversations ♦ *Proofs from Algorithms, Algorithms from Proofs* ♦ **Pravesh Kothari**, Princeton University; Member, School of Mathematics

Special Seminar ♦ *Diophantine Analysis in Thin Orbits* ♦ **Alex Kontorovich**, Rutgers, The State University of New Jersey; von Neumann Fellow, School of Mathematics ♦ *Markoff Surfaces and Strong Approximation* ♦ **Alexander Gamburd**, The Graduate Center, The City University of New York ♦ *Integral Points on Markoff-Type Cubic Surfaces* ♦ **Amit Ghosh**, Oklahoma State University ♦ *An Asymptotic for the Growth of Markoff–Hurwitz Triples* ♦ **Ryan Ronan**, Baruch College, The City University of New York ♦ *Integral Points and Curves on Moduli of Local Systems* ♦ **Junho Peter Whang**, Princeton University

December 11

Princeton/IAS Symplectic Geometry Seminar ♦ *Recent Developments in Knot Contact Homology* ♦ **Lenny Ng**, Duke University

Computer Science/Discrete Mathematics Seminar I ♦ *Recent Advances in High-Dimensional Robust Statistics* ♦ **Daniel Kane**, University of California, San Diego

Seminar on Theoretical Machine Learning ♦ *Learning with Little Data* ♦ **Richard Zemel**, University of Toronto; Visitor, School of Mathematics

Members' Seminar ♦ *Rigidity and Recurrence in Symplectic Dynamics* ♦ **Matthias Schwarz**, Universität Leipzig; Member, School of Mathematics

December 12

Locally Symmetric Spaces Seminar ♦ *Derived Deformation Rings for Group Representations* ♦ **Søren Galatius**, Stanford University ♦ *Transfer Operators between Relative Trace Formulas in Rank One* ♦ **Yiannis Sakellaridis**, Rutgers, The State University of New Jersey; von Neumann Fellow, School of Mathematics

Computer Science/Discrete Mathematics Seminar II ♦ *A PSPACE Construction of a Hitting Set for the Closure of Small Algebraic Circuits* ♦ **Amir Shpilka**, Tel Aviv University

December 13

Mathematical Conversations ♦ *Real Zeros of Random Polynomials in Several Variables* ♦ **Peter Sarnak**, Professor, School of Mathematics

Analysis Seminar ♦ *Sieve Methods: What Are They, and What Are They Good For?* ♦ **James Maynard**, Member, School of Mathematics

December 14

Joint IAS/Princeton University Number Theory Seminar ♦ *Ordinary Primes in Hilbert Modular Varieties* ♦ **Junecue Suh**, University of California, Santa Cruz

December 19

Locally Symmetric Spaces Seminar ♦ *Transfer Operators between Relative Trace Formulas in Rank One II* ♦ **Yiannis Sakellaridis**, Rutgers, The State University of New Jersey; von Neumann Fellow, School of Mathematics

January 16

Locally Symmetric Spaces Seminar ♦ *Working Group on Microlocal Analysis and Automorphic Forms* ♦ **Akshay Venkatesh**, Stanford University; Distinguished Visiting Professor, School of Mathematics ♦ *Modular Symbols and Arithmetic* ♦ **Romyar Sharifi**, University of California, Los Angeles; Member, School of Mathematics

January 17

Mathematical Conversations ♦ *Connections between Homotopy Theory and Number Theory* ♦ **Irina Bobkova**, Member, School of Mathematics

January 22

Computer Science/Discrete Mathematics Seminar I ♦ *The Matching Problem in General Graphs Is in Quasi-NC* ♦ **Ola Svensson**, École Polytechnique Fédérale de Lausanne

Members' Seminar ♦ *On a Conjecture for p -Torsion in Class Groups of Number Fields* ♦ **Lillian B. Pierce**, Duke University; von Neumann Fellow, School of Mathematics

January 23

Locally Symmetric Spaces Seminar ♦ *Modular Symbols and Arithmetic* ♦ **Romyar Sharifi**, University of California, Los Angeles; Member, School of Mathematics

Computer Science/Discrete Mathematics Seminar II ♦ *A Constant-Factor Approximation Algorithm for the Asymmetric Traveling Salesman Problem* ♦ **Ola Svensson**, École Polytechnique Fédérale de Lausanne

January 24

Mathematical Conversations ♦ *Zeros of Laplace Eigenfunctions* ♦ **Aleksandr Logunov**, Member, School of Mathematics

January 25

Seminar on Theoretical Machine Learning ♦ *Prediction and Control of Linear Dynamical Systems* ♦ **Cyril Zhang**, Princeton University

January 29

Computer Science/Discrete Mathematics Seminar I ♦ *Explicit, Epsilon-Balanced Codes Close to the Gilbert–Varshamov Bound* ♦ **Amnon Ta-Shma**, Tel Aviv University

Members' Seminar ♦ *Symmetries of Hamiltonian Actions of Reductive Groups* ♦ **David Ben-Zvi**, The University of Texas at Austin; Member, School of Mathematics

January 30

Locally Symmetric Spaces Seminar ♦ *Introduction to Spherical Varieties, 1* ♦ **Michal Zydor**, Member, School of Mathematics ♦ *Modular Symbols and Arithmetic* ♦ **Romyar Sharifi**, University of California, Los Angeles; Member, School of Mathematics

Computer Science/Discrete Mathematics Seminar II ♦ *Explicit, Epsilon-Balanced Codes Close to the Gilbert–Varshamov Bound* ♦ **Amnon Ta-Shma**, Tel Aviv University

January 31

Mathematical Conversations ♦ *Randomness to Structure* ♦ **Alex Kontorovich**, Rutgers, The State University of New Jersey; von Neumann Fellow, School of Mathematics

Analysis Seminar ♦ *Concentration Inequalities for Linear Cocycles and Their Applications to Problems in Dynamics and Mathematical Physics* ♦ **Silvius Klein**, Pontifical Catholic University of Rio de Janeiro ♦ *Möbius Disjointness Conjecture: Uniform Convergence and Entropy* ♦ **Mariusz Lemanczyk**, Nicolaus Copernicus University in Torun, Poland

February 1

Seminar on Theoretical Machine Learning ♦ *Two Approaches to (Deep) Learning with Differential Privacy* ♦ **Kunal Talwar**, Google Brain

February 5

Princeton/IAS Symplectic Geometry Seminar ♦ *Immersed Lagrangians near SYZ Singular Fibers* ♦ **Mohammed Abouzaid**, Columbia University

Computer Science/Discrete Mathematics Seminar I ♦ *Locally Repairable Codes, Storage Capacity, and Index Coding* ♦ **Arya Mazumdar**, University of Massachusetts

Members' Seminar ♦ *Some Things You Need to Know about Machine Learning but Didn't Know Whom to Ask (The Grad School Version)* ♦ **Sanjeev Arora**, Princeton University; Visiting Professor, School of Mathematics

February 6

Locally Symmetric Spaces Seminar ♦ *Moment Map for Spherical Varieties (after F. Knop)* ♦ **Michal Zydor**, Member, School of Mathematics

Computer Science/Discrete Mathematics Seminar II ♦ *Outlier-Robust Estimation via Sum of Squares* ♦ **Pravesh Kothari**, Princeton University; Member, School of Mathematics

February 7

Mathematical Conversations ♦ *An Introduction to Univalent Foundations* ♦ **Daniel R. Grayson**, University of Illinois at Urbana-Champaign; Visitor, School of Mathematics

Analysis Seminar ♦ *Nodal Sets of Laplace Eigenfunctions* ♦ **Aleksandr Logunov**, Member, School of Mathematics

February 8

Joint IAS/Princeton University Number Theory Seminar ♦ *The Galois Action on the Stable Homology of Symplectic Groups over \mathbb{Z}* ♦ **Akshay Venkatesh**, Stanford University; Distinguished Visiting Professor, School of Mathematics

Working Seminar in Algebraic Number Theory

February 12

Princeton/IAS Symplectic Geometry Seminar ♦ *Critical Toric Surfaces and Applications* ♦ **Weiwei Wu**, University of Georgia

Computer Science/Discrete Mathematics Seminar I ♦ *Nonlinear Dimensionality Reduction for Faster Kernel Methods in Machine Learning* ♦ **Christopher Musco**, Massachusetts Institute of Technology

Members' Seminar ♦ *Cocycles, Lyapunov Exponents, Localization* ♦ **Wilhelm Schlag**, The University of Chicago; Visiting Professor, School of Mathematics

February 13

Locally Symmetric Spaces Seminar ♦ *Moment Map for Spherical Varieties (after F. Knop)* ♦ **Michal Zydor**, Member, School of Mathematics, and **Yiannis Sakellaridis**, Rutgers, The State University of New Jersey; von Neumann Fellow, School of Mathematics ♦ *The Ngô Action via Geometric Satake* ♦ **David Ben Zvi**, The University of Texas at Austin; Member, School of Mathematics

Joint IAS/Princeton University Number Theory Seminar ♦ *Abstract Homomorphisms of Algebraic Groups and Applications* ♦ **Igor Rapinchuk**, Michigan State University

Computer Science/Discrete Mathematics Seminar II ♦ *Model Theory and Ultraproducts* ♦ **Maryanthe Malliaris**, The University of Chicago; von Neumann Fellow, School of Mathematics

February 14

Mathematical Conversations ♦ *The Ubiquity of Matrix Tuples across Mathematics* ♦ **Avi Wigderson**, Herbert H. Maass Professor, School of Mathematics

Analysis Seminar ♦ *On the Long-Term Dynamics of Nonlinear Dispersive Evolution Equations* ♦ **Wilhelm Schlag**, The University of Chicago; Visiting Professor, School of Mathematics

February 15

Joint IAS/Princeton University Number Theory Seminar ♦ *Categorical Representations of Reductive Groups* ♦ **David Ben-Zvi**, The University of Texas at Austin; Member, School of Mathematics

Working Seminar in Algebraic Number Theory

February 19

Princeton/IAS Symplectic Geometry Seminar ♦ *Quantum Periods Theorem for Landau–Ginzburg Potentials* ♦ **Dmitry Tonkonog**, University of California, Berkeley

February 20

Locally Symmetric Spaces Seminar ♦ *Knop’s Paper on Harish-Chandra Homomorphism for Reductive Group Actions* ♦ **Jonathan Peiyu Wang**, Member, School of Mathematics ♦ *Local to Global Relations of Periods* ♦ **Erez M. Lapid**, Weizmann Institute of Science; Member, School of Mathematics

Joint IAS/Princeton University Number Theory Seminar ♦ *Diophantine Approximation with Arithmetically Small Points* ♦ **Vesselin Dimitrov**, Member, School of Mathematics

Computer Science/Discrete Mathematics Seminar II ♦ *Some Closure Results for Polynomial Factorization* ♦ **Mrinal Kumar**, Harvard University

February 21

Mathematical Conversations ♦ *Dimension and Support of the Harmonic Measure; or, What Do Brownian Travelers See?* ♦ **Svitlana Mayboroda**, University of Minnesota; von Neumann Fellow, School of Mathematics

February 22

Working Group on Algebraic Number Theory

Seminar on Theoretical Machine Learning ♦ *On the Optimization of Deep Networks: Implicit Acceleration by Overparameterization* ♦ **Nadav Cohen**, Member, School of Mathematics

February 26

Princeton/IAS Symplectic Geometry Seminar ♦ *Chain Level Loop Bracket and Pseudo-holomorphic Disks* ♦ **Kei Irie**, Kyoto University

Computer Science/Discrete Mathematics Seminar I ♦ *A Tight Bound for Hypergraph Regularity* ♦ **Guy Moshkovitz**, Harvard University

Members’ Seminar ♦ *Representations of p -adic Groups* ♦ **Jessica Fintzen**, Member, School of Mathematics

February 27

Locally Symmetric Spaces Seminar ♦ *Invariant Differential Operators on Spherical Varieties (continued)* ♦ **Jonathan Peiyu Wang**, Member, School of Mathematics ♦ *Local to Global Relations of Periods (continued)* ♦ **Erez M. Lapid**, Weizmann Institute of Science; Member, School of Mathematics

Joint IAS/Princeton University Number Theory Seminar ♦ *Concentration Properties of Theta Lifts* ♦ **Farrell Brumley**, Université Paris 13; Member, School of Mathematics

Computer Science/Discrete Mathematics Seminar II ♦ *On the Communication Complexity of Classification Problems* ♦ **Roi Livni**, Princeton University

February 28

Mathematical Conversations ♦ *Bad Behavior* ♦ **Lillian B. Pierce**, Duke University; von Neumann Fellow, School of Mathematics

Analysis Seminar ♦ *Local Eigenvalue Statistics of Random Band Matrices* ♦ **Tatyana Shcherbina**, Princeton University

March 1

Working Group on Algebraic Number Theory

Joint IAS/Princeton University Number Theory Seminar ♦ *Fontaine–Mazur Conjecture in the Residually Reducible Case* ♦ **Lue Pan**, Princeton University

Seminar on Theoretical Machine Learning ♦ *Small-Loss Bounds for Online Learning with Partial Information* ♦ **Thodoris Lykouris**, Cornell University

March 5

Princeton/IAS Symplectic Geometry Seminar ♦ *Floer Cohomology and Maslov Flow* ♦ **Chris Woodward**, Rutgers, The State University of New Jersey

Computer Science/Discrete Mathematics Seminar I ♦ *Boolean Function Analysis: Beyond the Boolean Cube* ♦ **Yuval Filmus**, Technion–Israel Institute of Technology

Workshop on Representation Theory and Analysis on Locally Symmetric Spaces ♦ *Representations of p -adic Groups* ♦ **Jessica Fintzen**, Member, School of Mathematics ♦ *Supercuspidal L-Packets* ♦ **Tasho Kaletha**, University of Michigan ♦ *Wave-Front Set of Some Representations of Unipotent Reduction of the Group $SO(2n+1)$* ♦ **Jean-Loup Waldspurger**, Institut de Mathématiques de Jussieu–Paris Rive Gauche

March 6

Workshop on Representation Theory and Analysis on Locally Symmetric Spaces ♦ *About the Conjecture of Sakellaridis and Venkatesh on the Discrete Series for Archimedean Symmetric Spaces* ♦

Colette Moeglin, Institut de Mathématiques de Jussieu–Paris Rive Gauche ♦ *The Plancherel Formula for $L^2(GL_n(F) \backslash GL_n(\mathbb{E}))$ and Applications to the Ichino–Ikeda and Formal Degree Conjectures for Unitary Groups* ♦ **Raphael Beuzart-Plessis**, Centre National de la Recherche Scientifique, Paris ♦ *Restriction Problem for Non-generic Representation of Arthur Type* ♦ **Wee Teck Gan**, National University of Singapore ♦ *Relative Character Asymptotics and Applications* ♦ **Paul Nelson**, Eidgenössische Technische Hochschule Zürich

Computer Science/Discrete Mathematics Seminar II ♦ *Boolean Function Analysis: Beyond the Boolean Cube (continued)* ♦ **Yuval Filmus**, Technion–Israel Institute of Technology

March 7

Workshop on Representation Theory and Analysis on Locally Symmetric Spaces ♦ *Thin Part of Arithmetic Locally Symmetric Spaces* ♦ **Mikolaj Fraczyk**, Alfréd Rényi Institute of Mathematics, Hungarian Academy of Sciences, Budapest ♦ *Analytic Torsion for Congruence Quotients of $SL(n, \mathbf{R})/SO(n)$* ♦ **Jasmin Matz**, The Hebrew University of Jerusalem ♦ *Endoscopy and Cohomology Growth on Unitary Groups* ♦ **Simon Lindsay Marshall**, University of Wisconsin–Madison; Member, School of Mathematics

March 8

Workshop on Representation Theory and Analysis on Locally Symmetric Spaces ♦ *Special Cycles on Simple Shimura Varieties* ♦ **Wei Zhang**, Massachusetts Institute of Technology ♦ *Admissible Height Pairings of Algebraic Cycles* ♦ **Shouwu Zhang**, Princeton University ♦ *Arithmetic Theta Series* ♦ **Stephan Kudla**, University of Toronto ♦ *Euler Classes Transgressions and Eisenstein Cohomology of GL_N* ♦ **Nicolas Bergeron**, Institut de Mathématiques de Jussieu

March 9

Workshop on Representation Theory and Analysis on Locally Symmetric Spaces ♦ *The Present State of the Jacquet–Rallis Trace Formula* ♦ **Pierre-Henri Chaudouard**, Institut de Mathématiques de Jussieu–Paris Rive Gauche ♦ *Ax -Schanuel for Shimura Varieties* ♦ **Jacob Tsimerman**, University of Toronto ♦ *Endoscopy and Cohomology Growth on Unitary Groups* ♦ **Simon Lindsay Marshall**, University of Wisconsin–Madison; Member, School of Mathematics ♦ *Nodal Domains for Maass Forms* ♦ **Peter Sarnak**, Professor, School of Mathematics

March 12

Princeton/IAS Symplectic Geometry Seminar ♦ *Higher Ribbon Graphs* ♦ **David Nadler**, University of California, Berkeley

Members' Seminar ♦ *Math for Underprivileged High School Kids* ♦ **Rajiv Gandhi**, Program on Algorithmic and Combinatorial Thinking (PACT), and **Dan Zaharopol**, Bridge to Enter Advanced Mathematics (BEAM)

March 13

Locally Symmetric Spaces Seminar ♦ *Concentration Properties of Automorphic Forms and Spherical Varieties* ♦ **Farrell Brumley**, Université Paris 13; Member, School of Mathematics ♦ *Period Mappings Are Definable in the O-Minimal Structure $\mathbf{R}_{\{\text{an}, \text{exp}\}}$* ♦ **Jacob Tsimerman**, University of Toronto ♦ *Bounds for Character Twists of L-Functions* ♦ **Paul Nelson**, Eidgenössische Technische Hochschule Zürich

Joint IAS/Princeton University Number Theory Seminar ♦ *The Weyl Law for Algebraic Tori* ♦ **Ian Petrow**, Eidgenössische Technische Hochschule Zürich

Computer Science/Discrete Mathematics Seminar II ♦ *Abstract Convexity, Weak Epsilon-Nets, and Radon Number* ♦ **Shay Moran**, University of California, San Diego; Member, School of Mathematics

March 14

Mathematical Conversations ♦ *Synthetic Homotopy Theory: Going Beyond Set-Level Mathematics* ♦ **Guillaume Brunerie**, Member, School of Mathematics

March 15

Working Group on Algebraic Number Theory

Joint IAS/Princeton University Number Theory Seminar ♦ *Fourier–Jacobi Cycles and Derivative of L-Functions* ♦ **Yifeng Liu**, Northwestern University

March 19

Computer Science/Discrete Mathematics Seminar I ♦ *Operator Scaling via Geodesically Convex Optimization, Invariant Theory, and Polynomial Identity Testing* ♦ **Yuanzhi Li**, Princeton University

Members' Seminar ♦ *The Hidden Landscape of Localization* ♦ **Svitlana Mayboroda**, University of Minnesota; von Neumann Fellow, School of Mathematics

