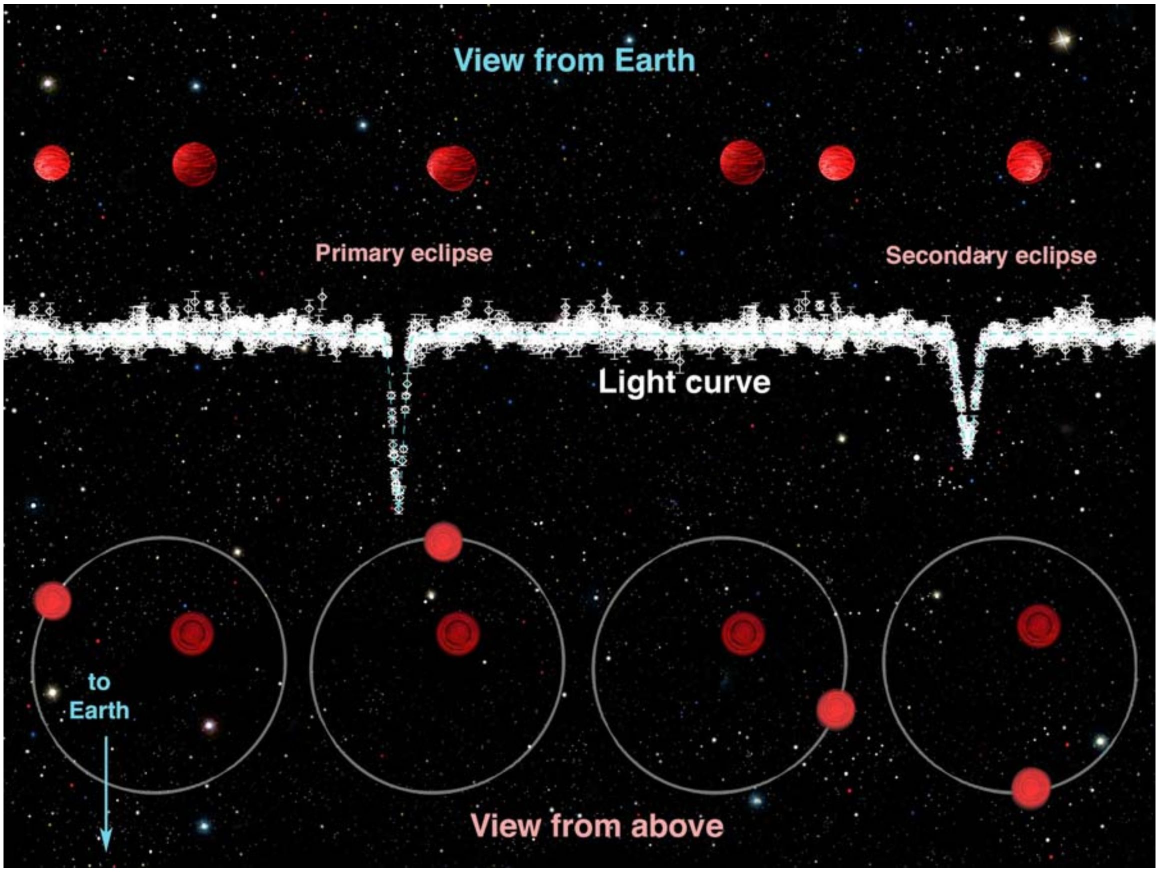

Supplementary Figure 1: Artist's representation of 2MASS J05352184–0546085, the first brown-dwarf eclipsing binary. Brown dwarfs are 'failed stars' that span the divide between stars and planets, and thus serve as a critical link between theories of star- and planet-formation. Yet even the most fundamental physical properties of brown dwarfs remain unconstrained by direct measurement; to date, the mass of only one brown dwarf has been measured directly and accurately, and in no case has a brown dwarf's radius been directly measured. Eclipsing binaries—two gravitationally bound objects that eclipse one another as they orbit their common centre of mass—have a long tradition in stellar astronomy as the primary tools for measuring the fundamental properties of stars and for testing the predictions of theoretical stellar evolution models. The power of eclipsing binaries lies in their provision of both objects' masses, radii, surface temperatures, and luminosities with only the most basic theoretical assumptions, and without requiring knowledge of the binary's distance or age. Finally, considering the two objects together permits study of the binary as twins at birth with differing evolutionary histories because of their different masses. 2MASS J05352184–0546085 was discovered as part of an ongoing, long-term program to identify and study new eclipsing binaries in nearby star-forming regions. While numerous brown dwarfs have now been found to be binary, 2MASS J05352184–0546085 represents the first discovery of a brown dwarf *eclipsing* binary, allowing the first direct measurements of both the masses and the radii of two brown dwarfs. Here the light curve of 2MASS J05352184–0546085 is shown and related to the geometry of the system at four orbital phases. Orbital diagrams are displayed in the rest frame of the more massive brown dwarf (the 'primary'). With masses of 0.054 ± 0.005 and 0.034 ± 0.003 solar masses, we firmly establish both objects in this young binary system as bona fide brown dwarfs. At the same time, with radii of 0.669 ± 0.034 and 0.511 ± 0.026 solar radii, these brown dwarfs are more akin to low-mass stars in size. Such large radii are generally consistent with theoretical predictions of young brown dwarfs in the earliest stages of gravitational contraction. Surprisingly, in this system the 'primary eclipse' (the eclipse when the most light is blocked) corresponds to the phase in the orbit when the lower-mass component (the 'secondary') is eclipsed; the secondary thus has the higher surface flux of the two, i.e., it has a higher surface temperature. This result is contrary to the predictions of all current theoretical models of coeval brown dwarfs.