The Parsec-Scale Magnetic Field Properties of Low-Optical Polarization Blazars

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Past variability studies[1] of flat-spectrum, compact extra-galactic radio sources have suggested that low- and high-optically polarized quasars (LPQ/HPQ) are the same type of object, differing only in the angle their relativistic jets make to the line of sight. This view has been challenged, however, by recent millimeter-wave polarization observations[2,3] which indicate intrinsic differences in the inner magnetic field properties of the two classes. The inner jets of LPQs tend to have lower fractional polarizations than HPQs, and inferred magnetic field directions that are mostly parallel to the jet. The magnetic fields of HPQs, on the other hand, lie mainly in a transverse direction. The latter configuration is a prediction of the standard shock-in-jet model[4], in which a portion of a jet undergoes a strong transverse compression, thereby enhancing the perpendicular components of an originally tangled magnetic field.

The main goal of this study is to establish a connection between the optical polarization and magnetic field properties of the inner jets of blazars. The magnetic field orientations of several HPQs have been shown to be stable over many years[2], which may be due to standing shock(s) located close to the base of the jet. Since these shocks are able to produce large amounts of optically polarized synchrotron radiation, their presence may very well determine whether an object is classified as an HPQ or LPQ.

We have imaged the parsec-scale jet regions and magnetic fields of 11 LPQs with the Very Long Baseline Array (VLBA) at 43 and 22 GHz, and have obtained near-simultaneous optical polarization data for the sample. We discuss correlations between the optical and radio polarization data, and compare the LPQ properties to those of a sample of HPQs presently being monitored with the VLBA and JCMT at mm and sub-mm wavelengths, respectively[5].

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References

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