

Multi-planetary systems: Observations and models of dynamical interactions

More than 600 multi-planet systems are known. The vast majority of these systems have been discovered by NASA's Kepler spacecraft, but dozens were found using the Doppler technique, the first multi-exoplanet system was identified through pulsar timing, and the most massive system has been found using imaging.

More than one-third of the 4000+ planet candidates found by NASA's Kepler spacecraft are associated with target stars that have more than one planet candidate, and the large number of such Kepler "multis" tells us that flat multiplanet systems like our Solar System are common. Virtually all of Kepler's candidate multis are stable, as tested by numerical integrations that assume a physically motivated mass-radius relationship. Statistical studies performed on these candidate systems reveal a great deal about the architecture of planetary systems, including the typical spacing of orbits and flatness.

The characteristics of several of the most interesting confirmed multi-exoplanet systems will also be discussed. HR 8799's four massive planets orbit tens of AU from their host star and travel on nearly circular orbits. PSR B1257+12 has three much smaller planets orbiting close to a neutron star. Both represent extremes and show that planet formation is a robust process that produces a diversity of outcomes.

Although both exomoons and Trojan (triangle Lagrange point) planets have been searched for, neither has yet been found.