AHB-CVAX$ type laing.txt
From: CVAX::GATEWAY::"RL@STARLINK.RO-GREENWICH.AC.UK" 14-OCT-1987 13:40
To: ABRIDLE AT NRAO
Subj:

Date sent: 14-OCT-1987 11:14:36 GMT +0100
To: abridle@NRAO

Dear Alan,

Thanks for your messages. The present state of the depolarization work is that two Letters have been submitted to Nature. We have just had the referees' reports, and only very minor changes are recommended, so they will soon be in press. Specifically:

Laing, R.A. Synthesis observations of 10 sources, 3 from Burch (1979) and 7 from my own work (all 3CR). 9/10 show faster depolarization on the counter-jet side. Frequencies 2.7 - 1.4 GHz (Burch) and 4.9 - 1.4 GHz (me). Also integrated component polarizations from Strom & Conway (1985; A&A Suppl. 61, 547). This gives 8/12 sources in the same sense. The reliability of the integrated polarizations is not perfect: of the 5 sources which have synthesis data so far, 4 agree in the sidedness of depolarization, 1 (the worst counter-example) does not.

Garrington, S.T., Leahy, J.P., Conway, R.G. & Laing R.A. VLA observations of 25 sources, 1.4 - 4.9 GHz. Of these, 23 depolarize faster on the counter-jet side, 1 has no polarization detected on the counter-jet side at all (?depolarizes at a higher frequency) and 1 is the wrong way round (although it shows very little depolarization on either side, so may not be significant).

The parent sample for the Garrington et al. paper is essentially all of the FR2 sources that we knew about which had one jet, were the right size and had not been done before. Those processed so far have LAS (25 arcsec (A confn. at 1.4 GHz; B at 4.9 GHz). There are 30 larger ones to come. We can see already that the typical depolarization wavelengths are longer for the larger sources, so we will probably not get as significant a result for them without another frequency.

I will send you copies of both papers when the revisions are done.

Regards, Robert

AHB-CVAX$ type review.rev
From: OUTBAX::VAX3::RPERLEY 12-NOV-1987 13:59
To: ABRIDLE
Subj: Your Review

I have read your review (and passed it on to Paddy Leahy and Chirs Carilli (I hope you don't mind)). Overall, I think it's great. I have a few comments, listed below.

You don't really define 'extended' anywhere in the preamble. About the only quantitative explanation for this term is at the bottom of the first page, 'kiloparsec and larger scales'. It's probably not of great importance, but you might want to state more definitely what scales your review deals with.

At the bottom of page 2, you state the absence of relatively powerful jets ranges from log P = 25 to log P = 26.3. My interpretation of your plot would be that there is no upper range - or at least, there's no information to allow an upper limit to be set for radio galaxies. (I found this plot, and Fig. 2 to be quite interesting...)

At the bottom of page 3, you have '...so that they interact with surrounding gas more through shocks...'. I had the view that the situation was more that the high Mach number, light jets didn't really interact at all with the surrounding medium. Isn't this isolation the central issue?

Middle of page 4, 'light jets therefore propagate through shock-heated, overpressured backflow cocoons...' - this implies the cocoons are overpressured everywhere. Is this the case? Everywhere? All sources? I doubt it myself, although I certainly believe it in regions near the hot spots. But, in the central regions, where (for Cyg A at least) the over-pressure problem is worst, I have trouble with great degrees of overpressure.

page 6, bottom. I find this interpretation interesting (I guess we discussed this while putting together the 3C219 paper). But, what if the head of the receding jet is actually a splash-back phenomenon. Then the emission becomes blue-shifted. (But then, of course, the model won't fit as well). I like the expression 'born-again jets'. Too bad you can't slip in a reference to the Bakers here, or Jessica Hahn.

page 7, bottom. On detecting counter jets at lower frequencies. Good idea! But how are we to do this? We need more resolution, by an order of magnitude or so. We have a nice map of Cyg A at 327 MHz now, but no sign of the jet (either one!) This is not surprising of course, and I take your point about looking to check on frequency dependent spectral index effects. But, given the known fact that lobes have steep spectra, and the diffraction limit, detection of jets at these frequencies will be hard.

