

Leveraging Small Telescopes to Investigate the HAT-P-37 System



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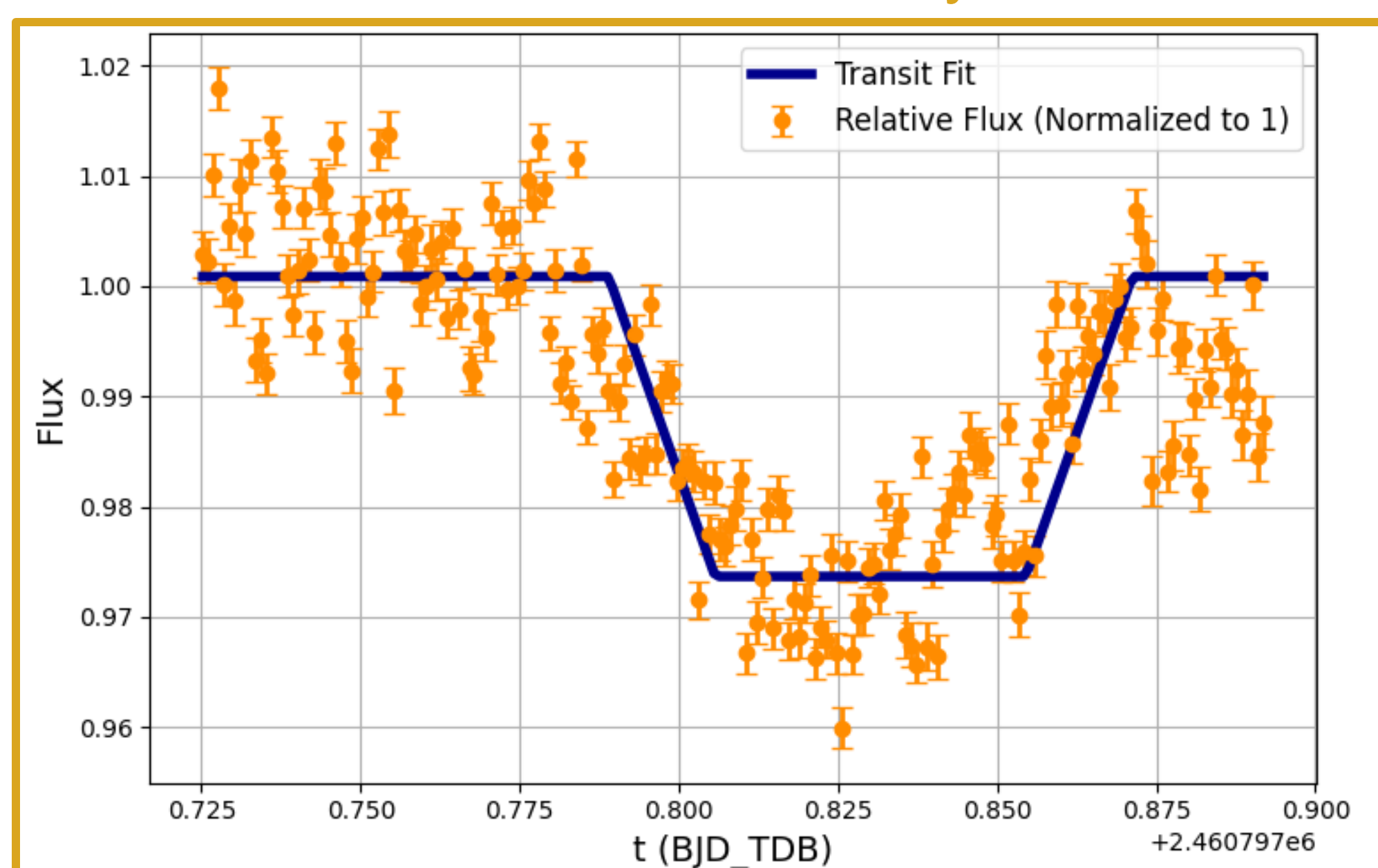
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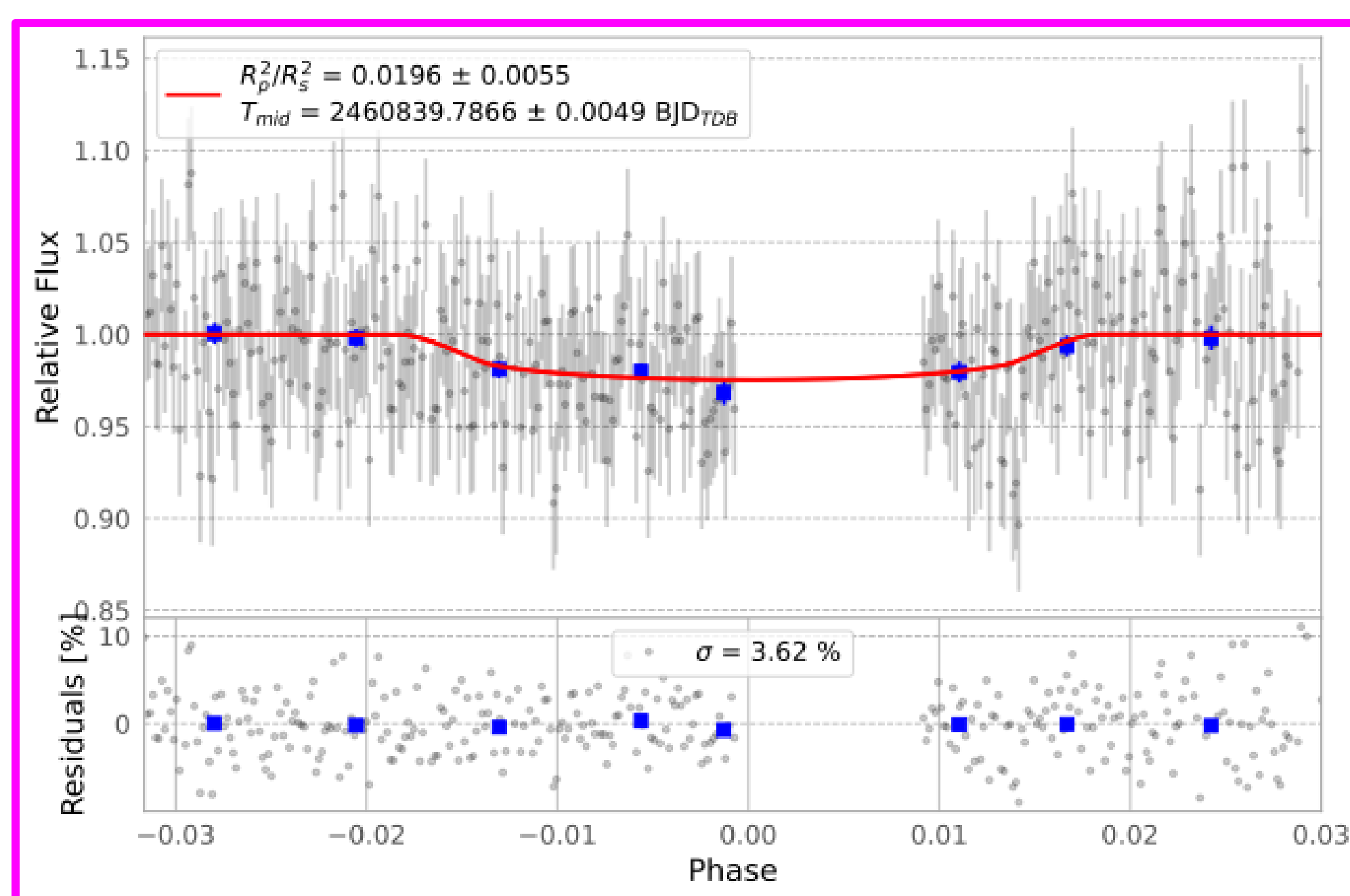
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BACKGROUND: HAT-P-37 b is a Hot Jupiter with an approximate 2.8 day period around a 0.9 solar mass G-type star. Recent studies of HAT-P-37 b have shown it exhibits transit timing variations (TTVs) most recently compared to a precession model (A-thano et. al.). Our group has been collecting transit light curves of HAT-P-37 b from the TESS-SPOC database, the on-campus observatory at Boise State University, Bruneau Dunes State Park Observatory, and from amateur astronomers (citizen scientists) to increase the observational baseline of HAT-P-37 b to distinguish the cause of the transit timing variation.

