



VLA OBSERVING APPLICATION

A

rcvd:

DEADLINES: 1st of Feb., June., Oct. for next configuration following review
INSTRUCTIONS: Each numbered item must have an entry or N/A
SEND TO: Director NRAO Edgemont Rd. Charlottesville, VA 22903-2475

- (1) Date Prepared: 31 May 94
(2) Title of Proposal: P-Band imaging of radio galaxy 3C353

Table with 5 columns: (3) AUTHORS, INSTITUTION, Who Will Come To The VLA?, Observations For Ph.D. Thesis?, Anticipated Ph.D. Year. Rows include Mark Swain, Namir Kassim, Alan Bridle, Stefi Baum.

- (4) Related VLA previous proposal number(s): AB 352, AB 389, AS 479, AS 510, AS 529
(5) Contact author for scheduling: Namir Kassim, address: Naval Research Lab.
(6) Telephone: 202-767-0668, Telex, Internet: nkassim@shimmer.nrl.navy.mil, Other E Mail, Telefax: 202-404-8894

(7) Scientific Category: planetary, solar, stellar, galactic, extragalactic

Table with 6 columns for configurations, wavelength, and time requested. Row 1: (8) Configurations (one per column) (A, B, C, D, BnA, CnB, DnC, Any) C. Row 2: (9) Wavelength(s) (400, 90, 20, 18, 6, 3.5, 2, 1.3, 0.7 cm) 90 cm. Row 3: (10) Time requested (hours) 6.

(11) Type of observation: mapping, point source, monitor, continuum, lin poln, circ poln, solar, VLBI, spectroscopy, multichannel continuum, phased array, pulsar, high-time resolution, other

(12) ABSTRACT (Do not write outside this space. Please type.)

We wish to make a preliminary observation of 3C353 at P band in C configuration to search for possible steep-spectrum, large-scale structure associated with a previous epoch of AGN activity or for a radio halo. Ionospheric "weather" permitting, we will also attempt polarization imaging to look for a possible large-scale depolarization asymmetry. If successful, these observations would be followed up by a full synthesis B imaging proposal, for both total and polarized intensity, with observations to be conducted during the Solar minimum (1996), which would complement our existing multi-configuration observations at L, C, X, and U bands.

- (13) Observing file prepared by?  NRAO  Observer  Calibration done at?  Home  AOC or CV (2 weeks notice)  
 Observer present for observations?  Yes  No  Mapping done at?  Home  AOC or CV (2 weeks notice)

(14) Help required:  None  Consultation  Friend (extensive help)  Staff Collaborator (contact VLA Director's Office)

(15) Spectroscopy Only:  line 1  line 2  line 3  line 1  line 2  line 3

Transition (HI, OH, etc.) \_\_\_\_\_ IF bandwidth(s) (MHz) \_\_\_\_\_  
 Rest Frequency (MHz) \_\_\_\_\_ Hanning smoothing (y/n) \_\_\_\_\_  
 Velocity (km/s) \_\_\_\_\_ Number of channels per IF \_\_\_\_\_  
 Observing frequency (MHz) \_\_\_\_\_ Frequency Resolution (kHz/channel) \_\_\_\_\_  
 Correlator mode \_\_\_\_\_ Rms noise (natural weighting) \_\_\_\_\_  
 after 1 hour (mJy) \_\_\_\_\_

(16) Number of sources 1 (If more than 10 sources please attach list. If more than 30 give only selection criteria and LST range(s).)

(17) NAME	Epoch 1950 <input checked="" type="radio"/> 2000 <input type="radio"/>		Band width (MHz)	Band (cm)	Config.	Total Flux		Largest ang. size	Weakest signal (mJy/beam)	Required dynamic range	Possible LST range hh - hh	Time requested
	RA hh mm	Dec ± xx.x°				line (Jy)	cont. (Jy)					
3C353=1717-009	17	17	90	3.125	C	155	4.5'	10	5000:1	1430-2030	6 hrs	

- (18) Special hardware, software, or operating requirements: N/A
- (19) Preferred range of dates for scheduling: We request to be scheduled at the beginning of C array so that the sun is as far from the source as possible.
- (20) Dates which are not acceptable:
- (21) Please attach a self-contained Scientific Justification not in excess of 1000 words. (Preprints and reprints will be IGNORED!)  
 When your proposal is scheduled, the contents of this cover sheet become public information (Any supporting pages are for refereeing only).

