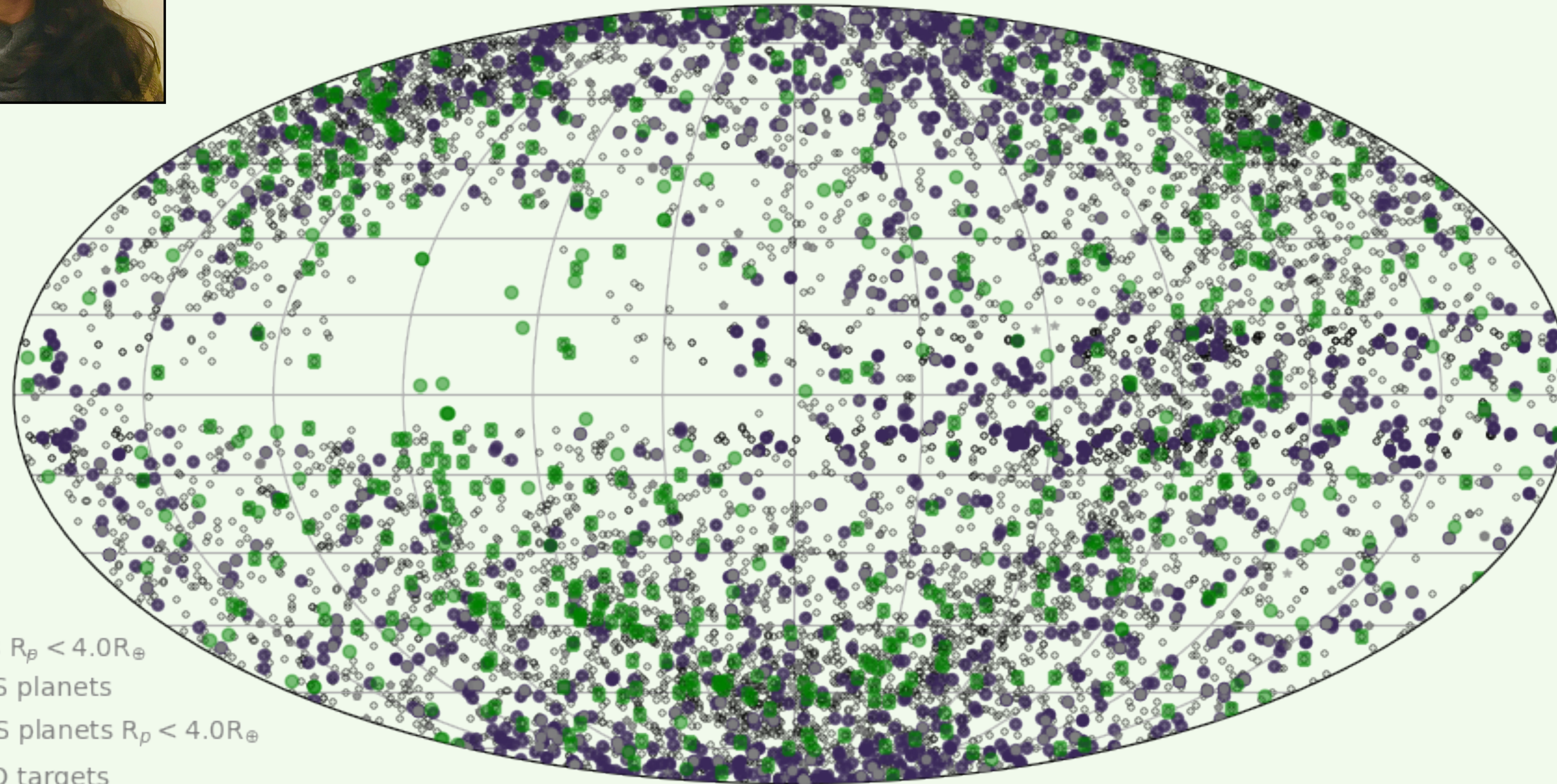




SEARCHING FOR SMALL PLANETS?

SHALLOW TRANSIT DETECTION WITH PRECISION PHOTOMETRY AT MINERVA-AUSTRALIS

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- TOIs
- TOIs $R_p < 4.0R_\oplus$
- TESS planets
- TESS planets $R_p < 4.0R_\oplus$
- HWO targets
- ARIEL targets

adapted from NASA/MIT/TESS, Natalia Guerrero (UF/MIT)
Greggy Bazile (Cornell), Ethan Kruse (USRA)

SMALL PLANET DEMOGRAPHICS

currently rely on **extrapolations** due to very few **small planet detections**.

Transit detections of high signal-to-noise observations, such as: small planets, long-period planets, or planets around active stars require **increasingly precise time-series photometry**.

TESS Follow Up (TFOP) SG1 works towards improving light curves and ephemerides in addition to identifying false positives, through seeing-limited photometry.

