RS OPHIUCHI - A RECURRENT NOVA WITH TWIN JETS

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ABSTRACT An analysis of European VLBI data of nova RS Ophiuchi shows the presence of a linear jet-like structure which has a brightness temperature of 10^7K at 1.7 GHz. This ejection is shown to be two sided and the 1.7 GHz emission is non-thermal. The light curves show the presence of a second, thermal component emerging at higher frequencies at a later epoch.

1. THE VLBI OBSERVATIONS

The recurrent nova RS Ophiuchi went into outburst on January 26th 1985 (Morrison 1985). The radio light curve was monitored initially at Jodrell Bank at 4.9 GHz (Padin et al. 1985) and from March 1985 by the VLA at its four operating frequencies (Hjellming et al. 1986). The behaviour was clearly very different from a classical nova, and from the rapid development of the radio light curve it was clear that the brightness temperature was much in excess of 10^4K. Observations were subsequently carried out with four antennas of EVN at 1.7 GHz on 13th April 1985. We used the Mk III recording system with 28 MHz bandwidth and the noise level on Jodrell-Bonn, the most sensitive baseline, was 0.4 mJy in 13 min integration. By global fringe fitting around one triangle of telescopes, a set of closure phases were measured. The hybrid map so obtained is shown in Figure 1. Because of the weakness of the source and the sparceness of the u-v coverage simulations were made to check the three component structure of the source. No one-sided ejection model can be fitted satisfactorily to the data. The map enables brightness temperatures for the three components to be calculated and values of $1.0 \pm 0.1 \times 10^7$K were obtained.

2. INTERPRETATION AND DISCUSSION

We initially tried to fit these observations with thermal emission from 10^7K gas. However, the level of X-rays measured with the Exosat satellite rules out the presence of sufficient 10^7K gas to produce this radio emission. The 1.7 GHz flux density must therefore be non-thermal and

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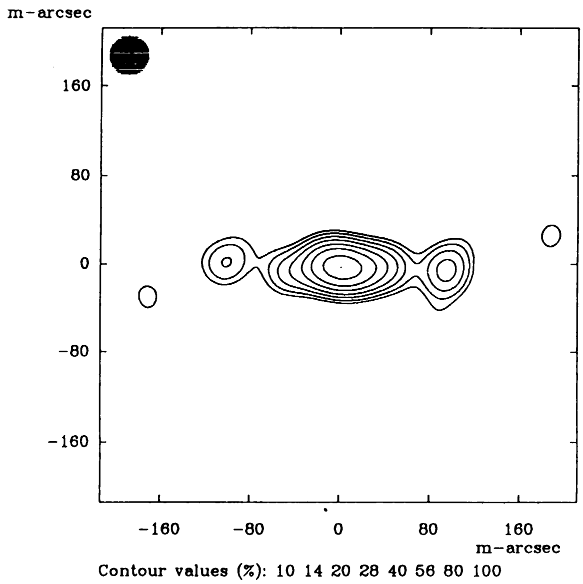

Figure 1. The EVN map made on 13 April 1985 at 1.7 GHz. The peak is 8.8 mJy and the resolution is 35 mas.

the synchrotron mechanism can easily fit the observations.

As the nova progresses a new spectral component emerges at high frequencies. The non-thermal flux extrapolated from 1.7 GHz has been subtracted from the other frequencies with a spectral index of $\alpha = -0.08$ and a new set of light curves were generated. These curves stay high ($\sim$23 mJy at 22 GHz) for $\simeq$100 days (cf. 30 days at 1.7 GHz) and initially have a spectral index of $\alpha \simeq +1$ thereafter decreasing. Thus there appears to be a two component spectrum, primarily non-thermal at 1.7 GHz with a thermal component emerging at higher frequencies.

Comparison of the total angular extent from the VLBI observations, and reinterpreted 15 GHz measurements made with the VLA but using the one dimensional model as seen in the VLBI map, indicate non-decelerating flow at 3800 km s^{-1}. This tangential velocity agrees well with the maximum radial velocity of 3500 km s^{-1} seen shortly after optical maximum.

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