EXOTIC PLANET CANDIDATES FROM PLANET HUNTERS NGTS

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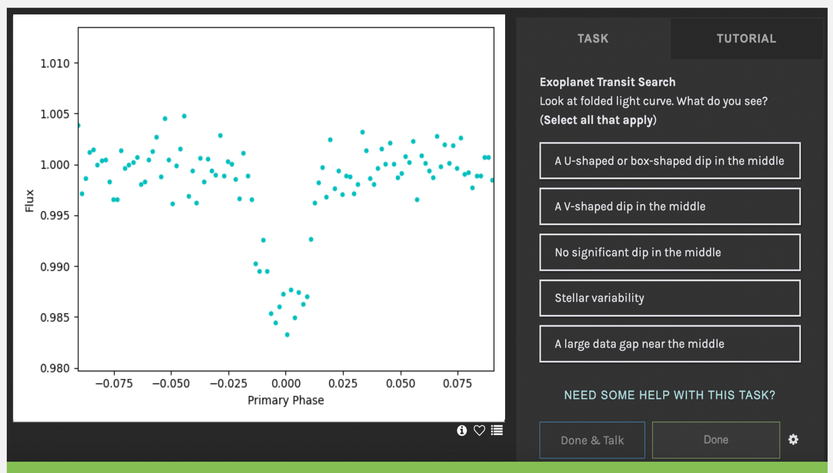
BACKGROUND

- Transit surveys, e.g. Next Generation Transit Survey (NGTS), produce lots of data that we need to look through
- Citizen science can sift through data: Planet Hunters NGTS (PHNGTS)[1]
- PHNGTS enlists public volunteers to classify NGTS candidates, found with a BLS algorithm, following the cascading workflow described below
- Multiple volunteers classify each candidate with responses averaged through a scoring/weighting scheme



METHODS

Exoplanet Transit Search

- Volunteers are asked to classify shape of potential transits in NGTS light curves folded on periods found by BLS (interface shown above)
- Scoring/weighting scheme applied and candidates with most convincing planet transits move to the next stage

Secondary Eclipse and Odd/Even Transit Checks

- Volunteers check for secondary eclipses or difference between odd and even transit depths to rule out obvious eclipsing binaries
- Scoring/weighting scheme applied and possible eclipsing binaries are cut

NGTS Team Vetting

- Remaining candidates vetted: discovery of **5 new planet candidates**

DATA

- Follow-up photometry: SHOC (SAAO:1.0m); *TESS*
- Speckle imaging: Gemini/Zorro
- RVs: NIRPS; CORALIE; FEROS

REFERENCES

[1] **O'Brien et al.** (2024, accepted), AJ; [2] **Andrews, S. M., et al.** (2013), ApJ, 771, 129; [3] **Bryant, E. M., et al.** (2023), MNRAS, 521, 3663; [4] **Burn, R., et al.** (2021), A&A, 656, A72; [5] **Kennedy, G. M. & S. J. Kenyon** (2008), ApJ, 682, 1264; [6] **Laughlin, G., et al.** (2004), ApJL, 612, L73; [7] **Thebault, P. & Haghighipour, N.** (2015), PES, 309

Crowd-sourced reviews provide unbiased searches that can spot unconventional systems

Speckle imaging is a necessary step for exoplanet confirmation

Scan here to check out Planet Hunters NGTS!

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https://astro-sobrien.github.io/

