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Status of Kepler Mission and Early Discoveries

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Kepler is a Discovery-class mission designed to determine the frequency of Earth-size planets in and near the habitable zone of solar-like stars. The instrument consists of a 0.95 m aperture photometer designed to obtain high precision photometric measurement of $> 100,000$ stars to search for patterns of transits. The focal plane of the Schmidt-type telescope contains 42 CCDs with a total of 95 megapixels that cover 115 square degrees of sky. The photometer was launched into an Earth-trailing heliocentric orbit on March 6, 2009, finished its commissioning on May 12, and is now in the science operations mode. During the commissioning, data were obtained at a 30 minute cadence for 53,000 stars for 9.7 days. During the first 33.5 days of science-mode operation, 156,000 stars have been observed. Discoveries based on these data are presented. Although the data have not yet been corrected for the presence of systematic errors and artifacts, the data show the presence of hundreds of eclipsing binary stars and variable stars of amazing variety. To provide some estimate of the capability of the photometer, a quick analysis of the photometric precision was made. Analysis of the commissioning data also show transits, occultations and light emitted from the known exoplanet HAT-P7b. The data show a smooth rise and fall of light from the planet as it orbits its star, punctuated by a drop of 130 ± 11 ppm in flux when the planet passes behind its star. We interpret this as the phase variation of the dayside thermal emission from the planet plus reflected light as it orbits its star and is occulted. The depth of the occultation is similar in amplitude to that expected from a transiting Earth-size planet and demonstrates that the Mission has the precision necessary to detect such planets. Discoveries of several new exoplanets are shown and compared with known exoplanets with respect to mass, size, density, and orbital period. Detection of stellar oscillations and unusual objects are also presented.

¹In collaboration with David Koch, NASA Ames, and the Kepler Team.