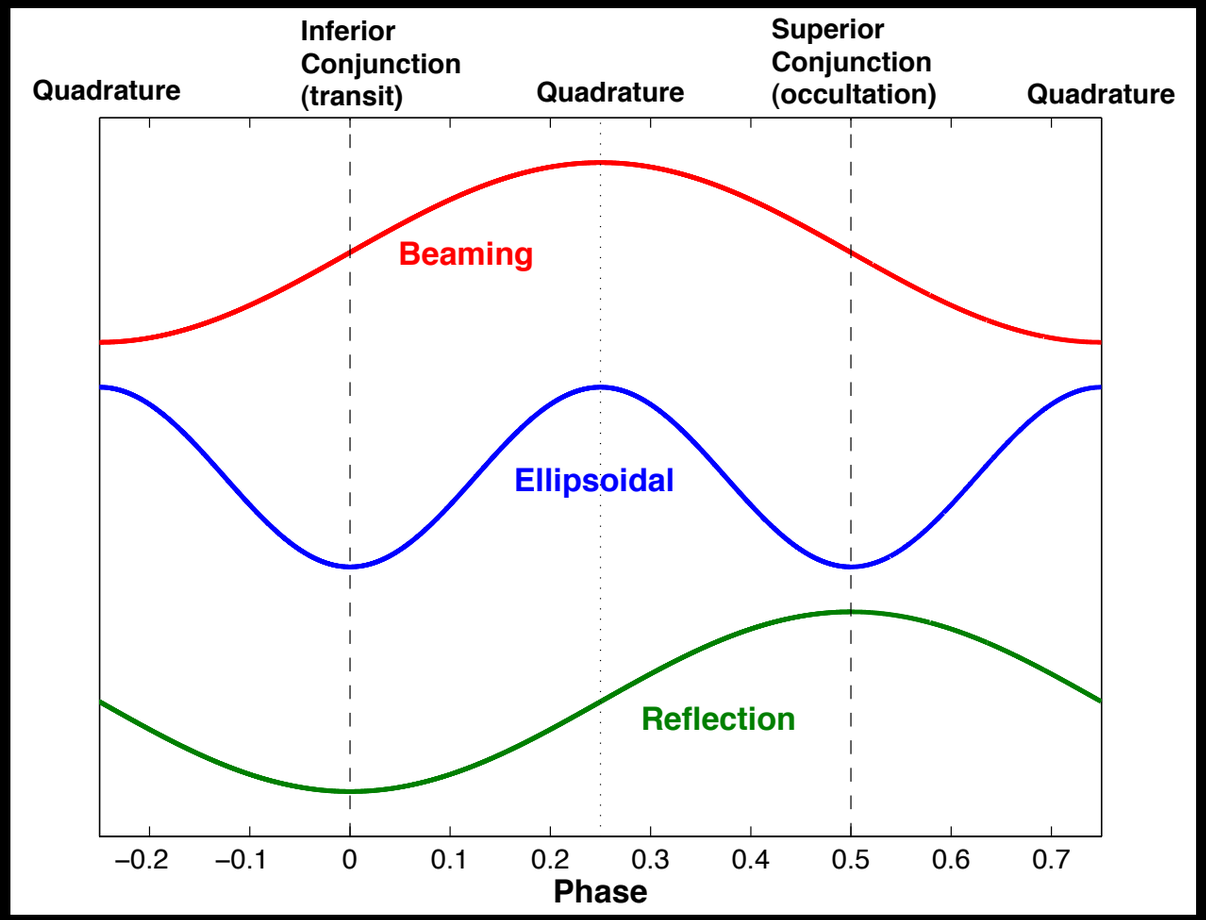
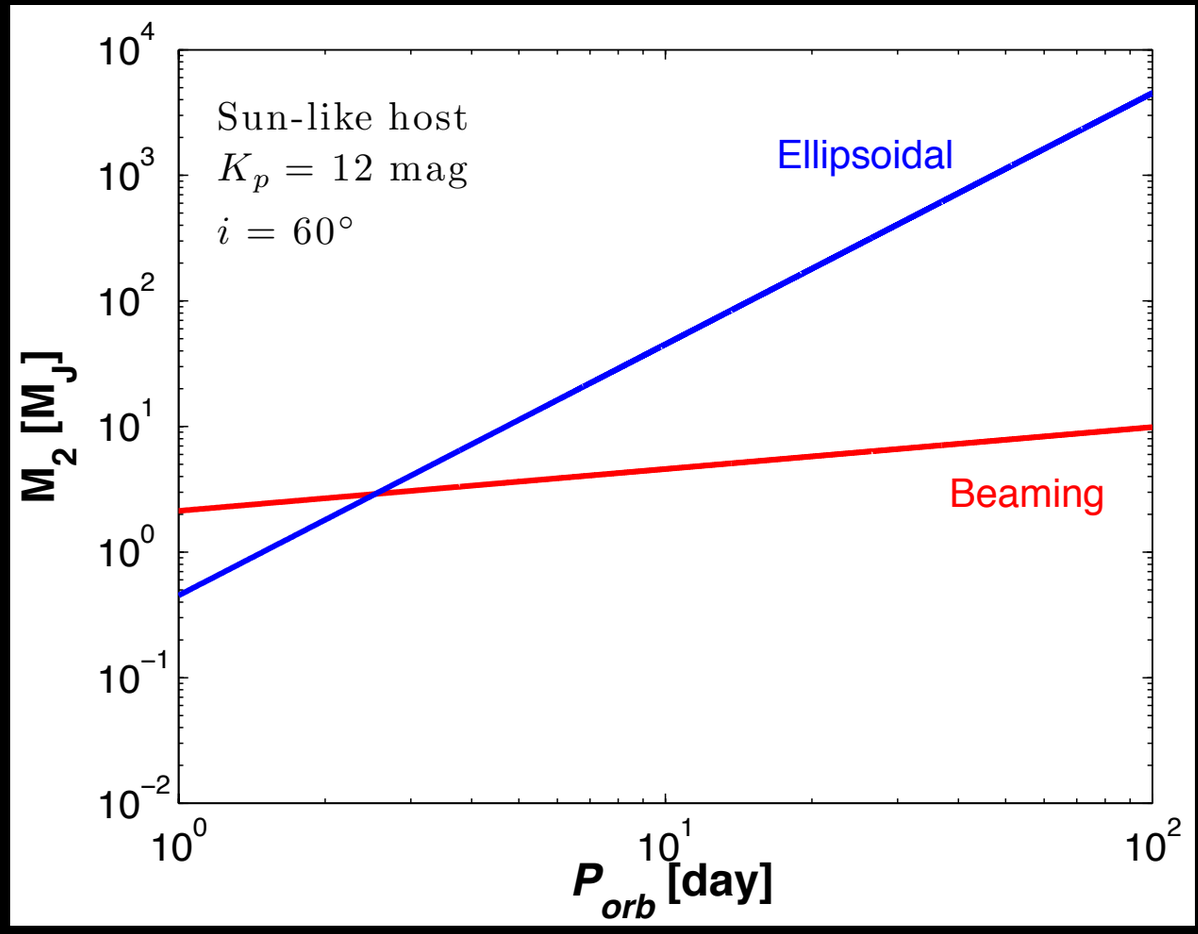
Using *Kepler* to discover non-transiting massive planets orbiting stars across the main sequence