HAT-P-37b - 5/2/2025 - Bruneau Dunes State Park Observatory

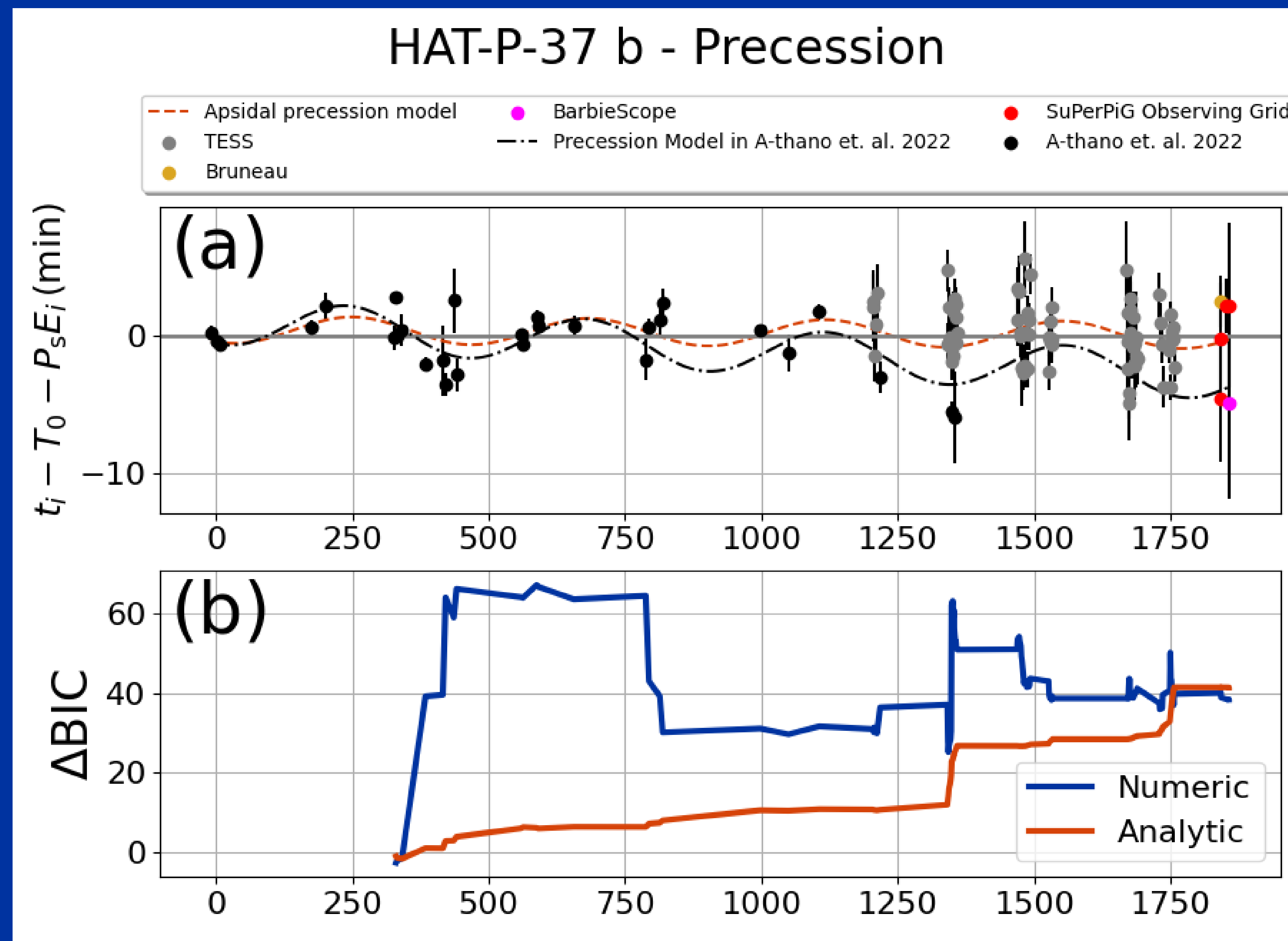


HAT-P-37b - 6/12/2025 - Boise State BarbieScope



This light curve is the output of the EXOTIC python package: <https://github.com/rzellem/EXOTIC>

