THE ALL-VARIABLE BINARY WR140 (HD 193793, WC7+O4, P=7.94 yr)

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Recently Williams et al. (1990, *M.N.R.A.S.* **243**, 662) presented new observations of the WC7+O4-5 Wolf-Rayet system HD 193793 (WR140) made between 1979 and 1989 at infrared, radio, UV and X-ray wavelengths. Striking variations were evident in all four regimes.

The most complete coverage was in the infrared, where the light curves at JHKLMN defined the 1985 outburst, when the infrared flux increased by up to a factor of ten on a time-scale of weeks before declining more slowly. The infrared observations were interpreted in terms of the formation of $2.8 \times 10^{-8} M_{\odot}$ carbon in the wind of the WC star at a distance of about $2400 R_{\star}$ between 1985.21 and 1985.54 and the subsequent cooling of the dust as it was carried away in the wind. Combined with earlier data, the infrared light curves led to a new period of 2900 ($\pm$10) days (7.94 yr). Re-analysis of published radial velocities using this infrared photometric period led to new elements for this system: $e = 0.84 \pm 0.04$, $\omega = 32° \pm 8°$ and $T_o(1985) = JD2446160 \pm 29$ (1985.26$\pm$0.08). Periastron passage coincided with the onset of grain formation.

The X-ray luminosity was 1-2 orders of magnitude above that of single O or WR stars, arguing for X-ray generation by interacting winds. Four X-ray observations made with *EXOSAT* showed evidence for greater extinction in the 1 *keV* region in mid-1985 than in 1984, indicating that the X-ray source moved deeper in the Wolf-Rayet star's wind, along with the O4-5 star, during periastron passage. The variation of circumstellar extinction and the dimensions of the orbit were used to determine independent information on the composition of the Wolf-Rayet wind. A *CNO* nuclei content equivalent to a fractional abundance $n_C \approx 0.06$ was derived: intermediate between the solar value and that predicted by contemporary models of evolved massive stars.

The available *IUE* high resolution spectra show 'eclipse' effects, particularly in the *SIV* and *CIV* resonance lines, around phase 0, when the O star is behind the extended atmosphere of the WR star, providing insight in the absorption component of the composite spectrum.

The radio observations show two components to the flux from WR140: the constant free-free emission from the stellar wind and a strong non-thermal source suffering variable extinction as it moves through the WC7 star's wind along the orbit of the O star. The free-free component and assumptions of distance, composition and ionization lead to a mass loss rate of $5.7 \times 10^{-5} M_{\odot} yr^{-1}$. It is shown that the Wolf-Rayet wind is not isotropic but has a low density cone in the shadow of the O star wherein the attenuation is 1-2% of that of the undisturbed wind. The intrinsic 2-11 *cm* spectral index of the non-thermal source is $\alpha = -0.5$. Recent (March, 1990) *WSRT* 6 *cm* radio observations show the predicted reappearance of the non-thermal radio source, which surprisingly also makes it self know at 21*cm*.

K. A. van der Hucht and B. Hidayat (eds.),
Wolf-Rayet Stars and Interrelations with Other Massive Stars in Galaxies, 251.