Variable Star Photometric Analysis

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The International Variable Star Index — Now cataloging 285,852 variable stars

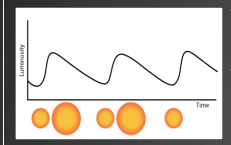
Introduction

Variable stars are stars that vary in brightness periodically. By using a photometric analysis program, MPO Canopus, we analyzed hundreds of images looking for intensity changes of the stars in the field. We found many different types of variable stars, such as intrinsic variable and eclipsing binary stars.

Classification of Variable Stars

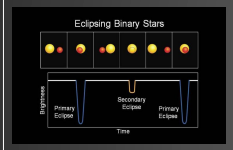
What are the different types of variable stars?

INTRINSIC VARIABLES are stars that change their physical properties by themselves. These variables are categorized:



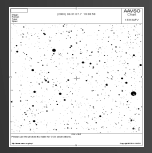
- Pulsating variables: swell and shrink in size periodically as part of their natural life sequence
- Eruptive variables: experience frequent surface eruptions e.g. novae and supernovae

EXTRINSIC VARIABLES are stars whose variability is caused by external factors



- Eclipsing binaries: two stars that rotate around the center of mass of the system
- Rotating variables: stars whose variability is caused by surface features related to their rotation e.g. sunspots

Is it an undiscovered variable?

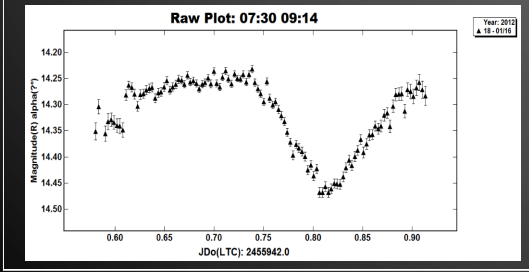


- First, check the Variable Star Index (VSX) with a coordinate based search
- Determine if the star is already catalogued
- Determine the type of variability

What types did we discover?

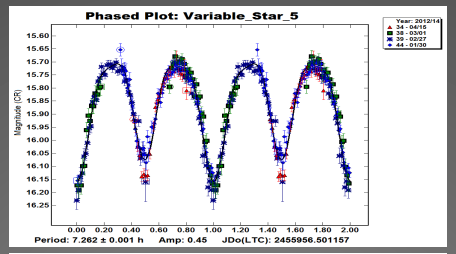
EA: β Persei-type (Algol) eclipsing binary systems are binaries with no restriction on the period length but with definite starts and ends to the eclipses.

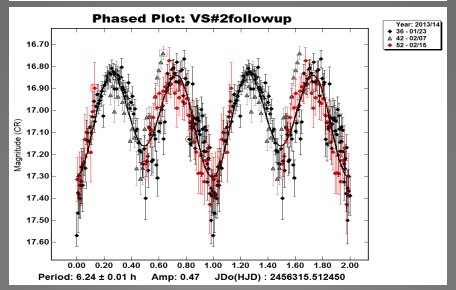
The light curve below is from a star we imaged during winter term. It has an obvious decrease in magnitude. However, when we tried to image it again, we did not image the eclipse because the period is so long. Instead of spending many telescope hours attempting to catch the next eclipse, we decided it was better to move on to the next star due to limited telescope time.



What types did we discover? (Cont'd)

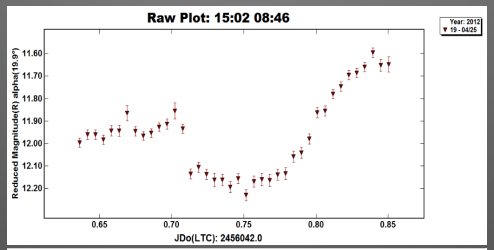
EW: W Ursae Majoris-type eclipsing variables are variables with periods less than one day. They have light curves that for which it is hard to distinguish the start of an eclipse and for which the depths of the troughs differ minimally.

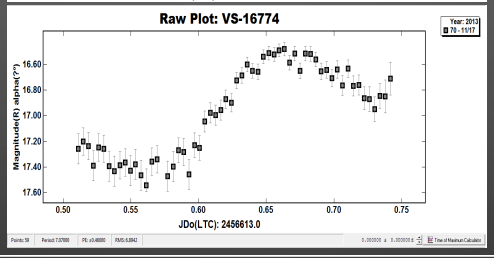




RRAB: RR Lyrae variable stars are fundamental mode pulsators with asymmetric light curves featuring steep ascending branches, usually with periods less than a day

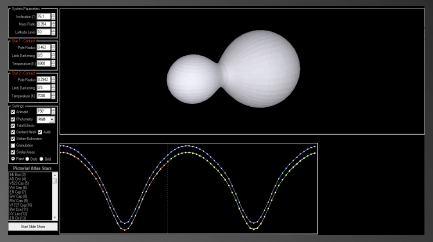
The light curve below does not feature follow up because when we searched for its coordinates in the VSX, the variability was already catalogued.



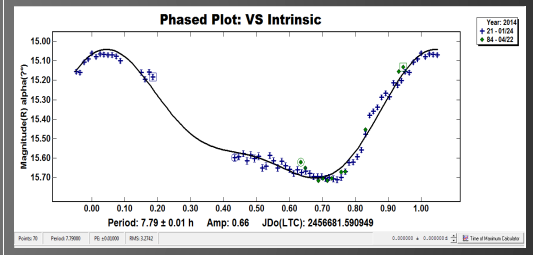


What do we do next?

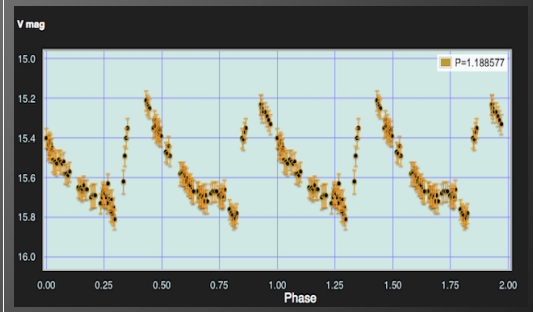
1. Submit the discoveries to the Variable Star Index (VSX)
2. Publish a paper in the Journal of the American Association of Variable Star Observers (JAAVSO)
3. 3-Dimensional modeling



4. Spectroscopy to determine the stellar type
5. Utilize the Catalina Sky Survey lightcurve data (featured below) to our advantage to compile more date for variable star discoveries



The Catalina Sky Survey has extensive coverage that could be used to fill holes in light curves, such as the one featured above.



Acknowledgments

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Credits:

MPO Canopus software was used to generate the light curves

http://www.aavso.org/