March 20

Locally Symmetric Spaces Seminar ♦ *Concentration Properties of Automorphic Forms and Spherical Varieties (continued)* ♦ **Farrell Brumley**, Université Paris 13; Member, School of Mathematics ♦ *Semiclassical Analysis, Amplification, and Subconvexity* ♦ **Simon Lindsay Marshall**, University of Wisconsin–Madison; Member, School of Mathematics

Computer Science/Discrete Mathematics Seminar II ♦ *Operator Scaling via Geodesically Convex Optimization, Invariant Theory, and Polynomial Identity Testing (continued)* ♦ **Yuanzhi Li**, Princeton University

March 21

Analysis Seminar ♦ *Vertical Perimeter versus Horizontal Perimeter* ♦ **Assaf Naor**, Princeton University; Member, School of Mathematics

March 26

Princeton/IAS Symplectic Geometry Seminar ♦ *Open Quantum Kirwan Map* ♦ **Guangbo Xu**, Princeton University

Computer Science/Discrete Mathematics Seminar I ♦ *Circuit Lower Bounds for Nondeterministic Quasi-Polytime: An Easy Witness Lemma for NP and NQP* ♦ **Cody Murray**, Massachusetts Institute of Technology

Members' Seminar ♦ *Kazhdan–Lusztig Theory for Matroids* ♦ **June Huh**, Visiting Professor, School of Mathematics

March 27

Locally Symmetric Spaces Seminar ♦ *Semiclassical Analysis, Amplification, and Subconvexity* ♦ **Simon Lindsay Marshall**, University of Wisconsin–Madison; Member, School of Mathematics ♦ *Analytic Aspects of Arthur's Trace Formula* ♦ **Tobias Finis**, Universität Leipzig

Joint IAS/Princeton University Number Theory Seminar ♦ *Summation Formulae and Speculations on Period Integrals Attached to Triples of Automorphic Representations* ♦ **Jayce Getz**, Duke University; Member, School of Mathematics

Computer Science/Discrete Mathematics Seminar II ♦ *Heisenberg Geometry and the Goemans–Linial SDP* ♦ **Assaf Naor**, Princeton University; Member, School of Mathematics

March 28

Mathematical Conversations ♦ *Hyperbolic Geometry and Quantum Invariants in Dimension 3* ♦ **Helen Wong**, Carleton College; von Neumann Fellow, School of Mathematics

Analysis Seminar ♦ *Polynomial Carleson Operators along the Paraboloid* ♦ **Lillian B. Pierce**, Duke University; von Neumann Fellow, School of Mathematics

March 29

Working Group on Algebraic Number Theory

Locally Symmetric Spaces Seminar ♦ *Kirillov Theory and Its Applications* ♦ **Ju-Lee Kim**, Massachusetts Institute of Technology; Member, School of Mathematics

Joint IAS/Princeton University Number Theory Seminar ♦ *The Structure of Generic Tame Type Galois Deformation Rings* ♦ **Bao V. Le Hung**, Member, School of Mathematics

Library Book Event ♦ *Piero della Francesca (ca. 1410–92), Painter/Mathematician: A Gift*

April 2

Princeton/IAS Symplectic Geometry Seminar ♦ *Generating the Fukaya Categories via Koszul Duality* ♦ **Yin Li**, University College London

Members' Seminar ♦ *On Expressiveness and Optimization in Deep Learning* ♦ **Nadav Cohen**, Member, School of Mathematics

April 3

Locally Symmetric Spaces Seminar ♦ *Kirillov Theory and Its Applications (continued)* ♦ **Ju-Lee Kim**, Massachusetts Institute of Technology; Member, School of Mathematics

Joint IAS/Princeton University Number Theory Seminar ♦ *The Generalized Whittaker Function on Quaternionic Exceptional Groups* ♦ **Aaron Pollack**, Member, School of Mathematics

Marston Morse Lectures ♦ *Exceptional Holonomy and Related Geometric Structures: Basic Theory* ♦ **Simon Donaldson**, Stony Brook University, The State University of New York

April 4

Marston Morse Lectures ♦ *Exceptional Holonomy and Related Geometric Structures: Examples and Moduli Theory* ♦ **Simon Donaldson**, Stony Brook University, The State University of New York

U.S. Income Tax Seminar for Members

April 5

Working Group on Algebraic Number Theory

Joint IAS/Princeton University Number Theory Seminar ♦ *Arithmetic of Automorphic L-Functions* ♦ **Anantharam Raghuram**, Indian Institute of Science Education and Research; Member, School of Mathematics

Seminar on Theoretical Machine Learning ♦ *A Compressed Sensing View of Unsupervised Text Embeddings, Bag-of-n-Grams, and LSTMs* ♦ **Mikhail Khodak**, Princeton University

April 6

Marston Morse Lectures ♦ *Exceptional Holonomy and Related Geometric Structures: Dimension Reduction and Boundary Value Problems* ♦ **Simon Donaldson**, Stony Brook University, The State University of New York

April 7

Workshop on Topology: Identifying Order in Complex Systems ♦ *Topologies of the Zero Sets of Random Real Projective Hypersurfaces and of Monochromatic Waves* ♦ **Peter Sarnak**, Professor,

School of Mathematics ♦ *Topological Filters: A Toolbox for Processing Dynamic Signals* ♦ **Michael Robinson**, American University ♦ *Fitting Manifolds to Data* ♦ **Charlie Fefferman**, Princeton University ♦ *Studying Fluid Flows with Persistent Homology* ♦ **Rachel Levanger**, University of Pennsylvania ♦ *Protein Folding Characterization via Persistent Homology* ♦ **Marcio Gameiro**, Universidade de São Paulo

April 9

Princeton/IAS Symplectic Geometry Seminar ♦ *Fukaya Categories of Calabi–Yau Hypersurfaces* ♦ **Paul Seidel**, Massachusetts Institute of Technology; Member, School of Mathematics

Computer Science/Discrete Mathematics Seminar I ♦ *Large Deviations in Random Graphs* ♦ **Eyal Lubetzky**, New York University

Emerging Topics Working Group ♦ *Arnold Diffusion for “Complete” Families of Perturbations with Two or Three Independent Harmonics* ♦ **Amadeu Delshams**, Universitat Politècnica de Catalunya ♦ *Symplectic Geometry of Hyperbolic Cylinders and Their Homoclinic Intersections* ♦ **Jean-Pierre Marco**, Université Pierre et Marie Curie

Diophantine Analysis working group seminar ♦ *Steenrod Operations and Tate’s Conjecture on the Brauer Group of a Surface* ♦ **Tony Feng**, Stanford University

April 10

Emerging Topics Working Group ♦ *A General Shadowing Result for Normally Hyperbolic Invariant Manifolds and Its Application to Arnold Diffusion* ♦ **Tere Seara**, Universitat Politècnica de Catalunya ♦ *Some Geometric Mechanisms for Arnold Diffusion* ♦ **Rafael de la Llave**, Georgia Institute of Technology

Joint IAS/Princeton University Number Theory Seminar ♦ *Nonspherical Poincaré Series, Cusp Forms, and L-Functions for $GL(3)$* ♦ **Jack Buttcane**, University at Buffalo, The State University of New York

Computer Science/Discrete Mathematics Seminar II ♦ *Explicit Binary Tree Codes with Polylogarithmic Size Alphabet* ♦ **Gil Cohen**, Princeton University; Visitor, School of Mathematics

April 11

Emerging Topics Working Group ♦ *Diffusion along Chains of Normally Hyperbolic Cylinders* ♦ **Marian Gidea**, Yeshiva University ♦ *Arnold Diffusion and Mather Theory* ♦ **Ke Zhang**, University of Toronto

Mathematical Conversations ♦ *Ordinary Points Mod p of Hyperbolic 3-Manifolds* ♦ **Mark Goresky**, Visitor, School of Mathematics

April 12

Working Group on Algebraic Number Theory

Emerging Topics Working Group ♦ *Growth of Sobolev Norms for the Cubic NLS near 1D Quasiperiodic Solutions* ♦ **Marcel Guardia**, Universitat Politècnica de Catalunya ♦ *The Way Weak $K.A.M.$ Pseudographs of Symplectic Twist Maps Fill the Annulus* ♦ **Marie-Claude Arnaud**, Université d’Avignon

Joint IAS/Princeton University Number Theory Seminar ♦ *S-Operators via the Categorical Trace* ♦ **Xinwen Zhu**, California Institute of Technology

Seminar on Theoretical Machine Learning ♦ *Stability and Generalization in Adaptive Data Analysis* ♦ **Vitaly Feldman**, Google Brain

April 16

Princeton/IAS Symplectic Geometry Seminar ♦ *The Wrapped Fukaya Category of a Weinstein Manifold Is Generated by the Lagrangian Cocore Disks* ♦ **Georgios Dimitroglou Rizell**, Uppsala University

Computer Science/Discrete Mathematics Seminar I ♦ *Sums of Squares over k -Subset Hypercubes* ♦ **Annie Raymond**, University of Massachusetts

April 17

Joint IAS/Princeton University Number Theory Seminar ♦ *A New Northcott Property for Faltings Height* ♦ **Lucia Mocz**, Princeton University

Computer Science/Discrete Mathematics Seminar II ♦ *A Simple Proof of a Reverse Minkowski Inequality* ♦ **Noah Stephens-Davidowitz**, Visitor, School of Mathematics

April 19

Working Group on Algebraic Number Theory

Joint IAS/Princeton University Number Theory Seminar ♦ *Mod p Points on Shimura Varieties with Parahoric Level Structure* ♦ **Rong Zhou**, Member, School of Mathematics

Seminar on Theoretical Machine Learning ♦ *Online Improper Learning with an Approximation Oracle* ♦ **Zhiyuan Li**, Princeton University

April 23

Princeton/IAS Symplectic Geometry Seminar ♦ *Mirror Spaces from Formal Deformation of Lagrangians and Their Gluing* ♦ **Hansol Hong**, Harvard University

April 24

Joint IAS/Princeton University Number Theory Seminar ♦ *Algorithms for the Topology of Arithmetic Groups and Hecke Actions II* ♦ **Michael Lipnowski**, Member, School of Mathematics

April 26

Working Group on Algebraic Number Theory

Joint IAS/Princeton University Number Theory Seminar ♦ *Ax–Schanuel Results for Shimura Varieties* ♦ **Jonathan Pila**, University of Oxford

Seminar on Theoretical Machine Learning ♦ *Entire Regularization Path for Maximum Entropy Models* ♦ **Yoram Singer**, Princeton University

April 30

Princeton/IAS Symplectic Geometry Seminar ♦ *Birational Calabi–Yau Manifolds Have the Same Small Quantum Products* ♦ **Mark McLean**, Stony Brook University, The State University of New York

May 1

Joint IAS/Princeton University Number Theory Seminar ♦ *A Converse to a Theorem of Gross–Zagier, Kolyvagin, and Rubin II* ♦ **Ashay Burungale**, Université Paris 13; Member, School of Mathematics

May 3

Working Group on Algebraic Number Theory

Joint IAS/Princeton University Number Theory Seminar ♦ *A p -adically Entire Function with Integral Values on \mathbb{Q}_p and p -adic Fourier Expansions* ♦ **Francesco Baldassarri**, Università degli Studi di Padova

May 7

Special Seminar ♦ *Benjamini–Schramm Convergence and Eigenfunctions on Riemannian Manifolds* ♦ **Miklos Abert**, Alfréd Rényi Institute of Mathematics, Hungarian Academy of Sciences, Budapest

May 8

Locally Symmetric Spaces Seminar ♦ *Eigenfunctions and Random Waves on Locally Symmetric Spaces in the Benjamini–Schramm Limit* ♦ **Nicolas Bergeron**, Université Pierre et Marie Curie

Joint IAS/Princeton University Number Theory Seminar ♦ *Towards Counting Rational Points on Genus g Curves* ♦ **Ziyang Gao**, Princeton University; Member, School of Mathematics

May 10

Working Group on Algebraic Number Theory

Special Probability Seminar ♦ *Percolation of Sign Clusters for the Gaussian Free Field I* ♦ **Pierre-François Rodriguez**, University of California, Los Angeles

Joint IAS/Princeton University Number Theory Seminar ♦ *Goldfeld’s Conjecture and Congruences between Heegner Points* ♦ **Chao Li**, Columbia University

May 11

Special Probability Seminar ♦ *Percolation of Sign Clusters for the Gaussian Free Field II* ♦ **Pierre-François Rodriguez**, University of California, Los Angeles

May 15

Special Mathematics Physics Seminar ♦ *An Introduction to Liouville Theory* ♦ **Antti Kupiainen**, University of Helsinki

May 17

Joint IAS/Princeton University Number Theory Seminar ♦ *A New p -adic Maass–Shimura Operator and Supersingular Rankin–Selberg p -adic L -functions* ♦ **Daniel Kriz**, Princeton University

May 19

2018 Program for Women and Mathematics

May 20

2018 Program for Women and Mathematics

Institute Film Series in partnership with Women and Mathematics

May 21

2018 Program for Women and Mathematics ♦ *Mathematics in Cryptography* ♦ **Toni Bluher**, National Security Agency ♦ *Beginner Review Session* ♦ *Mathematics in Post-Quantum Cryptography* ♦ **Kristin Lauter**, Microsoft Research ♦ *Advanced Review Session* ♦ *Research Seminars* ♦ *NTRU Lattice-Based Algorithms: History and Modern Developments* ♦ **Jill Pipher**, Brown University

May 22

2018 Program for Women and Mathematics ♦ *Mathematics in Cryptography* ♦ **Toni Bluher**, National Security Agency ♦ *Beginner Review Session* ♦ *Mathematics in Post-Quantum Cryptography* ♦ **Kristin Lauter**, Microsoft Research ♦ *Advanced Review Session* ♦ *Research Seminars/Ambassador Review* ♦ *Ambassador Program Introduction* ♦ *Women in Science Seminar: Career Panel*

May 23

Special Seminar ♦ *Approximate Spectral Theory in Heterogeneous Media, Asymptotic Ballistic Transport, and Beyond?* ♦ **Antoine Gloria**, Laboratoire Jacques-Louis Lions, Université Paris 1 Panthéon-Sorbonne

May 24

Joint IAS/Princeton University Number Theory Seminar ♦ *Burgess Bounds for Short Character Sums in New Settings* ♦ **Lillian B. Pierce**, Duke University; von Neumann Fellow, School of Mathematics

2018 Program for Women and Mathematics ♦ *Mathematics in Cryptography* ♦ **Toni Bluher**, National Security Agency ♦ *Beginner Review Session* ♦ *Mathematics in Post-Quantum*

Cryptography ♦ **Kristin Lauter**, Microsoft Research ♦ *Advanced Review Session* ♦ *Women in Science Seminar Ambassador Program Results*

May 25

2018 Program for Women and Mathematics ♦ *Mathematics in Cryptography* ♦ **Toni Bluher**, National Security Agency ♦ *Mathematics of Post-Quantum Cryptography* ♦ **Kristin Lauter**, Microsoft Research ♦ *Research Seminars*

June 4

Optimization, Complexity, and Invariant Theory ♦ *Motivations, Connections, and Scope of the Workshop* ♦ **Avi Wigderson**, Herbert H. Maass Professor, School of Mathematics ♦ *A Gentle Introduction to Group Representation Theory* ♦ **Peter Buergisser**, Technische Universität Berlin ♦ *An Introduction to Invariant Theory* ♦ **Harm Derksen**, University of Michigan

June 5

Optimization, Complexity, and Invariant Theory ♦ *Tensors: Rank, Entropy, and Entanglement* ♦ **Matthias Christandl**, University of Copenhagen ♦ *Introduction to Geometric Invariant Theory I: Noncommutative Duality* ♦ **Ankit Garg**, Microsoft Research New England ♦ *Introduction to Geometric Invariant Theory II: Moment Polytopes* ♦ **Michael Walter**, University of Amsterdam ♦ *Alternate Minimization Algorithms for Scaling Problems and Their Analysis* ♦ **Rafael Oliveira**, University of Toronto

June 6

Optimization, Complexity, and Invariant Theory ♦ *An Algebraic Algorithm for Noncommutative Rank over Any Field* ♦ **K. V. Subrahmanyam**, Chennai Mathematical Institute ♦ *Some PIT Problems in the Light of the Noncommutative Rank Algorithm* ♦ **Gábor Ivanyos**, Institute of Computer Science and Control, Hungarian Academy of Sciences, Budapest ♦ *Algorithmic Invariant Theory* ♦ **Visu Makam**, University of Michigan ♦ *Geometric Complexity Theory (GCT): Algorithmic Challenges in Invariant Theory* ♦ **Ketan D. Mulmuley**, The University of Chicago

June 7

Optimization, Complexity, and Invariant Theory ♦ *The Dynamics of Regularized Flows on Convex Bodies* ♦ **James Lee**, University of Washington ♦ *An Introduction to Geodesic Convexity* ♦ **Nisheeth Vishnoi**, École Polytechnique Fédérale de Lausanne ♦ *Operator Scaling via Geodesically Convex Optimization, Invariant Theory and Polynomial Identity Testing* ♦ **Yuanzhi Li**, Princeton University ♦ *Solution to the Paulsen Problem (via Operator Scaling)* ♦ **Lap Chi Lau**, University of Waterloo

June 8

Optimization, Complexity, and Invariant Theory ♦ *Combinatorial Methods for PIT (and Ranks of Matrix Spaces)* ♦ **Roy Meshulam**,

Technion–Israel Institute of Technology ♦ *Capacities, Hyperbolicity, Submodularity, and All the Jazz ...* ♦ **Leonid Gurvits**, The City College of New York

July 11

Conference for African–American Researchers in the Mathematical Sciences

July 12

Conference for African–American Researchers in the Mathematical Sciences

School of Natural Sciences

ASTROPHYSICS ACTIVITIES

September 11

Princeton University/Institute for Advanced Study Early Universe/Cosmology Lunch Discussion ♦ *Organizational Meeting* ♦ **Matias Zaldarriaga**, Professor, School of Natural Sciences; **David Spergel**, Princeton University and Center for Computational Astrophysics, Flatiron Institute; and **Jo Dunkley**, Princeton University

September 14

Astrophysics Informal Seminar ♦ *Convection Affects Magnetic Turbulence in White Dwarf Accretion Disks* ♦ **Matthew Coleman**, Member, School of Natural Sciences

September 19

Institute for Advanced Study/Princeton University Joint Astrophysics Colloquium ♦ *Circumgalactic Precipitation* ♦ **Mark Voit**, Michigan State University

September 21

Astrophysics Informal Seminar ♦ *Magnetic Fields in the Interstellar Medium* ♦ **Susan E. Clark**, Member, School of Natural Sciences

September 26

Institute for Advanced Study/Princeton University Joint Astrophysics Colloquium ♦ *Rejuvenation of Stars, Metal Enrichment, and Implants of Gravitational Wave Generators in AGN Disks: Analogue of Planetary Systems Around Massive Black Holes* ♦ **Doug Lin**, Lick Observatory; Member, School of Natural Sciences

September 28

Astrophysics Informal Seminar ♦ *Binary Mergers in Nonspherical Nuclear Star Clusters* ♦ **Cristobal Petrovich**, Canadian Institute for Theoretical Astrophysics

October 3

Institute for Advanced Study/Princeton University Joint Astrophysics Colloquium ♦ *Exoplanet Demographics versus Host Star Mass: Clues to Formation from Direct Imaging* ♦ **Michael Meyer**, University of Michigan

