Simultaneous Observations of Kepler Objects with TESS and NEID

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Using the new, ultra-precise NEID spectrometer at Kitt Peak, we have developed a collection of targets and data ideal for testing the best methods of using photometry to mitigate astrophysical variability at the sub m/s level. Photometry has long been used to inform RV models, but the best methods for doing so are not always obvious, and this is especially relevant in the era of EPRV and TESS. TESS's short 27 day baseline will not cover a single rotation period for many stars, and high cadence RV observations are challenging to coordinate on such time scales. TESS's all-sky nature, however, provides an advantage in that almost all stars in the sky will see TESS coverage at some point, if they haven't already.
We leveraged this fact to create a pool of Kepler targets, some with known exoplanets, some without, with detectable astrophysical variability in their photometry. We then obtained high cadence NEID RVs while TESS was observing them in order to explore and answer a series of questions: is long-baseline, more precise, but old photometry better at constraining astrophysical variability, or is the recent, less-precise TESS photometry better? Considering the high cost and scheduling challenge of obtaining simultaneous RVs with photometry, what kind of an advantage does this simultaneity provide? We further develop several new methods of modeling photometry simultaneously with RVs in order to obtain the best, most precise picture of the systems in our sample.