Avi Shporer



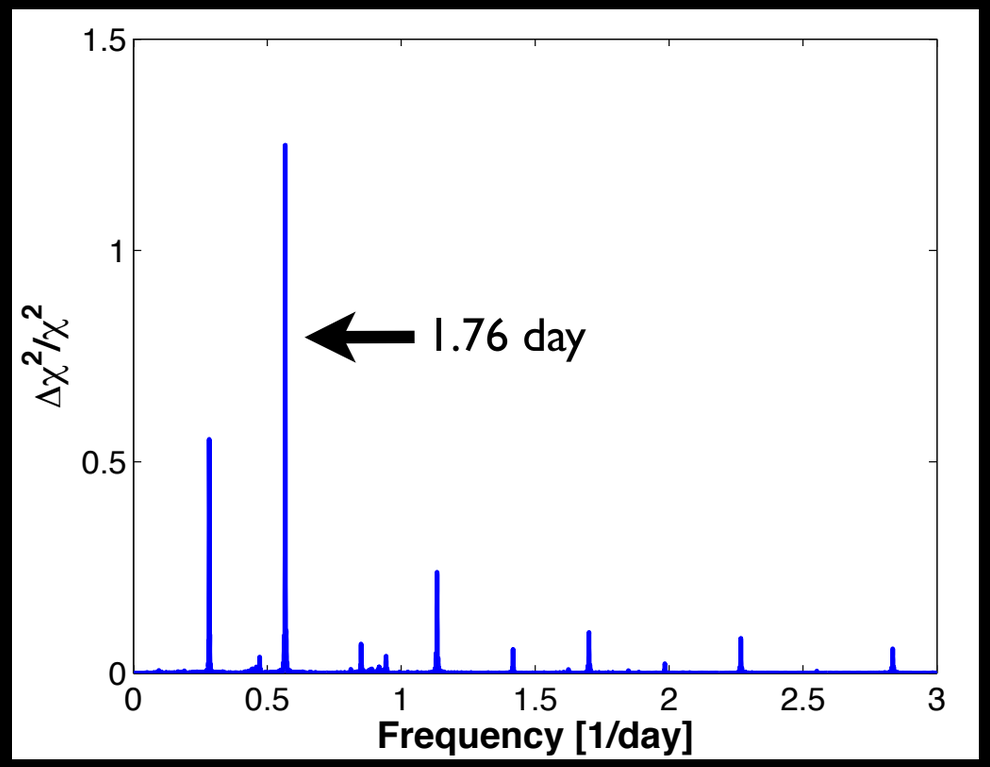
Schematic light curves of the three effects inducing photometric orbital modulations. Since they are well separated in phase they can be fitted simultaneously.

Sensitivity diagram, showing the predicted companion's mass the ellipsoidal and beaming effects are sensitive to, for the 3.5 year *Kepler* prime mission. This sensitivity encompasses short-period brown dwarfs and massive planets. Reflection effect not plotted as it is sensitive to size, not mass (based on Shporer et al. 2011).

