In a Galaxy Not so Far Away…

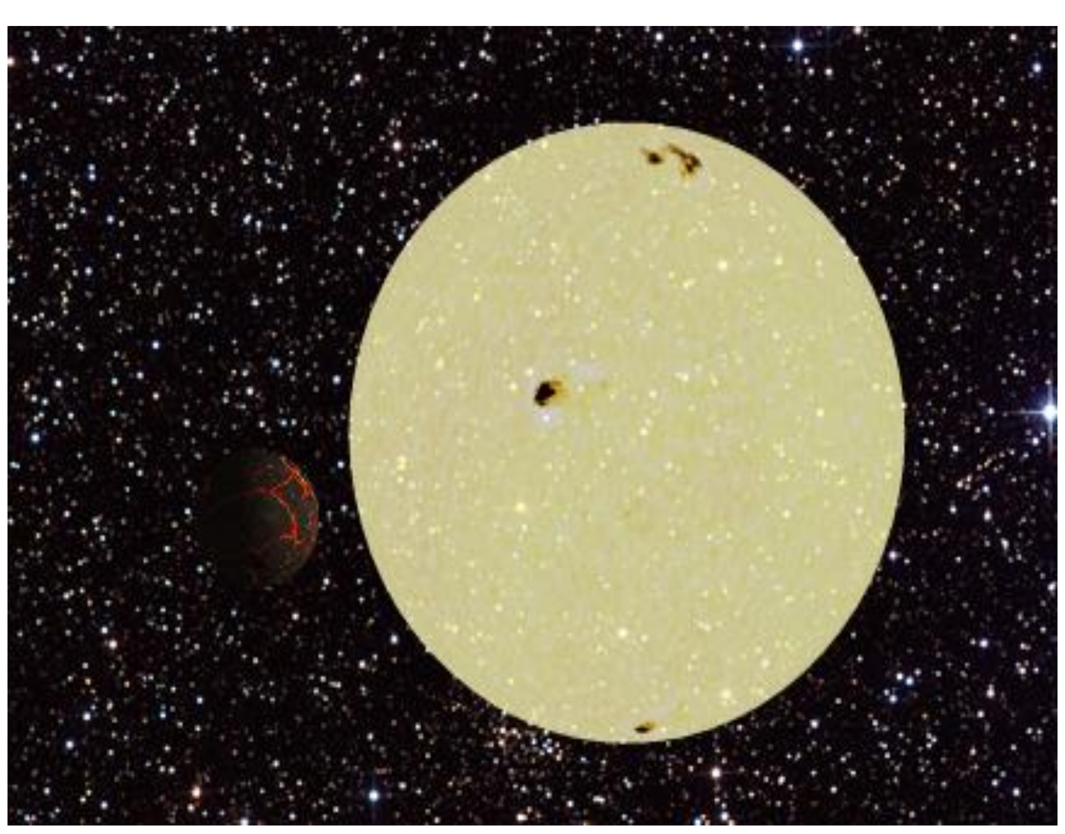
By: Hope Reyes, Allie Forst, James Smith, Evan Lowry, Sammie Coleman, and Jason Meekins

