

#3

19-DEC-1988 11:36:51

NEWMAIL

From: CVAX::GATEWAY::"ASTROJOPHAST.PHYS.WASHINGTON.EDU"
To: ABRIDLE AT NRAO
Subj: paper 880297

Date sent: Mon, 19 Dec 88 08:34 PST
To: ABRIDLE@NRAO.BITNET
X-VMS-To: INX"ABRIDLE@NRAO.BITNET"

Dear Dr. Bridle: As the paper has already been typeset, please make your revision on the proof copy which should be sent to you soon. Sincerely, Chaim Rosemarin, Assistant Editor

MAIL)

From: CVAX::ABRIDLE 16-DEC-1988 11:55
To: BITNET: "astroj@uwaphast", ABRIDLE
Subj: Paper 880297

Gentlemen,

I have received a communication from Dr. Stannard of Jodrell Bank that bears on the issue of spectral curvature that was of some concern to the referee of the paper "The Unusual Radio Galaxy 3C288" (880297) by myself, E.B.Fomalont, G.G.Byrd and M.J.Valtonen. You have already accepted the revised version of the paper, and have scheduled it for the March 1989 issue of the A.J. This is to enquire whether a small addition might be made either now, or during proof correction.

The addition would be as follows. To Section IVb, third paragraph from the end, the sentence now reading:

'This is not supported by the integrated spectral index that we derived in Table III.'

would be expanded to:

'This prediction is not supported by the integrated 1.4 to 5-GHz spectral index that we derived in Table III, or by preliminary reductions of a MERLIN 0.4-GHz image of 3C288 at 1" resolution (D.Stannard, private communication).'

I shall be happy to deal with this small change in any way that you wish (including not making it at all), for it does not change the conclusions of the paper in any way. Please let me know your preference, and whether you would like hard copy of this message sent to you or to the Production Office.

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+-----+  
| Alan H. Bridle  
| National Radio Astronomy Observatory  
| Edgemont Road, Charlottesville, VA 22903-2475, USA  
|  
| abridle@nrao.bitnet          abridle@nrao.arpa  
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+-----+
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THE ASTRONOMICAL JOURNAL

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880297

November 23, 1988

Dr. A. H. Bridle
National Radio Astronomy Observatory
Edgemont Road
Charlottesville VA 22901

Dear Dr. Bridle:

The manuscript, The Unusual Radio Galaxy 3C 288, number 880297, written by Alan H. Bridle, Edward B. Fomalont, Gene G. Byrd, and Mauri J. Valtonen, has been accepted for publication, and is tentatively scheduled for the March 1989 issue of The Astronomical Journal.

Proofs of the paper will be sent to you in a few weeks. The schedule for the Journal is tight, and it is important that the Production Office receive your corrected proofs without undue delay. If you are planning to be out of town within the next few weeks, it would be helpful if you could make arrangements for the proofs to be forwarded or otherwise appropriately handled in your absence.

Please consult the enclosed blue sheet of guidelines to answer any questions you might have about the next steps in the process of publishing your paper. The yellow form is to be sent to the AIP offices in New York as soon as possible.

I look forward to seeing your paper in the Journal.

Yours sincerely,



Paul Hodge
Editor

PH:cr
Enclosures

UNIVERSITY OF TURKU
DEPARTMENT OF PHYSICAL SCIENCES
SF - 20500 TURKU 50, FINLAND

June 17, 1988

Dear Alan:

Gene and I have again spent some time working together on various problems and noted that the 3C288 paper is still not submitted. In the past year a student of mine has simulated radio galaxies from the moving black holes point of view, among them 3C 75, 3C465 and 3C288,. We might leave these simulations to a separate paper, and not include the 3C288 simulation with our observations. We took your old version of the observational paper and made only some minor modifications to the slingshot-section. Those parts were retyped. I hope that you would agree to submit the paper to A.J. as soon as possible. Since you have the original figures, you could send it off directly. In case that you find that the paper still needs reworking, we could meet in Baltimore (I assume that you will be there) and discuss the matter.

With best regards,



Mauri

P.S. I prefer my name to appear last in the list of authors since my contribution has been very minor.

Dr. A. H. BRIDLE
Tel. [804] 296-0375
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November 14, 1988

Dr. Paul Hodge,
Editor, *The Astronomical Journal*,
Department of Astronomy, FM-20,
University of Washington,
Seattle, WA 98195.