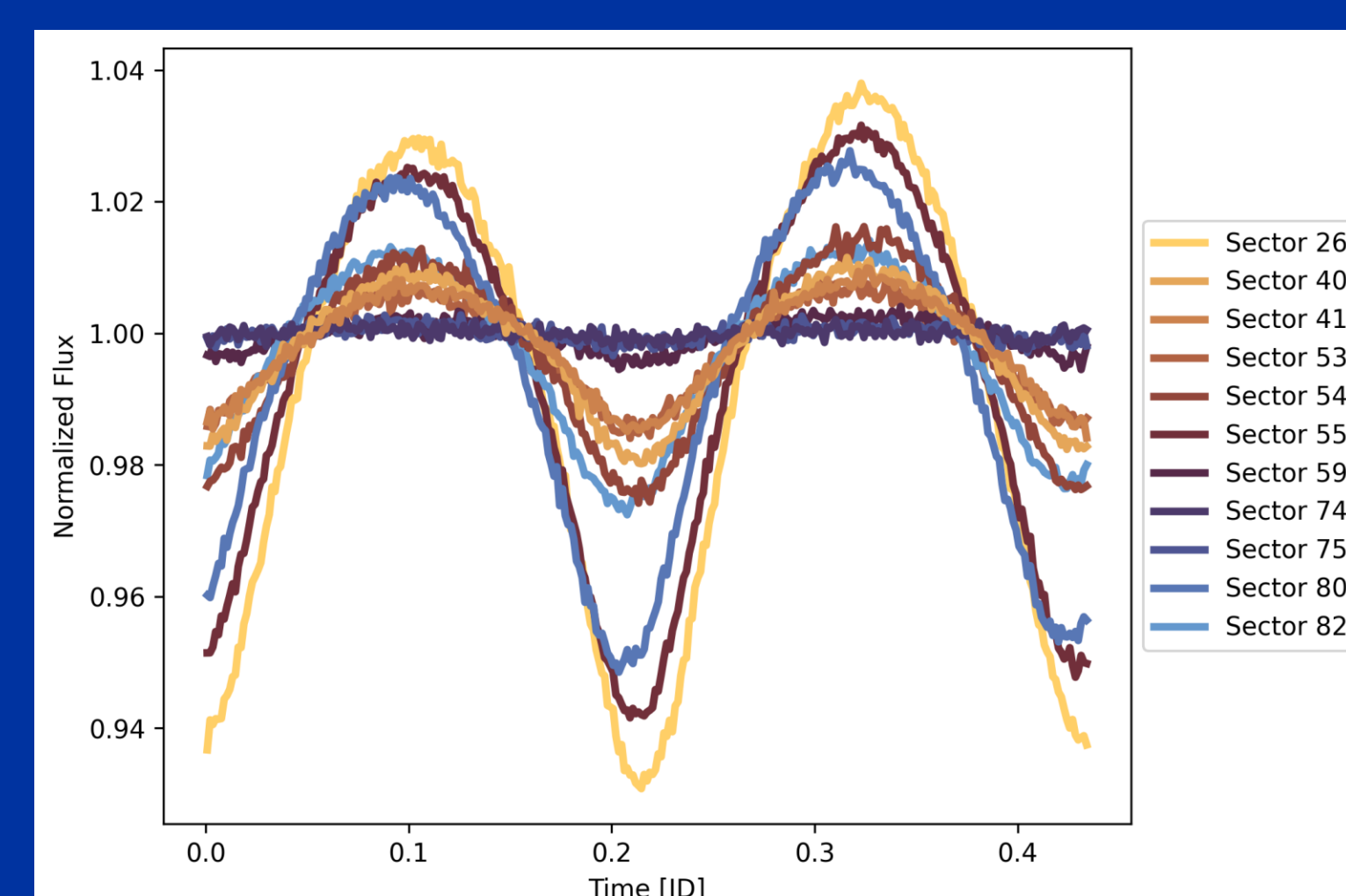
HAT-P-37 b exhibits tentative signs of non-Keplerian motion.



