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3 June 1981

Dr N.H.Baker,
Editor,
The Astronomical Journal,
Columbia University,
Pupin Building,
New York, NY 10027

Dear Dr. Baker,

We enclose two copies of a version of the paper THE LARGE AND SMALL-SCALE STRUCTURES OF 3C 293 by A.H.Bridle, E.B.Fomalont and T.J.Cornwell which has been slightly revised in the light of the referee's comments.

The referee's first point has been clarified with a new sentence on p.5, para.1.

We have dropped the sentence which prompted the referee's second comment.

The referee's third comment arose from a small error in the graphic work for Figure 7, which has been corrected on the the revised glossy for this Figure submitted herewith.

Glossies for seven Figures are enclosed with the manuscript copies.

We trust that the paper can now be accepted for publication in the Astronomical Journal.

Yours sincerely,

A handwritten signature in cursive script, appearing to read "Alan H. Bridle".

Alan H. Bridle

E.B.Fomalont

T.J.Cornwell

THE ASTRONOMICAL JOURNAL

COLUMBIA UNIVERSITY
PUPIN BUILDING | NEW YORK 10027

14 May 1981

Dr. A.H. Bridle
National Radio Astronomy Observatory
VLA Program
P.O. Box 0
Socorro, New Mexico 87801

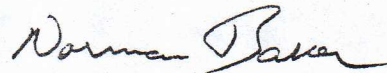
Dear Dr. Bridle:

The paper,

THE LARGE AND SMALL-SCALE STRUCTURES OF 3C293

was sent to a competent referee. I am returning
your paper together his report, for your consider-
ation.

Yours sincerely,



Norman H. Baker
Editor

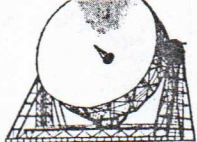
P.S. Please return two copies of your revision.

Referee's Report on;

"The Large and Small-Scale Structures of 3C293"
by A.H. Bridle, E.B. Fomalont and T.J. Cornwell.

This paper contains interesting new information on 3C293. I have only a few minor suggestions for improvements to the manuscript before it is acceptable for publication.

- 1) In their description of the observations the authors state that similar self-calibration routines were used for the VLA and MERLIN data. However the MERLIN scheme has lost the absolute position of the source whereas the VLA scheme has not (indeed the authors remark that the absolute position of the MERLIN map has to be inferred from comparison with the VLA data). I would like the authors to elaborate slightly on the difference between these self-cal routines and say why one loses the source position and the other appears to retain it.
- 2) At the bottom of page 11 the authors say "If the z-symmetry is attributed to rotation of the central collimator from north toward west over the lifetime of the source, it is surprising that the inner ~ 2 kpc core "leads" the bridges by as much as 35° in this rotation". I am not sure whether there is supposed to be a real difference in meaning between this sentence and the one that follows. If there is, could the authors please elaborate on their meaning. If there is not, then I suggest the authors drop this sentence.
- 3) In Figure 7, the second line with an arrow is noticeably non-perpendicular (by about 3°) with respect to the line with an arrow defining the Z axis, so I presume that this second line is not merely the Y axis. However, nowhere in the text or figure caption can I find any indication of what this unlabeled line represents. Thus the authors should state somewhere what it represents.



Director of the Laboratories
SIR BERNARD LOVELL, O.B.E., LL.D., D.Sc., F.R.S.

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1st June 1981

Dr. T.J. Cornwell,
National Radio Astronomy Observatory,
1000 Bullock Boulevard,
NW Post Office Box 0,
Socorro,
New Mexico 87801,
U.S.A.

*Alan, I think that we'll
have to change this, in
proofs if necessary
Turn.*

Dear Cornwell,

I am grateful to you for your letter of 22 May and for letting me have a preprint of the interesting paper on the structure of 3C293. There is one minor point about this paper which I hope you will correct. It is that the abbreviation MERLIN is used for the Multi-telescope Radio-Linked Interferometer. This abbreviation is not to be used. The official designation is MRLI, as printed in your covering letter. The use of the abbreviation MERLIN will cause great difficulty and confusion and I would be most grateful if you will make sure that the necessary correction is made. I am writing also to the editors of the journal.