Dear Dr. Hodge,

I enclose a revised version of the article "The Unusual Radio Galaxy 3C288" by A.H.Bridle, E.B.Fomalont, G.G.Byrd and M.J.Valtonen. It contains several alterations and additions prompted by the referee's comments. Our response has been as follows, in the order of his comments.

1. The possibility that the galaxy motion is not negligible was alluded to briefly in Section IVe of the paper. We have added four references that give evidence for subclustering or incomplete virialization, and two to the role of a luminous halo as a diagnostic for the peculiar velocity. Possibly one of these papers is the result that the referee has in mind. We have not otherwise added to the text on this matter, as we believe that it already makes the key point – that velocities must be measured for the 3C288 cluster itself to assess whether these ideas are relevant there.
2. We disagree in detail with the referee here. It is not correct that the north lobe has no spectral gradient, though we acknowledge that the grey scale in Figure 4 must be read carefully to see the effect, given the large total range in spectral index. We have amended the text to emphasize that there is both a spectral gradient and a spectral age gradient across the north lobe. Figure 8 shows the evidence for spectral ageing directly. We stand by our original statement that Figure 8 shows a gentle age gradient until the western knot, and a much steeper gradient thereafter. We also continue to interpret the apparently low spectral age of the western knot as part of the evidence that it may be an incipient hot spot. The more subtle, but nonzero, spectral gradient in the brighter part of the north lobe was built into our description of redirected outflow from this incipient hot spot.
3. The referee's comments raise a good point that we were skirting by saying only that the sense of the effect, and not its magnitude, is as predicted by the relativistic jet model. The referee's comment has encouraged us to expand our discussion to address the issue of spectral curvature explicitly. The implied spectrum is theoretically acceptable, though it would indeed be an extreme case if all of the emission has a Doppler ratio of 1.3. Some of the emission must however be from the pre-shock regime, where the Doppler ratio is 1.9. There are also effects in the nonlinear deconvolution and self-calibration that may artificially enhance the apparent curvature. These matters are now described in the paper. We had indeed proposed further observations as the referee suggests!

4. We had taken a short cut by referencing only a review of the asymmetry controversy and not the original articles. We now give original references for the main mechanisms that have been invoked to account for jet one-sidedness, in each case giving the earliest reference we know of. We also include the referee's own excellent contribution to this topic!

We trust that the revised paper will now be accepted for publication, and note that your office retained the glossies of our Figures. We have added an acknowledgement to the referee for his thoughtful comments which have indeed encouraged us to improve the presentation.

Yours sincerely,



Alan H. Bridle

THE ASTRONOMICAL JOURNAL

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880297

October 21, 1988

Dr. A. H. Bridle
National Radio Astronomy Observatory
Edgemont Road
Charlottesville VA 22901

Dear Dr. Bridle:

The manuscript, "The Unusual Radio Galaxy 3C 288," number 880297, written by Alan H. Bridle, Edward B. Fomalont, Gene G. Byrd, and Mauri J. Valtonen, has been sent to a referee. I understand that the referee has communicated the report to you directly.

After considering the recommendations, could you return two copies of your revised manuscript to this office?

I look forward to hearing from you soon.

Yours sincerely,



Paul Hodge
Editor

PH:cr



NATIONAL RADIO ASTRONOMY OBSERVATORY

EDGE MONT ROAD CHARLOTTESVILLE, VIRGINIA 22901
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September 22, 1988

Dr. Paul Hodge,
Editor, The Astronomical Journal,
Department of Astronomy, FM-20,
University of Washington,
Seattle, WA 98195

Dear Dr. Hodge,

I enclose two copies of the manuscript, and glossies for eight figures, for an article entitled "The Unusual Radio Galaxy 3C288", by A.H. Bridle, E.B. Fomalont, G.G. Byrd and M.J. Valtonen. I hope that this will be suitable for publication in the Astronomical Journal.

Please note that one copy of the manuscript is marked with Figure and Table locations, and with identifiers for unusual symbols. This copy is intended for use in your office, while the other, unmarked copy, is intended for use by the referee.

I also enclose a signed Transfer of Copyright agreement for the article.

If the article is accepted for publication, the publication costs will be divided between the NRAO, Dr. Byrd, and Prof. Valtonen.

Yours sincerely,


Alan H. Bridle

Alan: sorry for the delay in answering this. I enclose two references on dominant cluster members moving with respect to the mean. One, unfortunately, is a preprint. These aren't crucial but you may wish to include them.

