Ultra-High Precision Photometry of Exoplanet Transits with NGTS Multi-Telescopes

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- ★ **Exoplanets** are planets orbiting stars other than the Sun
- ★ Periodic reductions in the star's brightness can be observed when the exoplanet passes in front of the star - these events are called **transits**.
- ★ Searching for transits is one of the primary methods of discovering new exoplanets
- ★ The **Next Generation Transit Survey (NGTS)** is a 12-telescope facility in Chile hunting for the transits of new exoplanets
- ★ By using multiple NGTS telescopes to simultaneously monitor a single bright star we obtain ultra-high precision observations of exoplanet transits

- ★ These observations are crucial for:
  - Confirming new exoplanets
  - Accurately measuring the planet's radius
  - Predicting the time of upcoming transits

Fig.1: The NGTS telescopes

Contact me with any questions about my poster!!
Email: edward.bryant@warwick.ac.uk
Website: click this link to find out more about my work.
For more info on this method, please read the paper!

NGTS vs TESS: A Transit of WASP-166b

- ★ We used our multi-telescope method to obtain an ultra-high precision light curve of a transit of the exoplanet WASP-166 b
- ★ The same transit was also observed by the NASA space mission TESS
- ★ Both NGTS and TESS found the transit to be at the same time and to have the same depth

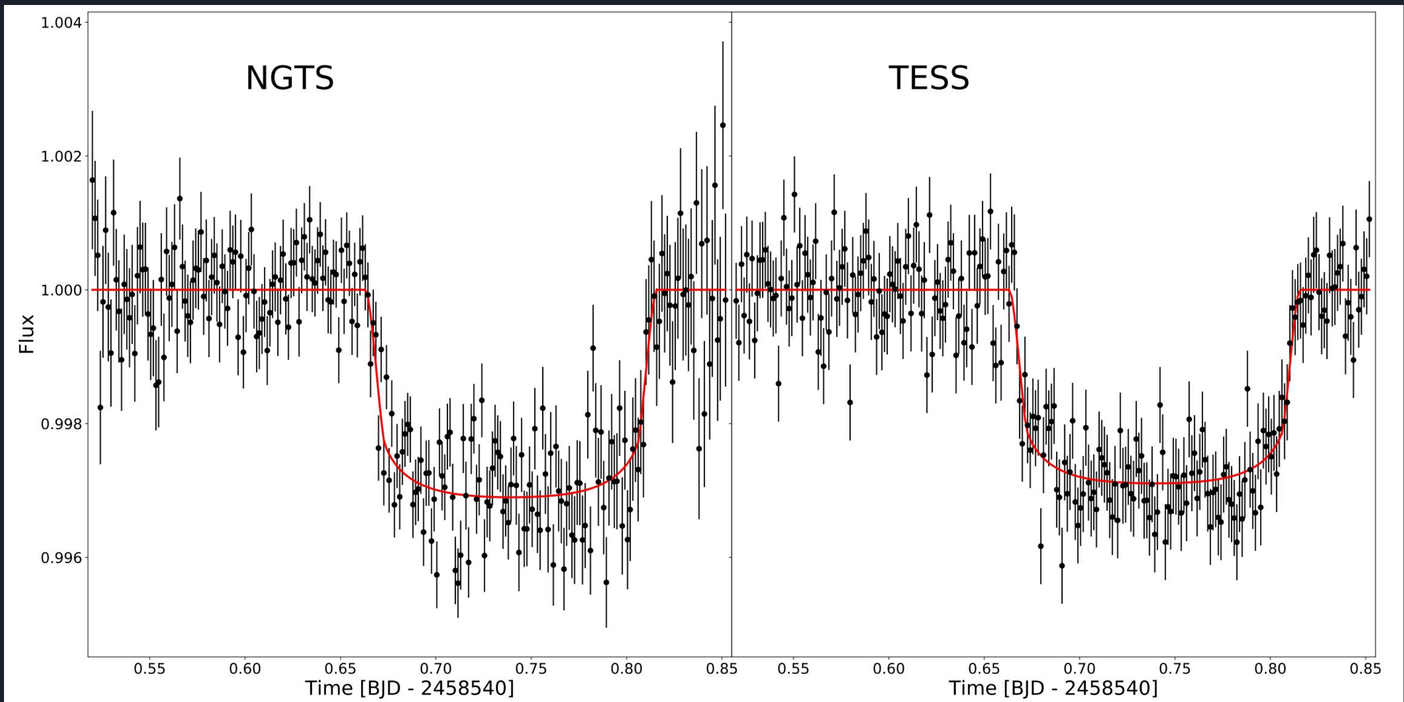

Fig.2: NGTS multi-telescope light curve (left panel) for the transit of WASP-166 b, compared to the TESS light curve (right panel) of the same event

The red lines give the transit models found from fitting the two data sets

Multi-Telescope Precision

- ★ We can use our 9-telescope observation to test the performance of the multi-telescope observing method
- ★ Fig.3 shows how the photometric precision improves as more telescopes are used
- ★ The black line shows the best-case improvement that is expected for uncorrelated noise

- ★ The light curve achieved with this method has a scatter of just **150 parts-per-million**.
- ★ This is the same precision achieved by TESS and is some of the **best photometric precision** ever achieved from the ground!

