



# Linear Radio Structures in Selected Seyfert and LINER galaxies



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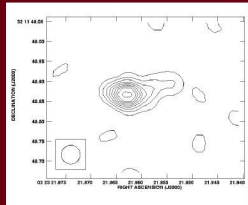
## Introduction & Scope

High resolution radio observations have revealed double and triple radio sources in many Seyfert nuclei, suggesting that the collimated ejection of material is occurring in these objects in the same way as the radio jets in quasars and radio galaxies. However, very few Seyfert galaxies have been found to have radio structures that can be described as jets.

## Observations & Data

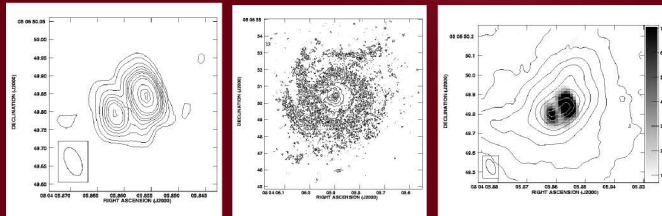
In order to understand the relationship between the relativistic ejecta and the optically-emitting ionized Narrow Line Region gas at the small scale of a few parsecs, we have selected 7 Seyfert galaxies from the Extended 12 micron sample that show evidence of collimated ejection and observed them with MERLIN at 5 GHz. We then compared these high resolution radio maps with the equivalent resolution HST images.

## Mrk 1034



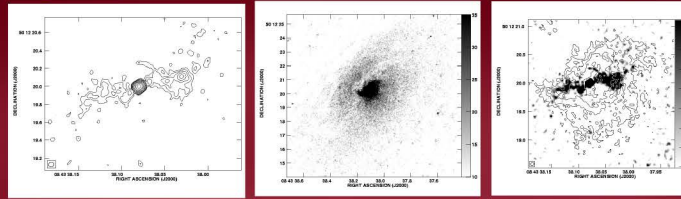
The MERLIN 5 GHz map (0.04" resolution) of one of the Seyfert 1 galaxies pair that are interconnected (Ark 80 & 81 -> here is Ark 81) shows an E-W elongated radio structure (20 mas) with a 10 mas jet extension to the E which is consistent with a highly collimated radio jet in that direction.

## Mrk 1210



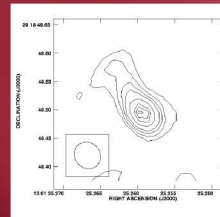
The MERLIN 5 GHz map (left) overlaid on the HST/ACS HRC near-UV image, 0.027" resolution (middle) and shown on the right, reveals a double nucleus in this amorphous Sy 2 galaxy.

## NGC 2639

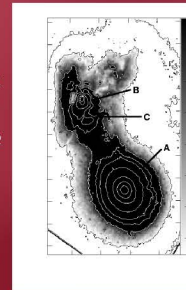


The MERLIN 5 GHz map (left) overlaid on the HST/ACS HRC near-UV image (middle) and shown on the right, reveals a bright core and symmetrical east-west 'wings' with rich structure (multiple knots). The radio emission follows closely the UV star formation morphology in this LINER megamaser galaxy.

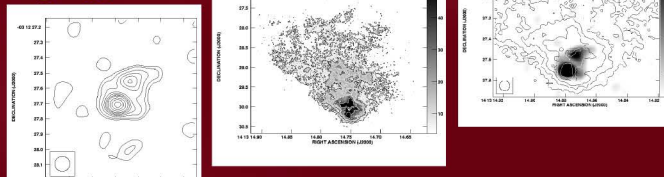
## NGC 4922



The MERLIN 5 GHz map to the left detects the middle component C, PGC 044896 (FIRST radio source), from the three galaxy system (NGC 4922A/B, both Seyfert 2) as shown in the WFPC2 (F606W) image on the right. The radio structure is elongated in NE-SW direction, in good agreement with the orientation of the interacting galaxies

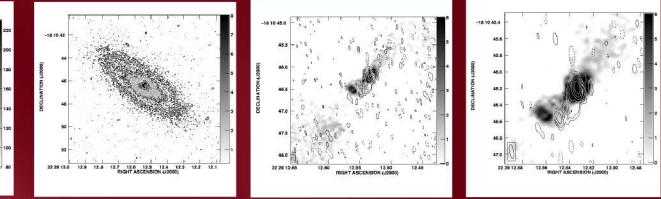


## NGC 5506



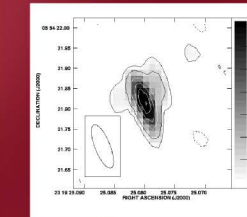
The MERLIN 5 GHz image (left) overlaid on a near-UV FOC image (middle), shown on the right reveals a NW radio loop that follows closely the rich UV emission.

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The MERLIN 5 GHz map is overlaid on the HST/WFPC2 Ha image shown in the middle and left. The multiple knot radio structure coincides with the nucleus and then follows the Ha emission in the larger scale (lower left in the middle image). (Left) The average red/green continuum image.

## JC 1481



The MERLIN 5 GHz map of this LINER water maser galaxy and a possible site of ongoing merger, shows a NE-SW elongated structure which agrees with VLBI observations that have shown that water maser emission is associated with thin, parsec-scale molecular disks located near the spout of radio continuum jets.

## Discussion

All 7 galaxies show complex extended structures. Using these data we: a) investigate the variety of collimated ejection in low luminosity AGN and increase the small number of multiple component "jets" known b) determine the alignment of the collimated ejection on scales of a few parsecs and compare this alignment with estimates made from extended NLR studies from HST and other optical observations. In the future we plan to use hydrodynamical simulations and multiwavelength data in order to constrain the bow shock and similar models and get a more complete picture of low luminosity AGN. The 5 GHz nuclear continuum emission will be compared with 22 GHz water maser observations of a number of these objects (Xanthopoulos et al. 2005, in preparation).