October 5

Astrophysics Informal Seminar ♦ *The First Detection of Warm Ionized Disk Around the Galactic Center Black Hole SgrA* ♦ **Elena Murchikova**, California Institute of Technology

Astrophysics Informal Seminar ♦ *Zooming in on Planet-Forming Zones of Disks Around Young Stars* ♦ **Ewine van Dishoeck**, Leiden Observatory and Max-Planck-Institut für Extraterrestrische Physik

October 9

Princeton University/Institute for Advanced Study Early Universe/Cosmology Lunch Discussion ♦ *Integrated Approach to Cosmology* ♦ **Andrina Nicola**, Eidgenössische Technische Hochschule Zürich ♦ *Cosmology Results from the Dark Energy Survey Year 1* ♦ **Elisabeth Krause**, Kavli Institute for Particle Astrophysics and Cosmology and SLAC National Accelerator Laboratory

October 10

Institute for Advanced Study/Princeton University Joint Astrophysics Colloquium ♦ *Dynamics of Strongly Magnetic Neutron Stars* ♦ **Yuri Levin**, Columbia University and Center for Computational Astrophysics, Flatiron Institute

October 12

Astrophysics Informal Seminar ♦ *Distances to Gaia Stars* ♦ **Lauren Anderson**, Center for Computational Astrophysics, Flatiron Institute

October 17

Institute for Advanced Study/Princeton University Joint Astrophysics Colloquium ♦ *Numerical Simulations of Black Hole Accretion* ♦ **Ramesh Narayan**, Harvard-Smithsonian Center for Astrophysics

October 19

Astrophysics Informal Seminar ♦ *Tidal Disruption Events: Accretion Flows Doing What They Shouldn't* ♦ **Julian Krolik**, Johns Hopkins University

October 23

Princeton University/Institute for Advanced Study Early Universe/Cosmology Lunch Discussion ♦ *Equivalence Principle in Scalar-Tensor Theories* ♦ **Lasma Alberte**, Scuola Internazionale Superiore di Studi Avanzati, Trieste

October 24

Institute for Advanced Study/Princeton University Joint Astrophysics Colloquium ♦ *The New Jupiter: Results from the Juno Mission* ♦ **Scott Bolton**, Southwest Research Institute

October 26

Astrophysics Informal Seminar ♦ *On the Origin of the Magic Scale of Galaxies* ♦ **Avishai Dekel**, Racah Institute of Physics, The Hebrew University of Jerusalem, and Center for Computational Astrophysics, Flatiron Institute

October 30

Princeton University/Institute for Advanced Study Early Universe/Cosmology Lunch Discussion ♦ *Exploring Neutrino Masses and Relativistic Effects with Large-Scale Structures* ♦ **Elena Giusarma**, Carnegie Mellon University

November 2

Astrophysics Informal Seminar ♦ *Convection in Cool Stars, as Revealed through Stellar Brightness and Radial Velocity Variations* ♦ **Fabienne Bastien**, The Pennsylvania State University

November 3

Astrophysics Informal Seminar ♦ *Kepler's Multiple Planet Systems* ♦ **Jack Lissauer**, Space Science and Astrobiology at Ames, National Aeronautics and Space Administration (NASA)

November 7

Institute for Advanced Study/Princeton University Joint Astrophysics Colloquium ♦ *What Can We Learn from Cosmic Structure?* ♦ **Benjamin Wandelt**, Sorbonne Université and Center for Computational Astrophysics, Flatiron Institute

November 9

Astrophysics Informal Seminar ♦ *On Detection of FRBs and Pulsars in Relativistic Binary Systems* ♦ **Barak Zackay**, Member, School of Natural Sciences

November 13

Princeton University/Institute for Advanced Study Early Universe/Cosmology Lunch Discussion ♦ *Separate Universe Simulations with Massive Neutrinos* ♦ **Chi-Ting Chiang**, Stony Brook University, The State University of New York

November 14

Institute for Advanced Study/Princeton University Joint Astrophysics Colloquium ♦ *Accessing Cosmic Dawn via the Hydrogen Epoch of Reionization Array* ♦ **Adrian Liu**, University of California, Berkeley

November 17

Astrophysics Informal Seminar ♦ *The Ejection Resonance: A Resurrection in Three Movements* ♦ **Jihad Touma**, American University of Beirut; Member, School of Natural Sciences

November 21

Institute for Advanced Study/Princeton University Joint Astrophysics Colloquium ♦ *Exploring the Galactic Halo with Gaia* ♦ **Vasily Belokurov**, University of Cambridge

November 27

Princeton University/Institute for Advanced Study Early Universe/Cosmology Lunch Discussion ♦ *Beyond CMB Cosmic Variance Limits on Reionization with the Polarized SZ Effect* ♦ **Joel Myers**, Canadian Institute for Theoretical Astrophysics

Astrophysics Informal Seminar ♦ *The Troubled Puberty of the Solar System* ♦ **Simon Portegies Zwart**, Leiden Observatory

November 28

Institute for Advanced Study/Princeton University Joint Astrophysics Colloquium ♦ *Growing Black Holes in Growing Galaxies* ♦ **Marta Volonteri**, Institut d'Astrophysique de Paris

November 29–December 1

Stellar Dynamics in Galactic Nuclei Workshop ♦ *Review—Our Galactic Center: A Unique Laboratory for the Physics and Astrophysics of Black Holes* ♦ **Andrea Ghez**, University of California, Los Angeles ♦ *An Update on Monitoring Stellar Orbits in the Galactic Center* ♦ **Stefen Gillessen**, Max-Planck-Institut für Extraterrestrische Physik ♦ *Investigating the Relativistic Motion of the Stars near the Supermassive Black Hole in the Galactic Center* ♦ **Andreas Eckart**, Universität zu Köln ♦ *Dynamics in the Galactic Center—the Effect of Binaries* ♦ **Re'em Sari**, Racah Institute of Physics, The Hebrew University of Jerusalem ♦ *Tidal Disruption Events from Eccentric Nuclear Disks* ♦ **Ann-Marie Madigan**, University of Colorado ♦ *Tidal Capture Runaway and the Formation of Seed Massive Black Holes* ♦ **Jeremiah Ostriker**, Princeton University ♦ *Tidal Disruption Event Rates: Diagnostics of Stellar Dynamics Inside the Sphere of Influence* ♦ **Nicholas Stone**, Columbia University ♦ *Review—Gravitational Wave Sources in Galactic Nuclei* ♦ **Bence Kocsis**, Eötvös Loránd University ♦ *Black Hole Mergers in Nuclear Star Clusters* ♦ **Fabio Antonini**, University of Surrey ♦ *Seed Binary Black Hole Production and Coalescence in Disks Around AGNs* ♦ **Doug Lin**, Lick Observatory; Member, School of Natural Sciences ♦ *Binary Dynamics within Galactic Nuclei* ♦ **Smadar Naoz**, University of California, Los Angeles ♦ *On the Rate of Black Hole Binary Mergers in Galactic Nuclei Due to Dynamical Hardening* ♦ **Nathan Leigh**, American Museum of Natural History ♦ *The Gravitational Capture of Compact Objects by Kerr Supermassive Black Holes* ♦ **Pau Amaro-Seoane**, Institut d'Estudis Espacials de Catalunya ♦ *Stellar Winds near Massive Black Holes: The Case of the S-Stars* ♦ **Nora Lützgendorf**, European Space Agency and Space Telescope Science Institute, NASA, Baltimore ♦ *Kinetic Theory of Stellar Systems* ♦ **Pierre-Henri Chavanis**, Laboratoire de Physique Théorique et Hautes Energies, Universités Paris VI–VII ♦ *Review—Kinetic Theory in Galactic Centers* ♦ **Christophe Pichon**, Institut d'Astrophysique de Paris ♦ *Modelling the Eccentric Disk of M31* ♦ **John**

Magorrian, University of Oxford ♦ *Review—Whither Resonant Relaxation?* ♦ **Jihad Touma**, American University of Beirut; Member, School of Natural Sciences ♦ *Equilibrium and Stability of Differentially Rotating Stellar Systems* ♦ **Anna Lisa Varri**, The University of Edinburgh ♦ *Radial Orbit and Loss Cone Instabilities in Spherical Systems* ♦ **Evgeny Polyachenko**, Russian Academy of Sciences, Moscow ♦ *Review—Supermassive BHs Mergers* ♦ **Marta Volonteri**, Institut d’Astrophysique de Paris ♦ *Dynamical Friction and the Evolution of Supermassive Black Hole Binaries: The Final Hundred-Parsec Problem* ♦ **Fani Dosopoulou**, Northwestern University ♦ *Implications of the Eccentric Kozai-Lidov Mechanism for Stars Surrounding Supermassive Black Hole Binaries* ♦ **Gongjie Li**, Harvard-Smithsonian Center for Astrophysics ♦ *Dynamics of Massive Black Hole Triplets: Promising Sources for LISA and Pulsar Timing* ♦ **Alberto Sesana**, University of Birmingham ♦ *Observational Constraints on the Formation and Evolution of the Milky Nuclear Star Cluster* ♦ **Tuan Do**, University of California, Los Angeles ♦ *GRAVITY in the Galactic Center* ♦ **Frank Eisenhauer**, Max-Planck-Institut für Extraterrestrische Physik ♦ *The Stellar Cusp Around the Milky Way’s Central Black Hole* ♦ **Rainer Schödel**, Instituto de Astrofísica de Andalucía ♦ *Galaxy Collision Simulations with Central Post-Newtonian Supermassive Binary Black Holes* ♦ **Peter Berczik**, Main Astronomical Observatory, National Academy of Sciences of Ukraine ♦ *Direct Million-Body Simulation of the Galactic Center* ♦ **Taras Panamarev**, Fesenkov Astrophysical Institute, Kazakhstan ♦ *Ergodicity in Chaotic Self-gravitating Systems* ♦ **Simon Portegies Zwart**, Leiden Observatory ♦ *Hierarchical Triple Systems: Effects of Higher Multipoles and General Relativity* ♦ **Clifford Will**, University of Florida ♦ *Hypervelocity Stars in the GAIA Era* ♦ **Elena Maria Rossi**, Leiden Observatory ♦ *Secular Dynamics and Systematic Eccentricity Changes of Inspiring IMBHs* ♦ **Yuri Levin**, Columbia University and Center for Computational Astrophysics, Flatiron Institute ♦ *The Ecology of the Galactic Center* ♦ **Melvyn Davies**, Lund Observatory

December 5

Institute for Advanced Study/Princeton University Joint Astrophysics Colloquium ♦ *Hearing and Seeing GW170817* ♦ **Daniel Holz**, The University of Chicago

December 7

Astrophysics Informal Seminar ♦ *The New Phase Space Complexity of Old Globular Clusters* ♦ **Anna Lisa Varri**, The University of Edinburgh

December 11

Princeton University/Institute for Advanced Study Early Universe/Cosmology Lunch Discussion ♦ *Reducing Noise in N-Body Simulations with Massive Neutrinos* ♦ **Arka Banerjee**, Kavli Institute for Particle Astrophysics and Cosmology ♦ *Galaxy Evolution*

within Clusters—Hints from Velocity Distributions ♦ **Susmita Adhikari**, Kavli Institute for Particle Astrophysics and Cosmology

December 12

Institute for Advanced Study/Princeton University Joint Astrophysics Colloquium ♦ *Fast Radio Bursts* ♦ **Victoria Kaspi**, McGill University

December 14

Astrophysics Informal Seminar ♦ *New Frontiers in Cosmology* ♦ **Cora Dvorkin**, Harvard University

January 4

Astrophysics Informal Seminar ♦ *How Habitable Are “Habitable” Planets?* ♦ **Manasvi Lingam**, Institute for Theory and Computation, Harvard-Smithsonian Center for Astrophysics

January 16

Astrophysics Informal Seminar ♦ *White Dwarf–Neutron Star Mergers: From Peculiar Supernovae to Pulsar Planets* ♦ **Ben Tal Margalit**, Columbia University

January 22

Princeton University/Institute for Advanced Study Early Universe/Cosmology Lunch Discussion ♦ *Unveiling Dark Structures with Accurate Weak Lensing* ♦ **Ricardo Herbonnet**, Stony Brook University, The State University of New York

January 25

Astrophysics Informal Seminar ♦ *New Information in Ancient Photons: Novel Approaches to CMB Foregrounds and Secondary Anisotropies* ♦ **James Colin Hill**, Center for Computational Astrophysics, Flatiron Institute; Member, School of Natural Sciences

February 5

Astrophysics Informal Seminar ♦ *The Full Transient Sky at <17 mag* ♦ **Subo Dong**, The Kavli Institute for Astronomy and Astrophysics at Peking University

Princeton University/Institute for Advanced Study Early Universe/Cosmology Lunch Discussion ♦ *Counts in Cells: Large-Scale Structure in the Semiclassical Approximation* ♦ **Mikhail Ivanov**, École Polytechnique Fédérale de Lausanne

February 8

Astrophysics Informal Seminar ♦ *A Galactic-Scale Gravitational Wave Detector* ♦ **Maura McLaughlin**, West Virginia University

February 16

Astrophysics Informal Seminar ♦ *Neutron Star Mergers and ULTRASAT* ♦ **Eli Waxman**, Weizmann Institute of Science

February 22

Astrophysics Informal Seminar ♦ *MOSFiT: Working Together to Understand Energetic Transients* ♦ **James Guillochon**, Institute for Theory and Computation, Harvard-Smithsonian Center for Astrophysics

February 26

Princeton University/Institute for Advanced Study Early Universe/Cosmology Lunch Discussion ♦ *Unveiling Cosmic Voids in Large-Scale Structure Surveys: The Impact of Tracer Bias on Voids* ♦ **Giorgia Pollina**, Ludwig-Maximilians-Universität München

March 1

Astrophysics Informal Seminar ♦ *Celestial Fluid Mechanics: New Perspectives on the Hydrodynamics of Astrophysical Disks* ♦ **Gordon Ogilvie**, University of Cambridge

March 8

Astrophysics Informal Seminar ♦ *Frankenstein Peers at the Milky Way Galaxy* ♦ **Wyn Evans**, Institute of Astronomy, University of Cambridge

March 12

Princeton University/Institute for Advanced Study Early Universe/Cosmology Lunch Discussion ♦ *Chiral Gravitational Waves and Baryon Superfluid Dark Matter* ♦ **Evan McDonough**, Brown University

March 15

Astrophysics Informal Seminar ♦ *Constraining Planetary Histories with New Architectures: Resonant Chains and Circumbinary Orbits* ♦ **Daniel Fabrycky**, The University of Chicago

March 16

Astrophysics Informal Seminar ♦ *The Complex Circumgalactic Medium* ♦ **Hsiao-Wen Chen**, The University of Chicago

March 19

Princeton University/Institute for Advanced Study Early Universe/Cosmology Lunch Discussion ♦ *Cross-correlating Galaxy Surveys with CMB Lensing* ♦ **Eric Baxter**, University of Pennsylvania

March 22

Astrophysics Informal Seminar ♦ *The New Era of Galactic Archaeology* ♦ **Yuan-Sen Ting**, Member, Institute for Advanced Study

April 2

Princeton University/Institute for Advanced Study Early Universe/Cosmology Lunch Discussion ♦ *Can Early Dark Energy Explain EDGES?* ♦ **James Colin Hill**, Center for Computational Astrophysics, Flatiron Institute; Member, School of Natural Sciences

April 5

Astrophysics Informal Seminar ♦ *NICER Early Operations and Initial Results* ♦ **Keith Gendreau**, National Aeronautics and Space Administration (NASA)

April 11

Astrophysics Informal Seminar ♦ *The Curious Case of Lyman-alpha Emitting Galaxies* ♦ **Zheng Zheng**, University of Utah

April 12

Astrophysics Informal Seminar ♦ *Astrophysical Probes of Dark Matter: The Road Ahead* ♦ **Francis-Yan Cyr-Racine**, Harvard University

April 16

Princeton University/Institute for Advanced Study Early Universe/Cosmology Lunch Discussion ♦ *Does Planck 2015 Polarization Favor High Redshift Reionization?* ♦ **Chen He Heinrich**, California Institute of Technology

April 19

Astrophysics Informal Seminar ♦ *Simulations of Disks, Jets, and Other Black Hole–Powered Transients* ♦ **Alexander Tchekhovskoy**, Northwestern University

April 26

Astrophysics Informal Seminar ♦ *The Origin of Heavy Elements* ♦ **Jonas Lippuner**, Los Alamos National Laboratory

April 30

Princeton University/Institute for Advanced Study Early Universe/Cosmology Lunch Discussion ♦ *New Approaches to Nonlinear Density Field Evolution and Triaxial Collapse* ♦ **Zachary Slepian**, University of California, Berkeley

May 3

Astrophysics Informal Seminar ♦ *The Kinematics of Inflation, Preheating, and Heating: A Playground for Kolmogorov-Sinai and Shannon Entropies* ♦ **J. Richard Bond**, Canadian Institute for Theoretical Astrophysics; Member, School of Natural Sciences

May 10

Astrophysics Informal Seminar ♦ *The Epoch of Reionization: What Can We Learn About It?* ♦ **Alexander A. Kurov**, Member, School of Natural Sciences

May 14

Princeton University/Institute for Advanced Study Early Universe/Cosmology Lunch Discussion ♦ *CHIME: The Canadian Hydrogen Intensity Mapping Experiment* ♦ **Kendrick Smith**, Perimeter Institute for Theoretical Physics

May 17

Astrophysics Informal Seminar ♦ *The Physics of AGN-Driven Galactic Winds* ♦ **Claude-André Faucher-Giguère**, Northwestern University

May 24

Astrophysics Informal Seminar ♦ *Dynamics of Eccentric Disks* ♦ **Ryan Miranda**, Member, School of Natural Sciences

June 4

Princeton University/Institute for Advanced Study Early Universe/Cosmology Lunch Discussion ♦ *General Discussion* ♦ **Matias Zaldarriaga**, Professor, School of Natural Sciences; **David Spergel**, Princeton University and Center for Computational Astrophysics, Flatiron Institute; and **Jo Dunkley**, Princeton University

June 7

Astrophysics Informal Seminar ♦ *Exploring the Diversity of Exoplanets through Their Birth Environments in Star Clusters* ♦ **Maxwell Xu Cia**, Leiden Observatory

HIGH ENERGY THEORY ACTIVITIES

September 4

High Energy Theory Seminar ♦ *Asymptotic Symmetries in Effective Field Theories* ♦ **Prahar Mitra**, Member, School of Natural Sciences

September 18

High Energy Theory Seminar ♦ *The Quantum Null Energy Condition from Causality* ♦ **Thomas Faulkner**, University of Illinois at Urbana-Champaign

September 22

High Energy Theory Seminar ♦ *Correlation Functions in $N=4$ SYM from Integrability* ♦ **Shota Komatsu**, Member, School of Natural Sciences

September 27

Physics Group Meeting ♦ *Markovian Property of Vacuum State and the a-theorem* ♦ **Horacio Casini**, Centro Atómico Bariloche, Argentina; Visitor, School of Natural Sciences

