

Refining the Orbit of TrES-3 b through Transit Photometry

Rudra Protap Nandi
Satkhira Government College

ABSTRACT

This research focuses on exoplanets by conducting observations on several of them using the MicroObservatory and the EXOTIC program to perform photometry on the data. The purpose of this research is to contribute to the periodic refinement of already discovered exoplanets, preparing them for missions like the James Webb Space Telescope (JWST) and the Nancy Grace Roman Space Telescope. By analyzing the transit light curve with the EXOplanet Transit Interpretation Code (EXOTIC), this study refined the orbital parameter of exoplanets, notably TrES-3 b. Through my observations, I have contributed to the orbital refinements of 20 observations.

INTRODUCTION

There are a vast number of planets in the universe. Besides eight known planets in the Solar System, many of them beyond the Solar System, which are called exoplanets [1]. This study focuses on TrES-3 b, a giant gas orbiting the G-type star (TrES-3) with a mass of 1.91 Jupiter and the orbital period 1.3 days [2]. With the refinement of orbital parameters, this research contributes to missions like JWST and the Nancy Grace Roman Space Telescope.

METHODOLOGY

a. Data Collection

The FITS images of TrES-3 b were captured using the MicroObservatory Robotic Telescope Network operated by the Center for Astrophysics | Harvard & Smithsonian [3]. The telescope was remotely controlled to capture a series of images during the exoplanet's transit. After image acquisition, the dataset was acquired from the MicroObservatory Image Directory for the photometric analysis.

b. Photometric Analysis

The FITS dataset was processed in the EXOTIC to find the target star TrES-3. Ten nearby comparison stars were identified from the AAVSO star chart to compare the brightness variations between TrES-3 b and the best comparison star.

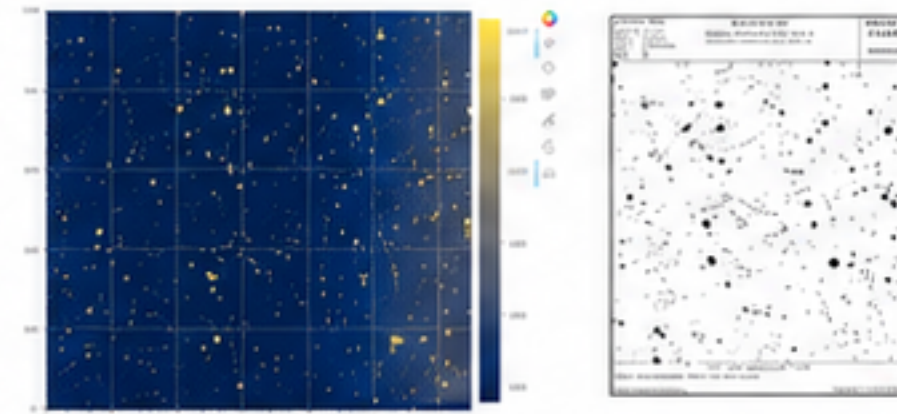


Figure 1. Image of TrES-3 b exoplanet photometry on EXOTIC (left) and its AAVSO star chart (right)

RESULTS/CONCLUSION

The photometric analysis resulted in a precise transit lightcurve for TrES-3 b with the refinement of orbital parameters. This methodology has been successfully applied to other exoplanets, specifically 20 observations of various exoplanets have been refined including WASP-12 b, WASP-43 b, HAT-P-12 b and TrES-5 b.

