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COLLIMATION AND SCATTERING OF THE AGN EMISSION IN THE SOMBRERO GALAXY

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We present an analysis of a data cube of the central region of M104, the Sombrero galaxy, obtained with the GMOS-IFU of the Gemini-South telescope, and report the discovery of collimation and scattering of the active galactic nucleus (AGN) emission in the circumnuclear region of this galaxy

M104, the Sombrero galaxy, is a highly inclined (nearly edge-on) SA(s)a galaxy at a distance of about 9.2 Mpc. Based on its optical emission-line spectrum, the nucleus of this object has been classified as a LINER (Low-ionization nuclear emission-line region - Heckman 1980).

The observations of M104 we analyze here were made with the Integral Field Unity (IFU) of the Gemini Multi-Object Spectrograph (GMOS) of the Gemini-South telescope. The data reduction was made in IRAF environment. A data treatment procedure was also applied to all data cubes, including the following steps: correction of the differential atmospheric refraction, calculation of a median of the data cubes, Butterworth spatial filtering, and Richardson-Lucy deconvolution.

After the data reduction, we applied the PCA Tomography technique (Steiner et al. 2009) to the data cube of M104. This analysis revealed a broad component in the Hα emission line of this galaxy. We also detected the existence of a collimation of the type 1 AGN emission of this galaxy, followed by a scattering of this light towards us.

After the analysis with PCA Tomography, we applied a spectral synthesis to the spectrum of each spaxel of the data cube of M104, using the Starlight software (Cid Fernandes et al. 2005). This procedure provided a map of the flux associated with the AGN featureless continuum and also an Av map. The first of these maps showed the presence of a featureless continuum in the FOV of the GMOS-IFU, but only in two regions, north and south from the AGN, not at the position of the AGN. This may be a consequence of a collimation of the AGN featureless continuum, followed by a scattering of this light. On the other hand, the Av map revealed the existence of dust along the inner stellar disk. The presence of dust in this area was confirmed by a V-I image, obtained with the HST, which also revealed the existence of a dense structure, made of dust, in the vicinity of the AGN that we interpret as a torus/disk. The existence of two opposite regions with featureless continuum along a direction perpendicular to this torus/disk suggests that this structure is approximately edge-on and collimates the AGN emission.

Finally, we subtracted the synthetic stellar spectra from the observed ones, leaving a data cube with emission lines only. We then extracted spectra from five circular regions of the residual data cube and fitted the emission lines [N II] $\lambda\lambda 6548, 6583$ and Hα in these spectra with a sum of Gaussian functions. Each emission line was fitted by two narrow Gaussians (with different widths). A broad Gaussian was also added to the fit, in order to reproduce the possible broad component of Hα. We observed that the broad component of Hα was detected at the position of the AGN and also in two regions, north and south from the AGN. This is compatible with the hypothesis of a collimation of this broad line emission, followed by a scattering of this light.

In summary, we conclude that all the analysis we performed revealed the existence of a collimation of the type 1 AGN emission in this galaxy, followed by a scattering of this light towards us. The proposed scenario is compatible with the Unified Model for AGNs and the existence of a nearly edge-on torus/disk (which blocks the direct emission from the Broad Line Region of the AGN) explains why only a weak broad component of the Hα emission line is visible and also why many previous studies of this object detected no broad Hα.

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REFERENCES

Cid Fernandes, R., Mateus, A., Sodré, L., Stasinska, G., & Gomes, J. M. 2005, MNRAS, 358, 363
Heckman, T. M. 1980, A&A, 87, 152
Ho, L. C., Filippenko, A. V., & Sargent, W. L. W. 1997, ApJS, 112, 315
Kormendy, J., et al. 1996, ApJL, 473, L91
Steiner, J. E., Menezes, R. B., Ricci, T. V., & Oliveira, A. S. 2009, MNRAS, 395, 64