

The asymmetric light curves of the GSC 2764 1417 (And), GSC 3355 0394 (Per) and GSC 2537 0520 (Psc)

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Abstract. Solar-type variability is enhanced in short period close binaries with increased dynamo driven activity. This activity is studied in our analysis of recent light curves taken of the newly discovered eclipsing binaries GSC 2764 1417 (And), GSC 3355 0394 (Per) and GSC 2537 0775 (CVn).

Keywords. binaries: close, stars: activity, spots, mass loss, winds, outflows; techniques: photometric

1. Observations and Analyses

Our recent CCD observations of these variables were taken with the Lowell 0.81-m though our association with NURO (the National Undergraduate Research Observatory) and the SARA (Southeastern Association for Research in Astronomy) 0.9-m telescope. Times of minima were calculated, period studies were carried out and orbital behaviors were determined and used to phase present light curves. B,V,R,I light curves were hand premodeled with Binary Maker 3.0 (Bradstreet 2002). Average parameters were used as initial input values for a simultaneous 4 color synthetic light curve calculation with the 2004 Wilson Differential Corrections Code (Wilson & Devinney 1971, Wilson, 1990, Wilson 1994, Van Hamme & Wilson 1998).

2. Results

GSC 2764 1417 is a contact binary probably in a transition from a semidetached configuration to contact. The primary, more massive component is filling its respective Roche Lobe while the secondary component is under filling. This is probably a V1010 Oph binary, that is, it is making its first transition into contact. The driving mechanism behind such a transition is physically provided by torques via stellar winds leaving the star along stiff rotating magnetic field lines. Rapid mass transfer is indicated by a hot spot on the secondary component near the L1 point slightly shifted to the following side. A large dark spot region is also apparent.

GSC 3355 0394 has an EB type light curve which is dominated by dark spot activity. It displays night to night variations in light curve shapes. The period study

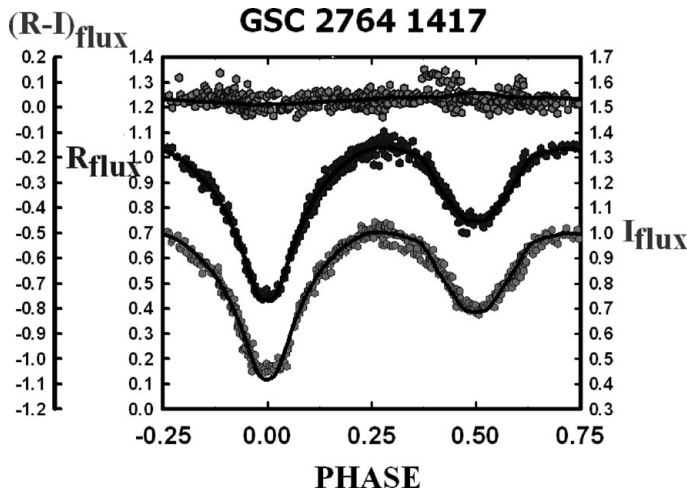


Figure 1. R and I light curves of GSC2764 1417 overlaid with Wilson code solution.

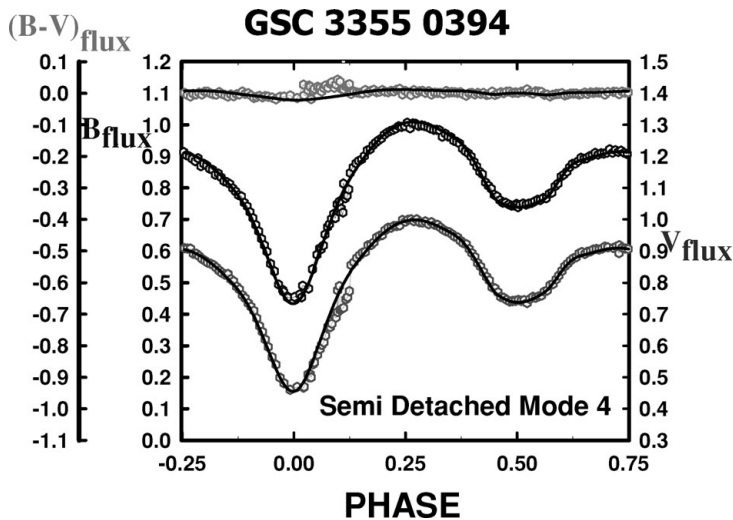


Figure 2. R and I light curves of GSC3355 0394 overlaid with Wilson code solution.

yields 6 new time of minimum light, and the first precision ephemeris: $\text{JD Hel Min I} = 2454427.903(\pm 0.0016) + 0.4621606(\pm 0.0000007)$. BVRI Wilson Synthetic light curve solutions are presented for both a mode 4 (V1010 Oph) configuration and a mode 3, critical contact configuration. It is the lowest residual solution. Four major spot regions are needed to model this binary, and one is evidently a stream spot.

GSC 2537 0520 is a rare EB-type extreme mass ratio solar type contact binary. The component temperature difference is an amazing 675K. Most other members of this group have nearly identical temperatures, $\Delta T = 168 \pm 146$. Its period is apparently decreasing as it is steadily losing angular momentum. The several spot regions are indicative of strong dynamo-driven magnetic activity.

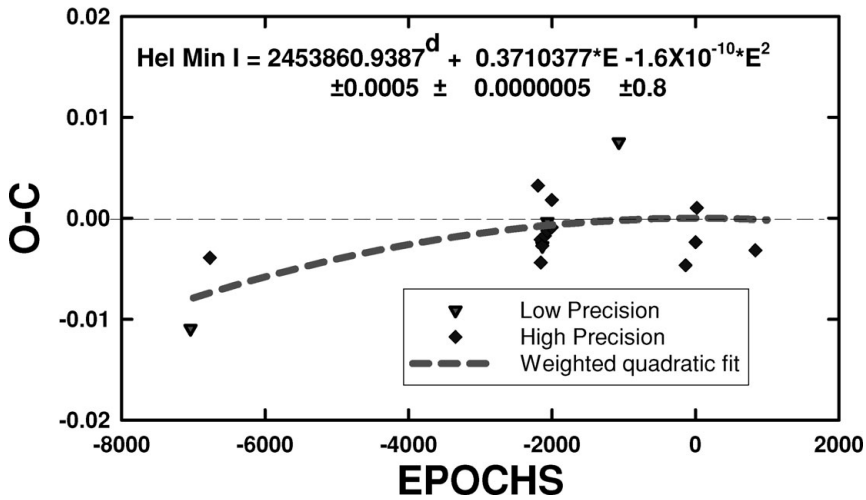
GSC 2537 520

Figure 3. O-C residual plot showing possible decrease in GSC 2537 0520 due to AML.

Acknowledgements

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References

- Bradstreet, D. H. 2005, *BAAS*, 201, 201.7502B
 Wilson, R. E. & Devinney, E. J. 1971, *ApJ*, 166, 606
 Wilson, R. E. 1990, *ApJ*, 356, 613
 Wilson, R. E. 1994, *PASP*, 106, 921
 Wilson, R. E. & Van Hamme, W. V. 1998, *BAAS*, 19310203V