Abstract:

Transiting planets are special. The amount of light blocked by the planet as it passes in front of its host star sets the size of the planet (relative to the star). If an orbit can be derived from Doppler spectroscopy of the host star, the light curve also provides the orientation of the orbit, leading to the mass of the planet (again relative to the star). The resulting density for the planet can be used to constrain models for its structure and bulk properties. We are on the verge of using these techniques to characterize super-Earths, planets in the range 1 to 10 Earth masses that may prove to be rocky or water worlds. An exciting example is the recent detection by the ground-based MEarth project of a probable water world orbiting Gliese 1214. Space missions such as Kepler and TESS promise to play key roles in the discovery and characterization of super-Earths.

Transiting planets also provide remarkable opportunities for spectroscopy of planetary atmospheres: transmission spectra during transit events and thermal emission throughout the orbit, calibrated during secondary eclipse. Spectroscopy of super-Earths will not be easy, but is not out of the question for the James Webb Space Telescope. Our long-range vision is to attack big questions, such as "Does the diversity of planetary environments map onto a diversity of biochemistries, or is there only one chemistry for life?" A giant first step would be to study the diversity of global geochemistries on super-Earths and Earth analogs.