UNRAVELLING THE MULTIPLE COMPONENT RADIO EMISSION OF RS OPH IN OUTBURST

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ABSTRACT VLBI observations of RS Ophiuchi during its 1985 outburst enable us to start to disentangle the multiple component radio emission. It appears that the emission at low frequencies was predominantly non-thermal, whereas at high frequencies the emission is most likely thermal. It is then possible to probe the physical properties of the remnant.

1. INTRODUCTION

RS Ophiuchi is a recurrent nova which has undergone 5 recorded outbursts, the latest of which was on 1985 January 26th ($t=t_o$). Radio observations showed a rapid rise in flux to a peak around 1 month from outburst (Hjellming et al 1986). Radio spectra showed the presence of at least two components, one at low frequencies with spectral index typically -0.08, and another at high frequencies with index of order +0.5.

2. OBSERVATIONS AND RESULTS

Single baseline (Jodrell-Effelsberg) observations at 4.9GHz were carried out on 1985 March 8th (day 40). A good fit to the limited data can be obtained with a 30mJy source of angular size 8m.a.s.. As the total 4.9GHz flux on day 40 was 60mJy, this suggests a possible core-halo structure. Far more information on the source geometry was derived from 1.7GHz observations on April 13th (day 77) using data from the Jodrell, Effelsberg and Westerbork telescopes. We have re-analysed the visibility data, but essentially derive a best fit source geometry very similar to that given in Porcas et al (1987). This consists of a dominant central source and two symmetrically placed weaker sources, forming a linear structure of total extent around 200m.a.s. at approximately position angle 90^o.

3. DISCUSSION AND CONCLUSIONS

The brightness temperature of the radio central source on day 77 is $6x10^6$K. This implies brightness temperatures on day 55, when the first EXOSAT data were obtained (Mason et al 1987), in excess of 10^7K. If the radio and X-ray emission arise from the same mass of gas, such high thermal temperatures would give rise to around 100

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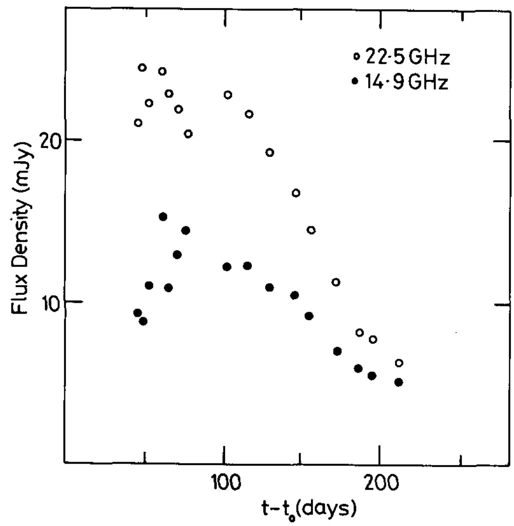

Fig. 1. Thermal radio light curves (see text for details).

times the X-ray flux observed. Thus the low frequency flux at early times must be non-thermal.

A thermal interpretation of the high frequency emission is permitted as $T_b \simeq 10^5$K here. Figure 1 shows the light curves which result by subtracting the non-thermal component, assumed to have spectral index -0.08 and to dominate the flux at 1.5GHz, from the high frequency fluxes. The results are now similar to the radio development of classical novae. These light curves also resemble those of the coronal lines (e.g. [FeXI], Snijders 1987). Simple arguments lead to an emitting mass of gas around $2 \times 10^{-6} M_\odot$, with kinetic energy of order 2×10^{43} ergs. The equipartition field strength of 52mG in the central component is similar to that required by Bode and Kahn (1985) to explain anisotropic ejection. The efficiency of conversion of the outburst energy into relativistic electrons and enhanced fields (around 0.1%) is similar to that in young supernova remnants (Reynolds and Chevalier 1984). A full discussion of this work will be given in Davis et al (1987, in preparation).

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