October 2

High Energy Theory Seminar ♦ *Twofold Symmetries and Simplification of the Gravity Action* ♦ **Grant Remmen**, University of California, Berkeley

October 5

Special High Energy Theory Seminar ♦ *Constraints on Particle Physics and Inflation from Quantum Gravity Conjectures* ♦ **Irene Valenzuela**, Max-Planck-Institut für Physik

October 9

High Energy Theory Seminar ♦ *Causality and the Length Operator* ♦ **Thomas Hartman**, Cornell University

October 10

Informal Physics Discussion ♦ *Lorentz Covariant Theories with Causality Violation* ♦ **Harvey Reall**, University of Cambridge

Special High Energy Theory Seminar ♦ *Indices, Localization, Rational Invariants, and H-Saddles* ♦ **Piljin Yi**, Korea Institute for Advanced Study

October 11

Physics Group Meeting ♦ *Delineating the Swampland via the Weak Gravity Conjecture* ♦ **Thomas Rudelius**, Member, School of Natural Sciences

October 20

High Energy Theory Seminar ♦ *Broken Symmetry Effects on Hydrodynamic Transport* ♦ **Anna Karlsson**, Member, School of Natural Sciences

October 25

Physics Group Meeting ♦ *Boundary State Black Holes: Escapability and Reconstruction of the Interior* ♦ **Ahmed Almheiri**, Member, School of Natural Sciences

October 30

High Energy Theory Seminar ♦ *What Does the Revolution in Artificial Intelligence Mean for Physics?* ♦ **Kyle Cranmer**, New York University

November 8

Physics Group Meeting ♦ *Singularities and the Amplituhedron* ♦ **Marcus Spradlin**, Brown University; Member, School of Natural Sciences

November 13

High Energy Theory Seminar ♦ *Quantum Closed Superstring Field Theory and the Weil-Petersson Symplectic Geometry* ♦ **Roji Pius**, Perimeter Institute for Theoretical Physics

November 27

High Energy Theory Seminar ♦ *Information Loss and Bulk Reconstruction in AdS_3/CFT_2* ♦ **Andrew Liam Fitzpatrick**, Boston University

December 5–6

Quantum Information and Black Holes Workshop ♦ *Near-Coherent Scrambling* ♦ **Alexei Kitaev**, California Institute of Technology ♦ *Non-perturbative Bulk Reconstruction* ♦ **Daniel Jafferis**, Harvard University ♦ *QM=GR?* ♦ **Leonard Susskind**, Stanford University ♦ *Trying to Tame Two Times* ♦ **Steve Shenker**, Stanford University ♦ *Modular Flow as a Disentangler* ♦ **Xiaoliang Qi**, Stanford University; Junior Visiting Professor, School of Natural Sciences ♦ *Solving SYK* ♦ **Vladimir Rosenhaus**, Kavli Institute for Theoretical Physics, University of California, Santa Barbara ♦ *The SYK Model at Low Energies* ♦ **Guy Gur-Ari**, Member, School of Natural Sciences ♦ *Quantum Error Correction and the Black Hole Interior* ♦ **Ahmed Almheiri**, Member, School of Natural Sciences ♦ *A Comment on the Regge/Chaos Limit and a Comment on BHs with Long Interiors* ♦ **Douglas Stanford**, Long-term Member, School of Natural Sciences ♦ *Discussion on Black Hole Entropy* ♦ **Aron Wall**,

Stanford Institute for Theoretical Physics ♦
*Discussion on the Status of the Black Hole
Information Paradox*

December 11

High Energy Theory Seminar ♦ *Constraints on
Interacting Massive High Spins* ♦ **Kurt
Hinterbichler**, Case Western Reserve
University

January 12

High Energy Theory Seminar ♦ *Genomic
Prediction of Complex Traits* ♦ **Steve Hsu**,
Michigan State University

February 5

High Energy Theory Seminar ♦ *CFT Data at
Large Charge from EFT* ♦ **Riccardo Rattazzi**,
École Polytechnique Fédérale de Lausanne

February 7

Physics Group Meeting ♦ *Modular Berry
Connection* ♦ **Bartłomiej Stanislaw Czech**,
Stanford University; Member, School of Natural
Sciences

February 23

High Energy Theory Seminar ♦ *Splittability and
Noether's Theorem in Quantum Field Theory* ♦
Daniel Harlow, Massachusetts Institute of
Technology

February 28

Physics Group Meeting ♦ *A Tactical Retreat from
the BH Information Problem* ♦ **Douglas
Stanford**, Long-term Member, School of
Natural Sciences

March 5

High Energy Theory Seminar ♦ *Going with the
Flow: A Solution to the Sign Problem* ♦ **Gökçe
Kemal Basar**, University of Illinois at Chicago

March 6

Informal High Energy Theory Seminar ♦ *A
Positive Sum Rule for the c Anomaly in 4D CFT* ♦
Markus Luty, University of California, Davis

March 9

High Energy Theory Seminar ♦ *Beyond
Symmetry: Topological Defect Lines and RG Flows
in Two Dimensions* ♦ **Shu-Heng Shao**,
Member, School of Natural Sciences

March 16

High Energy Theory Seminar ♦ *Axions Confront
High Temperature QCD* ♦ **Michael Dine**,
University of California, Santa Cruz; Member,
School of Natural Sciences

March 19

High Energy Theory Seminar ♦ *Tensor Networks
as Geometry* ♦ **Guifre Vidal**, Perimeter Institute
for Theoretical Physics

March 23

High Energy Theory Seminar ♦ *A Few Uses for
Theoretical Physics in Machine Learning* ♦ **Dan
Roberts**, Facebook AI Research

April 2

High Energy Theory Seminar ♦ *6d Theories on
Circle and Curves* ♦ **Cumrun Vafa**, Harvard
University

April 6

High Energy Theory Seminar ♦ *Topological Terms
in Yang-Mills Theory with Time-Reversal
Symmetry* ♦ **Pavel Putrov**, Member, School of
Natural Sciences

April 11

Physics Group Meeting ♦ *Group Meeting on
Moving the Holographic Boundary into the Bulk* ♦
Juan Maldacena, Carl P. Feinberg Professor,
School of Natural Sciences; and **Herman
Verlinde**, Princeton University

April 12

Informal High Energy Theory Seminar ♦
Wavefunctions for a One-Dimensional Black Hole ♦
S. Josephine Suh, California Institute of
Technology

April 16

High Energy Theory Seminar ♦ *FZZ Duality
and the Black Hole Horizon* ♦ **Nissan Itzhaki**,
Tel Aviv University

April 20

High Energy Theory Seminar ♦ *Simplicity in
AdS Perturbative Dynamics* ♦ **Ellis Ye Yuan**,
Member, School of Natural Sciences

April 25

Physics Group Meeting ♦ *Discussion on
Entanglement Entropy in Gauge Theories* ♦
Jennifer Lin, Member, School of Natural
Sciences

April 27

High Energy Theory Seminar ♦ *Good and Bad
Analogies of Physics in Deep Learning* ♦ **Guy Gur-
Ari**, Member, School of Natural Sciences

April 30

High Energy Theory Seminar ♦ *Probing Binary
Black Hole Environments in Hierarchical Triple
Systems* ♦ **Lisa Randall**, Harvard University

May 7

High Energy Theory Seminar ♦ *Chiral Algebras
and Twisted Gauge Theories* ♦ **Davide Gaiotto**,
Perimeter Institute for Theoretical Physics

May 8

Informal High Energy Theory Seminar ♦ *On
Melonic Matrix Models and SYK-like Black Holes* ♦
Frank Ferrari, Université Libre de Bruxelles

May 18

High Energy Theory Seminar ♦ *Conformal
Fishnet Theory* ♦ **Vladimir Kazakov**, École
Normale Supérieure, Paris

May 31

Informal High Energy Theory Seminar ♦
Scattering Amplitudes from Intersection Theory ♦
Sebastian Mizera, Perimeter Institute for
Theoretical Physics

June 4

High Energy Theory Seminar ♦ *The Future of
High Energy Physics and China's Role* ♦ **Yifang
Wang**, Institute of High Energy Physics,
Chinese Academy of Sciences

June 14

High Energy Theory Seminar ♦ *S-Matrix
Bootstrap (and Theories without Particle
Production)* ♦ **Pedro Vieira**, Perimeter Institute
for Theoretical Physics

July 16–27

Prospects in Theoretical Physics 2018: From
Qubits to Spacetime ♦ *Organizers and lecturers:*
Ahmed Almheiri, Member, School of Natural
Sciences; **Atish Dabholkar**, The Abdus Salam
International Centre for Theoretical Physics,
Trieste; **Thomas Faulkner**, University of
Illinois at Urbana-Champaign; **Daniel Harlow**,
Massachusetts Institute of Technology; **Matthew Headrick**, Brandeis University; **Juan Maldacena**, Carl P. Feinberg Professor,
School of Natural Sciences; **Douglas
Stanford**, Long-term Member, School of
Natural Sciences; **Leonard Susskind**, Stanford
University; **Aron Wall**, Stanford Institute for
Theoretical Physics; and **Edward Witten**,
Charles Simonyi Professor, School of Natural
Sciences

THE SIMONS CENTER FOR SYSTEMS BIOLOGY ACTIVITIES

September 13

The Simons Center for Systems Biology
Informal Talks on Abstract/Conceptual/
Quantitative Aspects of Biology ♦ *Adaptability in
Living Systems* ♦ **Tiberiu Tesileanu**

October 2

Convergence 2.0 Meeting ♦ *Linking New
Platforms for the Assessment of Anti-tumor T-Cell
Immunity with Clinical Outcomes of
Immunotherapy* ♦ **Drew Pardoll**, The Sidney
Kimmel Comprehensive Cancer Center, Johns
Hopkins University School of Medicine ♦
*Correlating Immunological Health to Cancer
Susceptibility* ♦ **Mark Davis**, Stanford
University ♦ *Computational Deconstruction of
Neoantigen-TCR Degeneracy for Cancer
Immunotherapy* ♦ **Benjamin D. Greenbaum**,
Icahn School of Medicine at Mount Sinai ♦
*Connecting Immune Health and Tumor Biology in
Gynecologic Cancers* ♦ **E. John Wherry**,
University of Pennsylvania ♦ *Responders and*

Non-responders to Endometrial Cancers with Mismatch Repair ♦ **Alessandro Santin**, Yale University ♦ *Single-Cell Functional Multi-omics to Characterize and Monitor CAR-T Therapy* ♦ **Rong Fan**, Yale University ♦ *Integrating Experimental and Computational Pipelines to Develop Biomarkers of Tumor Cell Resistance to NK Cells* ♦ **Constantine Mitsiades**, Dana-Farber Cancer Institute

October 10

The Simons Center for Systems Biology Seminar ♦ *Learning to Read the Immune Repertoire* ♦ **Harlan Robins**, Fred Hutchinson Cancer Research Center

October 25

The Simons Center for Systems Biology Informal Talks on Abstract/Conceptual/Quantitative Aspects of Biology ♦ *Bacterial Growth and Division* ♦ **Hanna Salman**, University of Pittsburgh

November 8

The Simons Center for Systems Biology Informal Talks on Abstract/Conceptual/Quantitative Aspects of Biology ♦ *Immune Responses to Cancer* ♦ **Benjamin D. Greenbaum**, Icahn School of Medicine at Mount Sinai

November 15

The Simons Center for Systems Biology Informal Talks on Abstract/Conceptual/Quantitative Aspects of Biology ♦ *Phase Separation in Living Cells* ♦ **Clifford Brangwynne**, Princeton University

December 5

The Simons Center for Systems Biology Informal Talks on Abstract/Conceptual/Quantitative Aspects of Biology ♦ *The Construction of Confidence* ♦ **Mariano Sigman**, Universidad Torcuato Di Tella, Argentina ♦ *Non-equilibrium Thermodynamics of Open Chemical Reaction Networks* ♦ **Riccardo Rao**, Université du Luxembourg

December 7

The Simons Center for Systems Biology Seminar ♦ *The World of Words: Experimental Approaches to Infer How We Humans Construct a Space of Words to Organize Meanings, and Then How This Can Be Used to Investigate the Past and the Future of Consciousness* ♦ **Mariano Sigman**, Universidad Torcuato Di Tella, Argentina

December 13–14

The Simons Center for Systems Biology Informal Talks on Abstract/Conceptual/Quantitative Aspects of Biology ♦ *Models of Immune Recognition and Antagonism* ♦ **Paul François**, McGill University

December 16–17

Joint Lab Meeting: Frequency of p53 Mutations in the Normal Population and the Possible Role of the Immune System in Influencing that

Frequency ♦ *Overview* ♦ **Arnold J. Levine**, Professor Emeritus, School of Natural Sciences ♦ *Role of the Immune System in Regulating p53 Mutations* ♦ **Benjamin D. Greenbaum**, Icahn School of Medicine at Mount Sinai ♦ *Frequency of Germline p53 Mutations in the Population* ♦ **Chang S. Chan**, Rutgers Cancer Institute of New Jersey ♦ *Phenotype of Inherited p53 Mutations—Experiences at Dana-Farber* ♦ **Junne Kamihara**, Dana-Farber Cancer Institute ♦ *Epidemiology of Li-Fraumeni Families and Pedigrees* ♦ **Pierre Hainaut**, Institute for Advanced Biosciences Inserm/CNRS/UGA

January 8

The Simons Center for Systems Biology Informal Talks on Abstract/Conceptual/Quantitative Aspects of Biology ♦ *Statistical Description of Mixed Phase Space Systems (Chaotic and Regular)* ♦ **Or Alus**, Technion-Israel Institute of Technology

January 10

The Simons Center for Systems Biology Informal Talks on Abstract/Conceptual/Quantitative Aspects of Biology ♦ *Adaptation Unifies Emergent Oscillations in Quorum-Sensing Populations and Revealing Evolutionary Constraints on Proteins through Sequence Analysis* ♦ **Shou-Wen Wang**, Princeton University

January 17

The Simons Center for Systems Biology Informal Talks on Abstract/Conceptual/Quantitative Aspects of Biology ♦ *T-Cell Proliferation and Antigen Decay* ♦ **Andreas Meyer**, Princeton University

February 5

The Simons Center for Systems Biology Informal Talks on Abstract/Conceptual/Quantitative Aspects of Biology ♦ *Dynamics of the Visual Cortex* ♦ **Lai-Sang Young**, Courant Institute of Mathematical Sciences, New York University

February 6

The Simons Center for Systems Biology Informal Talks on Abstract/Conceptual/Quantitative Aspects of Biology ♦ *Fruit Fly Embryonic Development and Information Theory* ♦ **Lauren McGough**, Princeton University

February 14

The Simons Center for Systems Biology Informal Talks on Abstract/Conceptual/Quantitative Aspects of Biology ♦ *Mechanical Properties of Transcription* ♦ **Stuart Sevier**, Rice University

February 28

The Simons Center for Systems Biology Informal Talks on Abstract/Conceptual/Quantitative Aspects of Biology ♦ *How Population Adaptability Is Impacted by Heterogeneity Focusing on the Regulation of Cell Cycle Duration* ♦ **Nash Rochman**, Johns Hopkins University

April 19

Governor's Conference on Effective Partnering in Cancer Research: The Role of p53 in Li-Fraumeni Syndrome ♦ *Epigenetic Pathways in Cancer and in Cancer Immunotherapy* ♦ **Shelley L. Berger**, University of Pennsylvania ♦ *Tumorigenesis and Penetrance in Li-Fraumeni Syndrome* ♦ **Chang S. Chan**, Rutgers Cancer Institute of New Jersey ♦ *p53-Driven Acute Promyelocytic Leukemia Cure by Retinoic Acid and Arsenic* ♦ **Hugues de Thé**, Collège de France ♦ *Lifetime Control of p53 Function: Walking the Ridge Trail between Degenerative Diseases and Cancer* ♦ **Pierre Hainaut**, Institute for Advanced Biosciences Inserm/CNRS/UGA ♦ *Early Detection and Prevention of Cancer in Li-Fraumeni Syndrome: A Multi-pronged Approach* ♦ **David Malkin**, The Hospital for Sick Children ♦ *The Hypomorphic Brazilian Mutant TP53-R337H and Variable Tumor Susceptibility: Identification of a Potential Genetic Modifier* ♦ **Gerard P. Zambetti**, St. Jude Children's Research Hospital

April 23

Joshua Lederberg–John von Neumann Symposium ♦ *Emergent Dynamics from Network Connectivity: A Minimal Model* ♦ **Carina Curto**, The Pennsylvania State University ♦ *The Physics of Cooperative Transport by Ants* ♦ **Ofer Feinerman**, Weizmann Institute of Science ♦ *A Language of Geometry for Human Acquisition of Spatial Sequences* ♦ **Santiago Figueira**, Universidad de Buenos Aires ♦ *Learning Protein Constitutive Motifs from Sequence Data* ♦ **Rémi Monasson**, École Normale Supérieure, Paris ♦ *Computations in Human Sensorimotor Control* ♦ **Daniel Wolpert**, University of Cambridge

April 24–25

Language of Thought Hypothesis Workshop ♦ *The Language of Thought: Six Suggestions* ♦ **Joshua Tenenbaum**, Massachusetts Institute of Technology ♦ *Childhood, Conceptual Change, and the Language of Thought* ♦ **Alison Gopnik**, University of California, Berkeley ♦ *What Deep Learning Is and Is Not Teaching Us about The Language of Thought* ♦ **Gary Marcus**, New York University ♦ *Probing the Flexibility of the Language of Thought* ♦ **Santiago Figueira**, Universidad de Buenos Aires ♦ *From Core Cognition to New Systems of Knowledge* ♦ **Elizabeth Spelke**, Harvard University ♦ *What Lies Below the Language of Thought* ♦ **Steven Piantadosi**, University of Rochester ♦ *Generalizing from Variable Linguistic Input* ♦ **Naomi Feldman**, University of Maryland ♦ *Nature versus Nurture in AI* ♦ **Matthew Botvinick**, Google DeepMind, London

May 22–23

Rita Allen Foundation Scholars Meeting ♦ *Thirsty for Blood: Genetic Approaches to Understanding Mosquito Behavior* ♦ **Leslie Vosshall**, The Rockefeller University ♦ *Pregnancy-Induced Epigenetic Reprogramming and Immune Modulation in Breast Cancer Prevention* ♦ **Camila dos Santos**, Cold Spring Harbor

