Identification and photometry of candidate transiting exoplanet signals

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Abstract

Exoplanet detection is important to the science of star and planet formation and the origin of life. There are currently 760 confirmed exoplanets. We investigate late-K to early M dwarf stars for exoplanets because the relatively small size and low luminosity of the stars increase the possibility of detecting smaller, Earth-like exoplanets. For my project, the transit method was utilized in planet detection. First, a list of candidate transiting signals was compiled. Data from 1753 late-K and early M dwarf stars collected by the WASP (Wide Angle Search for Planets) survey were analyzed. The signals from these stars were processed with a transit-hunting algorithm called HUNTER. One thousand and sixteen stars were found to have transiting signals. Each star had up to 5 possible transiting signals for a total of 3946 signals. I imposed a restriction on the signals to reject possible false positives which cut the list from 3946 signals to 1546 signals. The remaining signals were manually screened based on statistical analysis. The result was a list of 77 candidate transiting signals. Next, I completed followup photometry with the Faulkes-North telescope on 18 of the 77 candidate transiting signals. I used ephemeris data from the transit-hunting algorithm to create a list of predicted transit events. I have analyzed data on 18 unique targets across 22 observation times slots. Analysis included the calculation of an optimal aperture radius to use in photometry. A photometric precision of 4.0×10^{-4} has been achieved. With this RMS, I can detect a planet 2.83 times the radius of the Earth. Data from the Kepler Mission was used to predict 1-3 planets should be detected around the Super-WASP late-K and early M dwarf stars. So far, no transits have been witnessed.