## P-Band Imaging Of The Radio Galaxy 3C353

Mark Swain (U. Rochester, NRAO-CV)  
Namir Kassim (NRL)  
Alan Bridle (NRAO-CV)  
Stefi Baum (STScI)

We propose a preliminary P band observation of the bright (155 Jy) extended (5') FR II radio galaxy 3C353 to: (1) search for any previously undetected large-scale, steep-spectrum structure and (2) determine whether there is a large-scale depolarization asymmetry between the jetted and counterjetted lobes.

A P band total intensity map of 3C353 would address two questions. First, it would show whether or not the source has any steep-spectrum extensions (halo) or "wings" that are not evident from the low-resolution L-band images obtained by Swain for his Ph.D. thesis (in preparation). Such wings are not unusual in moderate-power FR II radio galaxies (e.g. Black et al. 1992), and have been variously interpreted as evidence for previous epochs of AGN activity (possibly oriented along a different axis) or diffuse backflow from lobes (as in the "wings" seen in the P-band map of Cygnus A). Second, A P-band map of the previously known structure in 3C353 would improve constraints on large-scale spectral-ageing/curvature models for the source. (We note that the lobes of 3C353 contain enough filamentary substructure that follow-up B-configuration observations would be needed at P band to explore spectral ageing models in detail. We would like to gain experience with P band observations of this region in the C configuration before requesting time for this more computationally difficult follow-up experiment, however.)

Our L-band (1.38, 1.66 GHz), C-band (4.9 GHz) and X-band (8.3 GHz) observations show some small depolarizing filaments in front of both lobes of 3C353 but also that any *large-scale* depolarizing screen becomes Faraday thick only below 1.4 GHz. We are interested in searching for the large-scale depolarization asymmetry at P-Band in order to check whether the depolarization correlates with the jet-brightness asymmetry as in strong-jet sources (Laing-Garrington effect) or is better explained by intrinsic asymmetries as in other FR II radio galaxies that may be near the plane of the sky (Pedelty et al. 1989; Garrington et al. 1991). If the former, the observation could strengthen the case that the jet/counterjet asymmetry in 3C353 is produced by large-scale bulk relativistic motions. If not, then the jet/counterjet asymmetries in this source are probably intrinsic. A C configuration, P-band polarization image would be sufficient for this as only low resolution images are necessary to determine the sign of the depolarization affect.

The observations would be made in multi-channel continuum mode to allow for off-line editing of narrow-band interference. The data would be processed in the SDE environment using Tim Cornwell's 3-D polyhedron imaging algorithm, "Dragon," to maximize effective sensitivity. One of us (NK) has extensive experience applying this program to image P-band data. SDE and "Dragon" are currently on-line at the Naval Research Laboratory so that we will not need to use NRAO facilities for this data reduction.

We intend to make polarization and depolarization images by splitting the six hour observation into a large number of snapshots, which would initially be imaged separately. The position angle of a bright, polarized region in 3C353 would be used to derive a time-dependent L-R phase difference correction which best aligns the polarized position angle in the bright region among the snapshots. The data would then be combined for imaging with the best sensitivity and dynamic range in total and polarized intensity. Under typical ionospheric conditions, we will not be able to determine the absolute polarized position angles, but this technique will allow proper combination of all the data with the correct relative position angles, and thus a reliable detection of any large-scale depolarization asymmetry in 3C353.

If granted observing time, we request to be scheduled at the beginning of C array so that the sun is as far from the source as possible. On October 21, the sun will be 4 hours of RA from the source; by December 15 it will be at the same RA as the source. Because of extensive confusion in the region (3C353 is located near the region where the North Polar Spur crosses the galactic plane) we need good uv coverage and request six hours of observing time. We expect to be able to produce polarization maps since the sun is currently entering a Solar minimum (see figure 1). Because we are looking for structure on the same scale or larger than what has been previously mapped (4.5' with L band in C array), P-band C array observations, with sensitivity to emission on scales up to 30', are ideal.

The proposed observations constitute a preliminary, diagnostic observation. If we find new evidence for steep-spectrum regions of the source or for a significant, depolarization asymmetry, we would follow up with a proposal for P band imaging in B configuration closer to Solar minimum. This would be used to produce two-configuration images in both total intensity and polarization.