QUEEN'S UNIVERSITY BELFAST

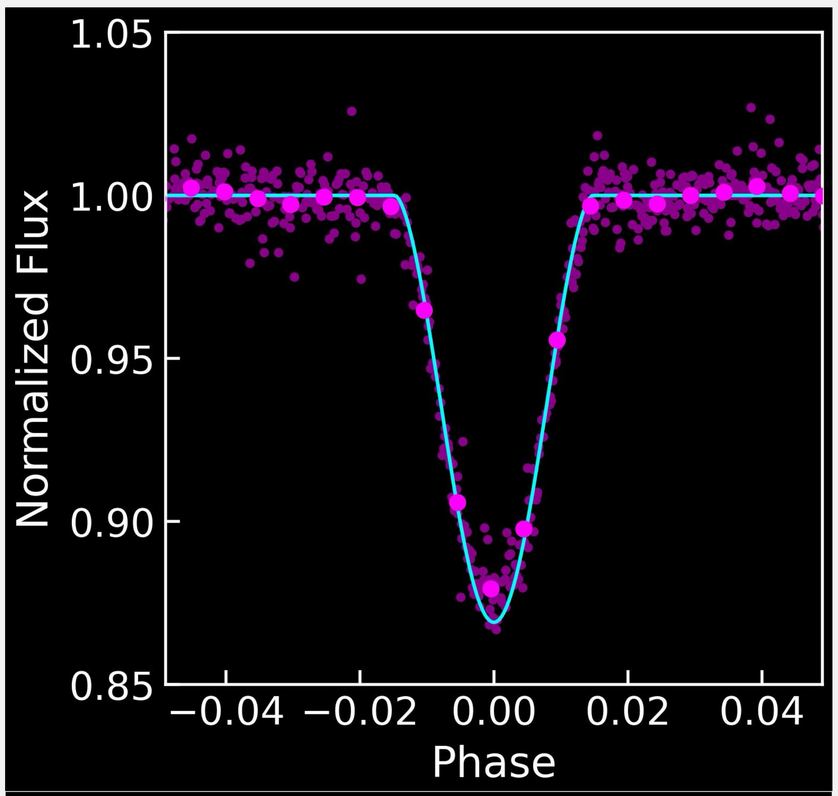
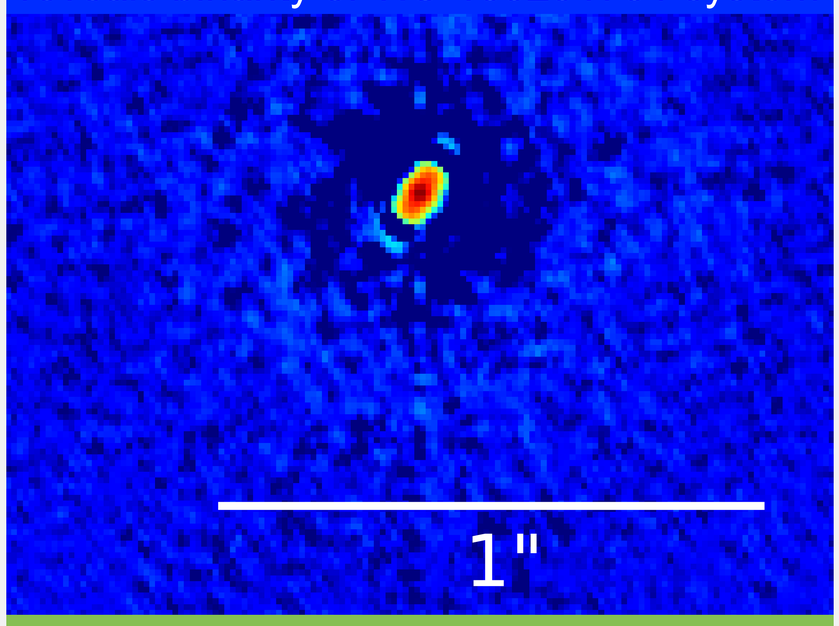


Figure: Phase folded NGTS light curve. Raw (dark magenta), 15-min binned (magenta), allesfitter model (cyan)

THE LOWEST MASS STAR TO HOST A HOT JUPITER?

- Planet candidate on 2.09 day orbit around a low-mass (0.33 $M_\odot$) M-dwarf
- Deep (13.1%) transit may have been ignored previously but estimated planetary radius of R_p= 1.61 R_{Jup}
- Unbiased classification by volunteers can highlight unconventional systems
- Low-mass stars should struggle to form giant planets compared to FGK stars (lower disk mass, longer dynamical timescales)[2-6]
- TIC-165227846 presents a challenge to planet formation theory
- NIRPS RV analysis ongoing

Elongated blob in Zorro speckle imaging reveals binarity of TIC-135251751 system



CHECK FOR OTHER STARS WHEN CONFIRMING PLANETS

- Apparent subgiant hosting planet candidate with 4.05 day orbital period
- RVs (CORALIE, FEROS) suggest companion mass < 2.4 M_{Jup} (though activity indicators hint something amiss)
- Zorro speckle imaging (above) reveals host is in fact binary system with two likely F-type stars on 50 year orbit
- P = 4.05 day transit signal suggests planet candidate orbits one of the stars, however mass measurement is challenging due to small separation of the two stars (0.033″)
- Exoplanets in close binaries interesting from planet formation perspective[7]