From: dclarke@ap.stmarys.ca (David Clarke)
To: abridle@polaris.cv.nrao.edu
Subject: Re: 3C219
Date: Mon, 4 Nov 1996 17:06:34 -0400

Alan:

Your message of last year now (!!) posed some very interesting problems. A month ago, I finally got the 3-D restarting jet simulation complete. I shall put an MPEG of the animation on my home page soon, so you can take a look at it. In the meantime, I thought I would let you know what some of the relevant features are as they apply to where we left things in the Clarke et al paper nearly 5 years ago.

1. As far as I can tell, the salient result of the "passive field model" as you called it, ie the jet seeming to disappear after the criss-cross shocks cease, does NOT carry over to 3-D. The reason is as follows: once the jet goes Kelvin-Helmholtz unstable (flaps), the criss-cross shocks are no longer permanent features of the jet. Now, it may be that the 219 jet is more stable than mine (higher Mach number, lighter perturbation, etc), and so the criss-cross shocks may come back even in 3-D. But as it stands now, I would have to say the passive field model is in serious trouble, as if it weren't already.....

2. For lines of sight consistent with the Barthel unification model (ie, 219 being a radio galaxy requiring it to be more than 45 degrees with respect to the line of sight), the bow shock stands out like a sore thumb. Only when you get to QSO angles with respect to the line of sight, can you begin to lose the bow shock in the tangled mess of the cocoon and lobe. The fact that the bow shock stands out even without particle aging means that in nature, the bow shock should stand out even more than in the simulations. So where is the bow shock around the 219 reborn jet?

   As you suggested earlier, perhaps the Mach number is so high that the Mach angle of the bow shock gives an extremely narrow bow shock, and so perhaps the edge-brightened jet itself is the bow shock. This I doubt very much. First, the old cocoon material is very hot and thus the sound speed there is probably approaching the relativistic limit of c/sqrt{3}. This being the case, a Mach angle of essentially zero would require an exceedingly high Lorentz factor. How would such an energetic outflow turn on so suddenly? Such a flow would be entirely ballistic given the huge gamma, and so the advance speed would be essentially c. That being the case, the odds of spotting 219 just in this state is exceedingly low. This by itself would not be so damning were it not for the fact that there are, as I recall, three or four other such partial jets in the literature? But even more damning is that at such high lorentz factors, being more than 45 degrees off the line of sight would mean we shouldn't see any jet at all---the stupid thing would be Doppler enfeebled to the point of not being there at all, yet we see a whopping jet. So, the lack of a bow shock is still a serious problem in my books.

3. It is clear that the hot spot cannot survive without a focussed jet---not for a radio lobe's blink of an eye. Thus, we must be observing the reborn jet at the same time the old vestigal jet is still pouring into the hot spot. That said, Rudnick's analysis might indeed prove interesting---some traces of the old jet and the still-existing channel should be there. I think this we can address with the current data and simulations.

At any rate, this is to update you on my slow progress on this computation. When I come to write this up, it might be well to combine it with a new 3C219