page 7, very bottom. What is a small source? We deduce you mean highly redshifted objects, but I didn't find a definition.

page 8, middle. I guess to check on Condon's hypothesis, one needs to image steep spectrum objects with the same luminosity, but which are radio galaxies or low redshift quasars. Any indications from this approach?

page 9, middle. Mike Norman and I have concocted a model for Cygnus A which has the gas mixed in a fairly deep layer around the source (10% of the source width), which will explain BOTH the rotation measure AND the tendency for the magnetic fields to lie along the source axis, both lobes looking the same. (This is called the 1 AM model, after the time that we did this at Cargese). The point is that we can't entirely rule out some form of intermixed emission and rotation - only that the thermal gas and non-thermal gas cannot be similarly distributed throughout the emission volume.

On M87, Frazer's work shows the huge RMs (>7000 rad/m/m) are entirely within the galaxy, and only on the 'unjetted' side. The physical scale of the effect is an order of magnitude less than those in Cyg A (at least).

page 10, bottom. We have done the work on depolarization in 3C449, but the results are most confusing. But, it (the depolarization) appears to be the same on both sides). I am waiting, still, for Killeen to write up the paper. I hope I don't have to wait until I retire.

page 11, middle. Mildly bulk relativistic motions... YES YES YES. I this case, rather than explore the endless consequences of magnetically dominated jets (which may be more interesting to him, but may also have much less physical applicability). What's your view?

There were a few typos, etc, but I haven't included these here. If you like, I'll send them on too.

Regards. How much snow did you get?

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AHB-CVAX$ type revreply.txt
From:   CVAX::ABRIDLE       12-NOV-1987 15:21
To:     RPERLEY,ABRIDLE
Subj:   Snow job
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To answer your question - we got about seven inches, much less than in D.C. It's pretty much all melted off today. Big surprise was how hard on the heels of a real Indian summer we got it (had been basking in warm sun only a couple days before !).

Re Figs. 1 and 2 of my review. I see a hole in the diagram above the 10% line (the line labeling will be explained in the captions, by the way - you probably guessed that it's the jet power as a % of the total extended power) between log P(ext) = 25 and log P(ext)=26.3. I agree that it's the QSRs that contribute all of the upper end excess (that is actually a large part of my point, maybe I should emphasize it harder ?). It may be doubly significant that not only do the wierder morphologies contribute most of the prominent jets in the powerful sources, but that the wierder morphologies generally belong to the quasars. In any case, I am trying to say that the prominence of the galaxy jets decreases above log P = 24, and that there is a hole in the total distribution between 25 and 26.3 that is due mainly to the absence of prominent jets in strong radio galaxies. I'll try to reword it to make it clearer in the next version.

Re the interactions of the hypersonic light jets. I guess you're right in saying that they don't interact as much with the ambient medium, but they do interact strongly with their own backflow (and keep the ambient medium at bay via shocks and the flow at the contact discontinuity). My point is that the interaction goes over from being one that mainly involves deceleration of the jet by entrainment to one that mainly involves pumping energy into shocks that do not stop the jet from progagating. Again, I'll look for some better words to clarify this.

Re the overpressure. If the Mach number of the jets is high and the density contrast is low, the bow shock's Mach number in the ambient medium is the same as the jet's mach number in the jet. Right behind the bow shock, you therefore can get up to about M**2 times the ambient pressure (and this is what is going on around the hot spot regions). As the backflow goes back down the jet it expands and cools, but stays behind what is in the limit of very hypersonic jets a cylindrical bow shock. The pressure behind that bow shock can stay very high for a long time. Mike Norman has done some simulations that show this effect directly. Various people have done calculations that approximate the dependence on M and eta in terms of jet length L and radius R. The L/R ratio to which the "back end" of the jet can stay overpressured depends on M and eta. I did a rough approximation to this myself based on the 2-d Sedov expansion while I was up at Aspen; I'll dig that out for you.

Re 219. If the head actually splashes-back, I think everything I have said is still true. That would do more than just remove an unfavorable beaming factor, it might create a favorable one for some of the material. I figured the "born again" reference would go down well in Georgia. I'll keep it in.

Re cjets at lower frequencies. How about MERLIN ? The VLA ain't the only one in the universe .....