VERY LONG PERIOD SUPERGIANT SEMIDETACHED AND CONTACT SYSTEMS

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It has been well known for some time that some close binary stars have a semidetached or contact configuration. Many late-type systems —— W WMa systems —— are known to have these configurations. Their dimensions are typically of solar mass to fractions of solar masses, and solar radius to fractions of solar radii. Early-type systems with semidetached and contact configurations have been found in recent years. Their typical dimensions are from several solar masses to tens of solar masses, and from several solar radii to tens of solar radii. Generally, both late and early-type close systems are located in the vicinity of ZAMS and TAMS in an H-R diagram. They are believed to be the result of case A or B mass exchange of close binary evolution. Some of us have been wondering why we do not find semidetached or contact systems with much larger dimensions consisting of supergiant stars?

For very wide binary pairs, the more massive components are not constrained by the critical equal potential surface until they are in their advanced phase of single star evolution. For example, an early-type (or massive) component could evolve into a supergiant (or giant) stage before the onset of mass exchange phase of the close binary evolution. It is expected, as a consequence of binary evolution, these systems may become semidetached or contact binary systems. Since these systems are evolved from well detached wide binary pairs, their periods may be the order of tens or over hundreds of days. Generally, observers (especially true for photometrists) favor the study of short period binaries. As a result, very long period binary systems are being ignored, with the exception of those of the atmospheric eclipsing systems.

Recently, photoelectric light curves are available for three very long period eclipsing binaries: PW Pup (CoD-30°5135) by Eggen (1983a); HD104901B by Eggen (1983b); and 5 Cet by Lines et al (1984). The first system has a β Lyr type light curve and the other two systems have W UMa type light curves. Their photometric light curves have been analyzed by us with the method of Wilson-Devinney. PW Pup (F2ep Iab + B, P = 158 days) was found to have an over-contact configuration. Due to the poor observational coverage of the light curves of this system

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we are unable to determine the mass ratio from our analysis. The system has over-contact (about 40%) solutions at mass ratio of 0.6, 1.1 and 1.6. For the system of HD104901B (FO Ib-II + B8Ib-II, P = 106 days), we found a semidetached solution. Again, the poor coverage and the scatter of the observations have prevented us from obtaining a unique value of mass ratio. For 5 Cet (K_2III + ?, Period = 96.4 days), our analysis has not been completed. It is suspected this system may be either in contact or semidetached. We believe that these very long period semidetached and contact systems are the consequence of case C binary evolution. Further extensive study of these systems if of vital importance in our understanding close binary evolution.

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