Circumbinary Planets: New Challenges Of Exoplanetary Astronomy

Nader HAGHIGHIPOUR[#+]
University of Hawaii, United States
[#]Corresponding author: nader@ifa.hawaii.edu [+]Presenter

Among major achievements of the *Kepler* space telescope is the detection of planets around close binary star systems. The discovery of circumbinary planets (CBPs) has opened a new chapter in research on the formation, detection, and characterization of extrasolar planets, in particular in multiple star systems. While the detection of multiple transits in many of these systems points to the (almost) co-planarity of the planet-binary orbits, recent detections of non-transiting CBPs has given strong support to the idea that planet-planet and disk-planet interactions play important roles in the dynamical evolution and final assembly of these bodies. The proximity of some of the CBPs to the boundary of orbital instability suggests an evolutionary scenario in which these planets form in large distances in their circumbinary disks (where planet formation can proceed similar to that around single stars) and either migrate to their current orbits or are scattered to their present locations. The deviations of the orbits of the binary and its planet(s) from Keplerian allow extremely precise estimates of the mass and radii of these objects. Finally, the detection of systems with multiple CBPs such as Kepler 47 confirms that, similar to planets around single stars, complete planetary systems can form around binary stars as well. How such planets form, and how the binarity of the system affects their formation, multiplicity, and subsequent migration and dynamical evolution are among major topics of research. In this talk, I will discuss the methodology used in detecting circumbinary planets and present the results of our recent discoveries of new CBPs. I will also outline their theoretical challenges and present results of our new model of the formation and dynamical evolution of CBPs around different types of binaries.