Laboratory ♦ *Extracellular Matrix-Mediated Plasticity in Neuropathic Pain* ♦ **Arkady Khoutorsky**, McGill University ♦ *On the Causes of Childhood Cancer* ♦ **Alex Kentsis**, Memorial Sloan Kettering Cancer Center ♦ *A CRISPR Screen Identifies a New Cell Intrinsic Antiviral Mechanism* ♦ **John Schoggins**, University of Texas Southwestern Medical Center ♦ *Cell Signaling Through Intracellular Protein Glycosylation* ♦ **Michael Boyce**, Duke University School of Medicine ♦ *Awakening Old Foes: TDP-43 Connects Transposons to Neurodegeneration* ♦ **Molly Hamell**, Cold Spring Harbor Laboratory ♦ *Algorithms for Predicting Responses to Cancer Immunotherapy and Long-Term Survival* ♦ **Arnold J. Levine**, Professor Emeritus, School of Natural Sciences ♦ *Prefrontal Circuit Mechanisms for Supporting Working Memory* ♦ **Conor Liston**, Feil Family Brain & Mind Research Institute, Weill Cornell Medicine ♦ *The Neural Circuits of Itch and Pain* ♦ **Sarah Ross**, University of Pittsburgh ♦ *BRCA DNA Replication Instability and Mitochondria* ♦ **Katharina Schlacher**, The University of Texas MD Anderson Cancer Center ♦ *Circular RNAs: Unexpected Outputs of Many Protein-Coding Genes* ♦ **Jeremy Wilusz**, Perelman School of Medicine, University of Pennsylvania ♦ *Regulation of Behavior by the Blood-Brain Barrier* ♦ **Richard Daneman**, University of California San Diego School of Medicine ♦ *The Regulation of Hematopoietic Stem Cells* ♦ **Lei Ding**, Columbia University ♦ *Molecular Adaptations to Extreme Temperatures in Ground Squirrels and Other Mammalian Extremophiles* ♦ **Elena Gracheva**, Yale University ♦ *Neural Substrates of Pain Unpleasantness* ♦ **Greg Scherrer**, Stanford University ♦ *Peripheral Mechanisms of Ischemic Myalgia* ♦ **Michael Jankowski**, Cincinnati Children's Hospital Medical Center ♦ *The Neurobiology of Hunger* ♦ **Zachary Knight**, University of California San Francisco School of Medicine ♦ *Anterior Cingulate Cortex in Pain Tolerance* ♦ **Steve Davidson**, University of Cincinnati College of Medicine ♦ *Neural Mechanisms Underlying Vocal Sensorimotor Transformations* ♦ **Michael Long**, New York University Langone Health ♦ *Gene Expression Regulation Through RNA Methylation* ♦ **Kate Meyer**, Duke University School of Medicine

May 30

Joint Lab Meeting: Cancer Immunotherapy

June 18

The Simons Center for Systems Biology Informal Talks on Abstract/Conceptual/Quantitative Aspects of Biology ♦ *Molecular Insights into Bacterial Signaling* ♦ **Felipe Trajtenberg Pareja**, Institut Pasteur de Montevideo

June 22

Joint Lab Meeting: Cancer Immunotherapy ♦ *Neoantigen Models for Tumor Evolution Due to Immune Editing, Kras Mutant Lung Cancer Cell Lines* ♦ **Hyejin Choi**, Memorial Sloan

Kettering Cancer Center ♦ *Mouse Models for Immunotherapy Response* ♦ **Mattieu Gigoux**, Memorial Sloan Kettering Cancer Center ♦ *p53 Fitness Models* ♦ **David Hoyos**, Icahn School of Medicine at Mount Sinai ♦ *Identifying T-Cell Expansion in Pancreatic Cancer Patients* ♦ **Alexander Solovyov**, Icahn School of Medicine at Mount Sinai ♦ *Unspecific Binding of T-Cell Receptors in Pancreatic Cancer Patients* ♦ **Vinod Balachandran**, Memorial Sloan Kettering Cancer Center

June 27–28

Convergence Scholars Meeting ♦ *Introduction to Immunotherapy* ♦ **Arnold J. Levine**, Professor Emeritus, School of Natural Sciences ♦ *Analysis of T-Cell Population of Pancreatic Cancer Survivors* ♦ **Alexander Solovyov**, Icahn School of Medicine at Mount Sinai ♦ *Reading the Immune System: Matching Antigens to T-Cell Receptor Sequences* ♦ **Miriam Gutschow**, Fred Hutchinson Cancer Research Center ♦ *Statistical Analysis of the T-Cell Spatial Distribution in the Tumor Microenvironment of Breast Cancer* ♦ **Julie Wortman**, University of California, Irvine ♦ *Transcriptional Landscape of Stroma Progression in the Breast Tumor Microenvironment* ♦ **Raditya Utama**, Cold Spring Harbor Laboratory ♦ *Spatiotemporal Genomic Analysis of AML and NSCLC* ♦ **Merzu Belete**, Rutgers Cancer Institute of New Jersey ♦ *The Genetic Architecture of Acute Myeloid Leukemia During Treatment* ♦ **Friederike Pastore**, Memorial Sloan Kettering Cancer Center ♦ *Clonal Dynamics in Cancer* ♦ **Junfei Zhao**, Columbia University ♦ *Inhibition of Cancer Repeat RNA Retroviral Mimicry Triggers Necroptotic Immunosurveillance* ♦ **Mihir Rajurkar**, Massachusetts General Hospital Cancer Center ♦ *Sequential Profiling of Acquired Resistance in EGFR Mutant Non-Small-Cell Lung Cancers* ♦ **Heidie Frisco-Cabanos**, Massachusetts General Hospital ♦ *Interferon Gamma Triggers Paradoxical Signal to Modulate Drug Response in EGFR Mutated NSCLC Cells* ♦ **Xiaoxiao Sun**, University of California, San Francisco ♦ *A Network Modeling Approach to Elucidate Drug Resistance Mechanisms and Predict Combinatorial Drug Treatments in Breast Cancer* ♦ **Jorge Zanutto**, The Pennsylvania State University ♦ *Mechanisms of Target Therapy Resistance in ER-Positive Breast Cancer* ♦ **Guotai Xu**, Memorial Sloan Kettering Cancer Center ♦ *FGF/FGFR As a Resistance Mechanism for Endocrine Therapy in ER+ Breast Cancer* ♦ **Pingping Mao**, Dana-Farber Cancer Institute

School of Social Science

September 22–23

Workshop ♦ *Words and Worlds: A Lexicon for Dark Times* ♦ Organized by **Veena Das**, Johns Hopkins University; Trustee, Institute for Advanced Study; and **Didier Fassin**, James D. Wolfensohn Professor, School of Social Science

September 25

Social Science Seminar ♦ *Colonial Sociologists in the French and British Empires, 1930s–1960s: Between Scientific Dependency and Intellectual Autonomy* ♦ **George Steinmetz**, University of Michigan, Ann Arbor; Visiting Professor, School of Social Science

October 2

Social Science Seminar ♦ *Disunity in the Social Sciences: Dreadful or Fruitful?* ♦ **Jean-Louis Fabiani**, Central European University; Member, School of Social Science

October 4

The Social Sciences in a Changing World Seminar ♦ Discussion of readings around the theme “Positivism and Its Critics” ♦ Curated by **George Steinmetz**, University of Michigan, Ann Arbor; Visiting Professor, School of Social Science

October 9

Social Science Seminar ♦ *Fiercely Nationalistic or European Cosmopolitan? Max Weber on World Politics* ♦ **Álvaro Morcillo-Laiz**, Centro de Investigación y Docencia Económicas, Mexico City; Member, School of Social Science

October 16

Social Science Seminar ♦ *Khomeini's Theory of Islamic State and the Making of the Iranian Revolution* ♦ **Mehdi Shadmehr**, University of Calgary; Member, School of Social Science

October 18

The Social Sciences in a Changing World Seminar ♦ Discussion of readings around the theme “Intellectual History and the Sociology of the Intellectuals” ♦ Curated by **Jean-Louis Fabiani**, Central European University; Member, School of Social Science; **Nicolas Guilhot**, CNRS, Center for International Research in the Humanities and Social Science; Member, School of Social Science; and **Tomaž Mastnak**, Research Centre of the Slovenian Academy of Sciences and Arts; Visitor, School of Social Science

From the Banned Countries Film Series ♦ *Last Men in Aleppo*, directed by Firas Fayyad ♦ Post-screening discussion led by **Kevin Martin**, Indiana University; Member, School of Historical Studies

October 23

Social Science Seminar ♦ *Provincializing Global History and Decolonizing Theory: Guinea Sam Nightingale and Magic Marx in Civil War Missouri* ♦ **Andrew Zimmerman**, The George Washington University; Member, School of Social Science

October 30

Social Science Seminar ♦ *When the Subaltern Speaks* ♦ **Peter D. Thomas**, Brunel University; Member, School of Social Science

November 1

Colloquium: A Research Seminar + Discussion of paper presented by **Johan Heilbron**, Centre Européen de Sociologie et de Science Politique, Université Paris 1

November 6

Social Science Seminar + *The Kruger National Park and the Conservation of Science* + **Jacob S. T. Dlamini**, Princeton University; Member, School of Social Science

Seminar + *History of the School of Social Science* + Chaired by **Didier Fassin**, James D. Wolfensohn Professor, School of Social Science

November 8

The Social Sciences in a Changing World Seminar + Discussion of readings around the theme “Decolonizing the Social Sciences” + Curated by **Miriam Kingsberg Kadia**, University of Colorado, Boulder; Member, School of Social Science; **Peter D. Thomas**, Brunel University, Member, School of Social Science; and **Andrew Zimmerman**, The George Washington University; Member, School of Social Science

From the Banned Countries Film Series + *Taxi*, directed by Jafar Pahani + Post-screening discussion led by **Firoozeh Kashani-Sabet**, University of Pennsylvania

November 13

Social Science Seminar + *Making Sense of Globalizing Social Science* + **Johan Heilbron**, Centre Européen de Sociologie et de Science Politique, Université Paris 1; Member, School of Social Science

November 15

Colloquium: A Research Seminar + Discussion of paper presented by **Álvaro Morcillo-Laiz**, Centro de Investigación y Docencia Económicas, Mexico City; Member, School of Social Science

November 20

Social Science Seminar + *Virtually Radical: Speech, Surveillance, and Silence in (Indian) Kashmir* + **Chitrlekha Dhamija**, Jawaharlal Nehru University; Member, School of Social Science

November 27

Social Science Seminar + *The Horrific History of Comparisons Between Animals and the Cognitively Disabled (and How to Move Beyond It)* + **Alice Crary**, The New School for Social Research; Member, School of Social Science

November 30

Guest Seminar + *The Black Woman's Womb. Capitalism, Race, Feminism* + **Françoise Vergès**, Collège d'études mondiales + Organized by **Sara Farris**, Goldsmiths, University of London; Visitor, School of Social Science

December 4

Social Science Seminar + *From Cohabitation to Disposability: Dogs of Istanbul* + **Ayten Alkan**, Member, School of Social Science

December 6

Joint School of Social Science/School of Natural Sciences Seminar + *Presentation on Neuroscience and the Social Sciences* + **Mariano Sigman**, Integrative Neuroscience Laboratory, University of Buenos Aires

December 11

Social Science Seminar + *The Japanese Student Movement of 1968, Epistemological Revolution, and the End of the Field Generation* + **Miriam Kingsberg Kadia**, University of Colorado, Boulder; Member, School of Social Science

December 12

Colloquium: A Research Seminar + Discussion of paper presented by **George Steinmetz**, University of Michigan, Ann Arbor; Visiting Professor, School of Social Science

December 13

The Social Sciences in a Changing World Seminar + Discussion of readings around the theme “Socialist and Post-Socialist Social Sciences” + Curated by **Agata Zysiak**, University of Łódź, Poland; Member, School of Social Science, **Johanna K. Bockman**, George Mason University; Visitor, School of Social Science, and **Vladimir Kulić**, Florida Atlantic University; Member, School of Historical Studies

From the Banned Countries Film Series + *Karama Has No Walls* and *The Mulberry House*, directed by Sara Ishaq + Post-screening discussion led by **Steven Caton**, Harvard University

January 22

Social Science Seminar + *Make Yourselves Gods: Secularism, Sex, and the Radiant Body of Early Mormonism* + **Peter Coviello**, University of Illinois at Chicago; Member, School of Social Science

January 29

Social Science Seminar + *The Religion Machine; or, a Particular History of the Brain* + **John Lardas Modern**, Franklin & Marshall College; Member, School of Social Science

February 5

Social Science Seminar + *A Field of European Social Science?* + **Kristoffer Kropp**, Roskilde University; Member, School of Social Science

February 7

The Social Sciences in a Changing World Seminar + Discussion of readings around the theme “Funding and the Social Sciences” + Curated by **Bregje van Eekelen**, Erasmus University Rotterdam; Member, School of Social Science; **Kristoffer Kropp**, Roskilde

University, Member, School of Social Science; and **Álvaro Morcillo-Laiz**, Centro de Investigación y Docencia Económicas, Mexico City; Member, School of Social Science

February 12

Social Science Seminar + *University for Working Classes: Rise and Fall of Socialist Modernization in Postwar Poland* + **Agata Zysiak**, University of Łódź, Poland; Member, School of Social Science

February 14

Colloquium: A Research Seminar + Discussion of paper presented by **Miriam Kingsberg Kadia**, University of Colorado, Boulder; Member, School of Social Science

February 21

The Social Sciences in a Changing World Seminar + Discussion of contributions for a collective volume

From the Banned Countries Film Series + *Stronger Than Bullets*, directed by Matthew Millan + Post-screening discussion led by the director, **Matthew Millan**

February 26

Social Science Seminar + *Together, Apart: Suspected Lives in West Bank Refugee Camps and Israeli Cities* + **Silvia Pasquetti**, Newcastle University; Member, School of Social Science

February 28

Colloquium: A Research Seminar + Discussion of paper presented by **Carel E. Smith**, Universiteit Leiden; Visitor, School of Social Science

March 5

Social Science Seminar + *Switching Scientific Paradigms for a Political Revolution: Bourdieu during the Algerian Liberation War* + **Amín Pérez**, École des Hautes Études en Sciences Sociales, Paris; Member, School of Social Science

March 7

The Social Sciences in a Changing World Seminar + *The Prehistory and History of Modernization Theory between the 1920s and the 1960s* + **Wolfgang Knöbl**, Hamburger Institut für Sozialforschung

March 12

Social Science Seminar + *The European Common Market: “A New Frontier” for US Business Elites or an “Economic Frankenstein”?* + **Janick Marina Schaufelbuehl**, Université de Lausanne; Member, School of Social Science

March 14

Colloquium: A Research Seminar + Discussion of paper presented by **Kristoffer Kropp**, Roskilde University; Member, School of Social Science

March 19

Social Science Seminar ♦ *The Political Economy of Natural Resources and Petro-Authoritarianism* ♦ **Gubad Ibadoghlu**, The Economic Research Center of Azerbaijan; Visitor, School of Social Science

March 26

Social Science Seminar ♦ *Culture as Process: Notes toward a Theory* ♦ **Paul DiMaggio**, New York University; Member, School of Social Science

March 28

Colloquium: A Research Seminar ♦ Discussion of paper presented by **Chitralekha Dhamija**, Jawaharlal Nehru University; Member, School of Social Science

April 2

Social Science Seminar ♦ *Chimpanzee Culture Wars* ♦ **Nicolas Langlitz**, The New School for Social Research; Member, School of Social Science

April 4

The Social Sciences in a Changing World Seminar ♦ Discussion of readings around the theme “Economics and the Other Social Sciences” ♦ Curated by **Paul DiMaggio**, New York University; Member, School of Social Science; **Johan Heilbron**, Centre Européen de Sociologie et de Science Politique, Université Paris 1; Member, School of Social Science; and **Johanna K. Bockman**, George Mason University; Visitor, School of Social Science

April 5

From the Banned Countries Film Series ♦ *Stolen Seas*, directed by Thymaya Payne ♦ Post-screening discussion led by **Lee Cassanelli**, University of Pennsylvania

April 9

Social Science Seminar ♦ *Contemplating Spectacular Black Death Across Generations: Lynching, Lethal Police Violence, and the Black Female Body* ♦ **Shatema Threadcraft**, Dartmouth College; Member, School of Social Science

April 12

Bourdieu Course ♦ Curated by **Álvaro Morcillo-Laiz**, Centro de Investigación y Docencia Económicas, Mexico City; Member, School of Social Science

April 16

Social Science Seminar ♦ *Rights of Place: A Spanish American view of Property and Territory* ♦ **Paulina Ochoa Espejo**, Haverford College; Member, School of Social Science

April 18

Guest Seminar ♦ *The Humanities at the Turn of the Millennium: A Historical Comparative Sociology of Current Research Practices in the Humanities* ♦ **Lasse Gøhler Johansson**, Aalborg Universitet, Copenhagen

The Social Sciences in a Changing World Seminar ♦ Discussion of readings around the theme “Philosophy” ♦ Curated by **Alice Crary**, The New School for Social Research; Member, School of Social Science; **Chitralekha Dhamija**, Jawaharlal Nehru University; Member, School of Social Science; **Jean-Louis Fabiani**, Central European University, Member, School of Social Science; and **Carel E. Smith**, Universiteit Leiden; Visitor, School of Social Science

April 23

Social Science Seminar ♦ *Disciplining Creativity: A Cultural History of Unstructured Thought* ♦ **Bregje van Eekelen**, Erasmus University Rotterdam; Member, School of Social Science

April 30

Social Science Seminar ♦ *The Economy of the Mysteries: Administering Sacramental Wealth in the Age of Lights* ♦ **Charly Coleman**, Columbia University; Member, School of Social Science

May 2

Informal Colloquium ♦ *Bourdieu and the Sociology of (Social) Sciences* ♦ Curated by **George Steinmetz**, University of Michigan, Ann Arbor; Visiting Professor, School of Social Science; **Johan Heilbron**, Centre Européen de Sociologie et de Science Politique, Université Paris 1; Member, School of Social Science; and **Kristoffer Kropp**, Roskilde University; Member, School of Social Science

May 3

Guest Seminar ♦ *Meaning and Metaphor: How to Receive Thoughts from an Elsewhere* ♦ **Veena Das**, Johns Hopkins University; Trustee, Institute for Advanced Study

May 7

Social Science Seminar ♦ *The Politics of Decision: The Modern Social Sciences from Decisionism to Rational Choice* ♦ **Nicolas Guilhot**, CNRS, Center for International Research in the Humanities and Social Science; Member, School of Social Science

May 9

Workshop ♦ *Network Correspondence Analysis* ♦ **Ramina Sotoudeh**, Princeton University

From the Banned Countries Film Series ♦ *We Come as Friends*, directed by Hubert Sauper ♦ Post-screening discussion led by **Alden H. Young**, Drexel University

May 14

Social Science Seminar ♦ *Equality in French Politics: An Unfinished Business* ♦ **Anne-Claire Defossez**, Visitor, School of Social Science

May 16

The Social Sciences in a Changing World Seminar ♦ Discussion of contributions for a collective volume

June 17–30

Summer Program in Social Science ♦ Organized by **Didier Fassin**, James D. Wolfensohn Professor, School of Social Science

Director’s Office Events

September 15

Friends Lunch with a Member ♦ *Black Holes and the Butterfly Effect* ♦ **Douglas Stanford**, Long-term Member, School of Natural Sciences

September 25

Member Welcome Reception

October 6

Friends Breakfast with a Member ♦ *The Collective Computation of Life* ♦ **Olaf Witkowski**, Earth-Life Science Institute, Tokyo Institute of Technology; Visitor, Program in Interdisciplinary Studies

October 7

Member Family Barbeque

October 8

Gathering in Remembrance of Vladimir Voevodsky

October 11

Friends Talk ♦ *The Pattern Makers: Season 2* ♦ **David Lang**, Artist-in-Residence

October 13

Friends Talk ♦ *Salvaging the Rational Heritage of Islam: The Zaydi Manuscript Tradition Project* ♦ **Sabine Schmidtke**, Professor, School of Historical Studies

