

COMPOSITIONAL CONSTRAINTS ON THE BEST CHARACTERIZED ROCKY EXOPLANET, KEPLER-36 b

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Kepler-36 is an extreme planetary system, consisting of two transiting sub-Neptune-size planets orbiting around a sub-giant star with periods of 13.84 and 16.24 days. Mutual gravitational interactions between the two planets perturb the planets' transit times, allowing the planets' masses to be measured. Despite the similarity of their masses and orbital radii, the planets show a stark contrast in their mean densities: the inner planet (Kepler-36 b) is more than eight times as dense as its outer companion planet (Kepler-36 c). We perform a photo-dynamical analysis of the Kepler-36 system based on more than three years of Kepler photometry. With N-body integrations of initial conditions sampled from the photo-dynamical fits, we further refine the properties of the system by ruling out solutions that show large scale instability within 5 billion days. Ultimately, we measure the planets' masses with 4.2% precision and the planets' radii with 1.8% precision. Kepler-36 b is the rocky exoplanet with the most precisely measured mass and radius. Kepler-36 b's mass and radius are consistent with an Earth-like composition, whereas an iron-enhanced Mercury-like composition is ruled out.