Orbital Period of Eclipsing Binary of Variable Star V357 Peg

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Abstract

This project studies the orbital period of the eclipsing binary system V357peg at coordinate RA 23h45m35.06s Dec +25 28' 28.94". The variation in apparent magnitude of the system is recorded at different phases and constructed into a light curve that can be used to measure the orbital period of the binary system. The variable period of the system is measured to be 0.8 days.

Introduction.

There are generally four types of binary systems: visual binary, astrometric binary, spectroscopic binary, and eclipsing binary; here we will learn about Eclipsing binaries. In an eclipsing binary system, the two stars close together and cannot be resolved separately. The orbital plane of the system lies almost parallel to the line of sight. However, we can observe the orbit of eclipsing binary by the changing in apparent magnitude. As two stars orbit and block each other from line of sight, the light observed is reduced and give a characteristic light curve of the system. As the orbit comes back to the starting point, the light curve repeats and the time it takes for the light curve to repeat is equal to the orbital period of the system.

V357peg is an eclipsing compact binary system where two stars orbit really close to each other. Such system may have its physical characteristics, orbital period that changes over time along with the system evolution. By studying orbital period, it can lead to calculating the system's mass, orbital velocity, and separation. Furthermore, the orbital period can provide insight to the birth, evolution and modeling of the star system.

Method.

1. Choose a variable star with visibility and period suitable for studying during September-December 2012. V357 Peg is used to study the transition period. By courtesy of Assoc. Prof. Boonraksa Soonthornthum In the database.

2. Take images using PROMPT telescopes (CTIO) with filter V, Exposure Length 10 seconds every 15 minutes.

3. Identify V357 peg and reference star from the images.

4. Obtain flux from the image.

5. Calculate the apparent magnitude of v357peg from Flux, using the formula

$$m2 = m1 + 2.5 \log (f1) / (f2).$$

Where m2 is the Apparent Magnitude of V357 peg.

m1 is the Apparent Magnitude of reference star.

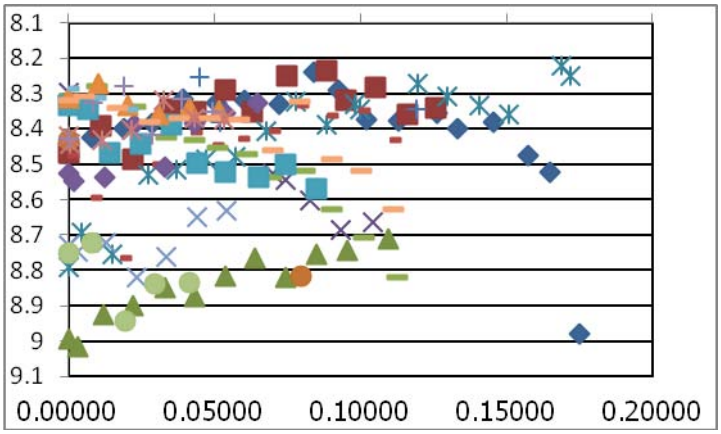
f2 is Flux of V357 peg.

f1 is Flux of reference star.

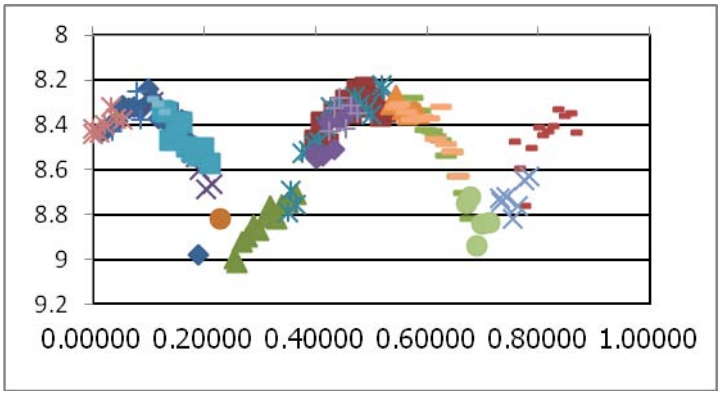
6. Use the apparent magnitudes to create a light curve. Since the light curve is fragmented and the phases do not match, period stacking must be used to generate a continuous light curve spanning the entire period. Period stacking is done manually.

7. Graphs were analyzed for variable periods at Apparent Magnitude position to come close to setting a starting point.

Results



Graph showing the relationship between the Apparent Magnitude and time series from each of the measurement session of V357 peg.



This graph shows the relationship between the Apparent Magnitude and Phase of the eclipsing binary system V357 peg.

Discussion

After period stacking, we are now able to see the characteristic light curve of this binary system. From the light curve we then can estimate the orbital period to be around 0.8 days, with some uncertainties owing to Unfavorable weather conditions such as strong winds or the light from the moon limit some observation. The period stacking process is also done manually and prone to some errors.

Conclusion.

The study found that the variable star V357 peg has apparent magnitude varying from 8.2 to 9.1 with the variable period of about 0.8 days.