October 18

Friends Lunch with a Member ♦ *The Dark Side of the Earth in the Sixteenth Century* ♦ **Alexander Nagel**, New York University; Member, School of Historical Studies

October 20

Edward T. Cone Concert Series and Talk ♦ **Stephen Drury**

October 21

Edward T. Cone Concert Series ♦ **Stephen Drury**

October 25

Princeton Symphony Orchestra Concert ♦ **LARK Quartet**

October 27

Theoretical Machine Learning Lecture Series ♦ *Machines: How Do They Learn and Where Are They Headed?* ♦ **Sanjeev Arora**, Princeton University; Visiting Professor, School of Mathematics; **Richard Zemel**, University of Toronto; Visitor, School of Mathematics; and **Robbert Dijkgraaf**, Director and Leon Levy Professor

November 3

AMIAS Public Lecture ♦ *A Refuge for Scholars: Contemporary Challenges in Historical Perspective* ♦ **Joan Scott**, Professor Emerita, School of Social Science; **Thomas Dodman**, Boston College; **Ian Jauslin**, Member, School of Mathematics; **Ayşe Parla**, Sabanci University; Visitor, School of Social Science; and **Robbert Dijkgraaf**, Director and Leon Levy Professor

November 10

Friends Lunch with a Member ♦ *The (Ancient) Hippocratic Oath in Context: Death, Physicians, and Suicide* ♦ **Hartwin Brandt**, Otto-Friedrich-Universität Bamberg; Member, School of Historical Studies

Edward T. Cone Concert Series and Talk ♦ **The Crossing**

November 11

Edward T. Cone Concert Series ♦ **The Crossing**

November 15

Theoretical Machine Learning Lecture Series ♦ *Deep Learning and Cognition* ♦ **Christopher Manning**, Stanford University

November 17

Friends Talk ♦ *A Square Meal* ♦ **Jane Ziegelman**, author; **Andrew Coe**, author

December 1

Friends Talk ♦ *Art, Music, and Politics in the Book of Revelation* ♦ **Elaine Pagels**, Princeton University

December 3

Princeton Symphony Orchestra Concert ♦ **The Exponential Ensemble**

December 7

S.T. Lee Public Lecture ♦ *The Visual Culture of Iranian Tiveler Shiism in the Qajar Period* ♦ **Ulrich Marzolph**, Georg-August-Universität Göttingen

December 12

Theoretical Machine Learning Lecture Series ♦ *How Could Machines Learn as Efficiently as Animals and Humans?* ♦ **Yann LeCun**, Facebook AI Research Labs

December 21

Institute Community Holiday Party

January 12

Edward T. Cone Concert Series and Talk ♦ **Vicky Chow**

January 13

Edward T. Cone Concert Series ♦ **Vicky Chow**

January 24

Friends Dessert with a Member ♦ *Dust, Distortions, and Shadows in the Universe's Oldest Light* ♦ **James Colin Hill**, Columbia University; Member, School of Natural Sciences

January 26

Friends Talk ♦ *Impeachment: The Constitutional Remedy of Last Resort* ♦ **Alan Baron**, Former Special Impeachment Counsel for the U.S. House of Representatives

February 9

Friends Talk ♦ *The Virtues of Violence: Amphitheaters, Gladiators, and the Roman System of Values* ♦ **Kathleen Coleman**, Harvard University; Member, School of Historical Studies

February 16

Artist Salon ♦ *Radical Cello* ♦ **Maya Beiser**, cellist

February 23

Friends Lunch with a Member ♦ *What is Wrong with Border Walls?* ♦ **Paulina Ochoa Espejo**, Haverford College; Member, School of Social Science

February 24

Midwinter Party for Faculty, Members, and Staff

March 4

Princeton Symphony Orchestra Concert ♦ **Aureole Trio**

March 9

Edward T. Cone Concert Series and Talk ♦ **Ensemble Signal**

March 10

Edward T. Cone Concert Series ♦ **Ensemble Signal**

March 14

Groundbreaking Ceremony for Rubenstein Commons

March 16

Friends Talk ♦ *How and Why We Write the History of the Social Sciences* ♦ **George Steinmetz**, University of Michigan, Ann Arbor; Visiting Professor, School of Social Science

March 20

Reception for Robert Langlands in Honor of His Abel Prize

April 6

Friends Lunch with a Member ♦ *Liquid Crystals and the Heilmann–Lieb Conjecture* ♦ **Ian Jauslin**, Member, School of Mathematics

April 13

Public Lecture ♦ *Celebrating Freeman Dyson's Maker of Patterns* ♦ **Freeman Dyson**, Professor Emeritus, School of Natural Sciences; and **Robbert Dijkgraaf**, Director and Leon Levy Professor

April 15

Princeton Symphony Orchestra Concert ♦ **Patterson/Sutton Duo**

April 20

Friends Talk ♦ *Before Menus, Cookbooks, and Writing: Reconstructing Cuisines from the Archaeological Record* ♦ **Katherine Moore**, University of Pennsylvania

April 26

Ideas 2017–18 ♦ *Topology and Physics* ♦ **Clay Cordova**, Long-term Member, School of Natural Sciences; **Edward Witten**, Charles Simonyi Professor, School of Natural Sciences ♦ *Spectacular Black Death* ♦ **Shatema Threadcraft**, Dartmouth College; Member, School of Social Science; **Didier Fassin**, James D. Wolfensohn Professor, School of Social Science ♦ *Liquid Crystals: Order upon Disorder* ♦ **Ian Jauslin**, Member, School of Mathematics; **Thomas Spencer**, Professor Emeritus, School of Mathematics ♦ *A Child Prodigy in Ancient Rome* ♦ **Kathleen Coleman**, Harvard University; Member, School of Historical Studies; **Angelos Chaniotis**, Professor, School of Historical Studies ♦ *Panel Discussion: Challenges and Opportunities* ♦ **Robbert Dijkgraaf**, Director and Leon Levy Professor; **Nicola Di Cosmo**, Luce Foundation Professor in East Asian Studies, School of Historical Studies; **Johan Heilbron**, Centre Européen de Sociologie et de Science Politique, Université Paris 1; Member, School of Social Science; **June Huh**, Visiting Professor, School of Mathematics; **Scott Tremaine**, Richard Black Professor, School of Natural Sciences

April 27

Reception for Didier Fassin in Honor of His NOMIS Distinguished Scientist Award

May 4

Public Lecture ♦ *The Cool Alter-Ego of a Black Hole* ♦ **Juan Maldacena**, Carl P. Feinberg Professor, School of Natural Sciences; **Douglas Stanford**, Long-term Member, School of Natural Sciences; and **Robbert Dijkgraaf**, Director and Leon Levy Professor

May 16

Friends Talk ♦ *Excavating at the Birthplace of Zeus* ♦ **David Gilman Romano**, The University of Arizona; Member, School of Historical Studies

June 6

Friends Lunch with a Member ♦ *The Revival of Psychedelic Research* ♦ **Nicolas Langlitz**, The New School for Social Research; Member, School of Social Science

June 7

Friends Annual Meeting and Picnic

June 8

Staff Picnic

ACKNOWLEDGMENTS

(for the year ended June 30, 2018)

Each year researchers from around the world come to the Institute for Advanced Study to interact, explore, take risks, share, build, and discover. This would not be possible but for the far-sighted vision and support of a worldwide network of philanthropists. We thank our donors for their contributions in Fiscal Year 2017–18 during which new commitments to endowment and the IAS Fund totaled over \$12 million.

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The Institute expresses its continuing gratitude to donors who have provided support through these endowed funds and through gifts and pledges of operating support.

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¹ Annual gifts from July 1, 2017–June 30, 2018

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From September 25, 2017

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Miriam Harris
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Communications
From September 18, 2017

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Susan Olson
Director of Events

Karla Cosgriff
Director of Annual Giving
From March 6, 2018

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Librarian, Mathematics and Natural Sciences

Marcia Tucker
Librarian, Historical Studies and Social
Science (also Coordinator of Information
Access for Computing, Telecommunications,
and Networking Administration)

Casey Westerman
Archivist

School Administration

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Administrative Officer
School of Mathematics

Donne Petito
Administrative Officer
School of Social Science

Michelle Sage
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Manager of Databases and Integration

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(in order of service as of June 30, 2018)

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Institute for Advanced Study—
Louis Bamberger and Mrs. Felix Fuld Foundation

Financial Statements
June 30, 2018 and 2017
(With Independent Auditors' Report Thereon)

Independent Auditors' Report

The Board of Trustees
Institute for Advanced Study—Louis Bamberger and Mrs. Felix Fuld Foundation:

We have audited the accompanying financial statements of Institute for Advanced Study—Louis Bamberger and Mrs. Felix Fuld Foundation, which comprise the statements of financial position as of June 30, 2018 and 2017, and the related statements of activities and cash flows for the years then ended, and the related notes to the financial statements.

Management's Responsibility for the Financial Statements

Management is responsible for the preparation and fair presentation of these financial statements in accordance with U.S. generally accepted accounting principles; this includes the design, implementation, and maintenance of internal control relevant to the preparation and fair presentation of financial statements that are free from material misstatement, whether due to fraud or error.

Auditors' Responsibility

Our responsibility is to express an opinion on these financial statements based on our audits. We conducted our audits in accordance with auditing standards generally accepted in the United States of America. Those standards require that we plan and perform the audit to obtain reasonable assurance about whether the financial statements are free from material misstatement.

An audit involves performing procedures to obtain audit evidence about the amounts and disclosures in the financial statements. The procedures selected depend on the auditors' judgment, including the assessment of the risks of material misstatement of the financial statements, whether due to fraud or error. In making those risk assessments, the auditor considers internal control relevant to the entity's preparation and fair presentation of the financial statements in order to design audit procedures that are appropriate in the circumstances, but not for the purpose of expressing an opinion on the effectiveness of the entity's internal control. Accordingly, we express no such opinion. An audit also includes evaluating the appropriateness of accounting policies used and the reasonableness of significant accounting estimates made by management, as well as evaluating the overall presentation of the financial statements.

We believe that the audit evidence we have obtained is sufficient and appropriate to provide a basis for our audit opinion.

Opinion

In our opinion, the financial statements referred to above present fairly, in all material respects, the financial position of Institute for Advanced Study—Louis Bamberger and Mrs. Felix Fuld Foundation as of June 30, 2018 and 2017, and the changes in its net assets and its cash flows for the years then ended, in accordance with U.S. generally accepted accounting principles.

KPMG LLP

October 26, 2018

STATEMENTS OF FINANCIAL POSITION
JUNE 30, 2018 AND 2017

Assets	2018	2017
Cash and cash equivalents	\$ 2,046,757	1,005,909
Accounts receivable and other assets	3,457,752	3,074,199
Grants receivable	2,092,063	1,980,650
Contributions receivable, net	24,106,193	11,677,987
Mortgages receivable	5,407,378	6,284,894
Funds held by bond trustee	852,322	2,457,470
Beneficial interest in remainder trust	1,066,466	1,061,403
Land, buildings and improvements, equipment, and rare book collection, net	122,170,708	102,551,004
Investments	809,182,814	777,519,685
Total assets	\$ 970,382,453	907,613,201
Liabilities and Net Assets		
Liabilities:		
Accounts payable and accrued expenses	\$ 10,949,189	11,406,056
Deferred revenue	9,522,988	9,617,054
Liabilities under split-interest agreements	1,819,942	1,900,266
Postretirement benefit obligation	18,308,952	17,832,643
Asset retirement obligation	1,142,036	1,116,114
Bond swap liability	2,316,450	3,447,319
Long-term debt, net	92,039,675	70,387,750
Total liabilities	136,099,232	115,707,202
Net assets:		
Unrestricted	367,373,266	360,890,589
Temporarily restricted	211,062,206	177,061,931
Permanently restricted	255,847,749	253,953,479
Total net assets	834,283,221	791,905,999
Total liabilities and net assets	\$ 970,382,453	907,613,201

See accompanying notes to financial statements.

STATEMENT OF ACTIVITIES
YEAR ENDED JUNE 30, 2018

	Unrestricted	Temporarily restricted	Permanently restricted	Total
Revenues, gains, and other support:				
Private contributions and grants	\$ 91,245	35,595,398	1,894,270	37,580,913
Government grants	—	6,770,907	—	6,770,907
Investment return	26,719,615	30,223,024	—	56,942,639
Change in fair value of bond swap liability	1,130,869	—	—	1,130,869
Gain on sale of plant assets	2,518,055	—	—	2,518,055
Auxiliary activity	5,789,947	—	—	5,789,947
Net assets released from restrictions— satisfaction of program restrictions	38,589,054	(38,589,054)	—	—
Total revenues, gains, and other support	74,838,785	34,000,275	1,894,270	110,733,330
Expenses:				
School of Mathematics	11,860,863	—	—	11,860,863
School of Natural Sciences	11,661,281	—	—	11,661,281
School of Historical Studies	8,243,513	—	—	8,243,513
School of Social Science	3,725,912	—	—	3,725,912
Libraries and other academic	6,387,004	—	—	6,387,004
Administration and general	16,540,048	—	—	16,540,048
Auxiliary activity	9,937,487	—	—	9,937,487
Total expenses	68,356,108	—	—	68,356,108
Changes in net assets	6,482,677	34,000,275	1,894,270	42,377,222
Net assets—beginning of year	360,890,589	177,061,931	253,953,479	791,905,999
Net assets—end of year	\$ 367,373,266	211,062,206	255,847,749	834,283,221

See accompanying notes to financial statements.

STATEMENT OF ACTIVITIES
YEAR ENDED JUNE 30, 2017

	Unrestricted	Temporarily restricted	Permanently restricted	Total
Revenues, gains, and other support:				
Private contributions and grants	\$ 132,207	9,744,027	1,064,847	10,941,081
Government grants	—	6,922,152	—	6,922,152
Investment return	23,379,515	26,930,175	—	50,309,690
Change in fair value of bond swap liability	1,680,539	—	—	1,680,539
Loss on sale of plant assets	(11,834)	—	—	(11,834)
Auxiliary activity	5,372,411	—	—	5,372,411
Net assets released from restrictions— satisfaction of program restrictions	37,027,865	(37,027,865)	—	—
Total revenues, gains, and other support	67,580,703	6,568,489	1,064,847	75,214,039
Expenses:				
School of Mathematics	10,930,788	—	—	10,930,788
School of Natural Sciences	11,364,271	—	—	11,364,271
School of Historical Studies	7,579,365	—	—	7,579,365
School of Social Science	3,627,565	—	—	3,627,565
Libraries and other academic	6,491,183	—	—	6,491,183
Administration and general	15,196,630	—	—	15,196,630
Auxiliary activity	8,599,549	—	—	8,599,549
Total expenses	63,789,351	—	—	63,789,351
Changes in net assets	3,791,352	6,568,489	1,064,847	11,424,688
Net assets—beginning of year	357,099,237	170,493,442	252,888,632	780,481,311
Net assets—end of year	\$ 360,890,589	177,061,931	253,953,479	791,905,999

See accompanying notes to financial statements.

STATEMENTS OF CASH FLOWS
YEARS ENDED JUNE 30, 2018 AND 2017

	2018	2017
Cash flows from operating activities:		
Change in net assets	\$ 42,377,222	11,424,688
Adjustments to reconcile change in net assets to net cash used in operating activities:		
Depreciation and amortization expense	5,769,778	4,942,462
Contributions restricted for endowment and plant	(9,761,994)	(8,489,319)
Net appreciation on investments	(59,732,183)	(53,600,807)
Change in fair value of bond swap liability	(1,130,869)	(1,680,539)
(Gain) loss on sale of plant assets	(2,518,055)	11,834
Amortization of debt issuance costs	60,729	58,409
Amortization of bond discount	26,693	22,357
Changes in assets/liabilities:		
Receivables and other assets	382,550	322,292
Contributions receivable	(17,428,206)	8,227,415
Beneficial interest in remainder trust	(5,063)	1,552,066
Accounts payable and accrued expenses	(456,867)	2,573,288
Deferred revenue	(94,066)	(1,228,622)
Postretirement benefit obligation	476,309	(640,725)
Asset retirement obligation	25,922	33,337
	(42,008,100)	(36,471,864)
Cash flows from investing activities:		
Proceeds from sale of plant assets	3,453,425	1,201,172
Purchase of plant assets	(26,324,852)	(18,032,719)
Proceeds from sale of investments	312,370,302	317,226,232
Purchase of investments	(284,301,248)	(275,976,095)
	5,197,627	24,418,590
Cash flows from financing activities:		
Contributions restricted for endowment and plant	14,761,994	8,489,319
Decrease in liabilities under split-interest agreements	(80,324)	(12,872)
Proceeds from issuance of long-term debt	24,724,503	—
Principal payments on long-term debt	(3,160,000)	(2,915,000)
Principal payments on note payable	—	(74,665)
(Increase) decrease in funds held by bond trustee	1,605,148	(30,597)
	37,851,321	5,456,185
Net cash provided by financing activities	37,851,321	5,456,185
Net increase (decrease) in cash and cash equivalents	1,040,848	(6,597,089)
Cash and cash equivalents—beginning of year	1,005,909	7,602,998
Cash and cash equivalents—end of year	\$ 2,046,757	1,005,909
Supplemental data:		
Interest paid	\$ 3,006,937	2,747,631

See accompanying notes to financial statements.

NOTES TO FINANCIAL STATEMENTS
JUNE 30, 2018 AND 2017

(1) **Organization and Summary of Significant Accounting Policies**

(a) *Organization*

The Institute for Advanced Study—Louis Bamberger and Mrs. Felix Fuld Foundation (the Institute), an independent, private institution devoted to the encouragement, support, and patronage of learning, was founded in 1930 as a community of scholars where intellectual inquiry could be carried out in the most favorable circumstances.

Focused on mathematics and classical studies at the outset, the Institute today consists of the School of Historical Studies, the School of Mathematics, the School of Natural Sciences, and the School of Social Science. Each school has a small permanent faculty, and some 190 fellowships are awarded annually to members visiting the Institute from other research institutions and universities throughout the world.

The Founders' original letter to the first trustees described the objectives of the Institute as follows: "The primary purpose is the pursuit of advanced learning and exploration in fields of pure science and high scholarship to the utmost degree that the facilities of the institution and the ability of the faculty and students will permit."

(b) *Summary of Significant Accounting Policies*

Basis of Presentation

The accompanying financial statements, which are presented on the accrual basis of accounting, have been prepared to focus on the Institute as a whole and to present net assets and revenues, expenses, gains, and losses based on the existence or absence of donor-imposed restrictions. Accordingly, net assets and changes therein are classified as follows:

- Permanently restricted net assets—net assets subject to donor-imposed stipulations that they be maintained permanently by the Institute. Generally, the donors of these assets permit the Institute to use all or part of the income earned on related investments for general or specific purposes.
- Temporarily restricted net assets—net assets subject to donor-imposed stipulations that will be met by actions of the Institute and/or by the passage of time.
- Unrestricted net assets—net assets not subject to donor-imposed stipulations. Unrestricted net assets may be designated for specific purposes by action of the Board of Trustees.