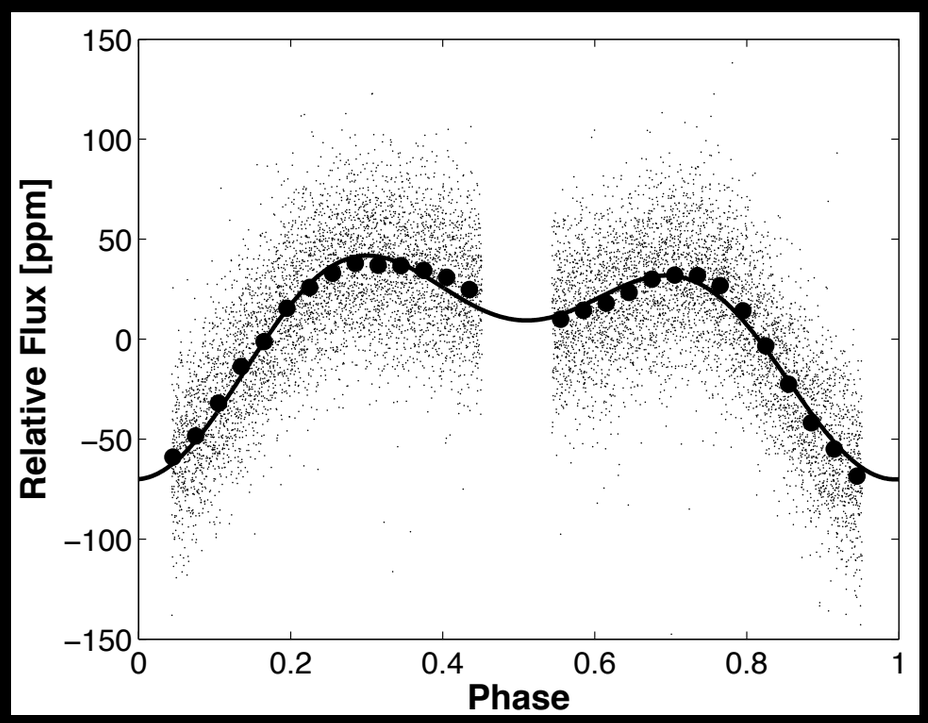


Case study:
Analysis of KOI-13.01 photometric orbital modulations

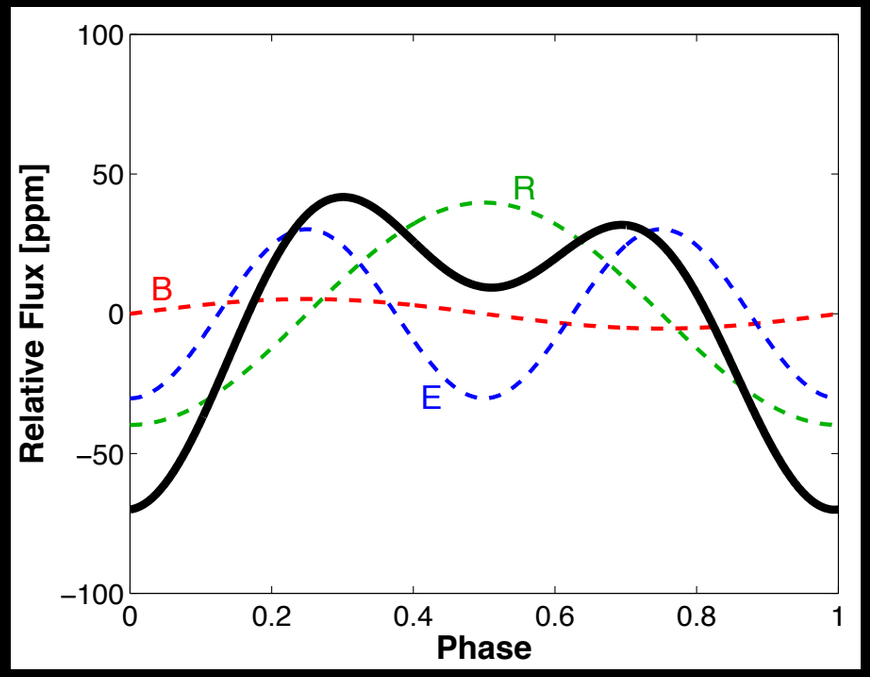
Shporer et al. 2011



Period analysis of KOI-13.01 out-of-eclipse *Kepler* data. Detected period+phase is consistent with transit ephemeris, showing that similar, but *non*-transiting objects can be detected.

