the Tierras Observatory

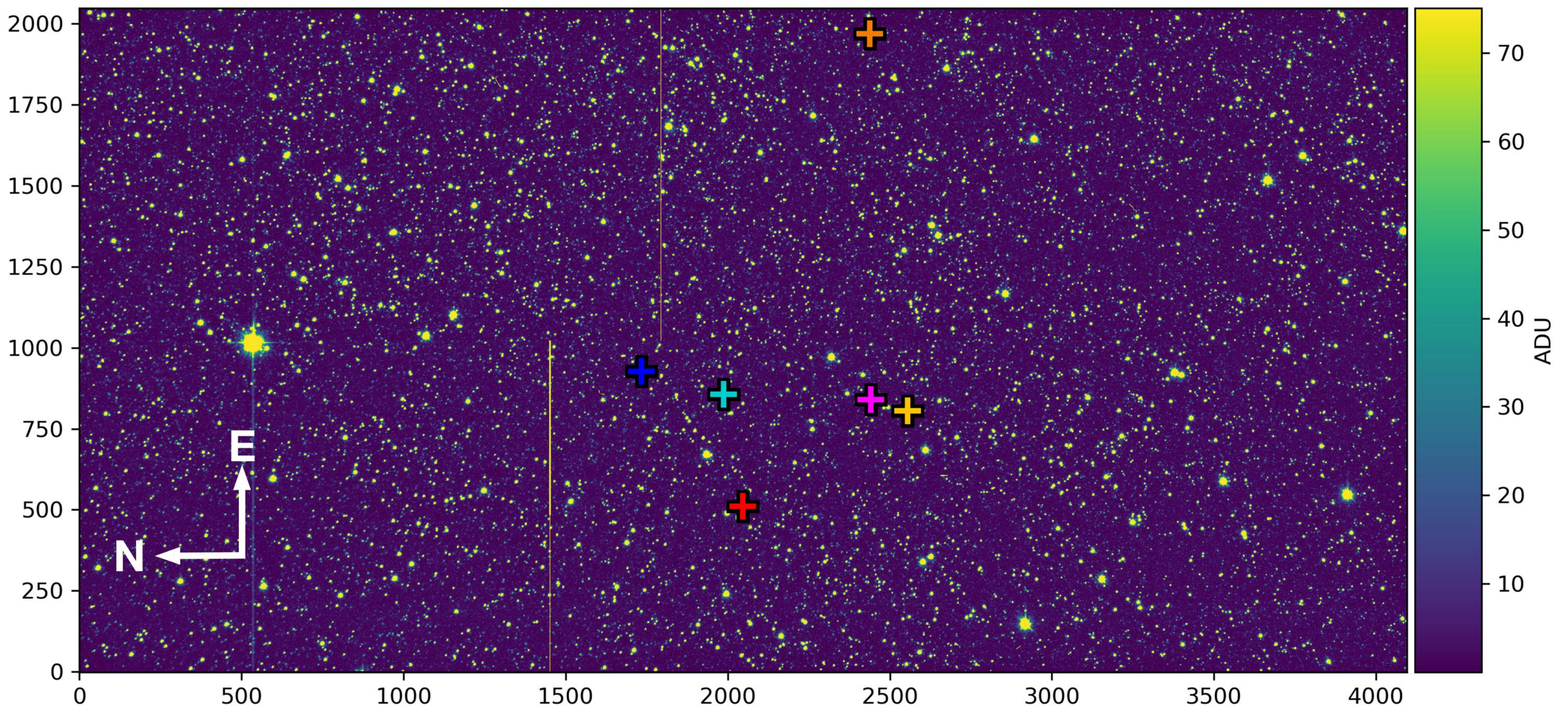
CENTER FOR ASTROPHYSICS
HARVARD & SMITHSONIAN

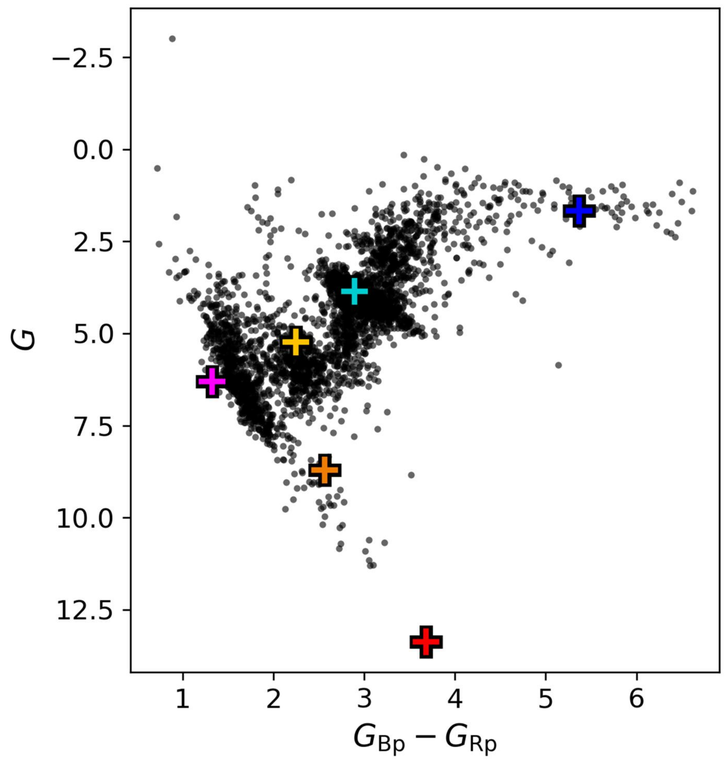
Photometric Pipeline and Night-to-Night Stability

