

## MEASURING STELLAR VARIABILITY BY VISUAL PHOTOMETRY

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### Abstract

As a student participating in the AAVSO's Hands-On Astrophysics: Variable Stars in the Physics/Math Lab (HOA) project,\* I have learned how to observe variable stars, begun to understand the astrophysical reasons for stellar variability, and am now able to contribute my observations in response to *AAVSO Alert Notices*. My involvement in HOA has been the driving force for my high school science project.

As a freshman at Glastonbury High School in Connecticut, I began my study of the types of variable stars by making observations in the family observatory. I initially began observing with the idea for a Connecticut State Science Fair project in mind. I had participated in the second HOA teachers workshop held at AAVSO Headquarters, providing student reactions and ideas to participating teachers and HOA developers. I had selected five different types of variable stars, some requiring only naked eye observations. The list of targets included Algol, delta Cephei, R Leonis, SS Cygni, and Nova Cassiopeiae 1995. With the help of my father and mentor, Philip L. Dombrowski, I began to develop the required observing skills necessary to build a usable data base for my project. I have learned the use of the Julian Date and its importance in collecting and graphing my observations, and I have developed the skills required to make telescopic observations using AAVSO star charts.

Using the HOA Handbook and David Levy's *Observing Variable Stars: A Guide for the Beginner* (1989), I learned the basic procedures of variable star observation and collected over 300 variable star observations for my project. The variable nature of my selected stars became quickly apparent as my project progressed. I so much enjoyed seeing SS Cygni go from visual magnitude 12.0 to 8.5 in less than 48 hours. I learned to appreciate the value of digital setting circles for finding my faint targets and the difficulty I would have endured without their help. Equally, I enjoyed the relative simplicity in seeing the nightly change of delta Cephei and the rhythmic regularity of its light curve. My understanding of the reason for delta Cephei's variability and its astrophysical nature gave me insight to the use of the variability of this type of star to measure distances to distant galaxies.

My project was initially entitled "Did You See Algol Wink at You?" It did very well at the Connecticut State Science Fair, placing second in the Physical Science division. This award provided me the opportunity to represent Connecticut at the International Science and Engineering Fair (ISEF) held in Tucson, Arizona. The title of my entry was changed to "Measuring Stellar Variability by Visual Photometry" for this competition, and the 3x5-foot display was judged by a variety of professional scientists in Tucson.

I have learned how to develop light curves using various graphing software, and learned to better appreciate stellar variability by examining the nature of these light curves. I have also learned that observations sometimes require extra work of a non-

\* *Hands-On Astrophysics: Variable Stars in the Physics/Math Lab* is an educational outreach project of the AAVSO, funded by the National Science Foundation, designed to give high school students experience in the field of variable star astronomy.

astronomical nature. Clearing snow off the observatory roof so that it could roll, combatting the desire to sleep, and dealing with clouds were just some of the “observational challenges” that had to be met.

The appearance of Nova Cassiopeiae 1995, and its irregular behavior, excited my curiosity enough to set the alarm clock to see its changing condition in the predawn sky. The light curve I produced of Nova Cas 1995 was the most rewarding and interesting graph I made for my project. The behavior of Nova Cas 1995 has been very erratic, unlike the light curves I have seen of other novae, which showed a gradual and continuous dimming. Figure 1 is a light curve showing my continuing observations of Nova Cas 1995.

I have most enjoyed the unpredictable nature of cataclysmic variables and continue to observe them, even though the International Science Fair is over. The opportunity to learn about this facet of astronomy has been most satisfying to me. I am most appreciative of the generous guidance of Dr. Janet Mattei and my father. Without their support, the Bart & Priscilla Bok Honorable Mention Award, which I received at ISEF from the Astronomical Society of the Pacific and the American Astronomical Society, would have been much more difficult to claim.

My plan for next year’s project is to continue with my variable star observations and further develop my skills as an amateur astronomer.

### **Reference**

Levy, D. H. 1989, *Observing Variable Stars: A Guide for the Beginner*, Cambridge University Press, England.

