Phase Analysis of RV Tauri and Semi-regular Variables

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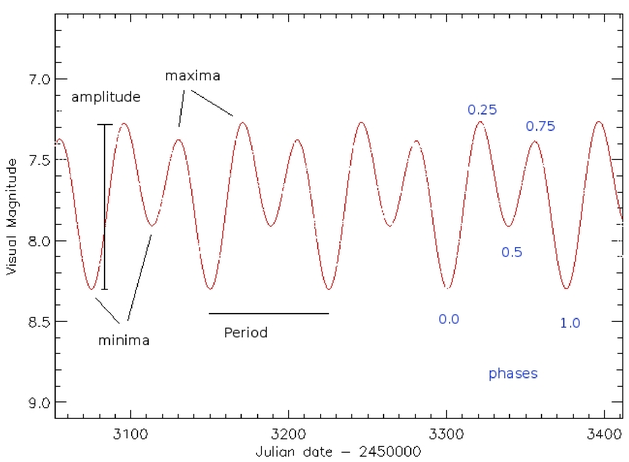
Abstract

We examined the light curves of ten Semi-Regular or RV Tauri variable stars, related classes of pulsating variable stars. The ultimate objective for our research is to determine whether the stars stellar properties such as temperature, radius, and luminosity correlate with their pulsation cycles. In order to determine this, we need to closely examine the light curves to determined the proper pulsation phase information. We used data from AAVSO spanning 1998 to 2012 for each star and then analyzed the light curves periodic behavior. We will present the results for our analysis.

Background

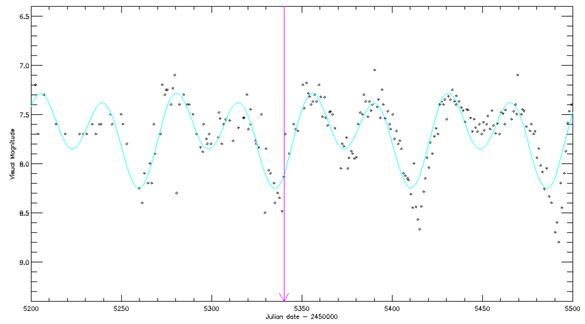
Variable stars are stars that change in brightness. There are numerous types of Variable stars. The stars that we focused on were pulsating variable stars. Pulsating variable stars expand and contract over time. The two specific types of pulsating variable stars that we researched were RV Tauri variable stars and Semi-Regular variable stars. RV Tauri variable stars are usually yellow supergiants, that have a light curve with alternating deep and shallow minima, a period range of 30-150 days, and a spectral class that ranges from G to K. Semi-Regular variable stars are a type of long period variable star. Semi-Regular stars are usually giants or supergiants that have noticeable periods with intervals of semiregular or irregular light curves and a period range of 30 to 1000 days. RV Tauri stars and semi-regular stars are similar and are sometimes mistaken as one another.

Ideal Light Curve



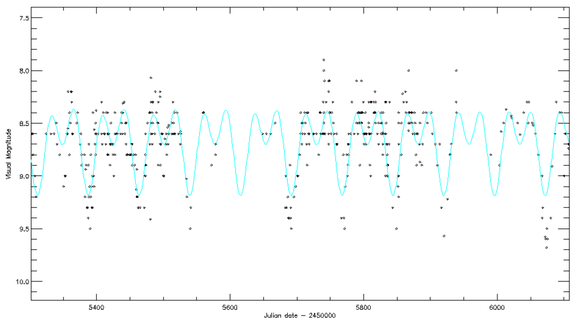
AC Her

AC Her is classified as a RV Tauri Variable star, with a period of 75.29 days. The graph below is the model-fit light curve that fit best for the spectral date of 2455340 Julian days.



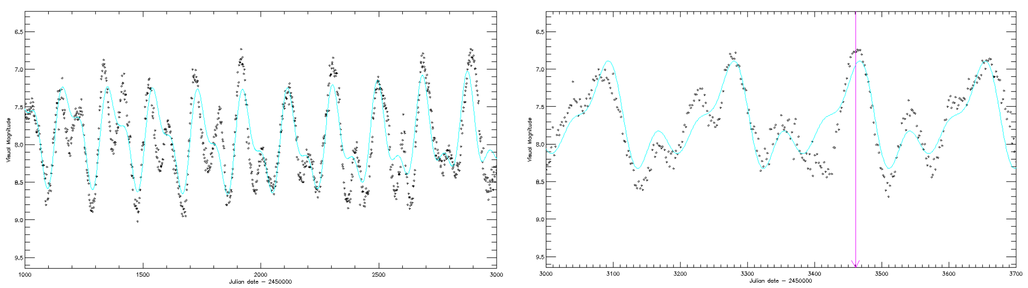
V Vul

V Vul is classified as a RV Tauri variable star, with a period of 76.07 days. The graph below illustrates V Vul's light curve.



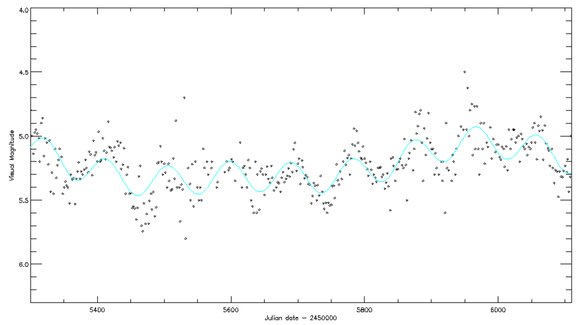
Z UMa

Z UMa is classified as a Semi-Regular variable star and has a period of 195.5 days. The graph below on the left is an example of a failed model-fit attempt and also illustrates Z UMa's semi-regular light curve. The graph on the right shows the model-fit light curve used for the spectral date of 2453460.8 Julian days.



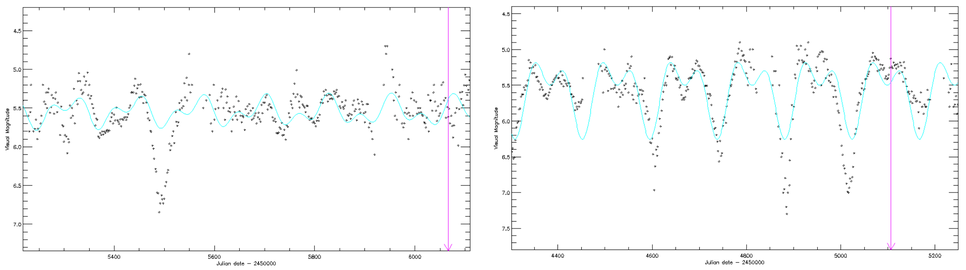
G Her

G Her is classified as a semi regular variable star, with an expected period of 89.2 days. The graph below is the best fitting model-fit light curve for the Julian dates closest to the end of the data.



R Sct

R Sct is classified as an RV Tauri variable star and has a period of 146.5 days. The graph below on the left is how a failed attempt at fitting the R Sct light curve looks. On the right the graph shows a the best fitting model-fit light curve and also showcases R Sct's sporadic amplitude change.



During my research I found the best model-fit for each stars light curve and estimated the photometric phase for the spectral dates provided by our spectroscopy team. The phases from this analysis were then used to determine whether the stars stellar properties correlated with their pulsation cycles by the spectroscopy team.

Acknowledgments

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