Contributed Talk

Splinter Exoplanets

Evolution of Planetary Systems on the Giant Branch

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With the growing number of exoplanets detected around evolved stars, it becomes evident that close-in planets (a $\lesssim 0.5$ AU) are very rare around giant stars, while they are abundant around main-sequence stars.
One proposed explanation for this is that the stellar post-main-sequence evolution may alter planetary systems and cause engulfment of close-in planets (e.g. Villaver et al. 2014).
We study the effect of stellar evolution on the orbital architecture by simulating the combined effects of tidally induced orbital decay and mass loss induced orbital expansion on the semi-major axes of a number of planets detected around evolved stars belonging to the sample of the Lick radial velocity survey of giant stars (Reffert et al. 2015).
Starting out with the observed stellar, planetary, and orbital parameters, we use evolutionary tracks to reconstruct the past stellar evolution. We implement mass loss, tidal forces, and the change of eccentricity and evaluate their effect on the semi-major axis. Finally, we determine the initial orbital separations at zero stellar age by running our simulation backwards in time.
To illustrate the capabilities of our method, we present detailed simulation results for three stars from our sample: η Cet hosting a system of two planets in a 2:1 resonance, 91 Aqr whose planet might just barely have avoided engulfment, and the peculiar case of ι Dra and its very eccentric planet.