

MERLIN OBSERVATIONS OF EXTENDED EMISSION AROUND GRS 1915+105.

S. J. NEWELL, R. E. SPENCER, F. H. JOWETT
NRAL, Jodrell Bank, Cheshire, SK11 9DL, UK

Abstract. We present MERLIN observations of the exciting X-ray transient GRS 1915+105. Previous radio observations of GRS 1915 have shown that it is a source of superluminal radio jets. The emission of anti-parallel radio knots has led to this being described as a ‘microquasar’. MERLIN observations presented here show further details of the structure. The two main features observed are a bright extension in the direction of the superluminal jet and also, an extended region of low brightness which is elongated almost at right angles to the jet. This latter feature could either be an associated nebulosity or the remains of a jet which has undergone a radical change in direction.

GRS 1915+105 was originally detected as an X-ray transient by the WATCH all-sky monitor on board the GRANAT satellite (Castro-Tirado, Brandt & Lund 1992). Its importance was not fully realised, however, until VLA observations were taken immediately after a flaring event in 1994 March (Mirabel & Rodriguez 1994; hereafter MR94). These observations showed a pair of anti-parallel radio knots (in the NW–SE direction) which were moving ballistically out from the central core of the system. The radio knots were emitted inclined to the line of sight and were undergoing relativistic beaming. The apparent proper motions of the two knots gave apparent velocities of the knots on the plane of the sky of $1.25 \pm 0.15 c$ and $0.65 \pm 0.08 c$ (MR94). From this an intrinsic velocity of $0.92 c$ at a jet angle 70° to the line of sight was deduced (MR94). This velocity is obviously far greater than the values seen in the other X-ray binaries and so required further study.

We observed GRS 1915 using the full MERLIN array at 408 MHz on 1994 November 28, a few days after a small outburst. The results of mapping the data using natural weighting are very interesting (Fig. 1). The resolution

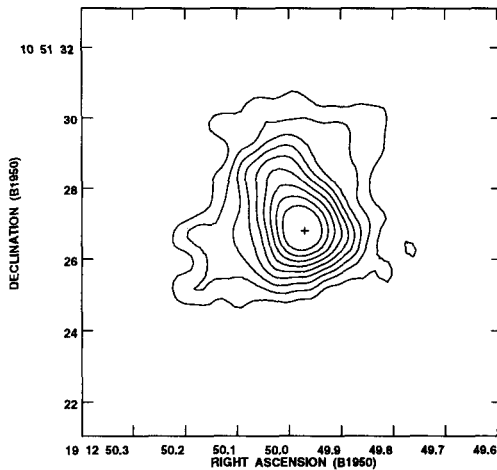


Figure 1. MERLIN map of GRS 1915. The NW–SE orientation which was observed in the original maps (MR94) can be seen. The new extension at right angles to the jet is also quite clear. The peak flux in this map is $15.3 \text{ mJy beam}^{-1}$. The contours are at $-3.0, 4.0, 5.0, 6.0, 7.0, 8.0, 9.0, 10.0, 11.0$ and 12.0 times $1.1169 \text{ mJy beam}^{-1}$.

of this map picks up a region of lower brightness which surrounds the source. This could be caused by:

1. Precession of the jet as seen in SS433. It is not clear, however, how we link the closely aligned ‘jet’ from the high resolution map with the idea that this jet has undergone precession. It is possible that we may be seeing the jet from an earlier period prior to the current alignment but this is not at all certain and requires more investigation
2. A low brightness nebulosity surrounding the source. This could be a gaseous halo around the source, or something more akin to a supernova remnant. Possibly this is material dumped into the ISM by leakage from the jets or released by the interaction of the jets with a supernova remnant.

We have verified the presence of a jet in this source which appears to agree with the observations of Mirabel & Rodriguez (1994). We have also added to the questions to be answered with our discovery of the low brightness nebulosity surrounding the source.

References

- Castro-Tirado, A.J., Brandt, S, Lund, N, 1992, IAUC 5590
 Mirabel, I.F., Rodriguez, L.F., 1994, *Nature*, **371**, 46 (MR94)