

NATIONAL RADIO ASTRONOMY OBSERVATORY
Edgemont Road, Charlottesville

2 July 1985

TO: Bob Havlen

FROM: Alan Bridle

RE: Material for annual BAAS Report

Bridle continued studies of the systematic properties of the jets in extragalactic sources using VLA imaging and polarimetry at 20cm, 6cm and 2cm. He reinforced his previously-reported conclusions that jets emanating from weak radio cores are two-sided, rapidly spreading and dominated by magnetic field components aligned perpendicular to the jet axes, while those emanating from strong cores are one-sided, narrow, and dominated by parallel magnetic field. The jets in weak sources have collimation and surface brightness properties characteristic of rapidly spreading, mildly supersonic flows in rough pressure balance with the surrounding medium, while jets in strong sources have some characteristics of narrow, light, hypersonic flows.

Bridle used VLA observations of the 'twin' jets in the radio galaxy 0326+396 at 20cm and 6cm to derive the detailed evolution of jet width, intensity, spectral index and degree of linear polarization across this source, in a collaboration with R.Fanti and P.Parma (Bologna), S.Baum (U.Md. and NRAO), R.Ekers and E.Fomalont (NRAO). Both jets exhibit alternating regimes of adiabatic and 'sub-adiabatic' behavior; the brightness symmetry of the outer 50 kpc of the two jets is strongly broken within 2 kpc of the center of the galaxy, where one jet is about eight times brighter than the other. The spectral index between 20cm and 6cm flattens at a bend in the jet about 17 kpc from the center of the galaxy.

Bridle used the VLA at 2cm to search for bright knots in a large sample of jets and hot spots in extragalactic sources at 0.1 arcsec resolution, to select targets for a search for optical synchrotron emission from such features. The goal of this work, done in collaboration with G.Miley and D.Machetto (STScI), T.Heckman (U.Md), W. van Breugel (UC Berkeley) and R.Laing (RGO), is to constrain descriptions of particle acceleration in radio jets and lobes by high-resolution imaging of the regions where fresh relativistic particles appear to be generated.

Bridle, with F.Clark (U.Kentucky and NRAO) and F.Mirabel (U. Puerto Rico) used the 140 foot telescope to search for OH emission and absorption from bipolar flows around star-forming regions and in the W50 region around SS433. Several tentative detections resulted; if confirmed, these may offer a new probe of the velocity fields in

NRAO Service Activities 1985 --- A.H. Bridle
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Observatory Committees

Chair, Scientific Staff Search Committee
Member, Tenure Committee
Member, NRAO Council

AIPS Group

Chair, AIPS Management Advisory Group
Chair, AIPS Priorities Meetings

Scientific liaison with AIPS Group programmers

- advise Eric Greisen on management and scientific priorities
- liaison with VLA staff on AIPS priorities issues
- liaison with VLA staff on AIPS redesign issues
- liaison with outside USER groups on AIPS development
- review AIPS "Gripe" inputs and responses

Review quarterly AIPSLETTER text (with B. Burns, E. Greisen)

AIPS contact person for Charlottesville users (until Dec 1 85)

- scheduled outside user visits
- advised outside users on data reduction strategy
- organized disk resources for large projects
- organized AIPS1 sign-up in Charlottesville

Organizer, AIPS Workshop (October 1985)

- arranged and scheduled talks and local arrangements
- reviewed talks and discussion (AIPS Memo No. 40)

AIPS Cookbook (with E. Greisen)

- writing, editing and updating

AIPS Site Survey (with D. Wells and N. Wiener)

- survey design

VLA Summer School on "Synthesis Imaging"

- lectured on "VLA Observing Strategies"
- led special topic discussion sessions
- reviewed and edited written versions of all 16 lectures
- prepared for NRAO publication (with R. Perley and F. Schwab)

VLBA

Member, Site and Configuration Committee
Liaison with Canadian VLB activity

NRAO Publications edited
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1. A.H.Bridle and J.A.Eilek, "Physics of Energy Transport in Extragalactic Radio Sources", Proceedings of NRAO Workshop No. 9, held at Green Bank, West Virginia on July 30 to August 3 1984. (published March 1985)
2. A.H.Bridle and E.W.Greisen, "The AIPS Cookbook: 15OCT85". (published October 1985)
3. 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. (to be published 1986)

Meetings attended -- 1985
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16th Meeting of Canadian Astronomical Society at University of Toronto, 28-31 May 1985. Gave contributed paper on "The Three Parallel Radio Sources in the Field of 3C130".

Conference on "Jets from Stars and Galaxies" at Canadian Institute for Theoretical Astrophysics, 24-27 June 1985. Gave invited review paper on "Extragalactic Jets - Trends and Correlations".

Los Alamos Workshop on "Plasma Processes in Astrophysical Jets" at Taos, New Mexico, 28 July - 2 August 1985. Gave invited review paper on "Extragalactic Jets - Trends with Radio Luminosity"

NRAO Summer School on "Synthesis Imaging" at Socorro, New Mexico, 5-9 August 1985. Gave lecture on "VLA Observing Strategies".

Non-NRAO committees
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CLBA Planning Committee
CAS Committee on Radio Astronomy

Refereeing
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National Science Foundation, Natural Sciences and Engineering Research Council of Canada (University Research Fellowships)

Ap.J., Ap.J.Letters, A. and A., Canadian J. Physics

Various U.S. and Canadian universities for promotion and tenure reviews.

SCIENTIFIC PLANS -- A.H.BRIDLE
September 1985

A.H.Bridle will continue using the VLA to obtain multifrequency data on knot structures, spreading rates and magnetic configurations in kiloparsec-scale extragalactic radio jets. These data will be used to study the processes of energy transport, collimation and relativistic particle reacceleration in large extragalactic sources. He will also seek evidence of counterjets in radio sources wherein bright jets appear to feed one side only of a double-lobed structure, to constrain competing models for such jet asymmetries.

VLA maps of jet knots and hot spots in radio lobes at 15 GHz will be used to select targets for a search for optical synchrotron radiation from extragalactic radio sources using the Faint Object Camera on the Space Telescope (with G.K.Miley and colleagues at S.T.Sc.I). The radio morphologies, magnetic structures and spectral shapes of such features will ultimately be used to test models of relativistic particle reacceleration by shocks and by turbulence-driven mechanisms.

Bridle and R.A.Perley (NRAO) will use the VLA to study the structures of four exceptionally large radio sources -- (1) the diffuse outer regions of the giant radio galaxy NGC6251, (2) the exceptionally relaxed radio lobes apparently associated with the radio galaxy 4C40.08, (3) an unusually large head-tail structure identified with the cluster galaxy IC260, and (4) an almost featureless diffuse emission region 1450+391 discovered in VLA observations of fields from the B3 radio survey. Such large radio sources provide limiting cases for models of relativistic particle diffusion in active extragalactic systems. These four have been selected for study because they represent different types of very diffuse radio source, all of which are underemphasised in existing radio structural studies at centimeter wavelengths.

Bridle and T.Heckman (U.Maryland) will cosupervise a Ph.D. thesis by S.Baum 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 will be (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.