CHARACTERIZING THE ORBITAL ECCENTRICITIES OF EARTH-LIKE PLANETS WITH KEPLER

Eric Ford
University of Florida

The discovery of over 200 extrasolar planets with the radial velocity technique has revealed that many giant planets have large eccentricities, in striking contrast with most of the planets in the solar system and prior theories of planet formation. The realization that many giant planets have large eccentricities raises a fundamental question: ``Do terrestrial-size planets of other stars typically have significantly eccentric orbits or nearly circular orbits like the Earth?'' Theorists have proposed numerous mechanisms that could excite orbital eccentricities. If the mechanism(s) exciting eccentricities of the known giant planets also affect terrestrial planets, then it may be that Earth-mass planets on nearly circular orbits are quite rare. On the other hand, if large eccentricities are only common in systems with massive giant planets and/or very massive disks, then there may be an abundance of planetary systems with terrestrial planets on low eccentricity orbits. On one hand, the idea that our solar system is special appears to fly in the face of the Copernican principle. On the other hand, most of the known giant planets zones of FGK stars have sizable eccentricities, and these eccentric giant planets would inevitably perturb the orbits of any nearby terrestrial planets. We propose to use Kepler data (and follow-up observations when available) to characterize the orbital eccentricities of transiting planets found by Kepler. This research would contribute to understanding the origin and history of solar systems, and particularly terrestrial planets. Since a significant eccentricity will cause the incident stellar flux to vary, a planet's eccentricity affects its climate and potentially its habitability. Thus, this research would contribute to NASA's goal of searching for Earth-like planets and the results could influence the design of future space missions that will attempt to characterize Earth-like planets and search for signs of life.