Wild Stars in the Old West
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66. On the nature of SW Sex

V. S. Dhillon[1], T. R. Marsh[2] and D. H. P. Jones[1]

[1]*Royal Greenwich Observatory, Cambridge CB3 0EZ, UK*

[2]*University of Southampton, Southampton SO17 1BJ, UK*

66.1. Abstract

We present spectrophotometry of the eclipsing nova-like variable SW Sex. The continuum is deeply eclipsed and shows asymmetries due to the presence of a bright spot. We derive a new ephemeris and, by measuring the eclipse width, we are able to constrain the inclination to $i > 75°$ and the disc, radius to $R_D > 0.6L_1$. In common with other members of its class (of which it is the proto-type), SW Sex shows single-peaked emission lines which show transient absorption features and large phase shifts in their radial velocity curves. In addition, the light curves of the emission lines show a reduction in flux around phase 0.5 and asymmetric eclipse profiles which are not as deep as the continuum eclipse. Using Doppler tomography, we find that most of the line emission in SW Sex appears to originate from three sources: the secondary star, the accretion disc and an extended bright spot. The detection of the red star allows us to constrain the radial-velocity semi-amplitude of the secondary to $K_R > 180$ km s^{-1} and hence the component masses to $M_1 \sim 0.3 - 0.7 M_\odot$ and $M_2 < 0.3 M_\odot$.

The Doppler maps (Figure 1) suggest a simple new model for SW Sex in which the dominance of single-peaked line emission from the bright spot over the weak double-peaked disc emission gives SW Sex its single-peaked profiles and forces the radial-velocity curves to follow the motion of the bright spot and thus exhibit large phase shifts. The transient absorption features in the Balmer-line profiles are mostly artifacts of the complex intertwining of the emission components from the secondary star, bright spot, and accretion disc and involve little true absorption. While the accretion disc and secondary star components of this model appear to be secure, the dominant bright-spot component fails in one important area – its inconsistency with the Balmer-line light curves. The eclipse profile requires the material emitting the Balmer lines to be eclipsed as early as phase 0.8, but which is not as deeply eclipsed as the continuum, exhibits a flat bottomed eclipse and then comes out of eclipse very sharply around phase 0.05. Although it is possible to explain the early ingress with a raised disc rim downstream from the bright-spot, the rapid egress is difficult to account for without speculating that either there are regions of strong Balmer absorption in the disc whose changing visibility during eclipse alters the shape of the light curve, or that there is Balmer emission from above the orbital plane which shares the velocity of the bright-spot.

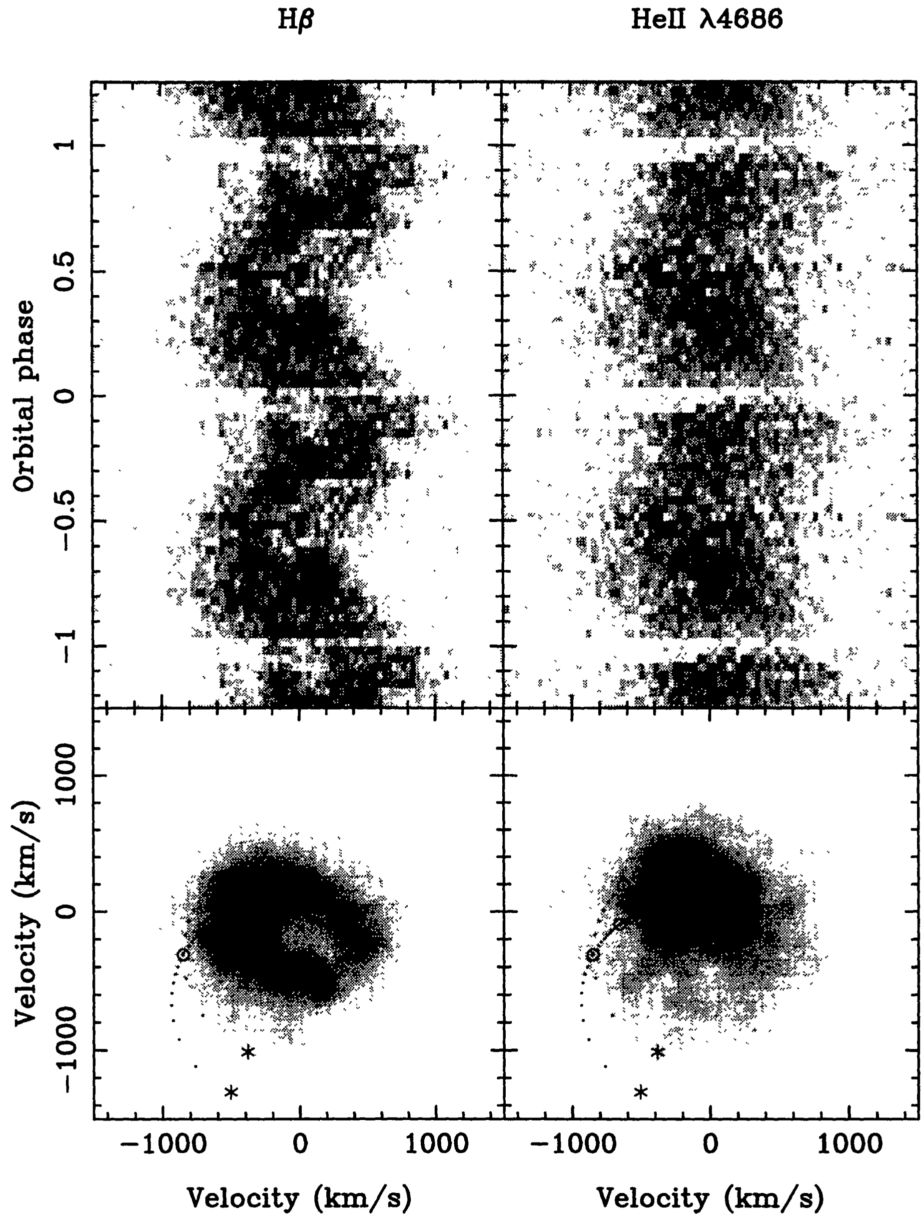

Figure 1. Upper panel – trailed spectra of Hβ and He II λ4686 Å in SW Sex. Lower panel – the corresponding Doppler maps. The three crosses in each map are, from top to bottom, the centres of mass of the secondary, the system and the white dwarf. The predicted outline of the secondary star is marked along with the gas stream and the Keplerian velocity of the disc along the gas stream (the lower and upper curves, respectively). The series of small circles along the gas streams mark the distance from the white dwarf at intervals of $0.1L_1$, ranging from $1.0L_1$ at the secondary star to the point of closest approach (marked by an asterisk).