Measuring Exoplanetary Radii Using Transit Photometry

Tang, Sarah (School: Fairview High School)

The goal of this study was to measure the radii and constrain the orbital periods of three Hot Jupiter exoplanets, HAT-P-25b, HAT-P-9b, and HAT-P-30b. Through remote observing, raw images of the host stars were acquired using the ARCSAT telescope and FlareCam Imaging Instrument in Sunspot, New Mexico. A data processing pipeline utilising the Python programming language was used to convert the raw data images into calibrated pixels and transit light curve graphs. The normalized transit graphs of HAT-P-25b and HAT-P-30b were fitted with multiple light curve models, which varied based on a given range of radius and time of mid-transit parameters within the Python code. The data associated with HAT-P-9b were not fitted with light curve models due to a non-detection in the data. Chi-square tests were performed on all the light curve models to isolate the chi-square value closest to 1.0, which would signify a strong data to model fitting. Chi-square maps were used to estimate the 1s error bars (68% Confidence Intervals) for all light curve calculations. A shift in mid-transit time (-0.41 ± 0.31 hours from expected value) was detected for HAT-P-25b. This will help scientists more accurately predict the transit times for this planet. The normalized radius (Rp/R?) calculated for HAT-P-30b differed significantly from the literature value by 0.04 ± 0.0020. This discovery can be used to more accurately constrain the radius of this planet. These findings will help scientists obtain more accurate knowledge about these exoplanets and their characteristics.

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