Gene - referee's (Larry Rudnick's) comments re 30288. Any particular wishes re response?

if you haven't already sent the paper in.
Gene

This is an interesting paper on what is indeed an unusual radio galaxy, and is appropriate for publication in the *Astronomical Journal*. It will be of interest to a range of people because of its implications for the nature of jets, for beaming models and for the effects of the circumgalactic medium.

I have several points which I think the authors should consider before publication:

1. I have seen a result (sorry, I don't remember where) that some dominant galaxy cluster members had high velocities with respect to the mean. It probably would be worth tracking this down, since many of the arguments made in this paper refer to slow velocities for the galaxy.
2. I always look at the pictures first. When I looked at the spectral index map, I saw that the northern lobe had no gradient across it, but that there was a rapid steepening when one got to the much lower surface brightness (at least a 6cm) wings. In the text, the discussion tries to force the northern lobe into this language of spectral gradients, and then derivation of velocities, which I felt was not reflected in the data. It seems to me that the simplest conclusion is that NO velocity and NO spectral aging is apparent in the northern lobe. The authors still may want to test how such a model agrees or conflicts with the data, but I find the current language in clear disagreement with the results (despite the "subtle" caveat given).
3. The spectral index difference between the jets is an interesting dilemma for the beaming picture. The authors state that such a difference could result from an intrinsically steepening spectrum in which we view different doppler shifted parts from the two sides. Is this a realistic possibility?
 - a. A change of .6 in alpha for a 30% change in frequency seems unreasonable to me. It may also be beyond theoretical expectations?
 - b. Small changes in the magnetic field would cause very large differences in measured alpha, if the particle spectrum were changing slope so rapidly.
 - c. This source might be a very nice testing ground for the intrinsically symmetric, relativistic beaming model by getting further information at e.g., 3.7 cm, to see if the spectra were sharply curved. (This last is really not relevant to the paper).

4. I can't resist noting that there are lots of comments but no references to intrinsically asymmetric models.

There is no need for me to see this paper again, after the authors have considered the comments above.

POSSIBLE MOTION OF 3C288

Valtonen and Byrd (1979, 1986) have shown and Mellier et al (1987) concur that the dominant galaxy in the Coma Cluster NGC4874 is indeed moving relative to NGC4889 forming a binary of the two most massive galaxies in the cluster. The two galaxies are on opposite sides of the geometric cluster center as determined from all other cluster members. One massive member has fewer cluster members redshifted with respect to it than those blue shifted (145 vs. 204) indicating motion relative to the cluster. The opposite asymmetry occurs for the other binary member. Such motion of the most massive members is also reasonable in light of O'Dae Sarazin and Owen's, (1987) statistical work on head-tail radio galaxies in clusters which indicated that the cluster members are not yet virialized.

Thus motion of 3C288 galaxy within its cluster is thus reasonable. However, since it is probably the most massive member its speed would not be so great with respect to the cluster medium as a less massive narrow angle tail source. The intermediate morphological and spectral index properties of 3C288's radio emission between a narrow angle tail and a wide angle (or classical double) radio galaxy is thus expected. However, motion of 3C288 can only explain some of the spectral age gradient from east to west across the lobes (Fig. 8) as discussed in Section 4.1. Hypothesizing that 3C288 moves does not contradict but instead complements the deflected backflow hypothesis discussed in the preceding section.

REFERENCES

Meillier, Y., Mazure, A., Mathez, G., Chauveineau, B., Proust, D.

1987 Astronomy and Astrophysics (~~in press~~). 199, 67.

Valtonen, M. J. and Byrd, G. G. 1986 AP. J. 303 523.

Valtonen, N. J. and Byrd, G. G. 1979 Ap. J. 230 655.

O'Dea, Sarazin, C. L., and Owen, F. N. (1987) Ap. J. (~~May 1 issue~~).

316, 113.

✓ Fitchett, M. & Webster, R. Ap. J. ³¹⁷ 653, (1987)

"Galaxies in central region of Coma have not yet relaxed to an equilibrium distribution"

✓ Beers, T. E. & Geller, M. J. (1983) Ap. J., 274, 491

"First-ranked galaxies on a population of mixed dynamical significance - luminous halo galaxies lie at bottom of cluster potential, first-ranked galaxies of new morphology have no obvious special location."

Beers & Tonry

✓ Merritt (1984) D galaxy envelopes cannot survive tidal forces, so must be at location of minimum in cluster.

ApJ 276, 26.

