Recent Results from the Kepler Mission: Hard Planets are Good to Find

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Abstract: Kepler vaulted into the heavens on March 6, 2009, initiating NASA's search for Earth-size planets orbiting Sun-like stars in the habitable zone, that range of distances for which liquid water would pool on the surface of a rocky planet. In the 900+ days since Kepler began science operations, a flood of photometric data on upwards of 190,000 stars of unprecedented precision and continuity has provoked a watershed of 2300+ planetary candidates (most sub-Neptune in size and many comparable to or smaller than Earth) and a resounding revolution in stellar asteroseismology. Kepler detected the first multiple transiting system, just one of over 360, including Kepler-11, a system of six transiting planets. Transit timing variations allow us to constrain or measure the masses of many of these planets without the need for expensive radial velocity observations, and promises to map out the dependence of planetary size and composition in the critical regime from 1 – 2 Re (Earth radii), that region where the transition from gassy, watery super-Earths to rocky terrestrial planets occurs. Important milestones include the discovery of the first transiting planet in the habitable zone, Kepler-22b. As the mission data accumulate and the sensitivity of the search pipeline improves, we are pushing down to smaller and smaller planets and to longer and longer orbital periods on the road to determining eta-Earth, that fraction of stars in our galaxy that host potentially habitable worlds.