



CALIFORNIA SCIENCE & ENGINEERING FAIR 2019 PROJECT SUMMARY

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Project Title How Far to the Stars?	
<p style="text-align: center;">Abstract</p> <p>Objectives There are multiple techniques used to find the distance to stars using observational data. Which of the two commonly used methods- spectroscopic parallax and period-luminosity (P-L) relationship of a Cepheid variable star- is more accurate in calculating the distance to stars when using data obtained from the Earth's surface?</p> <p>Methods I used a Newtonian telescope with a 6" aperture and analyzed the pixels on the deep-sky images taken with a DSLR camera with a CMOS sensor using astronomical imaging software in order to calculate the apparent and absolute magnitudes of the stars. For distance measurements with the spectroscopic parallax method, I pointed my telescope towards four stars with established distances and took images of them with a camera capable of discerning the starlight received by each pixel on its CMOS sensor. I found the apparent magnitudes of the stars using data obtained from astronomical image analysis software and their absolute magnitudes using Wien's Law and main-sequence fitting. Then, using the distance modulus equation, I found the observed distance to the stars. For the distance measurements with the P-L relationship of a Cepheid variable star method, I observed the periods of four Type I Cepheid variable stars with established distances. Using the P-L relationship equation, I found the apparent magnitudes. I repeated the process of analyzing images of these stars in order to find their absolute magnitudes, as well as finding the distance to these variable stars using the distance modulus equation. I then compared the observed distances obtained from both methods to the established distances and found which method was more accurate in measuring distances to stars.</p> <p>Results The distances to the stars calculated using the spectroscopic parallax method were fairly accurate but the distances calculated with the P-L relationship was markedly more accurate when compared to the established distance values.</p> <p>Conclusions The P-L relationship of a Cepheid variable star method produced more accurate measurements of distance to stars than the spectroscopic parallax method when compared to established values and is, therefore, the more accurate method in determining distances to stars when using data obtained from the Earth's surface.</p>	
Summary Statement By measuring the distances to stars using two different commonly-used methods, I discovered which method provides more accurate results.	
Help Received	