Science Plan 96-97

The kinematics of decelerating relativistic jets will be modeled and compared in detail with VLA imaging and polarimetry of the bases of well-resolved FRI radio jets at high angular resolution and high sensitivity. It is becoming clear that relativistic jet deceleration on kiloparsec scales within elliptical galaxies is a key factor in determining whether an AGN radio source develops the edge-darkened, plumed FRI morphology or the edge-brightened, double-lobed FRII morphology. Also, that the intensity asymmetries and apparent polarization states of well-resolved jets providu powerful constraints on the jet kinematics once one accounts fully for both (a) Doppler boosting of the intensities and (b) relativistic aberration of the apparent polarization.

With Robert Laing (RGO) and others, I will work on modeling of magnetic field configurations and velocity fields in decelerating relativistic jets, guided by detailed comparisons with high-quality VLA imaging, primarily of 3C31 at 8 GHz and NGC 315 at 5 GHz. These sources are chosen as bright, well-resolved jets at intermediate angles to the line of sight, offering particularly rich arenas for comparison with the predictions of the models. If successful, this work should provide the first firm constraints on the dynamics of relativistic jet deceleration by entrainment from the atmospheres of elliptical galaxies.

Studies of the spectral index and depolarization asymmetries of the lobes in a sample of powerful double-lobed radio galaxies with detected radio jets will be continued. These results suggest that a separable mixture of relativistic and intrinsic effects governs the large-scale asymmetries of powerful double radio sources, and reinforce the notion that some of the energy transport in powerful radio sources is in Doppler-hidden beams within the observed radio jets (which are then understood primarily as a boundary-layer phenomenon). VLBA imaging will be used to explore possible ultra-compact structure within the jets of 3C219, which may be another hint of such a high-speed "inner beam" or "jet spine".

Earlier work on the jet-counterjet asymmetries and jet prominence in a small, complete sample of 3CR quasars produced suggestive evidence for both relativistic bulk motion and jet deceleration on large scales (as far as the hot spots and possibly beyond) in these objects. This work will be extended to a larger sample using new VLA observations at 8 GHz.