Patrick Tamburo, Juliana García-Mejía, David Charbonneau

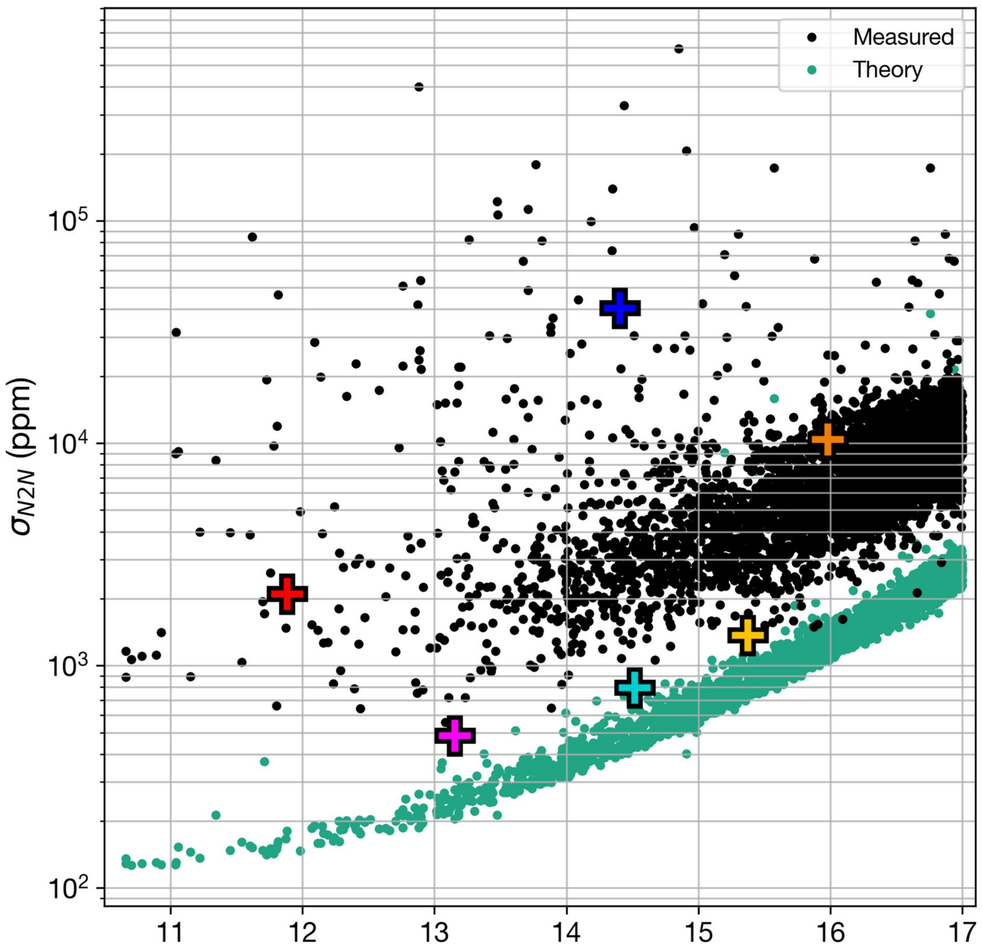
While many past efforts have focused on the limits of ground-based photometry within a night, we are interested in pushing the limits of *night-to-night* photometric precision.

We have developed a fully automated pipeline to create light curves for all targets in a *Tierras* field. Here, we demonstrate the night-to-night stability of these light curves through a recent observing run of LEP 1805-1422, one of the few active late-M dwarfs (SpT M6) within 15 pc that lacks a known rotation period.

