CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s)

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Project Number

S1814

Project Title

Looking for Another World? Rapid Inference Model for Exoplanets as Super Earths or Hot Jupiters

Abstract

Objectives/Goals

To create a rapid inference classification system by correlating transit curvature to mass and orbital radius of exoplanets. The rapid inference classification system provides astronomers with a more cost- and time-effective method of classifying exoplanets. Goal is to reduce costs of expensive instrumentation and improve efficiency of classification methodology.

Methods/Materials

a. Obtain raw transit data from the Kepler Public Survey Data
b. Select a sample of exoplanets corresponding to planet mass and size of Jupiter, Neptune and Earth.
c. Clean up data by filtering noise and outliers from the sample obtained from the Kepler Public Survey Data.
d. Plot clean data into transit graphs using MATLAB.
e. Establish curvature equations of the 6 transit flux graphs in a generalized model. Establish the goodness of fit or correlation co-efficient.
f. Deduce a family of transit curvature models from mapping transits. Verify correlation to exoplanets in the Kepler Public Survey Data and plot an inference model or classification.

Results

The following show the best fit curvature equations from each plot for classification of exoplanets.
Type 1 Hot Jupiter: close correlation between flux in/out versus time transit curves.
Type 2 Super Earth: close correlation between flux in/out versus time transit curves.

Conclusions/Discussion

The transit curve equations determined through MATLAB conclusively point to the possibility of creating a taxonomy of transit curves. The high degree of fit/correlation (R-squared) allows the use of these equations to be a reliable predictor of the nature of exoplanets in the currently categorized in the Kepler Public Survey Data and any other yet-to-be discovered exoplanets. The use of this mathematical estimation through the use of MATLAB makes it possible to eliminate the use of cumbersome instrumentation and mathematical analysis to compute the mass and exoplanet type used by contemporary astronomers and astrophysicists. While this method is not a substitute for precise measurement, it provides a rapid, first order inference model for the nature of a newly discovered exoplanet in the first step of an expanded study. In closing my analysis confirms the hypothesis that the shape of the transit curve trough varies predictably in proportion to the mass and temperature (gaseous, cold) of the planet.

Summary Statement

This project is a rapid inference model for characterizing extrasolarplanets.

Help Received

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