Of the SG1 planet candidates (PCs):
~2000* PCs have sizes $< 10 R_{\text{Earth}}$ and ~1000* PCs are $< 4 R_{\text{Earth}}$
~100* of the $< 10 R_{\text{Earth}}$ PCs are suitable^ for further, detailed characterization and atmospheric and architecture studies by telescopes like JWST, HWO, and ELT

*estimates as these candidates are yet to be confirmed or validated
^TSM values estimated using scaling factors from Kempton et al, 2018
TSM cutoffs applied from the same work

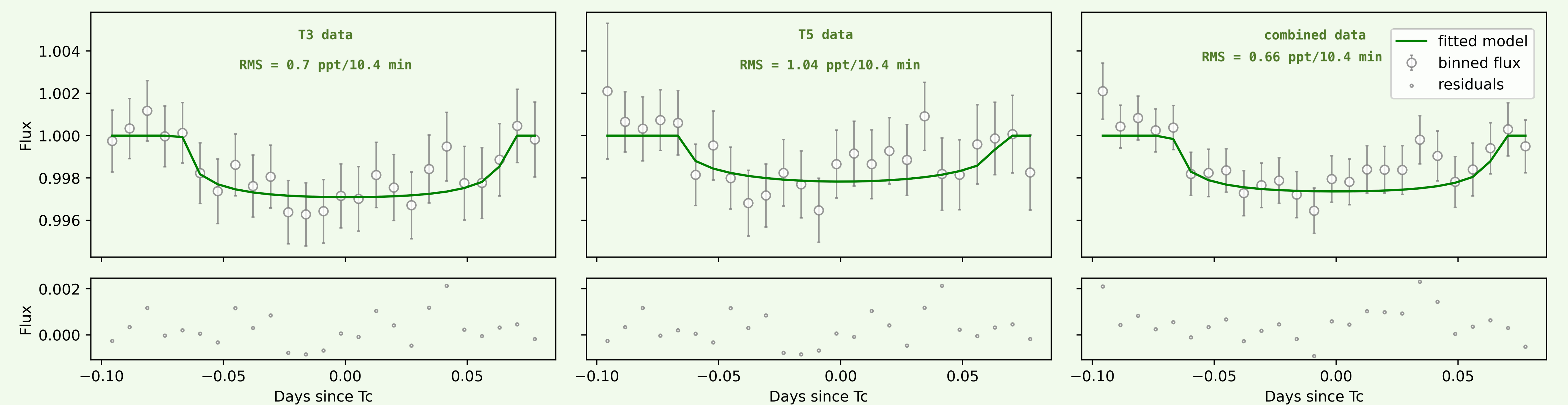
SUB-PPT PRECISION PHOTOMETRY WITH MINERVA-AUSTRALIS

Minerva-Australis:

- has been commissioned primarily for TESS follow-up (TFOP)
- can conduct **simultaneous photometry** using **2–5 telescopes** with unfiltered, CMOS detectors, within visual magnitudes 9–13, with an estimated detection limit of ~0.3 ppt; of ~50 **southern hemisphere SG1 "PC" (planet candidate) targets**
- can **enable the detection of some of the smallest planets around fainter stars**, especially where RV measurements are difficult, and in refining the ephemerides of long-period planets
- with multiple smaller telescopes, spaced sufficiently apart, provides greater precision than a single, larger telescope due to **reduction in correlated noise and atmospheric scintillation effects**

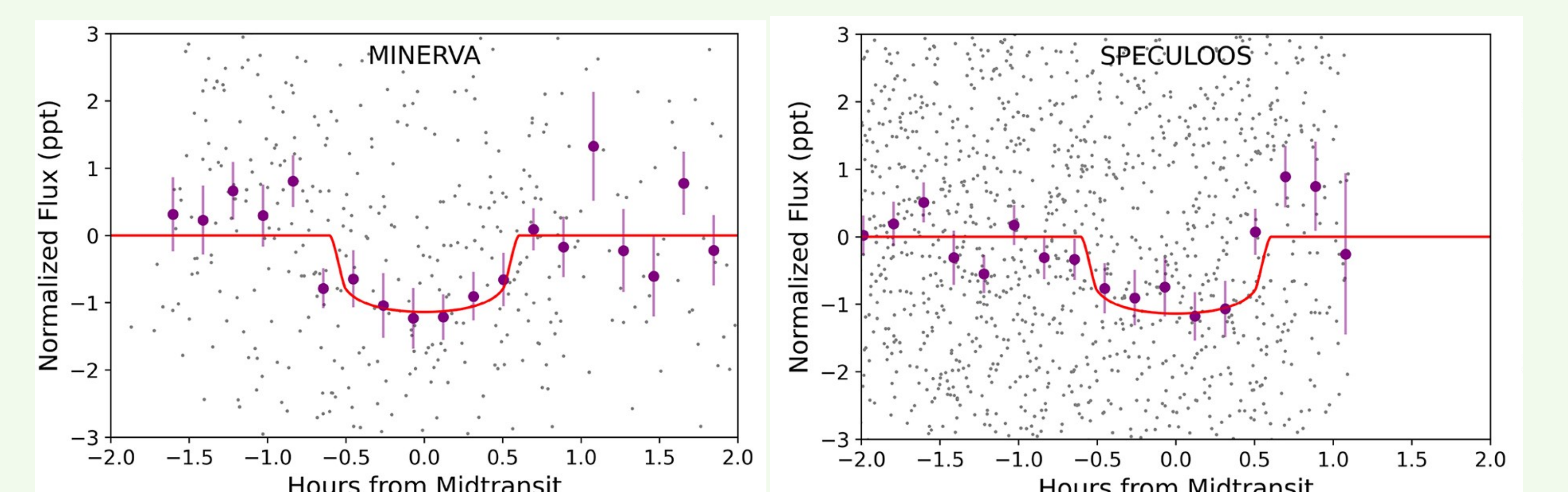


The Minerva-Australis Array at Mt. Kent Observatory, Queensland, Australia



OTHER SMALL PLANET OBSERVATIONS WITH MINERVA-AUSTRALIS

Gliese 12 b has recently been announced as a Rocky Worlds DDT target!!



Minerva-Australis 3x0.7 m telescopes

SPECULOOS 4x1.0 m telescopes

Gliese 12 b Dholakia, Palethorpe et al, 2024

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