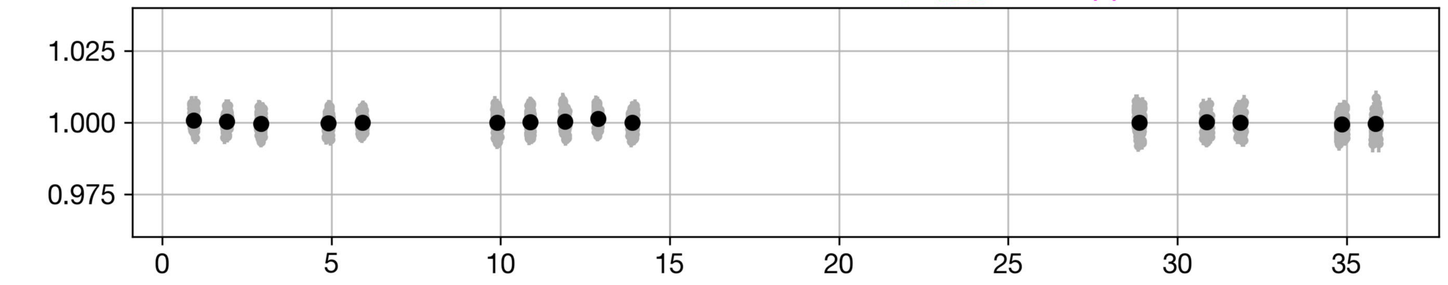




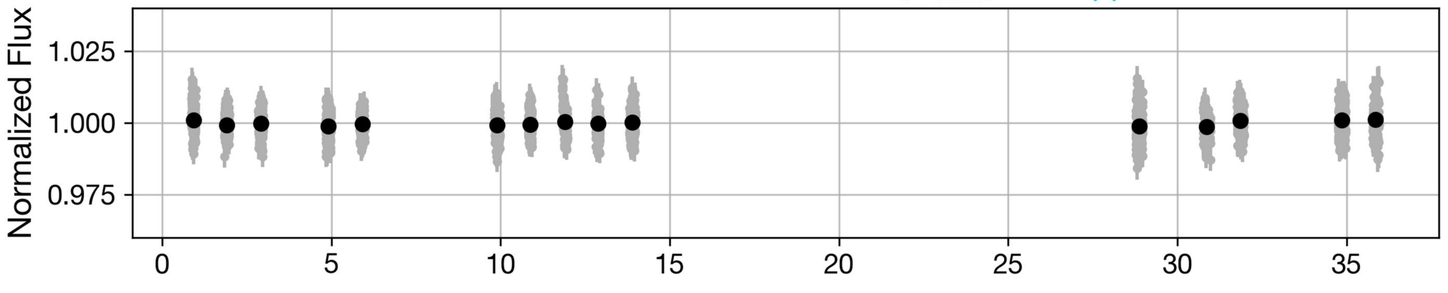
We define a target's night-to-night stability, σ_{N2N}, to be the standard deviation of its median flux on each observing night.
***Tierras* is delivering 480–1000 ppm σ_{N2N} for dozens of sources in the field over a time baseline of 36 days.**



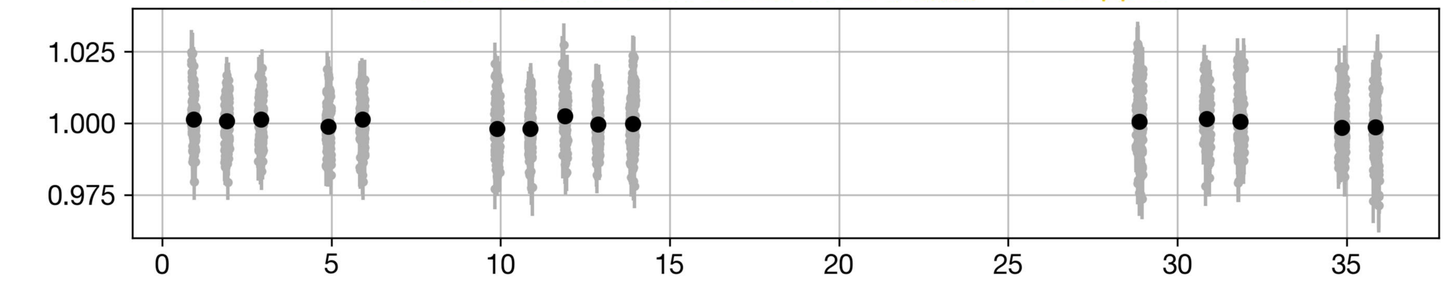
Gaia DR3 4146924480596458240, σ_{N2N} = 480 ppm



