

Another Look at the RV Tauri Period-Luminosity Relation

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The Period-Luminosity (P-L) relation for the RV Tauri variables (DuPuy 1973) contradicts those of other variables in the instability strip as it predicts lower luminosity at longer pulsational periods. It is based primarily upon three globular cluster variables. DuPuy determined secular and statistical parallaxes from 23 field variables, defining a simple P-L relation with a slightly negative slope.

The importance of the P-L relation goes beyond the ability to predict luminosity. Takeuti and Petersen (1983) addressed the nature of the light curves as a resonance between the fundamental and first overtone modes. Their linear, adiabatic, radial pulsation models for the longer periods required an unreasonably small mass of $0.1M_{\odot}$ as a direct result of the P-L relation. Masses of the cluster RV Tauri stars are believed to be near $0.6M_{\odot}$ (Gingold 1976) from stellar evolution models.

As a test of the P-L relation's applicability to the field variables, M_v was determined for 19 RV Tauri stars using the results from synthetic spectrum fitting (Wahlgren 1986). From 2.5 Å resolution spectra, the fitting procedure determined the effective temperature, gravity, metallicity, and turbulent velocity. The stellar mass was assumed to be solar. For twelve variables M_v was found to be between -1 and -3. All but three variables had absolute magnitudes fainter than predicted by the P-L relation. Those variables brighter than predicted displayed hydrogen-line emission, signifying a possibly peculiar spectrum. Decreasing the mass would act to increase the value of M_v and the discrepancy with the P-L relation. The results do not support the P-L relation of DuPuy for the field RV Tauri variables. No P-L relation is evident, and it is suggested that $M_v = -2$ to -3 be used when a general knowledge of RV Tauri luminosity is required.

Coude spectra have been obtained for the Ca II H & K and H α lines in RV Tauri and SRd variables. The data will be analyzed to determine whether luminosity can be estimated from the Wilson-Bappu effect and H α profiles.

References

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