Doppler Effect

- 1) The separation ratio is constrained to 1.3 by the data, and this indeed constrains the frequency ratio to 1.3 as the referee says.
(for the shocked emission).
- 2) The spectral "imbalance" is then surprisingly steep, tho no limits are exceeded. What is needed is that the critical frequency be $< 5 \text{ GHz}$ and the both the jet & counterjet spectrum be steepened by synch. losses.
- 3) How much of a problem depends on how ^{much} steep ^{er} the spectrum really is. The uncertainty in the jet spectrum is dominant. Also if we are seeing an approach to a shock, some of the emission ^{on the jet side} may be "pre-shock" and thus reflect a higher Doppler shift.
 $\alpha \sim 0.2$ $V_c \sim 9.5 \text{ GHz}$ ~~the~~
 0.2 13 GHz

So - if 10 limits taken, the steepening is rather surprising.
But may mean that the higher freq index is overestimated due to fairness of feature & feedback for scatter.
or, the Doppler effect is larger for some of the emission that has been interpreted into the spectrum.
So emission should be a good test.

THE ASTRONOMICAL JOURNAL

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880297

September 27, 1988

Dr. A. H. Bridle
National Radio Astronomy Observatory
Edgemont Road
Charlottesville VA 22901

Dear Dr. Bridle:

The manuscript, "The Unusual Radio Galaxy 3C 288," number 880297, written by Alan H. Bridle, Edward B. Fomalont, Gene G. Byrd, and Mauri J. Valtonen, has been received and will be given prompt attention.

I am enclosing a copy of the American Astronomical Society's Transfer of Copyright Agreement. Please complete this form and return it to our office as soon as possible, so that there will be no delay in handling your manuscript.

Yours sincerely,

Paul Hodge
Editor



PH:cr
Enclosure



NATIONAL RADIO ASTRONOMY OBSERVATORY

EDGEMONT ROAD CHARLOTTESVILLE, VIRGINIA 22901
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9 Sept 1988

Dear 288-ers,

Here's what will be final draft going to A.J. unless I hear from you by return. Main (and only) changes since pre-IAU draft are in response to Paddy Leahy's cogent comments. You will pick up almost all of them simply by rereading IVd and IVe, pp. 19-26. The connection with 3C171 was an excellent suggestion, and I've made a bit more of it than Paddy suggested. As it's not exactly "backflow" in 171, I've modified the language a bit.

I hope this is finally it!

Cheers,

Ala

From: CVAX::ST%"pleahy@vax3@outbax" 22-JUL-1988 17:42
To: ABRIDLE
Subj: Comments on 3C288 paper

Received: from outbax by NRAO.nrao with DECNET ;
Fri, 22 Jul 88 17:41:36 MDT
Received: from vax3 by outbax with DECNET ;
Fri, 22 Jul 88 15:39:28 MDT
Date: Fri, 22 Jul 88 15:41:22 MDT
From: pleahy @ vax3
Message-Id: <880722154130.006@vax3>
Subject: Comments on 3C288 paper
To: abridle @ vax3
X-ST-Vmsmail-To: ST%"abridle"

Dear Alan,

Thanks for your fascinating paper on 3C288, which I received today. The large-scale structure is certainly rather astonishing. I don't understand what's going on in this source. In addition to the options you put forward, here are a few other processes which might be relevant:

✓ (1) Galaxy motion. This isn't an ordinary head-tail or WAT, I agree. But if it is "born-again", residual wobble in the cluster centre might explain the displacement of the core by about 20 kpc from the apparent axis of the "wing" component.

✓ (2) Backflow. I don't believe unaided backflow is responsible for any of the clear examples of "wings", e.g. 3C52 or 315. I think I mentioned the reason to you: this model would involve the ends of the wings propagating out as fast or faster than the ends with hotspots, which in turn implies that the hotspots have little to do with the speed of lobe advance, whereas I'm sure they actually do. From the projected lengths and axial ratios of the wings you can argue that at least most of them are not enhanced by projection effects. The same applies, I think, in the admittedly more complicated case of 3C288.

✓ (3) Backflow into an old cavity works well for the South lobe but cannot explain why the North lobe is extended away from the hotspot to the East and not the west. Incidentally there is no reason I can see why the earlier outburst should have been more powerful; all that is required is a deep minimum (e.g. complete cessation) of the activity between the two outbursts.