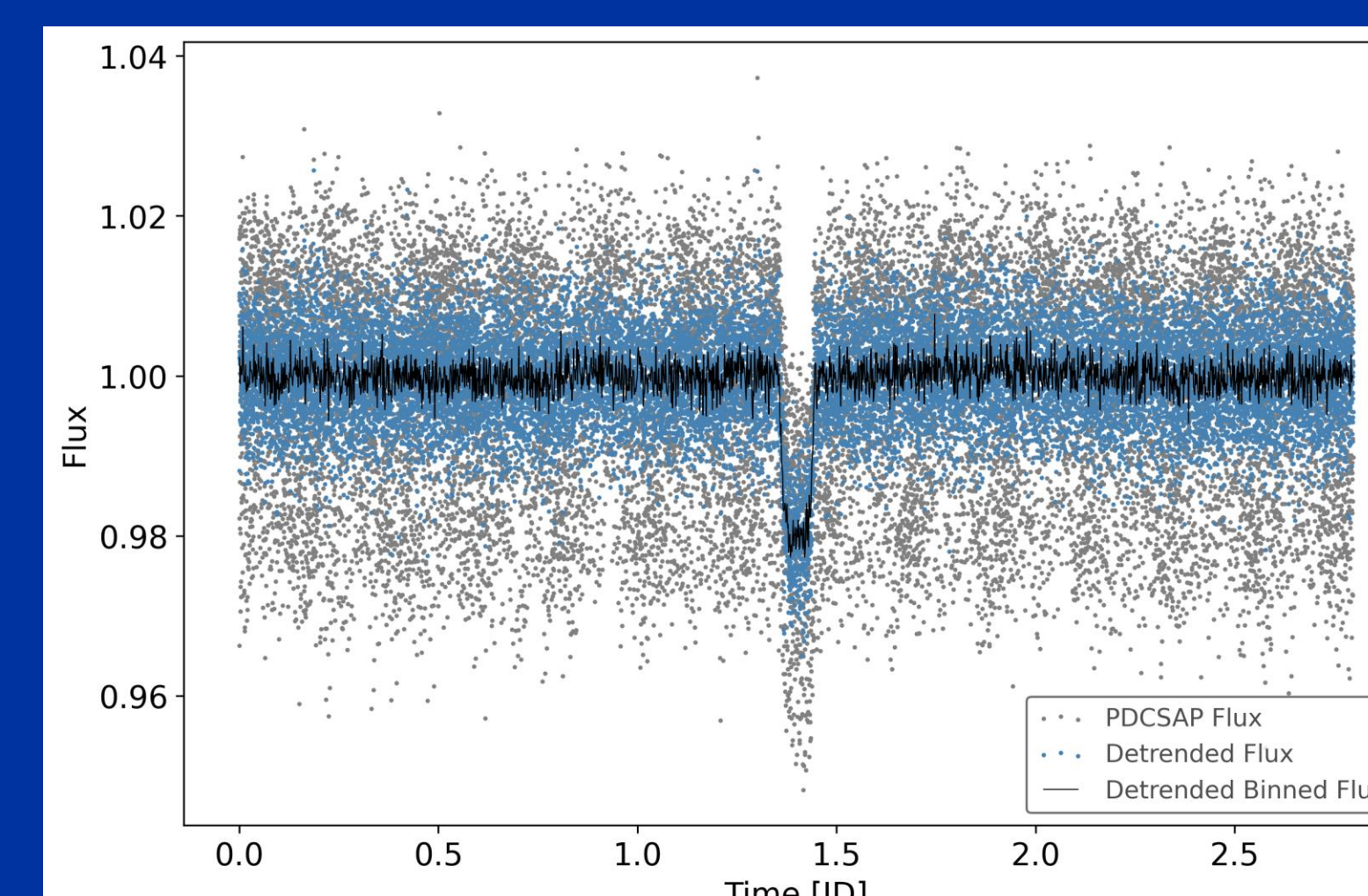
With the addition of transit observations taken in the Summer of 2025 and careful analysis of the TESS-SPOC light curves available through MAST, we have been able to extend the observational baseline of HAT-P-37 b. Using the precession model in the `susie` python package, our results with the extend baseline show agreement with that of previous work by A-thano et. al.

