

UNUSUAL RADIO STRUCTURES IN MARKARIAN 6

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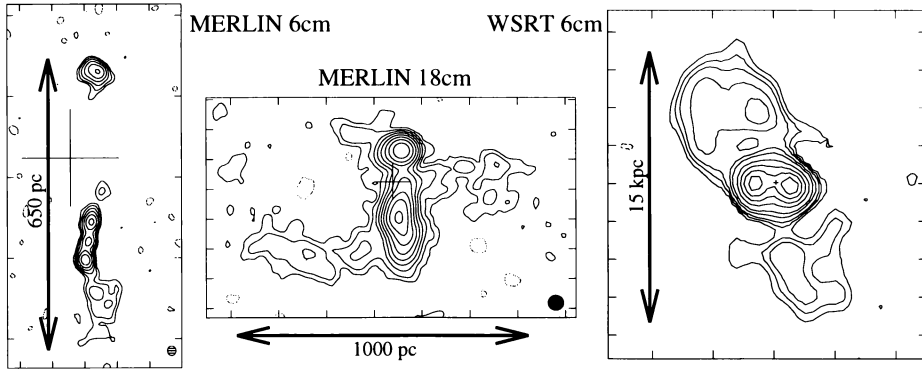
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Markarian 6, a Seyfert Galaxy of type 1.5, is one of several Seyfert nuclei to be observed with MERLIN at 6 and 18 cm as part of a project to investigate the radio structures of these objects on sub-arcsecond scales (corresponding to scales of a few tens of parsecs at typical distances). The angular resolution of MERLIN at 6 cm is equivalent to that of the HST, making the radio images ideal for comparison with HST images of the optical Narrow-Line Region (NLR). In this paper we briefly discuss the results of our MERLIN observations of Markarian 6, along with a 6-cm Westerbork Synthesis Radio Telescope (WSRT) map of the arcsecond (kpc) scale radio emission. The data is discussed in more detail by Kukula *et al.* (1996) and Baum *et al.* (1993).

The 6-cm MERLIN map reveals one of the best examples of a highly-collimated radio jet ever seen in a Seyfert galaxy. This is all the more remarkable considering that Mrk 6 is a Type 1.5 object. Recent studies have shown that whilst approximately 50% of Seyfert 2s feature some kind of extended radio structure, Types 1 and 1.5 almost invariably contain only a single unresolved point source (Kukula *et al.* 1995).

The jet is highly collimated, extending for 645 pc (assuming $H_0 = 75$) along PA 180°, and is strikingly similar in size and appearance to the jet in Markarian 3, a nearby Seyfert 2 (Kukula *et al.* 1993). The jet contains 6 distinct radio knots, but none of these are obviously associated with the peak of the optical continuum emission (marked by a cross on the contour



plots). However, the overall shape of the jet corresponds closely to the structure of the optical NLR as shown in the HST image of Capetti *et al.* (1995).

On a slightly larger scale, the 18 cm MERLIN map shows several highly unusual features which emerge from the sides of the jet and extend for several hundred parsecs to the east and west, *ie* orthogonal to the direction of the jet. We know of nothing comparable to these structures in any other Seyfert.

On a still larger scale the 6-cm Westerbork map shows large, edge-brightened lobes of emission to the NE and SW of the bright nuclear component (note that the nuclear component itself has been subtracted from this image), covering a region $\sim 40''$ (15 kpc) in extent. The position angle of the lobes is 30° , similar to that of the minor axis of the host galaxy (40°). We speculate that these structures are in fact shells created by material which is drifting out of the nucleus due to buoyancy effects.

Thus, Mrk6 exhibits complicated radio structures on a variety of scales and position angles. It is interesting to note that if these structures are the relics of a series of outbursts of activity then this suggests that the orientation of the central engine has altered with time.

References

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