✓ (4) Projection effects might be important in this particular case, based on the fact that it is one of the most unusual-looking objects in a large sample. On the other hand the lack of bright hotspots would be strange for a source of this power, and the relatively low jet-cj asymmetry suggests the angles aren't too small.

✓ (5) Precession is a distinct possibility, especially given your evidence for a merger. Maybe this is a brighter cousin of NGC326 (whatever THAT is).

(8) I'd add 3C171 to the list of possibly similar sources. This shows the same apparent twin-tail structure which breaks down because of the existence of diffuse emission "ahead" of the apparent direction of motion. Its luminosity and linear size are almost identical to 3C288's.

(7) The integrated polarization of this source depolarizes at 7 cm (Strom & Conway 1985, A&A Suppl, 61, 547). My interpretation of your polarization data is that the North lobe is completely wiped out by 6cm and the south lobe is highly chopped up by differential rotation. I would guess RMs of 100's or even 1000's (as in Hydra A). This wouldn't be unusual for a source at the centre of a cD in the middle of a cluster.

In the light of the last comment, multifrequency polarization at 6, 3 and 2 cm would be an obvious addition to the wish-list at the end of your paper.

One generic comment: throughout the paper you use the term "bridge" to refer to the jets, especially in the context of the low resolution maps. This is unnecessarily confusing for at least two reasons. First, you explicitly identify the "bridge" as a pair of jets (plus a core, true); so you are referring to the same structure in the paper by two different names, depending on the context. Second, the term "bridge" nowadays has a well-defined technical meaning as DIFFUSE structure connecting the hotspots to the central galaxy. This is not just my personal usage: Rick Perley gave the same definition when I asked him, and we used the term in that sense in LW because that was the universal interpretation used in Cambridge. Your "bridge" is certainly not bridge in that sense. In fact much of the usefulness of the term is that it allows us to make a clear distinction between jets and bridges and to ask meaningfully "Is this feature a jet or a bridge?". I know that historically the distinction wasn't always made so clearly (or even in the same sense), but the usage outlined above has been current since I entered the field. Consequently your usage in this paper is an unjustifiable source of entropy (especially given your status as guru on source systematics).

General impression: interesting paper. I liked the bit about restarting jets - a few more instances like this and the case will be pretty solid.

regards Patrick Leahy



NATIONAL RADIO ASTRONOMY OBSERVATORY

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TELEPHONE 804 296-0211 TWX 910 997-0174

15 July 1988

Dear Ed, Gene and Mauri,

Here's what might be the last draft of the 3C288 write-up. I'm happy to do as Mauri suggested and cut the slingshot discussion back to previous version, with reference now to his paper in preparation. I've also incorporated various comments from Ed and from Gene on the last version.

I realised that we could say a little more about depolarization, because the upper limits from the outer North lobe are interesting. I have also expanded the jet/counterjet section (now p. 14-18) along the lines I was talking about with Gene and Mauri in Atlanta. I'll plan on sending it to A.J. as soon as possible after I get back from Canada (Aug. 21st) so let me have final comments by then if you can. I've also sent a copy to Patrick Leahy for comments. Tom Muxlow at Jodrell has observed the source with MERLIN at 151 and 408 MHz. I've sent him our data to help him get his self calibration started, also a copy of this for his info and comments.

Cheers, JG

3C171

$$z = 0.2384$$

$$S_{1.4} = 3.8 \text{ Jy} \rightarrow 2.58 \times 10^{26}$$

$$\alpha = 0.94$$

Hor spots prominent, ~~but~~ ^{then} v. wide ~~the~~ ^{plumelike} extensions on ~~the~~ ^{both} lobes
 $\sim 35''$ total extent. (83 kpc) Oblique beam?

Also variously identified as a WAT (Overduin et al. 1996)

Emmitic line gas at edges predom. features.

Higher % of $\text{H}\alpha$ at 1.9 GHz in area ~~of~~ ^{part} of source.

Hedman TM, van BWSMA min. Br (1989) Ap. J 286, 50

Curved emmitic line filaments $\sim 5''$ to E of nucleus.
 Brightest member of group but not in well center.