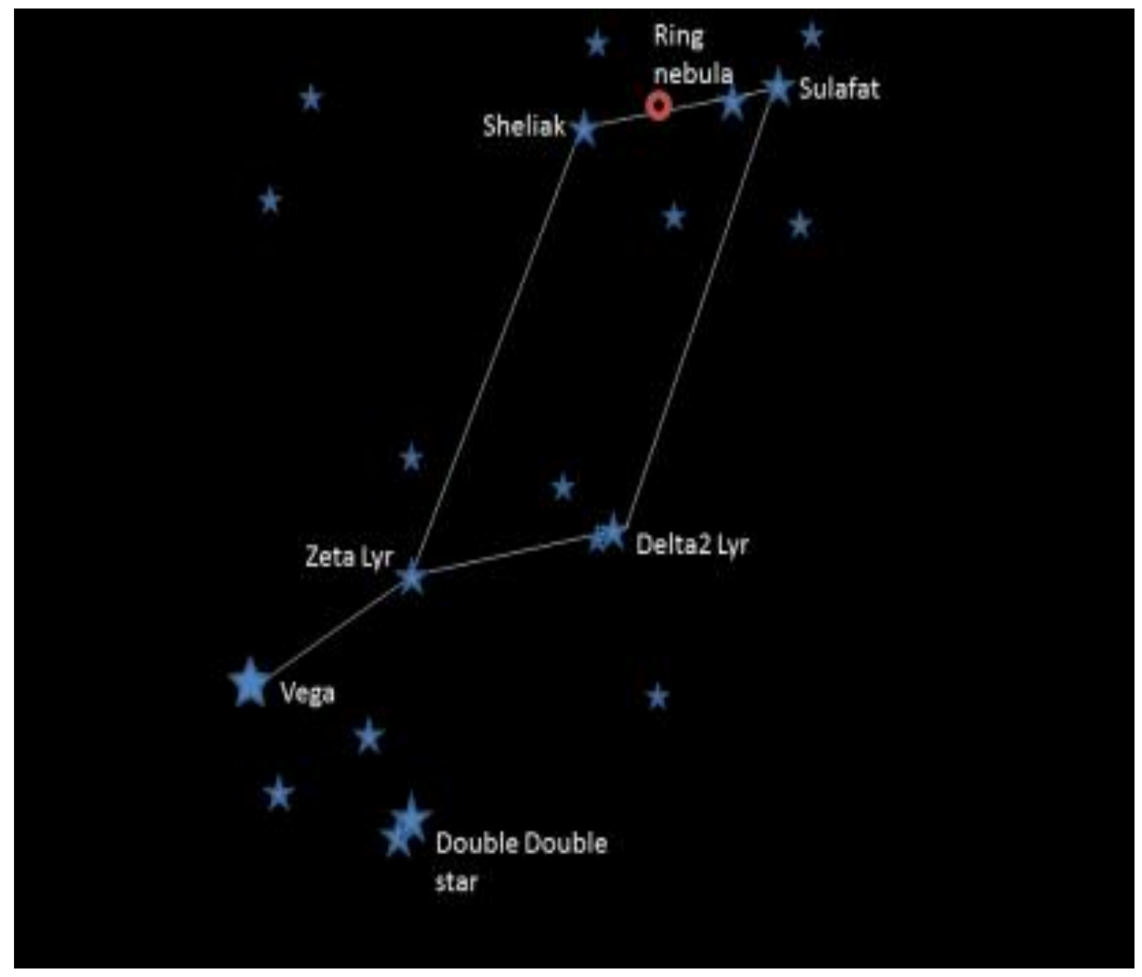
Introduction

Throughout the course of human history, astronomers have scoped the horizon in search of stars that contain Earth like planets. Until recently this goal was unachievable due to limited technology. In the last decade, several methods using light analysis have been developed to indicate the presence of planets for faraway solar system. In our examination of the star TreS1, we studied variations in light recorded by images taken by the 8th period class. We discovered the presence of a possible exoplanet, currently orbiting the star..