Gaia DR3 4147114047585405568, σ_{N2N} = 800 ppm

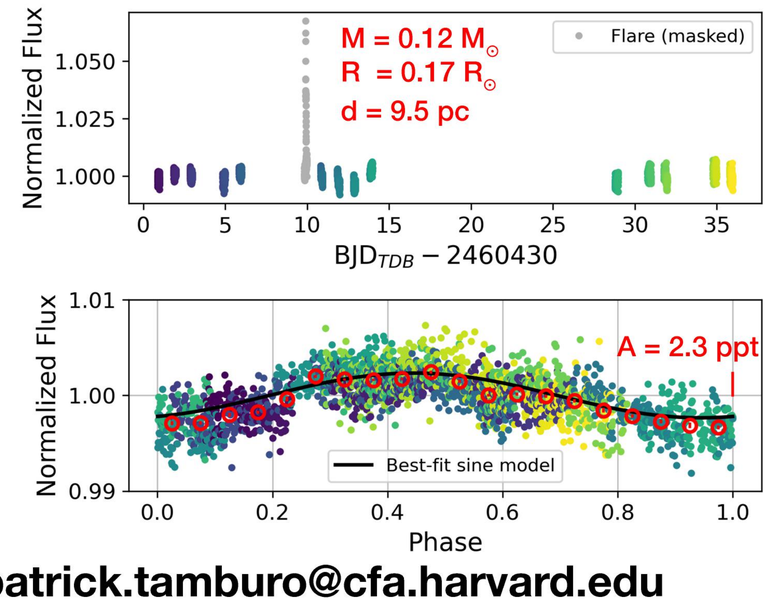


Gaia DR3 4146924446236717824, σ_{N2N} = 1400 ppm

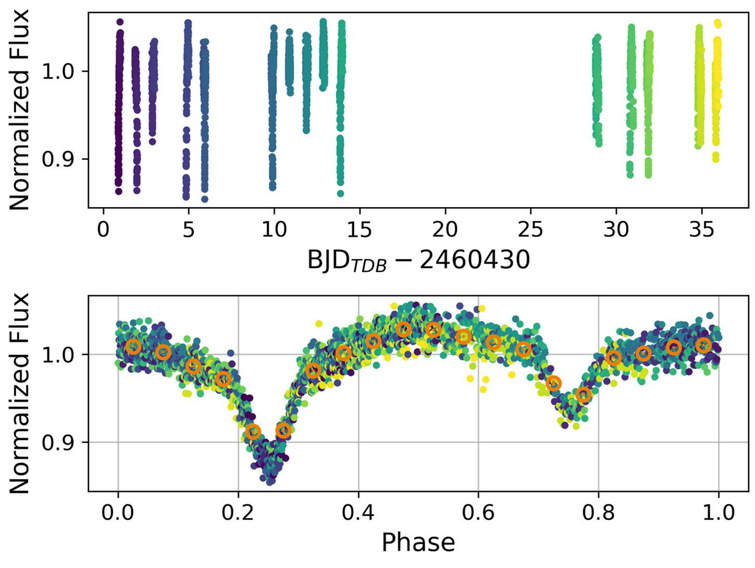


This stability presents the opportunity to measure significant brightness changes down to the part-per-thousand level over long timescales from the ground. We highlight three periodic variables below.

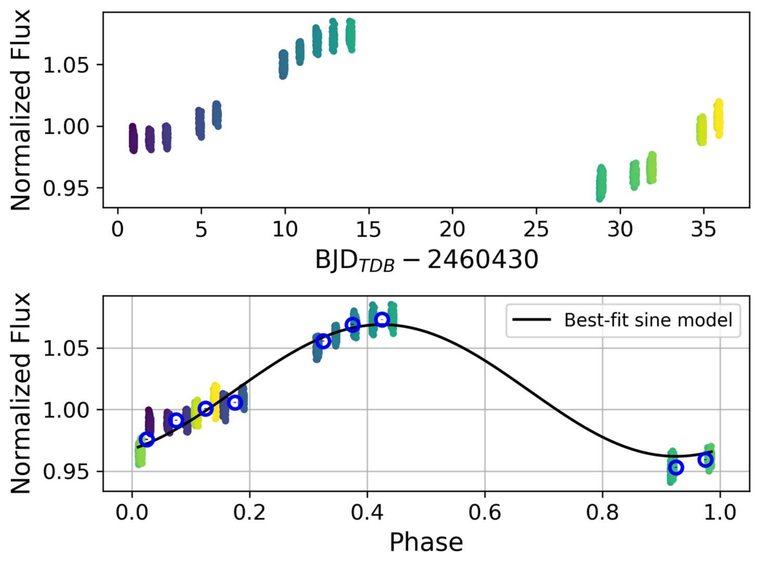
LEP 1805-1422 (our target M dwarf), for which we measure a rotation period of 0.80291 days.



Gaia DR3 4146925275198041216, a newly discovered main-sequence eclipsing binary.



Gaia DR3 4147114253743852416, a long-period variable.



patrick.tamburo@cfa.harvard.edu

This work is supported by the National Science Foundation and the Heising-Simon Foundation.