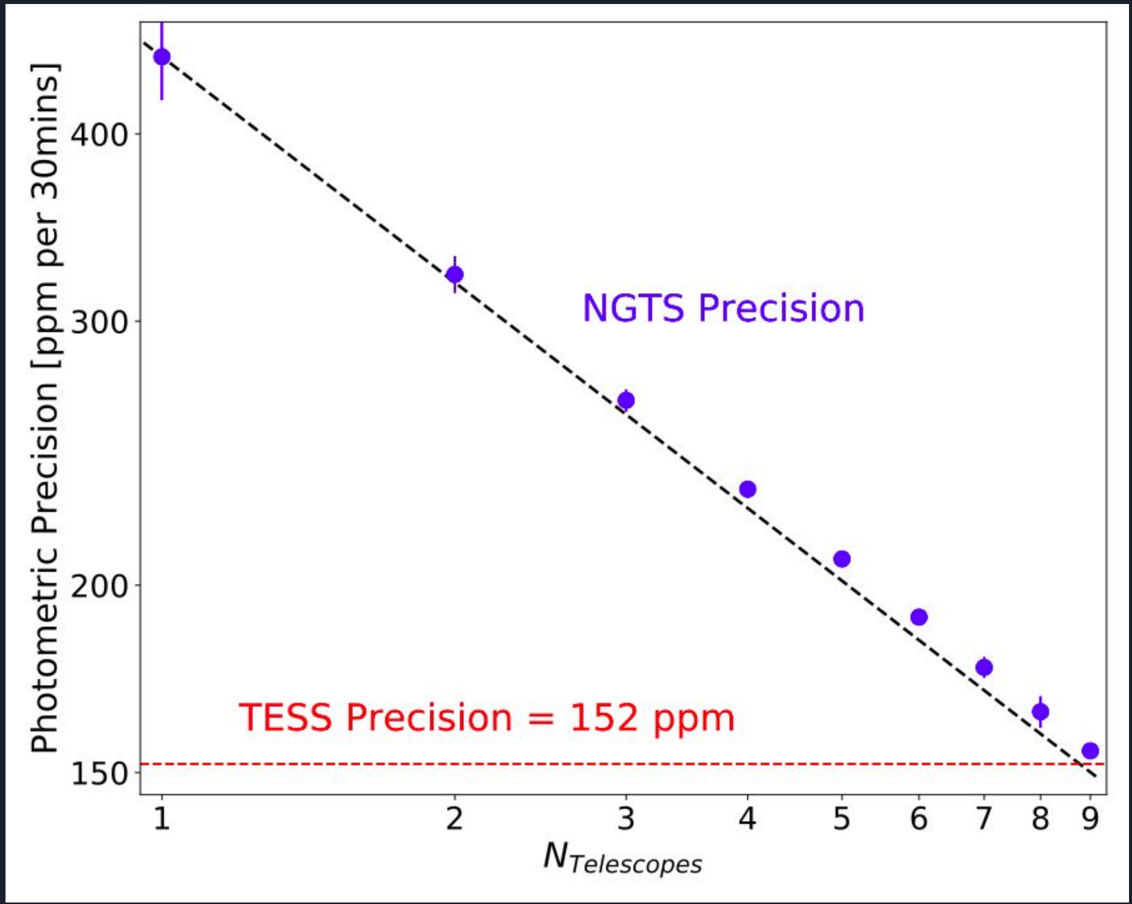

Fig.3: The improvement in photometric precision we achieve as we increase the number of telescopes used. The black line shows the theoretical best-case improvement. The red line gives the precision achieved by the NASA TESS space telescope for the same star.

Conclusions and Future

- ★ Obtaining high precision ground based light curves is a crucial step for confirming discoveries of exoplanets and studying their atmospheres
- ★ We have demonstrated that the noise in NGTS bright star light curves does not correlate between the individual telescopes
- ★ Therefore with multi-telescope observations with NGTS we can achieve ultra-high precision light curves for such exoplanets
- ★ We achieve a precision of 150 ppm for bright stars, the same precision achieved by the NASA TESS space mission
- ★ Through obtaining these light curves, we have contributed to some of the most exciting recent exoplanet discoveries
- ★ We will continue these observations over the next few years, contributing to many more exciting discoveries!

- ★ This multi-telescope observing method is an important step towards ESA's PLATO space mission (launch 2026), where every target star will be monitored with multiple telescopes

Fig.4: Artist impression of PLATO with 26 (!) individual telescopes