Revenues are reported as increases in unrestricted net assets unless use of the related asset is limited by donor-imposed restrictions. Expenses are reported as decreases in unrestricted net assets. Expiration of donor-imposed stipulations that simultaneously increase unrestricted net assets and decrease temporarily restricted net assets are reported as net assets released from restrictions.

(i) *Contributions and Grants*

Contributions and grants, including unconditional promises to give, are recognized initially at fair value as revenues in the period received. Conditional promises to give are not recognized until they become unconditional, that is when the conditions on which they depend are substantially met. Contributions of assets other than cash are recorded at their estimated fair value. Pledges of contributions to be received after one year are discounted at a risk-adjusted discount rate. The discount rates range from 1.24% to 2.81%. Amortization of discount is recorded as additional contribution revenue in accordance with donor-imposed restrictions, if any, on the contributions. The inputs to the fair value estimate are considered Level 3 in the fair value hierarchy.

Contributions of long-lived assets are reported as unrestricted revenue. Contributions restricted for the acquisition of grounds, buildings, and equipment are reported as temporarily restricted revenues. These contributions are reclassified to unrestricted net assets upon acquisition of the assets.

(ii) *Cash and Cash Equivalents*

Cash and cash equivalents consist of cash on hand and all highly liquid investments with an original maturity of three months or less, except for those managed as a component of the Institute's investment portfolio.

(iii) *Mortgages receivable*

The Institute regularly offers first mortgages on primary residences to full-time faculty and senior administrative employees who have met certain requirements stipulated by the Board of Trustees.

(iv) *Investments*

Investments in marketable securities are reported in the financial statements at fair value based on published market quotations. Investments in limited partnerships and hedge funds are reported in the financial statements at estimated fair value using net asset value (NAV) or its equivalent as a practical expedient, based upon values provided by external investment managers or general partners, unless it is probable that all or a portion of the investment will be sold for an amount different from NAV. The Institute reviews and evaluates the values provided by external investment managers and general partners and agrees with the valuation methods and assumptions used in determining the fair value of funds. These estimated fair values may differ significantly from the values that would have been used had a ready market for these securities existed. As of June 30, 2018 and 2017, the Institute had no plans or intentions to sell investments at amounts different from NAV.

The statements of activities recognize unrealized gains and losses on investments as increases and decreases, respectively, in unrestricted net assets unless their use is temporarily or permanently restricted by explicit donor stipulation or law. Gains and losses on the sale of investment securities are calculated using the specific-identification method.

(v) *Fair Value Measurements*

Fair value is defined as the exchange price that would be received for an asset or paid to transfer a liability (an exit price) in the principal or most advantageous market for the asset or liability in an orderly transaction between market participants on the measurement date. The fair value hierarchy requires an entity to maximize the use of observable inputs and minimize the use of unobservable inputs when measuring fair value. A financial instrument's level within the fair value hierarchy is based on the lowest level of any input that is significant to the fair value measurement. The three levels of inputs used to measure fair value are as follows:

- Level 1: Quoted prices in active markets for identical assets or liabilities
- Level 2: Observable inputs other than Level 1 prices, such as quoted prices for similar assets or liabilities, quoted prices in markets that are not active, or other inputs that are observable or can be corroborated by observable market data for substantially the full term of the assets or liabilities
- Level 3: Unobservable inputs that are supported by little or no market activity and that are significant to the fair value of the asset or liabilities.

Fair value estimates are made at a specific point in time based on available market information and judgments about the financial asset, including estimates of timing, amount of expected future cash flows, and the credit standing of the issuer. In some cases, the fair value estimates cannot be substantiated by comparison to independent markets. In addition, the disclosed fair value may not be realized in the immediate settlement of the financial asset and does not reflect any premium or discount that could result from offering for sale at one time an entire holding of a particular financial asset. Potential taxes and other expenses that would be incurred in an actual sale or settlement are not reflected in amounts disclosed.

NAV is used as a practical expedient for certain commingled funds, privately held investments, and securities held in partnership format for which a readily determinable fair value is not available, unless the Institute believes such NAV calculation is not measured in accordance with fair value. These values may differ significantly from values that would have been used had a readily available market existed for such investments, and that difference could be material to the change in net assets of the Institute.

(vi) *Plant Assets and Depreciation*

Proceeds from the sale of plant assets, if unrestricted, are transferred to operating funds or, if restricted, to amounts temporarily restricted for plant acquisitions. Depreciation is provided over the estimated useful lives of the respective assets on a straight-line basis (buildings and capital improvements 20–40 years, equipment 3–6 years).

(vii) *Deferred Revenue*

Amounts received on conditional grants are recorded initially as deferred revenue and are reported as revenues when expended in accordance with the terms of the condition.

(viii) *Split-Interest Agreements*

The Institute is the beneficiary of various unitrusts, a pooled income fund, and a gift annuity fund. The Institute's interest in these split-interest agreements is reported as a contribution in the year received and is calculated as the difference between the fair value of the assets contributed to the Institute and the estimated liability to the beneficiary. This liability is computed using actuarially determined rates and is adjusted annually to reflect changes in the life expectancy of the donor or annuitant, amortization of the discount, and other changes in the estimates of future payments. The assets held by the Institute under these arrangements are recorded at fair value as determined by quoted market prices and are included as a component of investments.

(ix) *Unamortized Debt Issuance Costs*

Debt issuance costs represent costs incurred in connection with debt financing. Amortization of these costs is provided on the effective interest method extending over the remaining term of the applicable indebtedness.

In fiscal year 2017, the Institute adopted the provisions of Accounting Standards Update (ASU) No. 2015-03, *Simplifying the Presentation of Debt Issuance Costs*, which requires that debt issuance costs related to the recognized debt liability be presented as a direct reduction from the debt liability on the statement of financial position.

(x) *Asset Retirement Obligation*

The Institute recognizes the fair value of a liability for legal obligations associated with asset retirements in the period in which the obligation is incurred if a reasonable estimate of the fair value of the obligation can be made. When the liability is initially recorded, the Institute capitalizes the cost of the asset retirement obligation by increasing the carrying amount of the related long-lived asset. The liability is accreted to its present value each period and the capitalized cost associated with the retirement obligation is depreciated over the useful life of the related asset. Upon settlement of the obligation, any difference between the cost to settle the asset retirement obligation and the liability recorded is recognized as a gain or loss in the statements of activities.

(xi) *Fund Raising Expenses*

Fund raising expenses incurred by the Institute amounted to \$1,958,071 and \$1,660,098 for the years ended June 30, 2018 and 2017, respectively. This amount is included in administration and general expenses in the accompanying statements of activities.

(xii) *Functional Allocation of Expenses*

The costs of providing program services and support services of the Institute have been summarized on a functional basis in the statements of activities. Accordingly, certain operating costs have been allocated among the functional categories.

(xiii) *Tax Status*

The Institute is exempt from federal income taxes pursuant to Section 501(c)(3) of the Internal Revenue Code (the Code) and is listed in the Internal Revenue Service Publication 78. The Institute has been classified as a public charity under Section 509(a) of the Code.

There are certain transactions that could be deemed unrelated business income and would result in a tax liability. Management reviews transactions to estimate potential tax liabilities using a threshold of more likely than not. It is management's estimation that there are no material tax liabilities that need to be recorded.

(xiv) *Use of Estimates*

The preparation of financial statements in conformity with U.S. generally accepted accounting principles requires management to make estimates and assumptions that affect the reported amounts of assets and liabilities and disclosure of contingent assets and liabilities at the date of the financial statements. Estimates also affect the reported amounts of revenues and expenses during the reported period. Actual results could differ from those estimates.

(xv) *Future Accounting Standards*

The FASB issued Accounting Standards Update (ASU) 2016-14, *Presentation of Financial Statements of Not-for-Profit Entities*, which among other things, changes how not-for-profit entities report net asset classes, expenses and liquidity in their financial statements. The significant requirements of the new ASU include the reduction of the number of net asset classes from three to two: with donor restrictions and without donor restrictions; the presentation of expenses by their function and their natural classification in one location; quantitative and qualitative information about the management of liquid resources and availability of financial

assets to meet cash needs within one year of the date of the Statement of Financial Position; and retaining the option to present operating cash flows in the Statements of Cash Flows using either the direct or indirect method. The Institute plans to adopt ASU 2016-14 for the year ending June 30, 2019.

The FASB issued Accounting Standards Update (ASU) 2018-08, to clarify and improve the scope and the accounting guidance for contributions received and contributions made. The amendments in this Update should assist entities in (1) evaluating whether transactions should be accounted for as contributions (nonreciprocal transactions) within the scope of Topic 958, Not-for-Profit Entities, or as exchange (reciprocal) transactions subject to other guidance and (2) determining whether a contribution is conditional. The Institute plans to adopt ASU 2018-08 for the year ending June 30, 2019. The Institute is continuing to evaluate the impact of adopting these guidances on its financial statements.

(2) Contributions Receivable

Unconditional promises to give at June 30, 2018 and 2017 were as follows:

	2018	2017
Unconditional promises to give:		
Less than one year	\$ 10,175,180	3,859,280
One to five years	16,869,901	8,670,212
	27,045,081	12,529,492
Discount on promises to give	(2,938,888)	(851,505)
Total	\$ 24,106,193	11,677,987

At June 30, 2018 and 2017, 78% and 92% of gross contributions receivable and 43% and 10% of contributions revenue are from four donors, respectively.

During fiscal year 2011, the Institute received two conditional pledges totaling \$100 million to enhance the Institute's endowment fund. The pledges were conditioned on the Institute raising an additional \$100 million in cash or pledges from third-party donors in the period January 1, 2011 through June 30, 2015, which have been met. The conditional pledge payments began in June 2011 and will continue through June 30, 2022. As of June 30, 2018 and 2017, the Institute has recorded revenue totaling approximately \$97.8 million and \$93.8 million, respectively, relating to these conditional pledges.

(3) Investments, Funds Held by Bond Trustee, and Beneficial Interest in Remainder Trust

(a) Overall Investment Objective

The overall investment objective of the Institute is to invest its assets in a prudent manner that will achieve a long-term rate of return sufficient to fund a portion of its annual operating activities and capital preservation. The Institute diversifies its investments among various managers and investment opportunities. Substantially all of the investments are pooled with each individual fund subscribing to or disposing of units on the basis of the market value per unit, determined on a quarterly basis. Major investment decisions are authorized by the Board's Investment Committee, which oversees the Institute's investment program in accordance with established guidelines.

(b) Allocation of Investment Strategies

In addition to traditional stocks and fixed-income securities, the Institute may also hold shares or units in traditional institutional funds as well as in alternative investment funds involving hedged strategies, private equity, and real asset strategies. Hedged strategies involve funds whose managers have the authority to invest in various asset classes at their discretion, including the ability to invest long and short. Funds with hedged strategies generally hold securities or other financial instruments for which a ready market exists and may include stocks, bonds, put or call options, swaps, currency hedges, and other instruments and are valued accordingly. Private equity funds employ buyout and venture capital strategies and focus on investments in turn-around situations. Real asset funds generally hold interests in public real estate investment trusts or commercial real estate through sole-member entities. Private equity and real asset strategies therefore often require the estimation of fair values by the fund managers in the absence of readily determinable market values. Because of the inherent uncertainties of valuation, these estimated fair values may differ significantly from values that would have been used had a ready market existed, and the differences could be material. Such valuations are determined by fund managers and generally consider variables such as operating results, comparable earnings

multiples, projected cash flows, recent sales prices, and other pertinent information and may reflect discounts for the illiquid nature of certain investments held.

The following tables summarize the Institute's investments and other assets at fair value by major category in the fair value hierarchy as of June 30, 2018 and 2017, as well as related strategy, liquidity, and funding commitments:

June 30, 2018					
	Total	Level 1	Level 2	Level 3	Investments at NAV
Investments:					
Long-term investment strategies:					
Hedge funds—onshore:					
Emerging markets	\$ 525,853	—	—	—	525,853
Multiple strategies	46,377,701	—	—	—	46,377,701
Total	46,903,554	—	—	—	46,903,554
Hedge funds—offshore:					
Structured credit	\$ 15,778,348	—	—	—	15,778,348
Distressed/high-yield	1,095,899	—	—	—	1,095,899
Emerging markets	25,332	—	—	—	25,332
Equities—long bias	19,569,096	—	—	—	19,569,096
Equities—long/short	56,970,468	—	—	—	56,970,468
Fixed income arbitrage	23,512,649	—	—	—	23,512,649
Multiple strategies	192,052,446	—	—	—	192,052,446
Quantitative/CTA	88,291,229	—	—	—	88,291,229
Quantitative equity long/short	11,523,826	—	—	—	11,523,826
Insurance	32,702,355	—	—	—	32,702,355
Bio tech/healthcare	30,308,671	—	—	—	30,308,671
Discretionary macro	18,065,459	—	—	—	18,065,459
Energy trading	1,016,895	—	—	—	1,016,895
Total	490,912,673	—	—	—	490,912,673
Limited partnerships	196,847,254	—	—	—	196,847,254
Cash and cash equivalents	70,648,379	70,648,379	—	—	—
Other investments:					
Assets held under split-interest agreements:					
Cash and cash equivalents	73,647	73,647	—	—	—
Fixed income securities	3,797,307	—	—	3,797,307	—
Total investments	\$ 809,182,814	70,722,026	—	3,797,307	734,663,481
Other assets:					
Beneficial interest in remainder trust	\$ 1,066,466	—	—	1,066,466	—
Funds held by bond trustee:					
U.S. government obligations	852,322	—	852,322	—	—
Total other assets	\$ 1,918,788	—	852,322	1,066,466	—

June 30, 2017

	Total	Level 1	Level 2	Level 3	Investments at NAV
Investments:					
Long-term investment strategies:					
Hedge funds—onshore:					
Emerging markets	\$ 675,262	—	—	—	675,262
Multiple strategies	56,904,046	—	—	—	56,904,046
Total	57,579,308	—	—	—	57,579,308
Hedge funds—offshore:					
Structured credit	14,265,782	—	—	—	14,265,782
Distressed/high-yield	2,744,308	—	—	—	2,744,308
Emerging markets	49,585	—	—	—	49,585
Equities—long bias	17,878,487	—	—	—	17,878,487
Equities—long/short	63,799,196	—	—	—	63,799,196
Fixed income arbitrage	21,832,494	—	—	—	21,832,494
Multiple strategies	211,369,357	—	—	—	211,369,357
Quantitative/CTA	84,026,742	—	—	—	84,026,742
Quantitative equity long short	10,731,857	—	—	—	10,731,857
Insurance	25,191,951	—	—	—	25,191,951
Bio tech/health care	13,170,260	—	—	—	13,170,260
Discretionary macro	17,592,713	—	—	—	17,592,713
Energy trading	11,005,872	—	—	—	11,005,872
Total	493,658,604	—	—	—	493,658,604
Limited partnerships	161,527,481	—	—	—	161,527,481
Cash and cash equivalents	60,839,644	60,839,644	—	—	—
Other investments:					
Assets held under split-interest agreements:					
Cash and cash equivalents	165,773	165,773	—	—	—
Fixed income securities	3,748,875	—	—	3,748,875	—
Total investments	\$ 777,519,685	61,005,417	—	3,748,875	712,765,393
Other assets:					
Beneficial interest in remainder trust	\$ 1,061,403	—	—	1,061,403	—
Funds held by bond trustee:					
U.S. government obligations	2,457,470	—	2,457,470	—	—
Total other assets	\$ 3,518,873	—	2,457,470	1,061,403	—

The following tables present the Institute's activities for the years ended June 30, 2018 and 2017 for investments classified in Level 3:

Level 3 roll forward	2018		
	Assets held under split-interest agreement	Beneficial interest in remainder trust	Total
	Fixed income securities		
Fair value at June 30, 2017	\$ 3,748,875	1,061,403	4,810,278
Dispositions	(276,218)	—	(276,218)
Net realized and unrealized gains	324,650	5,063	329,713
Fair value at June 30, 2018	\$ 3,797,307	1,066,466	4,863,773

Level 3 roll forward	2017		
	Assets held under split-interest agreement	Beneficial interest in remainder trust	Total
	Fixed income securities		
Fair value at June 30, 2016	\$ 3,729,096	2,613,469	6,342,565
Dispositions	(265,346)	(1,750,000)	(2,015,346)
Net realized and unrealized gains	285,125	197,934	483,059
Fair value at June 30, 2017	\$ 3,748,875	1,061,403	4,810,278

The Institute's accounting policy is to recognize transfers between levels of the fair value hierarchy on the date of the event or change in circumstances that caused the transfer. There were no transfers between investments classified as Level 1 and Level 2 for the years ended June 30, 2018 or 2017. There were no transfers in or out of investments classified as Level 3 for the years ended June 30, 2018 or 2017.

Private equity and venture capital investments are generally made through limited partnerships. Under the terms of such agreements, the Institute may be required to provide additional funding when capital or liquidity calls are made by fund managers. These partnerships have a limited existence, and they may provide for annual extensions for the purpose of disposing portfolio positions and returning capital to investors. However, depending on market conditions, the inability to execute the fund's strategy or other factors, a manager may extend the terms of a fund beyond its originally anticipated existence or may wind the fund down prematurely. The Institute cannot anticipate such changes because they generally arise from unforeseeable events, but should they occur, they could reduce liquidity or originally anticipated investment returns. Accordingly, the timing and amount of future capital or liquidity calls in any particular future year are uncertain. As of June 30, 2018, the Institute is obligated under certain limited partnership agreements to advance additional funding in the amount of \$112,097,031, which is anticipated to be called over the next 10 years.

Investment liquidity as of June 30, 2018 is aggregated below based on redemption or sale period:

	<u>Investment fair values</u>
Investment redemption or sale period:	
Daily	\$ 70,648,379
Monthly	104,671,178
Quarterly	127,859,904
Semiannually	101,881,720
Annually	61,105,576
Subject to rolling lock ups or other restrictions	137,610,724
Illiquid	<u>205,405,333</u>
Total as of June 30, 2018	<u>\$ 809,182,814</u>

(c) *Funds Held by Bond Trustee*

Funds held by bond trustee represent funds held for debt service payments to be made for the various bond indentures. These funds are being held in trust by US Bank.

(d) *Redemption Restrictions—Hedge Funds*

At June 30, 2018, the Institute had hedge fund investments of approximately \$537,816,000, of which approximately \$75,963,700 was restricted from redemption for lock-up periods. At June 30, 2017, the Institute had hedge fund investments of approximately \$551,237,900, of which approximately \$57,769,100 was restricted from redemption for lock-up periods. Some of the investments with redemption restrictions allow early redemption for specified fees. The terms and conditions upon which an investor may redeem an investment vary, usually with the majority requiring 30 to 180 days' notice after the initial lock-up period.

The expirations of redemption lock-up periods are summarized in the table below:

	<u>Amount</u>
Fiscal year:	
2019	\$ 46,728,492
2020	24,847,411
2021 and thereafter	<u>4,387,784</u>
Total	<u>\$ 75,963,687</u>

(e) *Redemption Restrictions—Limited Partnerships*

At June 30, 2018 and 2017, the Institute had limited partnership investments of approximately \$196,847,300 and \$161,527,500, respectively, which were restricted from redemption for lock-up periods. Some of the investments with redemption restrictions allow early redemption for specified fees. The terms and conditions upon which an investor may redeem an investment vary, usually with the majority requiring 30 to 180 days' notice after the initial lock-up period.

