Galaxy Evolution and Feedback across Different Environments
Proceedings IAU Symposium No. 359, 2020
T. Storchi-Bergmann, W. Forman, R. Overzier & R. Riffel, eds.
doi:10.1017/S1743921320001854

Outflow signatures in Gemini GMOS-IFU observations of 5 nearby Seyfert 2 galaxies

Izabel C. Freitas[1], Rogemar A. Riffel[2] and Thaisa Storchi-Bergmann[3]

[1]Universidade Federal de Santa Maria, Colégio Politécnico, 97105-900, Santa Maria, RS, Brazil
email: izabelfisica@gmail.com

[2]Universidade Federal de Santa Maria, Departamento de Física, Centro de Ciências Naturais e Exatas, 97105-900, Santa Maria, RS, Brazil

[3]Instituto de Física, Universidade Federal do Rio Grande do Sul, Av. Bento Gonçalves 9500, 91501-970, Porto Alegre, RS, Brazil

Abstract. We use Gemini Multi-Object Spectrograph (GMOS) Integral Field Unit (IFU) observations of a sample of 5 bright nearby Seyfert galaxies to map their emission-line flux distributions and kinematics at a spatial resolution ranging from 110 to 280 pc. For all galaxies, the gas kinematics show two components: a rotation and an outflow component.

Keywords. galaxies: Seyfert, galaxies: kinematics, galaxies: nuclei

1. Introduction

We present a study of the Narrow Line Region (NLR) of 5 nearby Seyfert galaxies: Mrk 6, Mrk 79, Mrk 348, Mrk 607 and Mrk 1058. We have mapped the gas emission-line flux distributions and kinematics, as well as of the stellar kinematics using Integral Field Spectroscopy (IFS) obtained at the Gemini North Telescope, using the Gemini Multi-Object Spectrograph (GMOS). The data cover the spectral range from 4300 Å to 7100 Å, that includes the strongest emission-lines from the NLR of AGNs: Hβ, [O III] $\lambda\lambda$4959,5007, [O I] λ6300, Hα, [N II] $\lambda\lambda$6548,83 and [S II] $\lambda\lambda$6716,31.

We fit the emission-line profiles with Gaussian curves in order to map the emission-line flux distributions and gas kinematics.

2. Results

In Figure 1, we present the resulting maps for the flux distributions, line ratios and gas and stellar kinematics for Mrk 348. The highest blueshifts and redshifts, seen at 1.5″ NE and 1.5″ SW, respectively, associated to high velocity dispersion values are interpreted as being due to ionized outflows. Mrk 79, Mrk 348 and Mrk 1058 show bipolar outflows, while in Mrk 6 and Mrk 607 the geometry of the outflows are not fully constrained by our data.

3. Conclusions

Our main conclusions are: (i) The highest gas densities ($N_e \approx 1000$–$2000\,\mathrm{cm}^{-3}$) are usually observed at the nucleus, in a few cases also extending towards regions of highest excitation. A particular case is Mrk 1058 that seems to show a circumnuclear ring of high-density gas at ≈1.7 arcsec (592 pc) from the nucleus. (ii) The average nuclear chemical