TESS Data Analysis

The HAT-P-37 system shows significant contamination in 9 out of the 11 sector light curves produced by the TESS-SPOC pipeline in the `lightkurve` package. Using the MAST database, we were able to determine that the main source of this contamination was a nearby variable star, ZTFJ185715.34+511631.4, which is a W Ursae Majoris (EW)-type Eclipsing binary, as characterized by Chen et. al. Using the orbital period of the binary star and the tools in the `lightkurve` package, we have been able to characterize the contamination and analyze transit light curves for HAT-P-37 b from these 9 sectors.



Each sector of the TESS data folded to the period of the eclipsing binary (0.47 d). Because each sector exhibits a different amount of contamination they must be detrended individually.

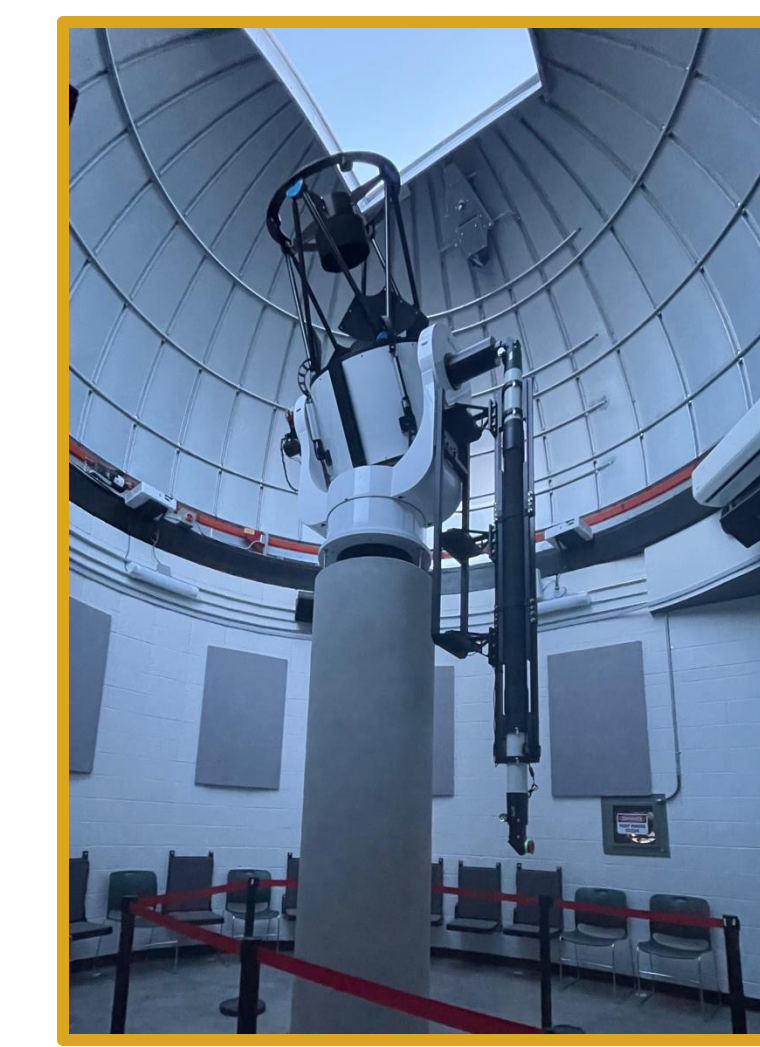


Example of the detrending results for TESS Sector 82. In this figure the sector is folded to the orbital period of HAT-P-37 b. The black line depicts the data binned (from 120s to 1d) for clarity.