The expirations of redemption lock-up periods are summarized in the table below:

	<u>Amount</u>
Fiscal year:	
2019	\$ 31,122,638
2020	4,523,838
2021	4,661,487
2022	41,597,886
2023	9,932,255
2024 and thereafter	<u>105,009,150</u>
Total	<u>\$ 196,847,254</u>

(4) Investment Return and Endowment Spending Policy

Investment return consists of interest, dividends, and realized and unrealized gains and losses on investments. Each year, the Institute includes a portion of its endowment return in its operating budget, with the amount of such planned support determined using its spending policy. The policy of the Institute is to distribute for current spending a percentage of the fair value of pooled investments, which is determined by the Board of Trustees annually. The spending rate for operating and capital purposes was 6.16% and 6.06% for 2018 and 2017, respectively.

The following tables summarize the investment return and its classification in the statements of activities for the years ended June 30, 2018 and 2017:

	2018		
	Unrestricted	Temporarily restricted	Total
Dividends and interest, net of investment expenses	\$ (1,066,685)	(1,722,859)	(2,789,544)
Net appreciation on investments	27,786,300	31,945,883	59,732,183
	<u>\$ 26,719,615</u>	<u>30,223,024</u>	<u>56,942,639</u>

	2017		
	Unrestricted	Temporarily restricted	Total
Dividends and interest, net of investment expenses	\$ (1,342,054)	(1,949,063)	(3,291,117)
Net appreciation on investments	24,721,569	28,879,238	53,600,807
	<u>\$ 23,379,515</u>	<u>26,930,175</u>	<u>50,309,690</u>

Total investment management and advisory fees were \$3,377,509 and \$3,359,045 for the years ended June 30, 2018 and 2017, respectively.

(5) Endowment

The Institute's endowment consists of approximately 120 individual funds established for a variety of purposes including both donor-restricted endowment funds and funds designated by the Board of Trustees to function as endowments. Net assets associated with endowments, including funds designated by the Board of Trustees to function as endowments, are classified and reported based on the existence or absence of donor-imposed restrictions.

(a) Interpretation of Relevant Law

The Institute has interpreted the New Jersey-enacted version of the Uniform Prudent Management of Institutional Funds Act (UPMIFA) as allowing the Institute to appropriate for expenditure or accumulate so much of a donor-restricted endowment fund as the Institute determines is prudent for the uses, benefits, purposes, and duration for which the endowment fund is established, subject to the intent of the donor as expressed in the gift instrument. Unless stated otherwise in the gift instrument, the assets in a donor-restricted endowment fund are donor-restricted assets until appropriated for expenditure by the Board of Trustees of the Institute. As a result of applicable accounting guidance, the Institute classifies as permanently restricted net assets (a) the original value of gifts donated to the permanent endowment, (b) the original value of subsequent gifts to the permanent endowment, and (c) accumulations to the permanent endowment made in accordance with the direction of the applicable donor gift instrument at the time the accumulation is added to the fund. The remaining portion of the donor-restricted endowment fund that is not classified as permanently restricted net assets is classified as temporarily restricted net assets until those amounts are appropriated for expenditure in a manner consistent with the standard of prudence prescribed by UPMIFA.

From time to time, the fair value of assets associated with individual donor-restricted endowments may fall below the original corpus the fund included in permanently restricted net assets due to unfavorable market fluctuations subsequent to the investment of the gift. Deficiencies of this nature, which are reported in unrestricted net assets, totaled approximately \$1,952,000 and \$2,012,000 at June 30, 2018 and 2017, respectively. Subsequent gains that restore the fair value of the assets of the donor-restricted endowment fund are classified as an increase in unrestricted net assets.

Endowment net assets consisted of the following at June 30, 2018 and 2017:

		2018			
		Unrestricted	Temporarily restricted	Permanently restricted	Total
Donor restricted	\$	(1,952,195)	179,358,274	255,847,749	433,253,828
Board designated		354,024,467	—	—	354,024,467
	\$	<u>352,072,272</u>	<u>179,358,274</u>	<u>255,847,749</u>	<u>787,278,295</u>

		2017			
		Unrestricted	Temporarily restricted	Permanently restricted	Total
Donor restricted	\$	(2,012,026)	166,280,649	253,953,479	418,222,102
Board designated		347,628,313	—	—	347,628,313
	\$	<u>345,616,287</u>	<u>166,280,649</u>	<u>253,953,479</u>	<u>765,850,415</u>

Changes in endowment net assets for the fiscal years ended June 30, 2018 and 2017 were as follows:

		Unrestricted	Temporarily restricted	Permanently restricted	Total
Net assets, June 30, 2016	\$	341,747,611	159,961,990	252,888,632	754,598,233
Dividends and interest income, net		(1,564,907)	(1,741,293)	—	(3,306,200)
Net appreciation on investments		24,721,569	28,344,865	—	53,066,434
Contributions		137,595	17,788	1,064,847	1,220,230
Appropriation for expenditure—operations		(19,425,581)	(20,302,701)	—	(39,728,282)
Net assets, June 30, 2017		345,616,287	166,280,649	253,953,479	765,850,415
Dividends and interest income, net		(1,368,357)	(1,587,839)	—	(2,956,196)
Net appreciation on investments		27,786,300	31,769,170	—	59,555,470
Contributions		137,000	4,000,576	1,894,270	6,031,846
Appropriation for expenditure—operations		(20,098,958)	(21,104,282)	—	(41,203,240)
Net assets, June 30, 2018	\$	<u>352,072,272</u>	<u>179,358,274</u>	<u>255,847,749</u>	<u>787,278,295</u>

(b) Return Objectives and Risk Parameters

The Institute has adopted investment and spending policies for endowment assets that attempt to provide a predictable stream of funding to programs supported by its endowment while seeking to maintain the purchasing power of the endowment assets.

(c) Strategies Employed for Achieving Objectives

The Institute manages its investments in accordance with a total return concept and the goal of maximizing returns within acceptable levels of risk. The Institute relies on a total return strategy in which investment returns are achieved through both capital appreciation (realized and unrealized) and current yield (dividends and interest). The Institute's spending policy is designed to provide a stable level of financial support and to preserve the real value of its endowment.

(6) Physical Plant

Physical plant and equipment are stated at cost at date of acquisition, less accumulated depreciation.

A summary of plant assets at June 30, 2018 and 2017 is as follows:

	2018	2017
Land	\$ 373,738	377,470
Land improvements	2,983,905	2,652,268
Buildings and improvements	175,816,514	152,314,153
Equipment	37,229,054	35,964,619
Rare book collection	203,508	203,508
Joint ownership property	4,728,370	4,728,370
	221,335,089	196,240,388
Accumulated depreciation	(99,164,381)	(93,689,384)
Net book value	\$ 122,170,708	102,551,004

(7) Long-Term Debt

A summary of long-term debt at June 30, 2018 and 2017 is as follows:

	2018	2017
2006 Series B—NJEFA	\$ 21,100,000	22,300,000
2006 Series C—NJEFA	14,900,000	15,500,000
2008 Series C—NJEFA	2,090,000	2,730,000
2012 Taxable	15,325,000	15,730,000
2015 Taxable	14,675,000	14,990,000
2017 Taxable	25,000,000	—
Long-term debt	93,090,000	71,250,000
Less:		
Unamortized bond discount	(297,976)	(240,322)
Unamortized debt issuance costs	(752,349)	(621,928)
Total long-term debt	\$ 92,039,675	70,387,750

Interest expense on long-term debt for the years ended June 30, 2018 and 2017 was \$2,946,063 and \$2,702,522, respectively.

(a) 2006 Series B

In July 2006, the Institute received proceeds of the Authority offering of \$29,600,000 Revenue Bonds, 2006 Series B of the Institute for Advanced Study Issue. The 2006 Series B Bonds were issued to finance the advance refunding of the outstanding 1997 Series G Bonds, the partial advance refunding of the 2001 Series A Bonds, and to pay a portion of certain costs incidental to the sale and issuance of the 2006 Series B Bonds.

(b) 2006 Series C

In March 2007, the Institute received proceeds of the Authority offering of \$20,000,000 Revenue Bonds, 2006 Series C of the Institute for Advanced Study Issue. Proceeds are being used to finance the costs of construction, renovating, and equipping certain educational facilities of the Institute to fund capitalized interest on the 2006 Series C Bonds during the renovation and construction and to pay certain costs incidental to the sale and issuance of the 2006 Series C Bonds.

(c) 2008 Series C

In March 2008, the Institute received proceeds of the Authority offering of \$11,255,000 Revenue Bonds, 2008 Series C of the Institute for Advanced Study Issue. The 2008 Series C Bonds were issued to finance the advance refunding of outstanding 1997 Series F Bonds, the advance refunding of outstanding 1997 Series G, and to pay a portion of certain costs incidental to the sale and issuance of the 2008 Series C Bonds.

(d) **2012 Taxable**

In December 2012, the Institute received proceeds of \$17,320,000 Taxable Bonds, 2012 Series of the Institute for Advanced Study Issue, which were issued at a discount of approximately \$92,000. The 2012 Taxable Bonds were used to finance the advance refunding of outstanding 2001 Series A Bonds, to fund renovations to the Members Housing facility and the costs of renovation and equipping certain educational facilities of the Institute and to pay certain costs incidental to the sale and issuance of the 2012 Taxable Bonds.

(e) **2015 Taxable**

In November 2015, the Institute received proceeds of \$15,300,000 Taxable Bonds, 2015 Series of the Institute for Advanced Study Issue, which were issued at a discount of approximately \$80,000. The 2015 Taxable Bonds were used to fund capital projects at the Institute and for other corporate purposes of the Institute and to pay certain costs incidental to the sale and issuance of the 2015 Taxable Bonds.

(f) **2017 Taxable**

In November 2017, the Institute received proceeds of \$25,000,000 Taxable Bonds, 2017 Series of the Institute for Advanced Study Issue, which were issued at a discount of approximately \$84,000. The 2017 Taxable Bonds were used to fund capital projects at the Institute and for other corporate purposes of the Institute and to pay certain costs incidental to the sale and issuance of the 2017 Taxable Bonds.

(g) **Interest Rates**

The 2006 Series B and C Bonds bear interest at variable rates. The bonds were issued in the weekly mode with weekly rates determined by Lehman Brothers Inc, as a Remarketing Agent and paid monthly. The maximum interest rate on the 2006 Bonds shall be twelve percent (12%) per annum. The 2006 bonds are subject to redemption at various prices and require principal payments and sinking fund installments through July 1, 2031 (Series B) and July 1, 2036 (Series C). The obligation to pay the Authority on a periodic basis, in the amounts sufficient to cover principal and interest due on the bonds, is a general obligation of the Institute. On September 18, 2008, the Institute entered into a contract with JPMorgan Chase Bank to take over as a remarketing agent, replacing Lehman Brothers Inc.

The 2008 Series C Bonds bear interest at rates ranging from 3% to 5% per annum, payable semiannually, are subject to redemption at various prices and require principal payments and sinking fund installments through July 1, 2021. The obligation to pay the Authority on a periodic basis, in the amounts sufficient to cover principal and interest due on the bonds, is a general obligation of the Institute.

The 2012 Taxable bonds bear interest at rates ranging from 0.388% to 3.892% per annum, payable semiannually, are subject to redemption at various prices and require principal payments and sinking fund installments through December 1, 2042. The obligation to make the interest payments on a periodic basis, in the amounts sufficient to cover principal and interest due on the bonds, is a general obligation to the Institute.

The 2015 Taxable bonds bear interest at rates ranging from 0.906% to 4.394% per annum, payable semiannually, are subject to redemption at various prices and require principal payments and sinking fund installments through December 1, 2045. The obligation to make the interest payments on a periodic basis, in the amounts sufficient to cover principal and interest due on the bonds, is a general obligation to the Institute.

The 2017 Taxable bonds bear interest at rates ranging from 1.713% to 3.732% per annum, payable semiannually, are subject to redemption at various prices and require principal payments and sinking fund installments through November 1, 2047. The obligation to make the interest payments on a periodic basis, in the amounts sufficient to cover principal and interest due on the bonds, is a general obligation to the Institute.

(h) **Bond Swap Agreement**

On December 22, 2008, the Institute entered into a swap agreement with Wells Fargo Bank covering \$28,900,000 of outstanding 2006 Series B Bonds that required the Institute to pay a fixed rate of 3.7702% to Wells Fargo Bank in exchange for Wells Fargo Bank agreeing to pay the Institute a variable rate equal to 67% of the USD-LIBOR-BBA rate with a term of three months, payable monthly, on an identical notional amount. The notional value of the 2006 Series B Bond is \$22,300,000. The effective date of the swap was December 22, 2008, and the termination date of the swap agreement coincides with the maturity of the bonds, which is July 1, 2031.

The Institute entered into this swap agreement with the intention of lowering its effective interest rate. At June 30, 2018 and 2017, the fair value of the interest rate swap was (\$2,316,450) and (\$3,477,319), respectively. The unrealized gain recognized during the years ended June 30, 2018 and 2017 in the amount of \$1,130,869 and \$1,680,539, respectively, is reported in the statements of activities in change in fair value of bond swap liability. The swap agreement utilizes Level 2 inputs to measure fair value. The fair value of the interest rate swap was determined using pricing models developed based on the LIBOR swap rate and other market data. Under the swap agreement, the Institute may be required to post collateral to the counterparty if certain triggering events (rates and dollar thresholds) are met. As of June 30, 2018 and 2017, there was no requirement to post collateral imposed by the swap counterparty.

The bonds are repayable as follows at June 30, 2018:

	Amount
Year ending June 30:	
2019	\$ 4,105,000
2020	4,275,000
2021	4,325,000
2022	3,735,000
2023	3,965,000
2024 through 2048	72,685,000
Total	\$ 93,090,000

The 2006 Series B, 2006 Series C, and 2008 Series C bonds are secured by a pledge of revenues pursuant to the respective Loan Agreements.

(i) Lines of Credit

As of June 30, 2018 and 2017, the Institute had unsecured loan agreements representing a line of credit. As of June 30, 2018 and 2017, the agreement provides for borrowings up to \$50,000,000, and \$30,000,000 is available through June 2020 and \$20,000,000 is available through April 2019. Interest payments are due on demand and interest accrues for the \$20,000,000 line of credit at the LIBOR rate plus 90 basis points, which was 3.66% as of June 30, 2018 and for the \$30,000,000 line of credit at LIBOR rate plus 50 basis points, which is 3.26% as of June 30, 2018. There were no borrowings in fiscal year 2018 or 2017 against the lines of credit. No interest expense was incurred for the years ended June 30, 2018 and 2017.

(j) Standby Bond Purchase Agreement

On July 17, 2017, in connection with the substitution of the Standby Bond Purchase Agreements, the 2006 Bonds were subject to mandatory tender for purchase and were remarketed with an alternate liquidity facility on July 17, 2017. The 2006 Bonds continue to be in the Weekly Mode, with J.P. Morgan Securities LLC serving as a Remarketing Agent for the Bonds. Each Series of the 2006 Bonds are secured by a new Standby Bond Purchase Agreement issued by TD Bank, N.A.

(8) Pension Plans and Other Postretirement Benefits

Separate voluntary defined-contribution retirement plans are in effect for faculty members and eligible staff personnel, both of which provide for annuities, which are funded, to the Teachers Insurance and Annuity Association and/or the College Retirement Equities Fund. Contributions are based on the individual participant's compensation in accordance with the formula set forth in the plan documents on a nondiscriminatory basis. Contributions for the years ended June 30, 2018 and 2017 totaled approximately \$2,389,000 and \$2,250,588, respectively.

In addition to providing pension benefits, the Institute provides certain health care and life insurance benefits for retired employees and faculty. Substantially, all of the Institute's employees may become eligible for these benefits if they meet minimum age and service requirements. The Institute accrues these benefits over a period in which active employees become eligible under existing benefit plans.

The following table provides a reconciliation of the change in benefit obligation of the plan at June 30, 2018 and 2017. There are no plan assets at June 30, 2018 or 2017.

	<u>2018</u>	<u>2017</u>
Postretirement benefit obligation:		
Retirees	\$ 6,508,512	6,411,773
Fully eligible active plan participants	3,014,814	2,519,942
Other active plan participants	8,785,626	8,900,928
	<u>18,308,952</u>	<u>17,832,643</u>
Change in benefit obligation:		
Benefit obligation at beginning of year	\$ 17,832,643	18,473,368
Service cost	799,501	868,823
Interest cost	680,320	658,434
Benefits paid	(437,552)	(404,078)
Actuarial gain	(565,960)	(1,763,904)
	<u>18,308,952</u>	<u>17,832,643</u>
Components of net periodic benefit cost:		
Service cost	\$ 799,501	868,823
Interest cost	680,320	658,434
Amortization of net gain	(565,960)	(1,763,904)
	<u>913,861</u>	<u>(236,647)</u>

	<u>2018</u>	<u>2017</u>
Benefit obligation weighted average assumptions at June 30, 2018 and 2017:		
Discount rate	4.13%	3.87%
Periodic benefit cost weighted average assumptions for the years ended June 30, 2018 and 2017:		
Discount rate	3.87%	3.61%

The healthcare trend rate is assumed to be 6.0% in fiscal 2018 and 6.0% in fiscal 2017, trending to an ultimate rate of 5.0% in 2027 and thereafter.

The effects of a 1% increase or decrease in trend rates on total service and interest cost and the postretirement benefit obligation are as follows:

	<u>2018</u>		<u>2017</u>	
	<u>Increase</u>	<u>Decrease</u>	<u>Increase</u>	<u>Decrease</u>
Effect on total service and interest cost	\$ 461,657	(323,423)	497,021	(345,716)
Effect on the postretirement benefit obligation	4,236,423	(3,129,519)	4,262,282	(3,072,704)

Projected payments for each of the next five fiscal years and thereafter through 2028 are as follows:

	<u>Amount</u>
Year ending June 30:	
2019	\$ 532,000
2020	538,000
2021	548,000
2022	568,000
2023	595,000
2024 through 2028	3,582,000

The Institute funds claims as they are incurred. The Institute does not expect to contribute any amounts in fiscal year 2018 or 2017, except as needed to provide for benefit payments.

(9) Temporarily and Permanently Restricted Assets

Restricted net assets are available for the following purposes at June 30, 2018 and 2017:

	<u>2018</u>	<u>2017</u>
Temporarily restricted net assets are restricted to:		
School of Mathematics	\$ 30,227,248	29,824,606
School of Natural Sciences	20,939,995	17,772,836
School of Historical Studies	38,004,769	37,110,599
School of Social Science	59,192,260	57,676,462
Libraries and other academic	6,595,422	6,026,748
Administration and general	56,102,512	28,650,680
	<u>\$ 211,062,206</u>	<u>177,061,931</u>
Permanently restricted net assets are restricted to:		
Investments to be held in perpetuity, the income from which is expendable to support academic services	\$ 255,847,749	253,953,479

(10) Subsequent Events

The Institute evaluated events subsequent to June 30, 2018 through October 26, 2018, the date on which the financial statements were issued, and determined there were no subsequent events required to be disclosed.



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