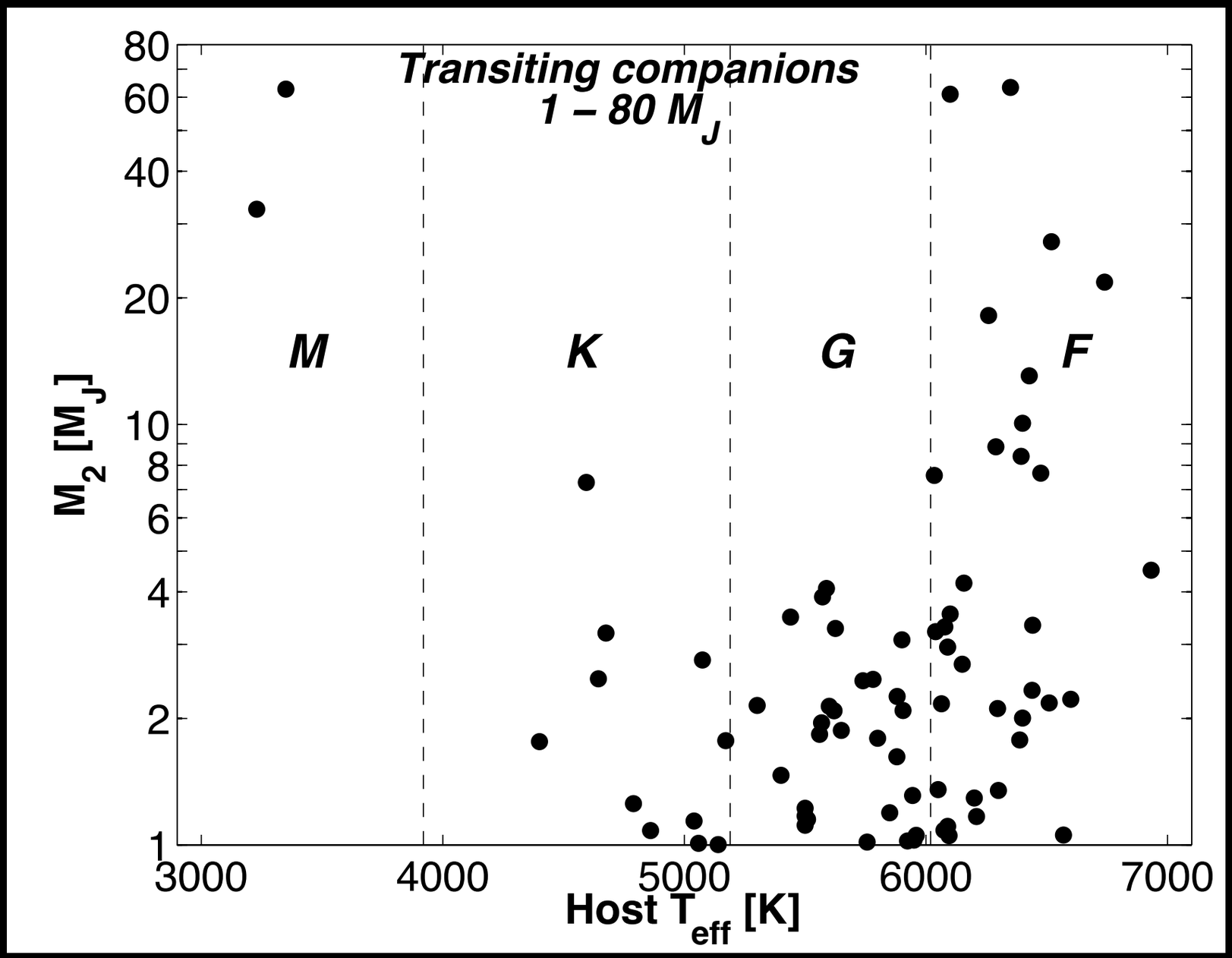


Phase folded light curve. Transit and occultation data removed.



Decomposition of the fitted model (solid line) to the three effects. B=beaming, E=ellipsoidal, R=reflection.

Kepler is obtaining high-precision and continuous data for a large sample of stars. Analysis of photometric orbital modulations will unveil the mass distribution of short-period objects encompassing the brown dwarf mass range as a function of host star's mass.



Based on exoplanets.org + literature (Nov 2012)

The project aims at populating the diagram on the left, where the position of rare known transiting low-mass companions is marked.