Methodology

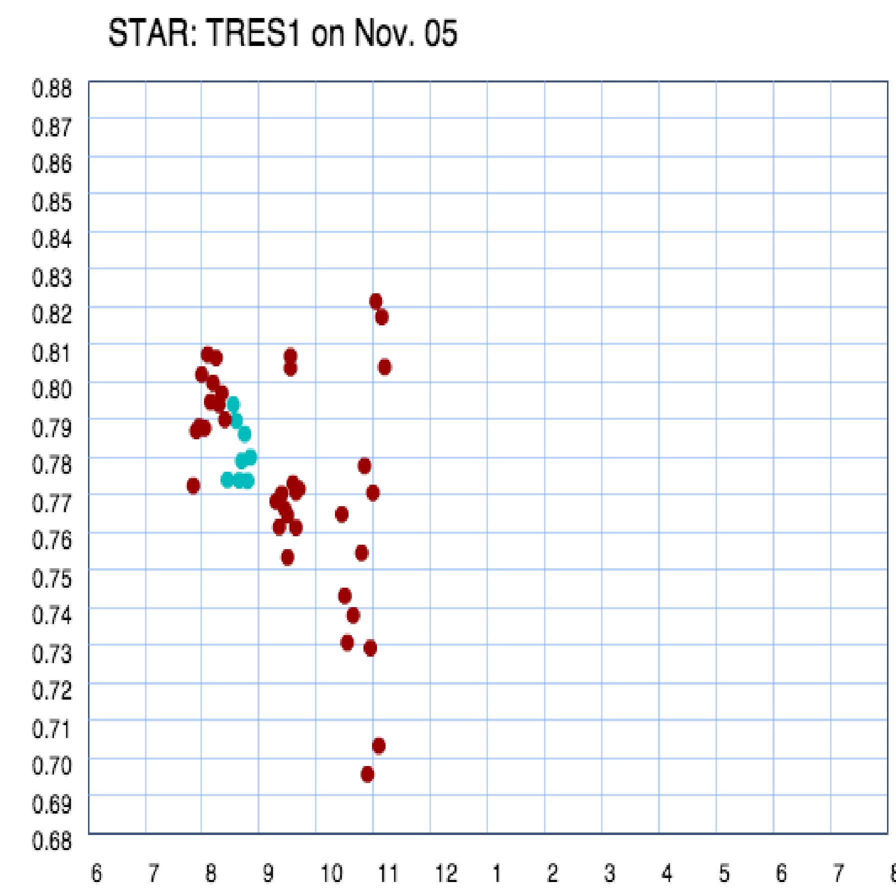
To determine whether there was an exoplanet orbiting TrES-1, we analyzed 54 images of the star taken in the cfa.harvard.edu astronomy lab and measured the difference in brightness of the star from image to image. We graphed the differences and determined, based on the data collected, that there was a constant depletion of brightness that occurred every 3.5 hours. The change was noticeable enough for the star's orbit to contain an exoplanet so we investigated the planet's properties further. We started calculating the size of the planet by examining the light curve size. We determined that the planet was .0005 times the area of its star. We then took the data collected and compared it to the base level brightness of TrES-1, the brightness before and after the light depletion. This step allowed us to determine the proximity of the planet to the star, the size of the planet in comparison to the star, and the approximate speed of its total orbit. This means that the star is larger than Jupiter, and because the planet is very close to the star, its climate most closely resembles Mercury's. We applied this information to the cfa.harvard.edu visual lab to come up with an accurate diagram of the planet in its relation to TrES-1.





Description of Brightness Curve

Our light diagram is in a v shape rather than a curve. Furthermore we concluded that if the planet passed directly in front of the star the data would form a curve. Since our planet is revolving around the star on a tilt the data forms on a downward point - a "v" shape.



Description of Exoplanet

The online laboratory allowed us to make many accurate observations based on data about the exoplanet orbiting the star TRES-1. Its diameter is .23 times the size of TRES-1, which is more than twice the size of Jupiter compared to the Sun. Gravity on the exoplanet would be much stronger than the force on Earth because of the planet's size. This was determined by comparing the amount of starlight blocked by the planet during transit and the star's normal brightness. The graph of the changes in brightness over a 3.5 hour period helped us determine that the orbit of the exoplanet is tilted about 50 degrees. The dip in the graph is sharp and not curved meaning that the planet just grazes the top of the star during transit. The graph also shows us that it only takes the planet 3.5 hours to pass in front of TRES-1. The short transit time indicates that the planet is very close to the star; the star's force of gravity has a strong hold on the planet causing it to orbit quickly in front of it. When compared to Mercury which revolves around the Sun in 4 hours, the planet's proximity to TRES-1 informs us that its climate is smoldering. This information is based on the assumption that the closer a planet is to its star, the hotter the climate. The analysis of TRES-1's distance from Earth is based on assumption because the data was calculated with the notion that the star is similar to the Sun. The Sun is 6.75814E15 times brighter than TRES-1. Calculations were done to ensure that the information about the Sun's brightness was comparable to that of TRES-1. We were able to account for the lack of exposure time that the photo of the Sun had and the filter that was used by multiplying the Sun's total brightness by 600 and 100,000,000. Our star is 8.2E7 times farther than the Sun which means that it is 7.645E15 miles and 1274.22 light-years away from Earth.