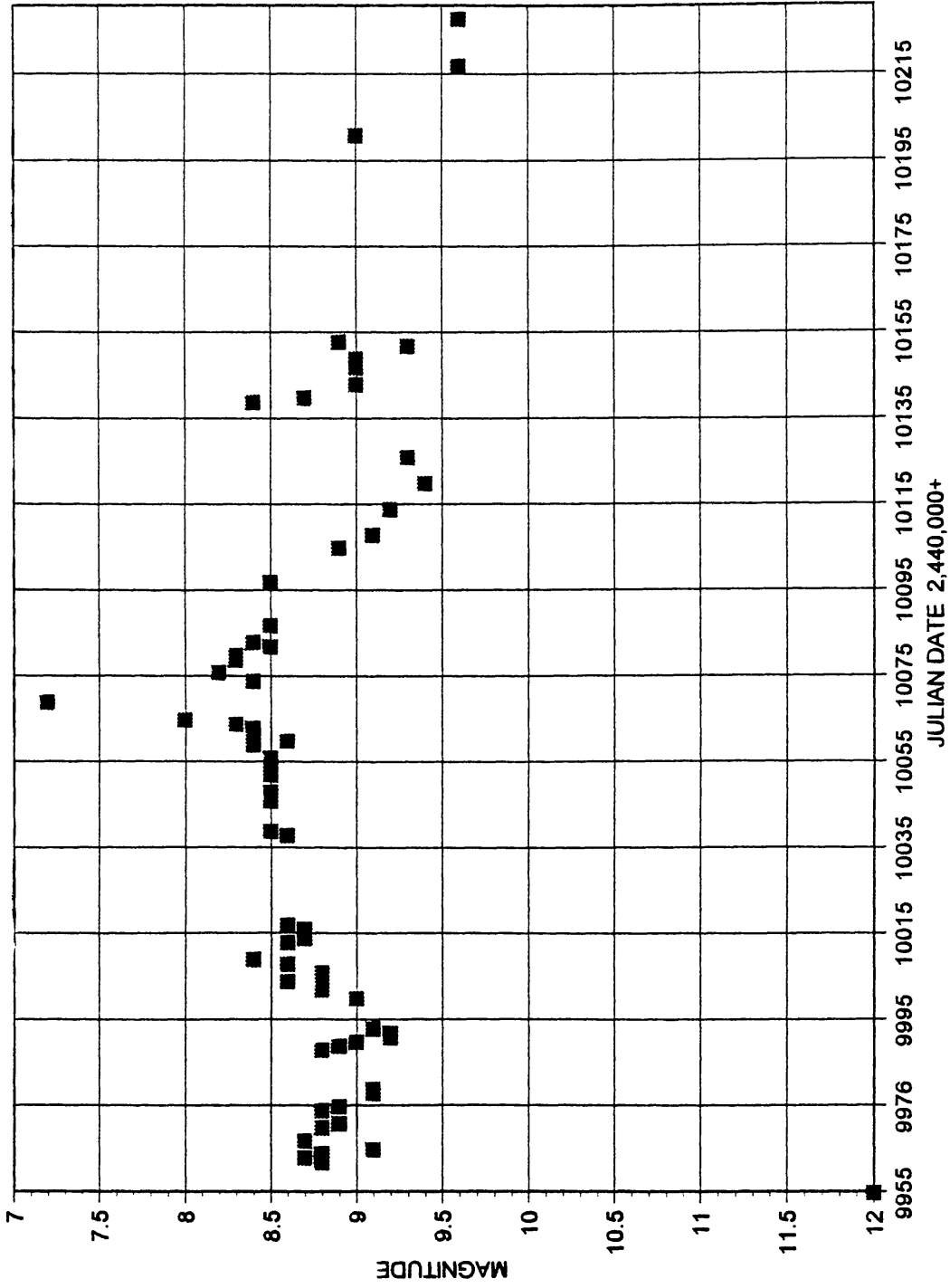


Figure 1. Visual observations of Nova Cassiopeiae 1995 made by the author August 1995–May 1996.