Name: Sam Hadden
Email: shadden@u.northwestern.edu
Institution: Northwestern
Title: Densities and Eccentricities of Kepler Planets from TTV through Q12
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Abstract: Authors: Sam Hadden, Yoram Lithwick
We analyze the TTVs of a sample of 178 planets in order to measure their masses and eccentricities, using simple analytic formulae for timing variations. We are able to extract density measurements for 39 planets which indicate qualitatively distinct planet populations for planets with radii above and below ~3 Earth radii. Planets larger than 3 Earth radii exhibit a density-radius relation with density scaling as the -2.5±0.5 power of radius and have typical masses of ~10 Earth masses. Planets smaller than 3 Earth radii have a large scatter in densities, independent of radius, with a median value of 1.5g/cm^3. Our analysis also
allows us to statistically characterize planet eccentricities. We find that the eccentricities of most of the planets in our sample are surprisingly small, with an root mean-squared value of ~0.02. Planets smaller than 3 Earth radii tend to have larger eccentricities, approximately twice as large as the planets comprising the rest of our sample.