CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)
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Project Number
J1722

Project Title
Can an Amateur Astronomer Measure Double Stars Accurately?

Abstract

Objectives/Goals
The purpose of this project was to determine if an amateur astronomer can contribute to science by measuring double stars accurately using amateur methods and equipment. Measuring changes in the separation and position angle of double stars is the most accurate way of calculating their orbit and masses. This project tested to see if separation angles (rho) can be measured within +-5% and position angles (theta) can be measured within +-1 degrees when compared to the most recent values listed in the U.S. Naval Observatory's Washington Double Star Catalog (WDS).

Methods/Materials
In this project, two methods available to amateurs were used to measure 11 double stars. First, 7 double stars were measured visually using a manually-guided 8" reflector with an astrometric eyepiece. For the second method, 4 double stars were CCD (charge-coupled device) imaged by a Planewave Imaging Platform telescope in Spain through the website iTelescope.net. The imaged double stars were measured using Aladin Astrometry Software.

Results
All measurements were compared to the most recent values in the WDS and differences were calculated. For all 75 visually measured rhos, the mean difference was 0.61 arcseconds, the standard deviation was 1.85 arcseconds, and the mean percentage difference was 2.7%. For all 60 visually measured thetas, the mean difference was -0.8 degrees and the standard deviation was 6.72 degrees. For all 20 CCD imaged rhos, the mean difference was -0.12 arcseconds, the standard deviation was 0.12 arcseconds, and the mean percent difference was -0.47%. For all 20 CCD imaged thetas, the mean difference was -0.12 degrees and the standard deviation was 0.33 degrees.

Conclusions/Discussion
The results were very accurate. CCD imaged measurements were consistently more accurate than visual measurements. Most individual visual double star measurements confirmed the hypothesis. All CCD imaged double star measurements confirmed the hypothesis. The recently published measurements of 06224+2640 STF 897 were confirmed and 06579+1430BPM 342 was measured for the first time in fifteen years. I plan to submit my measurements to the Journal of Double Star Observations. The results show that amateur astronomers can measure double stars accurately and make a scientific contribution.

Summary Statement
Using two methods, visual and CCD imaging, 155 measurements of 11 double stars were taken and found to be accurate when compared to recent listed values, confirming that amateur astronomers can make a contribution to science.

Help Received
This project was inspired by a seminar given by boyce-astro.org. Norman Negus, my advisor at Mount Everest Academy, gave me advice about statistics and my paper. My dad drove me to the San Diego Astronomy Association's observing site and helped me install astrometric software on my laptop.