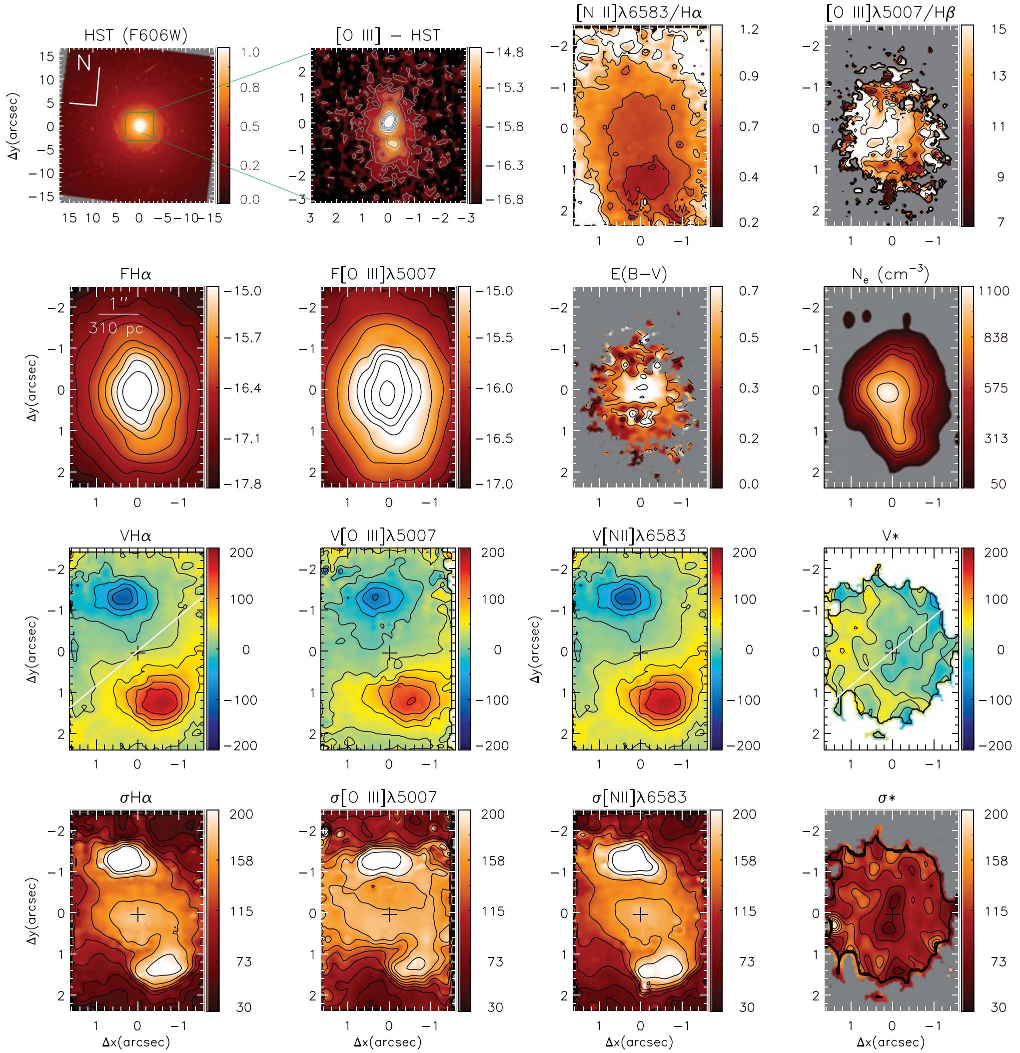

Figure 1. Two-dimensional maps for Mrk 348. The central cross marks the location of the nucleus, defined as the position of the peak of continuum emission and the spatial orientation is shown at the top left corner of the large-scale image. The contours overplotted to the [O III] λ5007 flux map (in green), velocity field (in white), and σ map (green) are from the 3.6 cm radio image of Schmitt *et al.* (2001). The white line shown in the Hα velocity field represents the major axis of the large-scale disk, measured using I-band images by Schmitt & Kinney (2000). Gray regions in the flux, ratio and velocity dispersion maps and white regions in the velocity fields correspond to locations where the signal-to-noise ratio was not high enough to obtain a good fit of the line profiles. Figure from Freitas *et al.* (2018).

abundance of the galaxies of our sample is $\langle 12 + \log O/H\rangle = 8.66 \pm 0.17$, measured within an aperture of 0.25×0.25 arcsec^2 using the strong lines method (Storchi-Bergmann *et al.* (1998)). (iii) The gas kinematics show a distorted rotation pattern that can be attributed to a combination of emission from gas in rotation in the galaxy plane and outflows. (iv) The rotation component of the gas is similar to that obtained from the stellar kinematics, except for Mrk 607 in which the gas is counter-rotating relative to the stars. (v) The gas velocity dispersion shows two typical patterns: it is enhanced at the location of the outflows or surrounding the nucleus in an elongated structure perpendicular to

https://doi.org/10.1017/S1743921320001854 Published online by Cambridge University Press

the outflow. This latter behaviour has been attributed to an equatorial outflow from the AGN, possibly originating in the torus. (vi) The (projected) velocities of the outflow reach at most $\approx 200\,\mathrm{km s^{-1}}$, but could be larger as they seem to be mostly in the plane of the sky.

The GMOS data are presented in Freitas *et al.* (2018) and a detailed discussion about the gas kinematics and chemical abundances will be presented in forthcoming papers.

References

Freitas, I. C., *et al.* 2018, *MNRAS*, 476, 2760
Schmitt, H. R., Ulvestad, J. S., Antonucci, R. R. J., *et al.* 2001, *ApJS*, 132, 199
Schmitt, H. R. & Kinney, A. L. 2000, *ApJS*, 128, 479
Storchi-Bergmann, T., *et al.* 1998, *ApJ*, 115, 909

https://doi.org/10.1017/S1743921320001854 Published online by Cambridge University Press