

NATIONAL RADIO ASTRONOMY OBSERVATORY
Edgemont Road, Charlottesville

9 July 1986

TO: Bob Havlen

FROM: Alan Bridle

RE: Material for annual BAAS Report

Bridle, with R.A.Perley (NRAO) and R.N.Henriksen (Queens U., Canada) completed a study of the collimation and polarization properties of the jet and counter-jet in the powerful radio galaxy 3C219. The jet is not free, but may instead be both brightened and collimated by interaction with hot gas that is bound to the cluster of which 3C219 is a member. The polarization properties of the jet qualitatively resemble those predicted by the Konigl-Choudhuri model of a confined, magnetized jet, but the quantitative agreement is poor. The major asymmetries of the jet and counter-jet can be ascribed to bulk relativistic motions in an intrinsically symmetric jet/counter-jet system if the jet contains moving shocks. Other descriptions are also possible, however, particularly if the outflow in 3C219 is unsteady or if the hot gas around 3C219 is clumpy.

Bridle, with R.H.Sanders (U.Groningen) and B.G.Clark (NRAO) used the VLA in its A configuration at 20cm to study the orientations of all 157 radio sources from the B3 survey that are within 3 degrees of a field in which Sanders had previously found a tendency toward parallelism in a subset of the B3 sources. The orientations of the 83 sources resolved by the VLA in this new sample are random at all separations from 0.5 to 5 degrees. This casts doubt on the astronomical reality of the previously claimed alignments (as well as on their interpretation as being due to gravitational distortion of the images of distant sources).

S.Baum (NRAO/U.Maryland) with Bridle, T.Heckman (U.Maryland), G.Miley (S.T.S.I.) and W.van Breugel (U.C.Berkeley) has used the VLA to survey the 20cm, 6cm and 2cm continuum emission from a complete sample of strong radio galaxies that are close to the celestial equator and have hitherto been little studied by synthesis telescopes. A parallel study of optical line emission from these galaxies is in progress. A goal of this work is to examine the relationships between extranuclear optical narrow line emission and the polarization properties of the radio sources, and thus to test models of the interactions between radio sources and ambient gas.

Bridle and R.Laing (R.G.O.) compared multifrequency VLA imaging of the radio source 3C272.1 in the Virgo cluster elliptical M84 with data on the source at 11cm from the Cambridge 5-km Telescope, at the optical emission lines of H-alpha, [OII], [NII] and [SII], and X-ray

data at 0.5-3 keV. They found a systematic pattern of Faraday rotation measure variations across the radio source. Several lines of evidence suggest that this rotation occurs mainly in a magnetoionic medium that lies in front of, and near, the radio source, within the inner few kiloparsecs of M84. The comparison with the optical line emission and radio depolarization data shows that the medium producing the Faraday rotation is generally not the source of the optical emission lines. It may however be a "sheath" around the radio source in which the Faraday depth has been increased by compression of a high-temperature phase of M84's ISM owing to its interaction with the source. This phase may correspond to an extended feature of M84's X-ray emission.

NRAD Service Activities 1986 --- A.H.Bridle

1. Observatory Committees

Chair, Scientific Staff Search Committee
Member, Tenure Committee
Member, NRAO Council (until January 1987)

2. AIPS Group

Chair, AIPS Management Advisory Group (meets monthly)
- I set the agenda for this group, and produce meeting minutes and a monthly calendar of critical dates and task assignments for the AIPS group
Chair, AIPS Priorities Meetings (meet quarterly)
AIPS Progress Review (I attend weekly lunch meeting of group)

Scientific liaison with AIPS Group programmers
- I advise Eric Greisen (AIPS Project Manager) on management issues that arise between management Group meetings, and on scientific priorities
- I have been testing the new AIPS calibration software written by Bill Cotton and am collaborating with him on designing and documenting it
- liaison with VLA staff on AIPS priorities issues
- liaison with outside user groups about AIPS development needs and AIPS services

Documentation
- I now co-edit the quarterly AIPSLETTER with E.Greisen
- AIPS Cookbook (with E.Greisen, quarterly minor updates, annual larger-scale revision)
- HELP/EXPLAIN files (revisions, documentation for new tasks)

AIPS Site Survey (with D.Wells and N.Wiener)
- survey design
- data base management
- statistical analysis and reporting

3. VLBA

Member, Site and Configuration Committee

4. VLA

When at the VLA, I act as an official contact person for visiting observers and/or "Night Scientist". I have also participated in the conceptual design of the image processing rooms and other user facilities for the new Socorro building. I attend VLA staff meetings and Research Equipment meetings when possible.

