RADIO MONITORING OF THE NON-THERMAL WOLF-RAYET OBJECTS WR125, WR146 AND WR147

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Abstract. The radio emission from WR125 (WC7+O9) has faded to a new low, apparently below its stellar wind level, while continuous, variable non-thermal emission has been observed from WR146 (WC6) and WR147 (WN8).

Key words: stars: Wolf-Rayet – binaries – non-thermal radio emission

The first WR star to show non-thermal radio emission was WR140 (HD 193793, Florkowski & Gottesman 1977). Subsequent observations showed that this emission varied with the binary period of 7.94 yr. At minima, only the free-free emission from the stellar wind is observed. This is periodically augmented by strong non-thermal emission from an intrinsically variable source suffering variable circumstellar extinction (Williams *et al.* 1990, Becker & White and Williams *et al.* these proceedings). We now know several WR stars having non-thermal radio emission (see van der Hucht *et al.* 1992) and have been monitoring a sample for variability.

WR125 (WC7+O9) has many characteristics in common with WR140, including episodic dust formation and variable non-thermal radio emission, (Williams *et al.* 1992, 1994). The radio emission from WR125 faded in the mid–1980s to a level (0.8 mJy at 6cm) consistent with emission by the WC7 stellar wind. We are monitoring it for the return of the non-thermal emission but were surprised to observe, in monthly one-hour *VLA* observations between 1992 February and 1993 April, only the upper limits: 0.13 mJy at 2cm, 0.17 mJy at 6cm, and 0.57 mJy at 20cm — below what had been thought to be the wind level. Whether the mass loss really fell or the distance (4.7 kpc) had been underestimated remains to be determined.

WR 147 is a complex radio source (Moran *et al.* (1989), Churchwell *et al.* (1992), Davis *et al.* these proceedings) with two primary components of which the southern is coincident with the WN8 star and has the spectral index of free-free emission. The northern component (separation about 580 *mas*) has a non-thermal spectrum. These are not resolved with the *WSRT* but we have used "filler" time to monitor the total flux from the system. The *WSRT* radio light-curves of WR147 (Fig. 1) show variability (25% at 6cm

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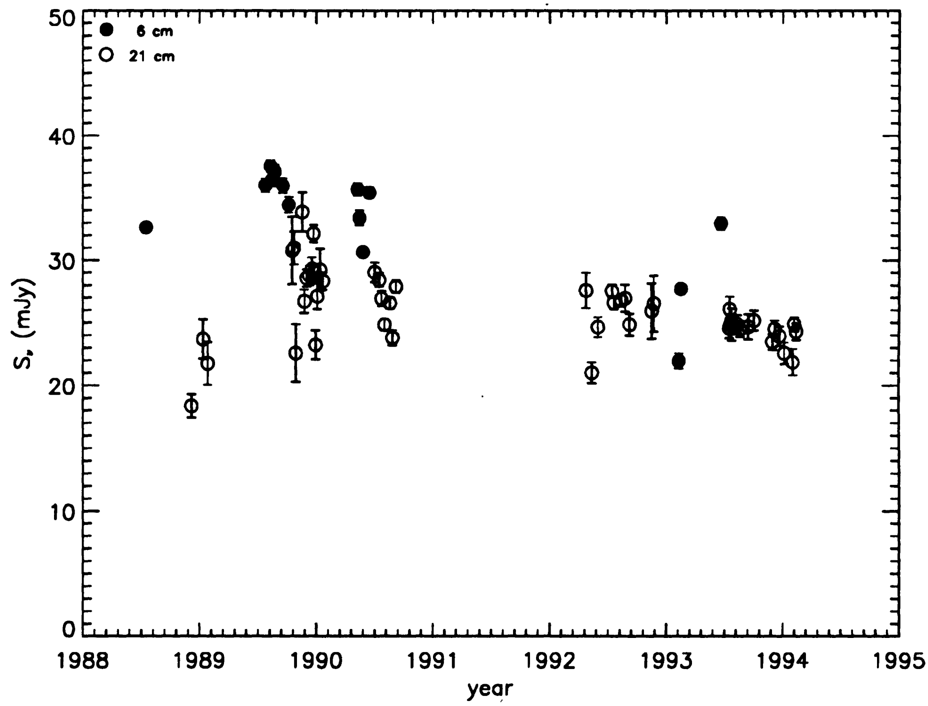

Fig. 1. Radio observations of WR147 at 6cm (•) and 21cm (o).

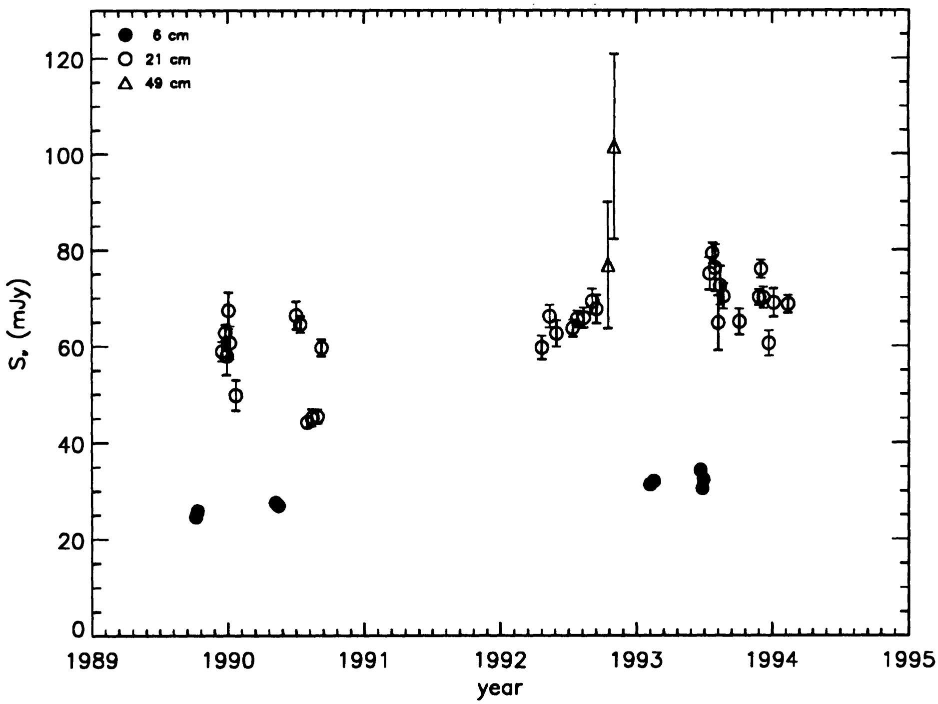

Fig. 2. Radio observations of WR146 at 6cm (•), 21cm (o) and 49cm (Δ).

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and 40% at 21cm) on a time-scale of weeks. We do not have simultaneous observations at the different frequencies so cannot determine spectral indices but the larger amplitude at the longer wavelength suggests that it is the non-thermal source that varies.

Felli & Massi (1990) reported non-thermal radio emission from WR146 (WC6, Smith *et al.* 1990) Its ionization and C/He ratio resemble those of WR140 in appearing anomalous for its spectral subtype (Eenens & Williams 1992), suggesting wind interaction. We have observed it with the *WSRT* since 1989 at 6cm, 21cm and 49cm. The data given in Fig. 2 reveal variability on a time-scale of months together with a slow rise over the years. The 6–21 cm spectral index calculated from the *mean* fluxes is $\alpha \sim -0.7$.

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