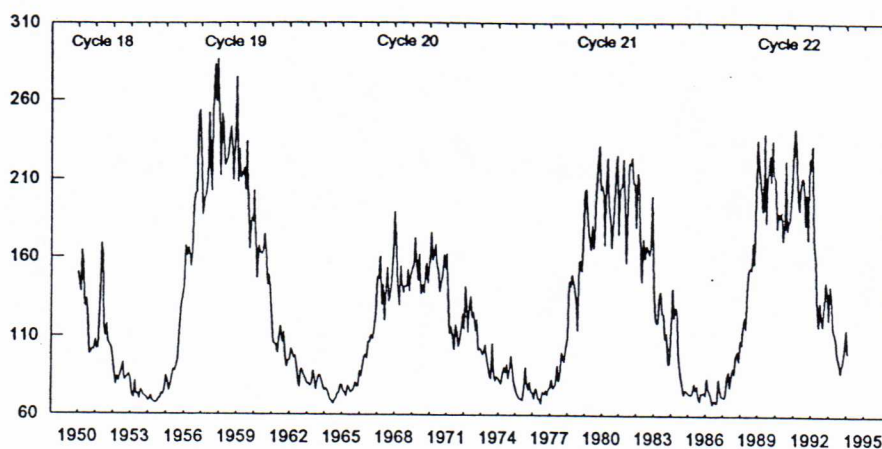


Fig.1.-The monthly mean observed 2800 MHz solar flux from January 1950 through February 1994 (from the Solar Geophysical Data prompt reports, March 1994, number 595, part 1).

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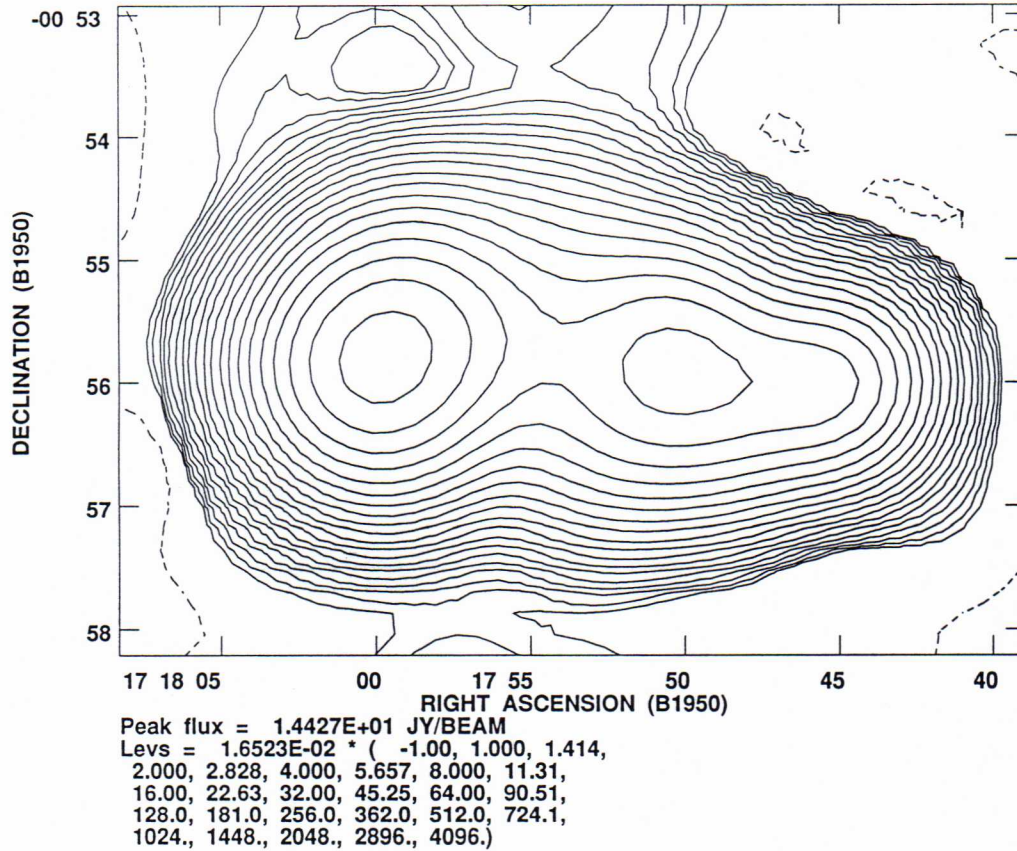


Fig.2-3C353 at P-Band C-configuration resolution (based on our L Band data).

### References

- Black, A.R.S., Baum, S.A., Leahy, J.P., Perley, R.A., Riley, J.M. and Scheuer, P.A.G. 1992, M.N.R.A.S. 256, 186.  
Garrington, S.T., Conway, R.G. and Leahy, J.P. 1991, M.N.R.A.S. 250, 171.  
Pedelty, J.A., Rudnick, L., McCarthy, P.J. and Spinrad, H. 1989, A.J. 97, 647.