PASCHEN ALPHA AS A PROBE OF RELATIVISTIC BEAMING +

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Is the theme of core-brightening by relativistic beaming, so useful for compact sources, helpful in explaining the nuclear properties of classical doubles? Certainly one can construct an attractive model - involving the usual beaming together with an anisotropic dust distribution at r $\lesssim$ 1 pc - to explain the differences in nuclear radio and optical properties of radiogalaxies as due differences in orientation.with respect to us. There are clear predictions about the strength of broad Pα. Preliminary results indicate that this kind of model is not *correct.*

The idea of relativistic beaming has proved extremely useful in accounting for core-jet morphology in compact sources. Can we fruitfully apply it to the nuclei of classical double radiogalaxies? There are sparse VLBI data on these sources, but one important piece of evidence suggests beaming may indeed be occuring : nuclear radio luminosity differs substantially between radiogalaxies with much the same extended, unbeamed properties like total luminosity and shape. Clearly, we could identify sources with bright nuclei as those with small values of angle θ between axis and line-of-sight. Then we must take account of the strong correlation existing between the radio luminosity ratio $P_{nucleus}/P_{total}$ and the strength of broad nuclear Balmer lines (see Hine and Longair 1979; extensive spectrophotometric work by Osterbrock's group and by the Cavendish group confirms this result). This correlation cannot be produced by the beaming of line emission because the peaks of all lines in a given radiogalaxy are at the same redshift. So we need a way of hiding broad lines except when θ is small : the obvious way is with dust - which reddens the visible - covering (or in) all the broad line region except for a pair of "channels" centred on the source axis. Note that there is no implicit requirement that the channel opening angle should be the same as the range of θ over which relativistic boosting occurs. The resulting model is shown in the Figure.

Is the model right? There are two immediate tests.

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(a) Compare the projected linear sizes of BLRGs (broad-line radio galaxies) and NLRGs (narrow-line RGs) - the BLRGs should be smaller on average. The observed difference is not statistically significant because of the combination of small numbers of BLRGs and of the great range in size of RGs in general.

(b) Search for broad Pα in NLRGs. Pα is hardly reddened by dust and is often redshifted into the K band, and broad Pα has been looked for and found in a few quasars and BLRGs despite major technical difficulties. If the model is right, the new Cooled Grating Spectrometer on UKIRT should detect broad Pα in many radiogalaxies. Lance Miller and I have just attempted such a search. Despite serious weather and instrument problems, we detected broad Pα as expected in quasars but failed, with high significance, to find it in NLRG Cygnus A : our 3σ upper limit is 1.5×10^{-17} W/m^2/channel in each channel of width 1700 km/s. If Cygnus A were a sideways-on version of a BLRG of the same P_{total}, we would have found 3×10^{-16} W/m^2/channel. The conclusion from this preliminary result is that this kind of model is wrong.

REFERENCE

Hine, R.G. and Longair, M.S.: 1979, Monthly Notices Roy. Astron. Soc., 188, pp. 111-130.