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CIRCUMNUCLEAR GASEOUS KINEMATICS AND EXCITATION OF FOUR LOCAL RADIO GALAXIES

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We present our results using optical integral field spectroscopy of four nearby ($z < 0.07$) radio galaxies obtained with GMOS in Gemini North and South telescopes. The field-of-view probes a circumnuclear region of $\approx 3.5'' \times 5''$, with average spatial resolution of $\approx 0.6''$. In this presentation, we will resume our results for two galaxies of our sample, Arp 102B and Pictor A, which are already published (Couto et al. 2013, 2016), as well as discuss the preliminary results for the other two, 3C 33 and 4C +29.30. While these galaxies present different characteristics, like radio jet morphology, they display in common signatures of interactions or merger events.

For Pictor A, e.g., we find unusually low [N II]6584/Hα ratio (0.15 - 0.25), suggesting low metallicity of the gas, not expected in AGNs (Active Galactic Nuclei). This suggests a acretion of gas through an interaction event, in agreement with the tidal tail observed by Gentry et al. (2015). The presence of more than one kinematical component in the galaxies of our sample suggests that mechanisms of feeding or feedback are dominating the central region. Although we estimate low energetic input of the radio jet in the circumnuclear gas (outflow kinetic power of $\dot{E} < 1\% L_{bol}$), we do observe indications of jet-cloud interaction. This is the case of Arp 102B, where apparent nuclear spiral arms traced by ionized gas is the result of circumnuclear gas being pushed by the radio jet. We also present resolved diagnostic diagrams for these galaxies using the optical emission-lines, and the comparison with shocks and photoionization models, which suggests more presence of shocks in regions closer to the radio jet, but also contribution of photoionization.

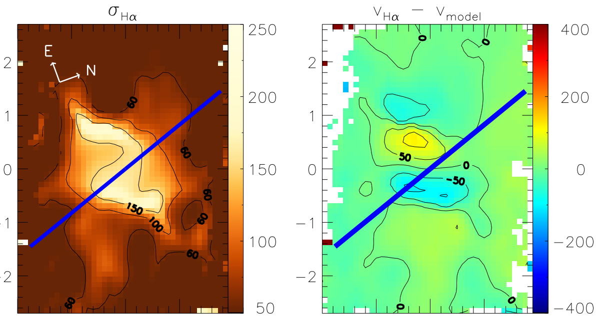

Fig. 1. Hα velocity dispersion and residuals from the rotation model fitted to the Hα centroid velocity field of 3C 33. The blue line indicates the radio jet axis present in this galaxy. X and Y-axis are in arcsec, and the units are $\mathrm{km\,s^{-1}}$.

3C 33, present clear signatures of the presence of shock-ionized gas. Two regions located $\sim 0\farcs5$ east and west from the nucleus present higher velocity dispersion ($\sigma \sim 170\,\mathrm{km\,s^{-1}}$). The residual velocity map obtained from a rotation model fit to the Hα centroid velocity field displays high values ($> \pm 50\,\mathrm{km\,s^{-1}}$) in the same regions (see Fig. 1). We also observe that these regions present an increase of gas temperature ($\sim 18000\,\mathrm{K}$), electron density ($> 500\,\mathrm{cm^{-3}}$), aside from high [NII]/Hα, [SII]/Hα and [OI]/Hα ratio values. The apparent symmetry of the regions towards the radio jet axis led us to interpret that the gas is in outflow due to a lateral expansion, producing the shock ionization we observe.

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REFERENCES

Couto, G. S., Storchi-Bergmann, T., Axon, D. J., et al. 2013, MNRAS, 435, 2982

Couto, G. S., Storchi-Bergmann, T., Robinson, A., et al. 2016, MNRAS, 458, 855

Gentry, E. S., Marshall, H. L., Hardcastle, M. J., et al. 2015, ApJ, 808, 92