Light Curves and Analyses of the Eclipsing Binaries
EG Cas and EP Cas

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New precision V & R light curves of the eclipsing binaries EG Cas and EP Cas have been obtained using the 41-cm telescopes at the Bradstreet Observatory of Eastern University equipped with SIC ST-10000E CCDs. Analysis was performed using Binary Maker 3.0 to obtain initial models. These preliminary solutions were then more precisely fitted using the PHOEBE suite of light curve analysis tools based upon the Wilson-Devinney code.

EG Cas: P = 0.6115 days, Vmax = 12.9 has no published light curves and only a few dozen (mostly visual) timings of minimum light. The system was observed throughout the fall of 2009 and the light curves distinctly show that the system is a totally eclipsing overcontact binary. All available times of minimum light were analyzed and the resulting D-C diagram is shown below. The resulting period study clearly indicates that the period of EG Cas has been decreasing at the significant rate of -0.019 sec/yr. This is almost exactly the period decrease observed for VW Cep, an overcontact binary that showed substantial changes in its light levels over short time periods.

The light curves of EG Cas are also significantly asymmetric (strong D-Cornell effect) probably indicating the presence of large, active spot regions, most likely on both stars. Over the four months of monitoring the binary displayed extensive changes in the light curves from phases 0.4-0.8. However the light curves were very stable around primary eclipse. Therefore only the symmetrical portions of the light curves were modeled. A robust solution was achieved and the parameters for it are listed below. Despite the asymmetries in parts of the light curves, the mass ratio of this A-type (the larger, more massive star is the hotter component) binary is well determined because of the small angle of the primary eclipse. It is also important to note the extremely poor thermal contact (13.2% of) of this overcontact binary, one of the largest known, especially for a system with a flight of 20K! We fully intend to carefully monitor this very active binary in the next observing season to confirm the rapid and extreme changes in its light output and hopefully better model its asymmetries.

EP Cas: P = 0.6134 days, Vmax = 11.2 is a partially eclipsing detached system with a relatively deep primary eclipse of 1.0 mag. No published light curves exist for this system although many timings (mostly visual) of minimum light have been published. The D-C curve indicates that the period for the binary has remained relatively constant since 1940. This constant period for a binary with such close components is extremely rare. The light curve analysis indicates that the stars of EP Cas are almost in contact with each other. The light curves themselves are slightly asymmetrical and have been modeled with two cool spots on the hotter, more massive star. Stars were initially placed upon a cooler secondary star but because of its contribution to the light curves is small (~13% of the total light) it was readily impossible to create the observed asymmetries in the light curves with cool spots on its surface.

Light Curve Parameters for EG Cas

- Period (P): 0.6115 days
- Maximum brightness (Vmax): 12.9
- Mass ratio (M1/M2): 0.2397 (14)
- Inclination (i): 70.0 (assumed)
- Gravity darkening (X): 0.3 (assumed)
- Albedo (Albedo): 1.0 (assumed)
- Temperature Factor (T): 6405 K (52)
- Linear fit to the O-C residuals of EG Cas, open circles represent visual timings, solid circles CCD timings.

Light Curve Parameters for EP Cas

- Period (P): 0.6134 days
- Maximum brightness (Vmax): 11.2
- Mass ratio (M1/M2): 0.2397 (14)
- Inclination (i): 90.0 (assumed)
- Gravity darkening (X): 0.497 (assumed)
- Albedo (Albedo): 1.0 (assumed)
-Temperature Factor (T): 6405 K (52)
- Linear fit to the O-C residuals of EP Cas, open circles represent visual timings, solid circles CCD timings.