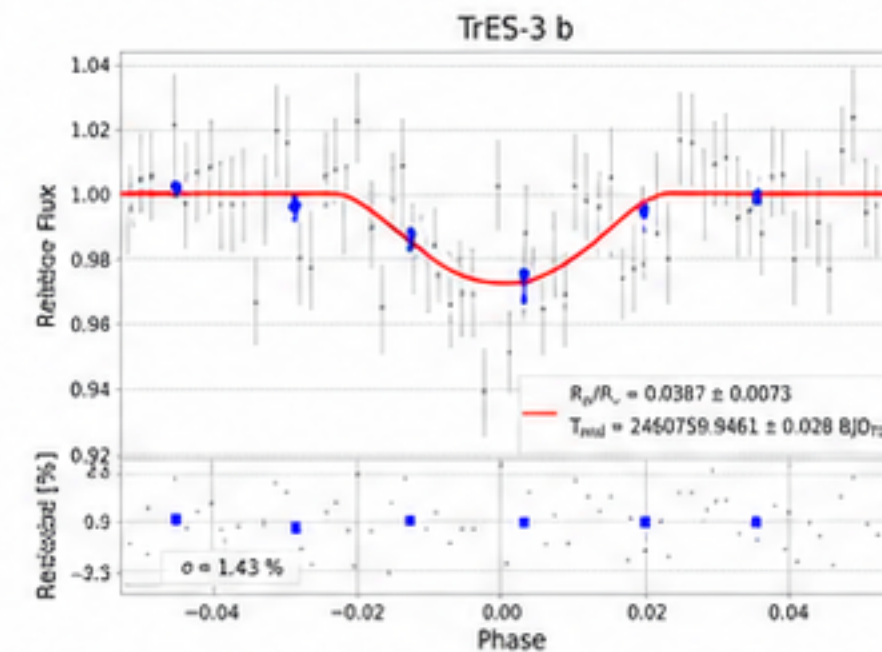


Figure 2. Transit lightcurve of TrES-3 b

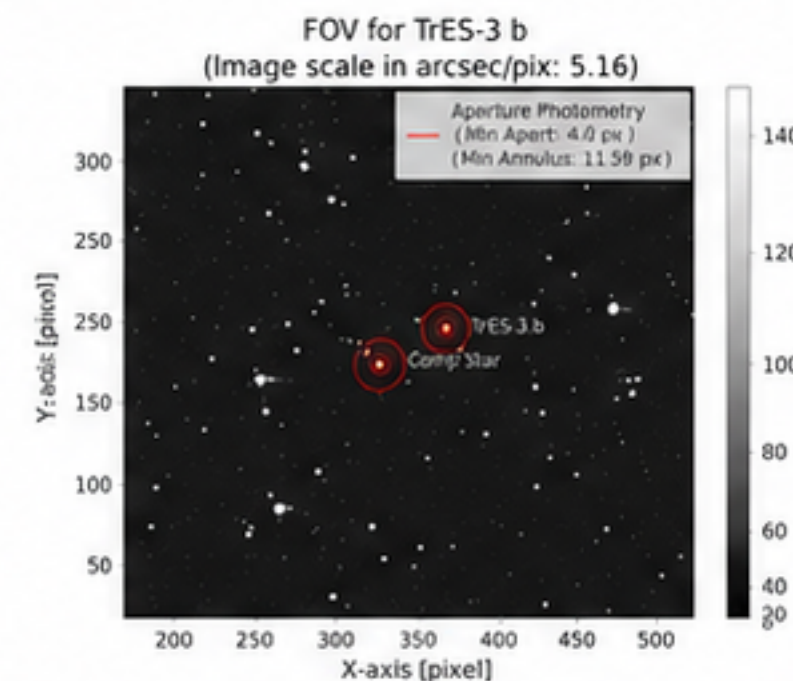
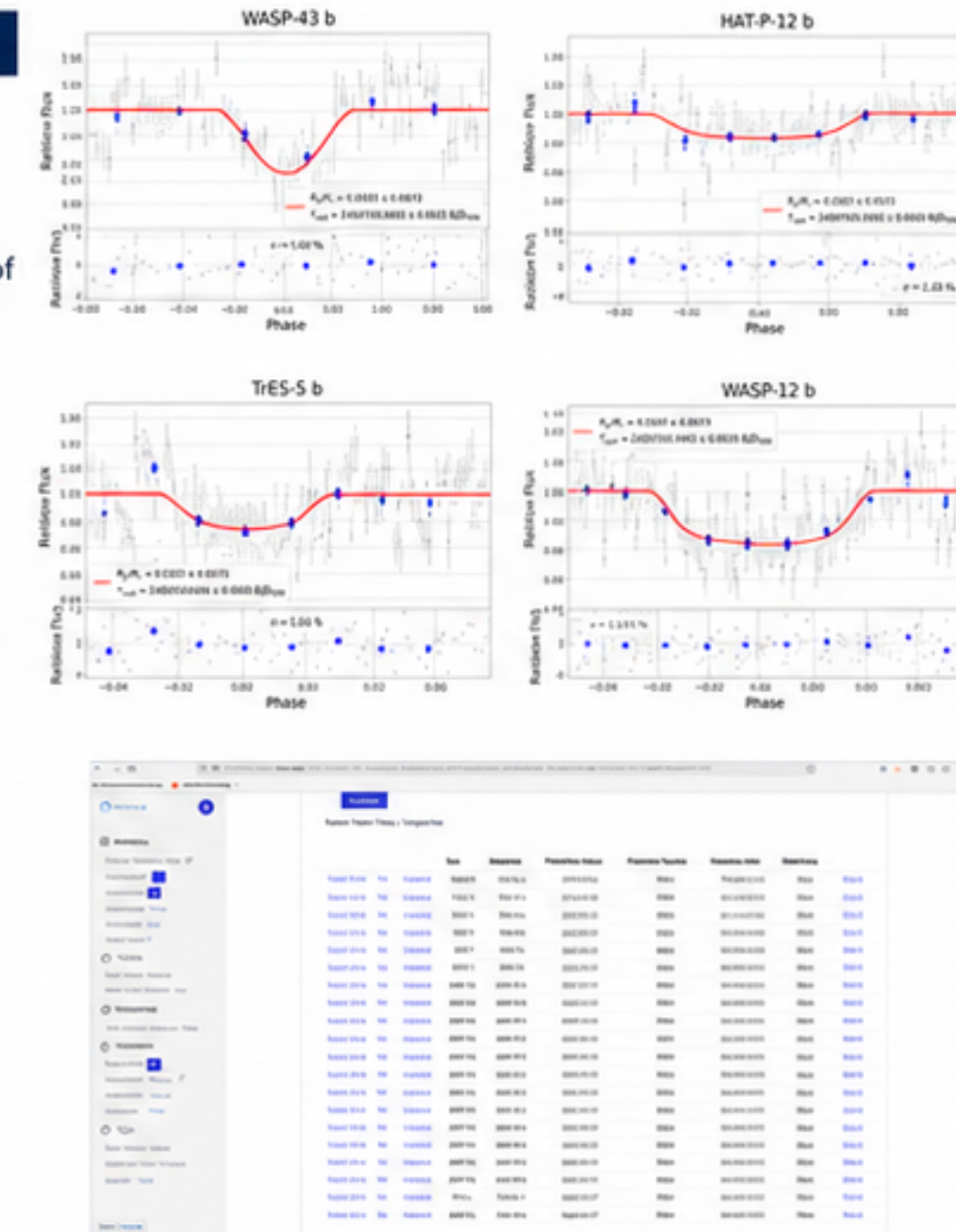


Figure 3. Field of View (FOV) for TrES-3 b



REFERENCE

- [1] "Overview | What is Exoplanet Watch?," Exoplanet Exploration: Planets Beyond our Solar System. <https://exoplanets.nasa.gov/exoplanet-watch/about-exoplanet-watch/overview/>
- [2] A. Cermak, "TrES-3 b," NASA Science, Oct. 02, 2017. <https://science.nasa.gov/exoplanet-catalog/tres-3-b/> (accessed Mar. 30, 2025).
- [3] "MicroObservatory Splash Page," mo-www.cfa.harvard.edu. <https://mo-www.cfa.harvard.edu/MicroObservatory/>