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Title: Investigation of Kepler Objects of Interest Stellar Parameters from Observed Transit Durations
Type: Contributed Talk
Session: Exoplanet Statistics, False Positives, and Completeness Corrections
Abstract: KOIs discovered with the Kepler mission enable a plethora of ensemble analysis of the architecture and properties of exoplanetary systems. We compare the observed transit durations to a synthetic distribution generated from the known eccentricities of radial velocity (RV) discovered exoplanets. We find that the Kepler and RV distributions differ at a statistically significant level. We identify three systematic trends that are likely due to errors in stellar radii, which in turn affect the inferred exoplanet radii and the distribution thereof, and prevent a valid analysis of the underlying eccentricity distribution. First, 15% of KOIs have transit durations >20% longer than the transit duration expected for an edge-on circular orbit, including 92 KOIs with transit durations >50% longer, when only a handful of such systems are expected. Second, the average transit duration is too long by ~10-20%. Random errors of <50% in the stellar radius are not adequate to account for these two trends, and they are present for all spectral types in the Kepler sample. We identify that incorrect estimates of stellar metallicity and extinction could account for these anomalies, rather than astrophysical effects such as eccentric exoplanets improbably transiting near apastron. Third, we find that the median transit duration is correlated with stellar radius, when no such trend is expected. All three systematic effects are still present, although less pronounced, when considering only multiple transiting KOI systems which are thought to have a low false positive rate. These results were recently confirmed with spectroscopy by other teams, and that KOI exoplanet radii in the ensemble are under-estimated by up to ~30%. Improved stellar parameters for KOIs are necessary for the validity of future ensemble tests of exoplanetary systems found by Kepler.