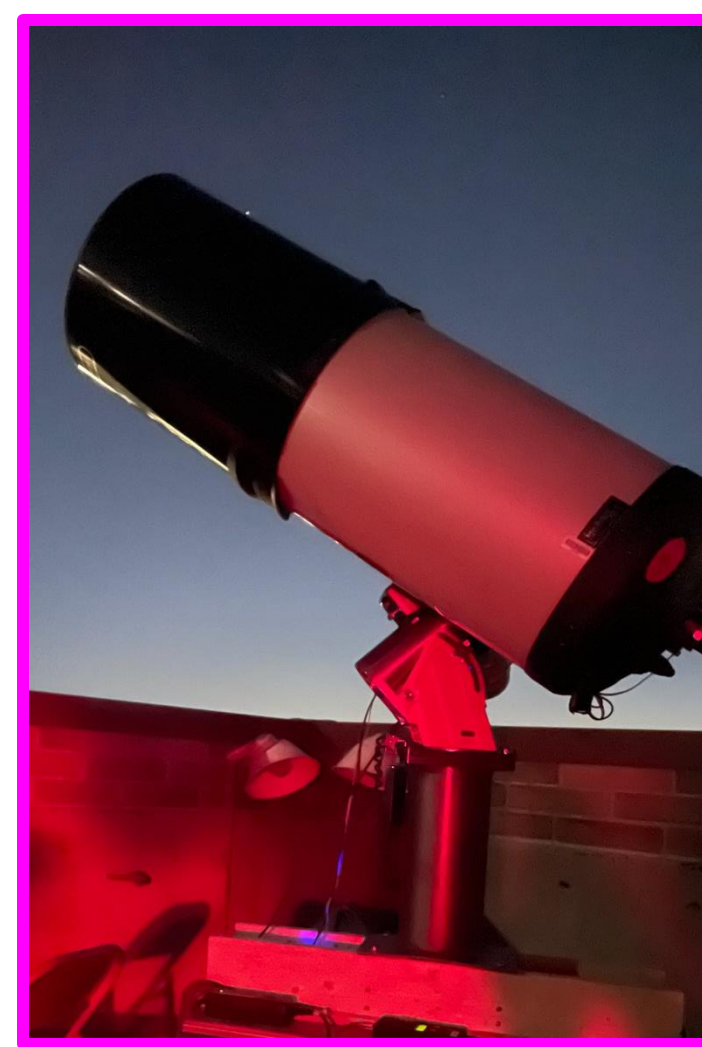
NEW DATA SOURCES



Unistellar
eQuinox 2



Bruneau Dunes
State Park
Observatory



Boise State
BarbieScope



SuPerPiG Observing Grid: By leveraging the infrastructure of active projects like NASA's Exoplanet Watch (Zellem et. al.), Unistellar's exoplanet science mode (Sgro et. al.), and our own NASA Science Activation Project Telescopes for Teachers, we have created the SuPerPiG Observing Grid. The goal of this project is to invite K-12 teachers across Idaho to get involved with the exoplanetary research being done in the Short Period Planets Group (SuPerPiG) at Boise State.

SCAN THIS QR CODE TO LEARN MORE OR VISIT: boi.st/telescopes



IDAstro: An NSF-funded collaboration between four Idaho colleges and Bruneau Dunes Observatory. Bruneau hosts a CDK700 Observatory System with a 28-inch telescope, precision mount, and two CMOS cameras, making the observatory suited for photometric observations. This collaboration provides students at these colleges time on the telescope for their research in exchange for volunteering on public nights at the Observatory.

SCAN THIS QR CODE TO LEARN MORE OR VISIT: boisestate.edu/idaastro



REFERENCES:

A-thano et. al. Bibcode: 2022AJ....163...77A
Chen et. al. Bibcode: 2020ApJS..249...18C
Zellem et. al. Bibcode: 2020PASP..132e4401Z
Sgro et. al. Bibcode: 2024AJ....168...26S

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