Dep. in secondary filaments is $17 \mu\text{gams}$ at $H=75$
 $19 \mu\text{gams}$ at $H=100$

June 9, 1987

Dear Alan & Ed

Here, finally, is the augmented copy of the 3C288. I say augmented because the ^{only} major change is an additional section on an additional hypothesis to explain the observations, the moving merger galaxy. While the backflow idea is possible, we think the merger hypothesis is less arbitrary in that the major parameters of the model are connected to the ~~ob~~ observations. In the merger model, we assume the galaxy is moving with respect to the cluster medium (not unreasonable in a poor cluster) so that the medium flows out around the galaxy's own interstellar medium. Next, the galaxy must have two jet sources which beam material out somewhat beyond the edge of the interstellar medium (mathematically equivalent are two oscillating supermassive objects ^(SMO's) which trail streams of material out to the same distance). The oscillating SMO's or two jet sources arise

from a merger of the 3C 288 galaxy with another comparable galaxy. The two jet sources are tilted with respect to one another so as to point at the northeast and southeast bright lobes (these are also equivalently the lines of oscillation of the two sources). As is common, the two jet sources switch directions 180° at regular intervals (just as the sources oscillate). This alternate generation of lobes in the past plus their being swept out and behind by the cluster medium accounts for the intermediate type appearance of 3C 288 plus (perhaps) its power via the merger. The main problem for the twin-engined idea is lack of a clear jet track to the northeast bright front lobe, however, failure to leave a track between center and lobe is not uncommon in sources with simpler structure. All this is in a separate section⁴⁴ plus a paragraph in the conclusion. We've changed the bibliography to the A&T style as per your remark about it being that type paper.

Aside from the difference in type styles between the additions and what you sent, we consider the manuscript ready to go to the journal. We are enclosing originals of the illustrations we've added (Figs. 9 & 10) so you can send it on the A.J.

Any comments on the merger idea?

Gene & Mauri

Sorry for the delay. I was in Sweden awhile before I came to Finland, then the merger idea occurred to us, finally we didn't want you to have to decipher our handwriting.

National Radio Astronomy Observatory

EDGEMONT ROAD, CHARLOTTESVILLE
VIRGINIA 22903-2475, U.S.A.

Dr. A. H. BRIDLE
tel. [804] 296-0375 BitNet: abridle@nrao

April 20, 1987

Dear Mauri, Gene and Ed.

Here is a draft of the 3C288 paper. I started when Mauri's draft arrived here and got into a few more bits of data reduction to fill out some of the details, e.g. polarization comparison at the low resolution, and improved CLEANing of the maps for the spectral index work. I also tried a maximum entropy deconvolution of the untapered 6cm data. It showed that maximum entropy could have given us the jet structure at 6cm without further observations had we had it available in time ! It also showed that the ridgelike features of the CLEAN are all real. But there is no entirely new information from it and I have left it out of this paper.

Relative to Mauri's draft I have tried to flesh out the comparison with other types of radio source, and have also pointed out a few features of the radio structure that don't agree well with the published massive-object model. I think the jet model is sufficiently entrenched that we have to give some discussion of the source in its terms, and have tried to do so. I have also done the spectral ageing sums to show explicitly where the source comes on the "apparent velocity if no reacceleration" spectrum. I have rambled on a bit in places and expect vigorous editing from you all !

There are some small additions needed to the Figures (e.g. degree of polarization scales) and I will have NRAO graphics do that once I hear from you that you are happy with the content. You can infer them for now from the AIPS captions. NRAO graphics will also letter the figure borders more neatly. I have good quality laser printer plots of all the figures so can handle them here.

I guess this is an A.J. or M.N. type of paper.

I'll be here for most of the summer apart from a week around the AAS and a holiday in the first two weeks of August. I may have some VLA observing in the third quarter, but don't know the schedule yet.

Best wishes,

Alan



THE UNIVERSITY OF ALABAMA
College of Arts and Sciences

DEPARTMENT OF PHYSICS & ASTRONOMY

March 17, 1947

Dear Alan Surprise! Surprise!

Enclosed is a tentative draft of a paper describing our two sets of observations of 3C288. This represents primarily Mauri Valtonen's efforts. What comments or additions do you suggest? In particular, we don't have all the information for Table I. Also, do you have additions to the "discussion" section. All the figures can be drawn at Turku Finland or here in Alabama. We have access to draftsmen who aren't too busy. Any changes or additions to the figures? Maybe we can get it submitted this time!! It's funny how time slips by. I can't believe

its been almost 4 years since I spent Halloween at the VLA. It's certainly easy to get overwhelmed by other things.

Speaking of such other things, we are having a busy time this spring trying to hire our 3 people at Alabama. We're getting a micro VAX ~~two~~ plus an image processing system (I²S). Thanks for your info (via Phil Hardee) on people who might be available for the Asst. Prof. & post doc. positions.

Gene