The Interplay among Black Holes, Stars and ISM in Galactic Nuclei
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Two interesting cases of oddball AGN

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Abstract. We present new observations from Gemini-South for two unusual AGNs: the recently-discovered, largest-known FR I radio galaxy ($> 1.1 Mpc$), and a FR I radio galaxy originating from a spiral host (the wrong kind of galaxy!). Both AGNs may represent missing classes of objects, not present in current surveys and samples.

1. The Largest FRI Radio Galaxy

As part of a large study of cluster and non-cluster radio galaxies, the radio galaxy B2 1108+27, was found to be much more extended than previously thought. With FIRST, B2 1108+27 appears as a naked-jet source with a full extent of only 44 kpc. Deeper imaging with the VLA at 20cm in the D-array has confirmed that the source is considerably more extended; $\geqslant 1.1$ Mpc (see Figure 1), thus falling within the class of giant radio galaxies. B2 1108+27 is unique, however, in that the radio luminosity is an order of magnitude less than the lowest luminosity giant radio galaxies currently known, and is also of FR I morphology.

In figure 1, we show followup optical imaging with Gemini-South and $H\alpha$ imaging from Cerro Tololo. These data reveal that B2 1108+27 shares similar morphological properties to Centaurus-A, and hence is most likely the result of a major merger. Yet such a violent environment would seem to be the last place that one should find a giant low-luminosity radio galaxy with extremely straight and undisturbed jets. A recent Gemini+GMOS longslit spectrum has revealed a central dust-disk in scattered light from a powerful AGN. The implied mass is $4 \times 10^{10} M_{\odot}$ within 2 kpc and $2 \times 10^{11} M_{\odot}$ within 6 kpc, pointing to a very large central BH mass (possibly a binary)?

2. A Unique Spiral Radio Galaxy

The discovery of the spiral-host radio galaxy 0313-192 was reported in Ledlow et al. (1998), Ledlow et al. (2001). Here, we present new images (see also: Keel et al. (2002)) from HST and Gemini, illustrating beyond doubt the spiral (Sa/Sb) nature of the host and clearly showing a warped disk. From narrow-band HST imaging, we also find evidence of an inner, tilted disk, possibly indicating an interaction or minor merger. We have attempted an indirect measurement of the BH mass from the dispersion-width of the Ca-Triplet with Gemini, but the results are inconclusive. This object makes an interesting test-case for understanding the relationship between BH mass and nuclear activity. Based on bulge luminosity, we might expect a BH mass of $\geqslant 10^8 M_{\odot}$, however the spiral nature of the host places it in a relatively unsampled region of the M_{BH}/M_{bulge} plane.