Miscellaneous Professional Activities 1986 --- A.H.Bridle

NRAO Publications edited

R.A.Perley, F.R.Schwab and A.H.Bridle, "Synthesis Imaging", Course Notes of an NRAO Summer School held in Socorro, New Mexico on August 5 to August 9 1985, (published August 1986)

A.H.Bridle and E.W.Greisen, "The AIPS Cookbook: 15OCT86". (published October 1986)

Scientific Meetings attended

Aspen Center for Theoretical Physics workshop on "Astrophysical Jets", 9-29 June. Organised session on "Large Scale Jets in Radio Galaxies and Quasars", presented invited review paper on "Internal Structures of Kpc-scale Jets", contributed paper on "Magnetic Field Configurations in Jets" and display paper on "Rotation Measure and Magnetic Field Structure in M84"

Green Bank Workshop on "Radio Astronomy from Space", 30 Sept - 2 Oct
Chaired session on "Centimeter-Wavelength Astronomy".

Refereeing

Research grant and fellowship proposals -- National Science Foundation, Natural Sciences and Engineering Research Council of Canada (University Research Fellowships), Z.W.O. (Netherlands)

Journal papers -- Ap.J., Ap.J.Letters, A. and A., Monthly Notices

Staff promotion and tenure reviews -- various U.S., Canadian and European universities and research organizations

Talks given

Naval Research Laboratory, University of New Mexico, Queen's University, NRAO/CV, NRAO/VLA

SCIENTIFIC PLANS -- A.H.BRIDLE
August 1986

Bridle will continue using the VLA to search for counterjets in strong extragalactic radio sources, especially quasars, in which bright jets appear to feed one side only of a double-lobed structure. Successful detection of counterjets can be used to constrain models of jet asymmetries by determining brightness ratios and jet/counterjet symmetry relationships.

Bridle, E.Fomalont (NRAO) and R.Laing (RGO) will use VLA observations of the bases of the jets in the low-power radio galaxies NGC315, 3C31, 3C272.1 (M84) and 3C296 to examine how the initial one-sidedness at the bases of such sources correlates with their magnetic field structures, collimation properties and clumpiness.

Bridle, N.Killeen (NRAO), C.O'Dea (NRAO) and R.Perley (NRAO) will search for linear polarization in the jets of several giant radio galaxies using the VLA at 327 MHz both to explore the techniques of polarization mapping at this low frequency and to obtain constraints on radio jet depolarization far from the parent galaxies in such sources. Bridle and Perley will also continue a multi-frequency study of the large scale structure of the jets and lobes in the giant radio galaxy NGC6251.

Bridle will continue work with S.Baum (NRAO) and T.Heckman (U.Maryland) on three-frequency polarimetry of a complete sample of bright radio galaxies near the celestial equator, with an associated search for extranuclear optical narrow line emission regions. The aims of this work are (a) to document and classify the polarization characteristics of a sample of bright radio galaxies that was previously understudied because of the limitations of East-West radio interferometers, (b) to determine how often Faraday screens in radio galaxies produce observable polarization asymmetries, and (c) to correlate radio and optical evidence for such screens in order to understand their layout, origin and excitation.

Bridle will extend his earlier numerical work on modeling the synchrotron emission from radio jets with prescribed magnetic fields; he will study the effects that turbulence and field randomization on various scales produce on the distributions of total intensity, polarization, depolarization and Faraday rotation over radio jets, in collaboration with A.Gill (Queen's U., Canada) and R.N.Henriksen (Queen's U., Canada).