CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)
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Project Number
35833

Project Title
Discovering New Worlds at Home

Abstract

Objectives/Goals
My science project is to determine if I can detect an exoplanet using easily available equipment. My general approach is to take a series of photographs of a star in an effort to see if it dims as a planet crosses in front of it. To do this, I used a DSLR camera, 300mm telephoto lens, a simple tracking mechanism, and image processing software.

Methods/Materials
A technique that can be used to detect exoplanets is differential photometry. Images are collected of the star as the planet crosses in front of it. Each image is analyzed to determine the intensity of the star. Because the dimming of the star is very slight and the background noise is very large, differential photometry must be used, which eliminates much of the background noise.
Because long exposures are necessary, the star must be tracked to prevent blurring and light trails. To solve this problem, I built a barn door tracker, a simple mechanism using two planks of wood hinged together with a motor that compensates for the Earth's rotation.
For each image collected, the intensity of the star must be calculated. Because the amount of dimming is so small, sophisticated image processing techniques must be exercised. For this task, I used a software package called IRIS.

Results
On October 30, 2014, I collected data of the star HD189733 as a transit occurred from the planet that orbits it. The reduction in brightness I detected is estimated to be 2.5% The theoretical reduction in brightness for the planet crossing of HD189733 is 2.6%.

Conclusions/Discussion
Using differential photometry, I detected a 2.5% dimming of HD189733. In fairness, I picked the ideal star with the ideal planet. The star planet combination is an unusual pair because the planet is so large and orbits so frequently. The majority of known exoplanets produce less dimming than HD189733b. As a result, my technique, while very successful for this planet, would likely be less affective with the majority of exoplanets in our galaxy.

Summary Statement
My science project is to determine if I can detect an exoplanet using easily available equipment, such as a DSLR camera, 300mm telephoto lens, a simple tracking mechanism, and image processing software.

Help Received
Rachel Street at LCOGT helped with data collection, father helped build instrument, Dr. Schneider at IEEE Spectrum helped with data analysis.