Abstract: We present multi-frequency radio observations from the Very Long Baseline Array (VLBA) of selected AGN that have B-field structures with a central “spine” of B-field orthogonal to the jet and a longitudinal B-field near one or both edges of the jet. We find transverse RM gradients across a number of these jets, consistent with the idea that helical jet B-fields are the origin of this polarization structure. One of our sources shows a “slanted” RM gradient, which may be due to the combination of a helical jet B-field and a fall-off in electron density from the core. Future work will include testing the hypothesis that these jets have helical B-fields by jointly analyzing their transverse intensity, polarization and RM profiles.

**Observations and results**

Observations of 24 AGNs with “spine-sheath” polarization structure were obtained at 4.6, 5.1, 7.9, 8.9, 12.9 & 15.4 GHz with the VLBA on the 27th and 28th of September 2007. The data were calibrated and imaged in the NRAO AIPS package using standard techniques. Images for roughly half these sources have now been made.

We have found well ordered transverse RM gradients providing evidence for helical magnetic fields in several objects. The examples in Figs. 1-3 show 4.6-GHz intensity contours with the RM maps superposed in colour.

**Faraday Rotation**

When the linearly polarized EM wave travels through magnetized plasma, the polarization angle $\chi$ rotates. In the simplest case, the rotation is proportional to $\lambda^2$ and its sign is determined by the direction of the line-of-sight B-field:

$$\chi = \chi_0 + \text{RM} \times \lambda^2$$

where $\chi_0$ is the unrotated polarization angle, $n_e$ is the electron density and $B_{||} \ dl$ is the line-of-sight magnetic field.

**Observations and results**

Observations of 24 AGNs with “spine-sheath” polarization structure were obtained at 4.6, 5.1, 7.9, 8.9, 12.9 & 15.4 GHz with the VLBA on the 27th and 28th of September 2007. The data were calibrated and imaged in the NRAO AIPS package using standard techniques. Images for roughly half these sources have now been made.

We have found well ordered transverse RM gradients providing evidence for helical magnetic fields in several objects. The examples in Figs. 1-3 show 4.6-GHz intensity contours with the RM maps superposed in colour.

**References**


Figure 1 shows a monotonic transverse RM gradient across the core and jet of 1633+382. 4.6-GHz intensity contours are shown. RM slices across the core and jet are shown on either side.

Figure 2 shows two oppositely directed transverse RM gradients in the core and jet of 0923+392. This could be due to a “nested-helix” B-field structure, where the B-field emerging with the jet closes in the outer accretion disk (Mahmud et al. 2009).

Figure 3 displays a transverse RM gradient in the core region and a slanted RM gradient across the jet of 0333+321 (top image), confirming the results of Asada et al. (2008, bottom image). RM slices across the core, inner jet and outer jet are shown. Such a well ordered but oblique RM gradient could be the result of a transverse RM gradient + a decreasing RM along the jet, for example, due to a helical magnetic field combined with a fall-off of electron density/magnetic field strength with distance from the core.

Figure 4 shows simple calculated RM fields for combined gradients along and transverse to the jet for cases when the transverse gradient is symmetric (top) and predominantly of one sign (bottom). The core is located to the left and the jet axis is horizontal and located halfway up the panels. The RM scales are shown to the right.