In the meantime we will look forward to the time when you are able to observe this source with the MRLI on $\lambda 6$ cm. The system will be working on 408 MHz probably until the end of November when we then hope to move over to a $\lambda 6$ cm programme.

With kind regards,

Yours sincerely,

Samuel Lauer



Director of the Laboratories
SIR BERNARD LOVELL, O.B.E., LL.D., D.Sc., F.R.S.

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1st June 1981

The Editors,
Astrophysical Journal,
The University of Chicago Press,
5801 S. Ellis Avenue,
Chicago,
IL 60637,
U.S.A.

Dear Sirs,

One of our ex-students, Dr. T.J. Cornwell, has sent to me a preprint of a paper which has been submitted for publication in the Astrophysical Journal. This paper entitled "The large and small-scale structures of 3C293" is by A.H. Bridle, E.B. Fomalont and T.J. Cornwell, and deals with observations made both with the VLA facility and with the Multi-telescope Radio-linked Interferometer at this Jodrell Bank establishment. Unfortunately, the authors have used the abbreviation MERLIN for the multi-telescope system. This is not the official designation and its use will cause great confusion. If an abbreviation is desired for the Multi-telescope Radio-linked Interferometer then the official designation is MTRLI. May I ask if you would be kind enough to make sure that this correction is made throughout the text of this article?

Yours faithfully,

Dr. Alan H. Bridle,
NRAO-VLA Program,
P.O.Box 0, Socorro, NM 87801,
USA

Ottawa, 08 April 1981

Dear Alan, Hi! How are you? And Mary?

Thank you very much for your letter of 25 March 1981, received yesterday. Much thanks also for the second draft of your paper with Ed and Cornwell (BFC), on jet refraction of the jet in the core-bridge of 3C293. Great paper!

Overall, I get the impression that the optical major axis may continuously change with increasing separation from the center of the galaxy 3C293. Therefore, Alan, you may wish to pursue theoretically what a jet refraction model should predict. It would seem to me at first sight that the outermost jet refraction would be amenable to the theory of Henriksen et al (HVB), and only the outermost halo.

Your last figure, the curved trajectory of the jet (core-bridge) superposed on the MERLIN map, is great. It appears at first sight somewhat strange that your jet curved trajectory has a small slope with respect to the horizontal (RA50) axis. I really wonder what is your prediction for the bridge-halo refraction (the south-eastern jet there is observed to gradually bend; the north-eastern jet there is observed to quickly bend at a large distance). At first sight, the halo parameters may differ from core.

Your equation (1) for the jet refraction is O.K., but it might be better, Alan, to define the inclination $i=i(x,y,z)$ explicitly for the reader of your paper; that was not clear to me at first sight.

You may be right, but it is difficult to believe that most of the mass of 3C293 is in your core-bridge model; many galaxies are now known to have a massive halo, more massive than their core. Furthermore, the paper of Fabricant et al(1980) shows clearly a temperature profile (their Fig. 3, vol.241, p.555) rising steeply with radial distance from the center of that elliptical galaxy. Now the jet refraction model of HVB uses a pressure relation to get the solution, where the pressure is proportional to the thermal density and the temperature. You assumed that the halo mass is extra-huge by first using isothermality (an improbable assumption). In fact, it may appear at first sight that the density will decrease much faster than the pressure with increasing radius, so as to give a reasonable mass for the halo of 3C293.

May I differ in opinion on your statement that "the regime where jet refraction is most likely to occur is in the inner cores of radio galaxies, where densities and pressures are greatest" since a slow gradient over several hundred kpc is numerically as good as a steep gradient over only a few kpc. But you may be right in some galaxies, Alan.

You may wish to change the text of the BFC paper about X-ray predictions with the Einstein satellite, in view of its demise (see letter of Seward dated 19 Feb. 1980, stating "enough (gas) for one month"). Maybe you should drop the Einstein name.

The BFC paper does have the making of a great paper, and please don't think too much of my comments in this letter (above).

Please accept, dear Alan, the expressions of my best and sincere sentiments.

Yours truly,

J.P.V.

P.S. Never hesitate to communicate with me!