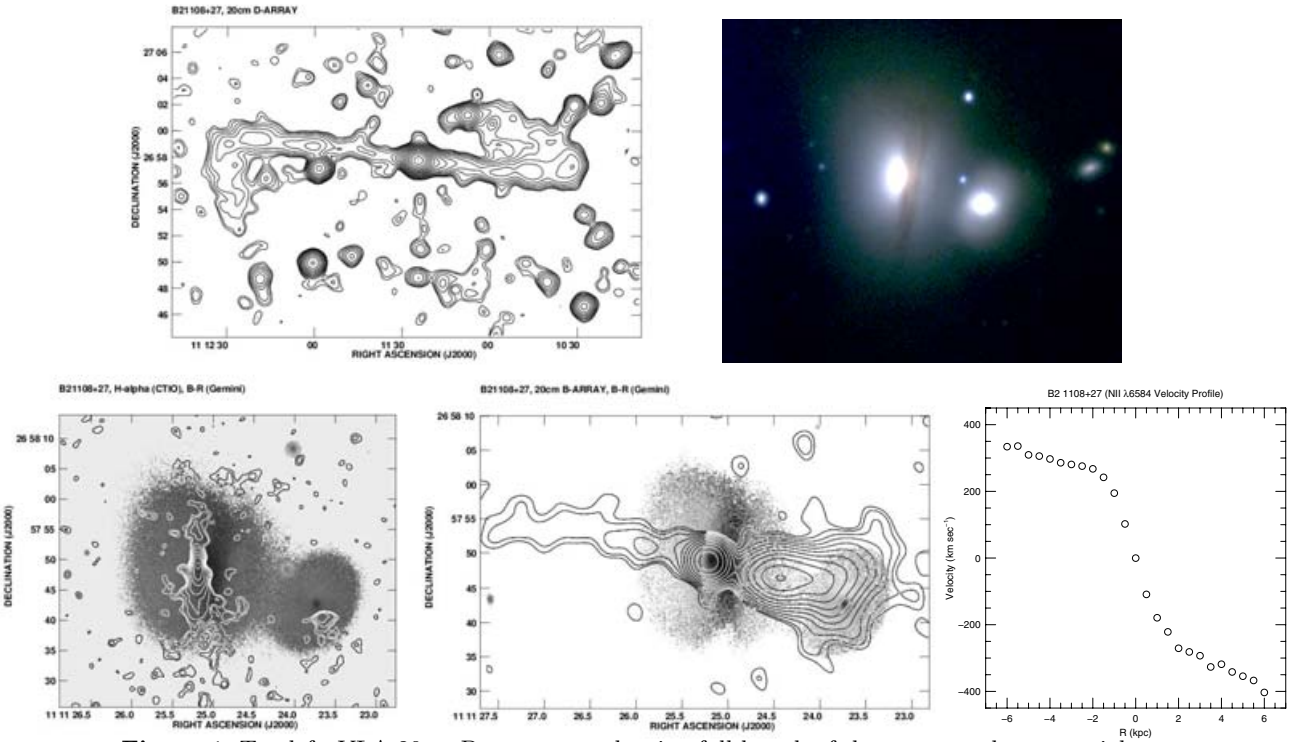

Figure 1. Top left: VLA 20cm D-array map showing full-length of the source and very straight jets, Top right: BVR image from Gemini-South with the Acquistion camera and an image quality of 0.8 arcsec. Bottom left: $H\alpha + [NII]$ narrow-band image from CTIO (countours) overlayed on B-R color map. Note the dust-lane parallel to the extended emission-line gas. Middle: Inner radio jets overlayed on B-R color map, Right: rotation profile measured from [NII] from GMOS-S longslit spectrum.

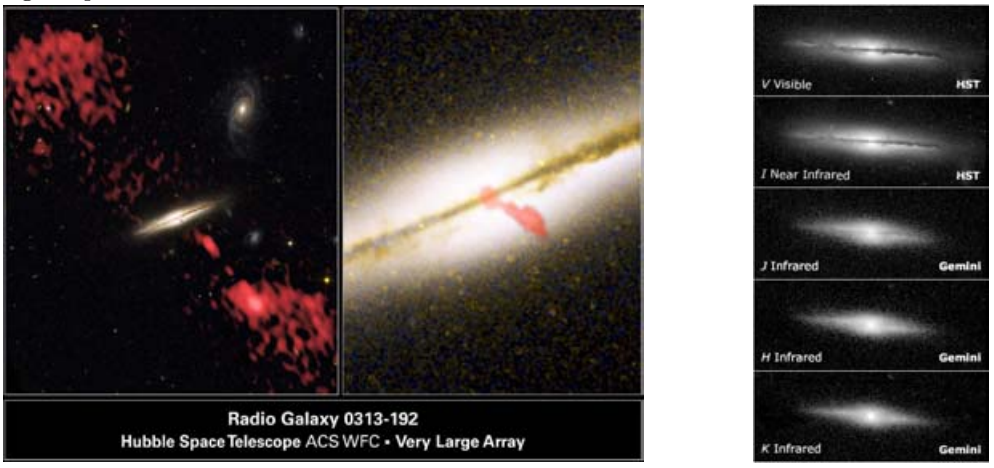

Figure 2. Left: HST/ACS + VLA overlay of 0313-192. Right: HST V,I-band and Gemini-S Flamingos-I, J,H,K images (IQ=0.39 arcsec)

References

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