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Turbulence/outflows perpendicular to low-power jets in Seyfert galaxies†

Giacomo Venturi[1,2], Alessandro Marconi[3,2], Matilde Mingozzi[4], Giovanni Cresci[2], Stefano Carniani[5,2] and Filippo Mannucci[2]

[1]Instituto de Astrofísica, Pontificia Universidad Católica de Chile, Avda. Vicuña Mackenna 4860, 8970117, Macul, Santiago, Chile
email: gventuri@astro.puc.cl

[2]INAF - Osservatorio Astrofisico di Arcetri, Largo E. Fermi 5, I-50125, Firenze, Italy

[3]Dipartimento di Fisica e Astronomia, Università degli Studi di Firenze, Via G. Sansone 1, I-50019, Sesto Fiorentino, Firenze, Italy

[4]INAF - Osservatorio Astronomico di Padova, Vicolo dell'Osservatorio 5, 35122, Padova, Italy

[5]Scuola Normale Superiore, Piazza dei Cavalieri 7, I-56126 Pisa, Italy

Abstract. We present recent results from our MAGNUM survey of nearby active galactic nuclei (AGN), which exploits observations from the optical/near-IR integral field spectrograph MUSE at VLT. We detect strongly enhanced line widths in emission line maps of four galaxies perpendicularly to their low-power jets and AGN ionisation cones, indicative of turbulent/outflowing material. The observation of a similar phenomenon in other works suggests that it originates from an interaction mechanism between the jet and the galaxy disc through which it propagates.

Keywords. galaxies: jets, galaxies: Seyfert, galaxies: individual (IC 5063, NGC 5643), galaxies: ISM, galaxies: kinematics and dynamics, techniques: spectroscopic

1. Introduction

Ionised outflows are routinely observed in active galactic nuclei (AGN), either powered by the strong AGN radiation pressure or by powerful jets (see e.g. Fabian 2012).

Here we focus on new results from our 10-to-100 pc spatially-resolved MAGNUM survey (Measuring Active Galactic Nuclei Under MUSE Microscope) of nearby AGN (e.g. Venturi *et al.* 2017, 2018; Mingozzi *et al.* 2019) observed with the optical and near-IR integral field spectrograph MUSE at VLT (Bacon *et al.* 2010), revealing a peculiar phenomenon in objects hosting low-power jets.

2. Turbulence/outflows perpendicular to low-power jets

In Fig. 1 we present MUSE maps of two Seyfert galaxies from our survey, IC 5063 and NGC 5643. Here, while the high bulk velocity gas (panels b and e) indicates an outflow in the direction of the AGN ionisation cones (traced by [O III], panels a and d), as normally expected in AGN (e.g. Fischer *et al.* 2013), a strongly enhanced line velocity width ($\gtrsim$800 km/s; panels c and f), indicating turbulent/outflowing motions with low bulk velocity, is observed instead perpendicularly to the ionisation cones and radio jets (black contours in panels c and f). We detect this phenomenon in two other galaxies of

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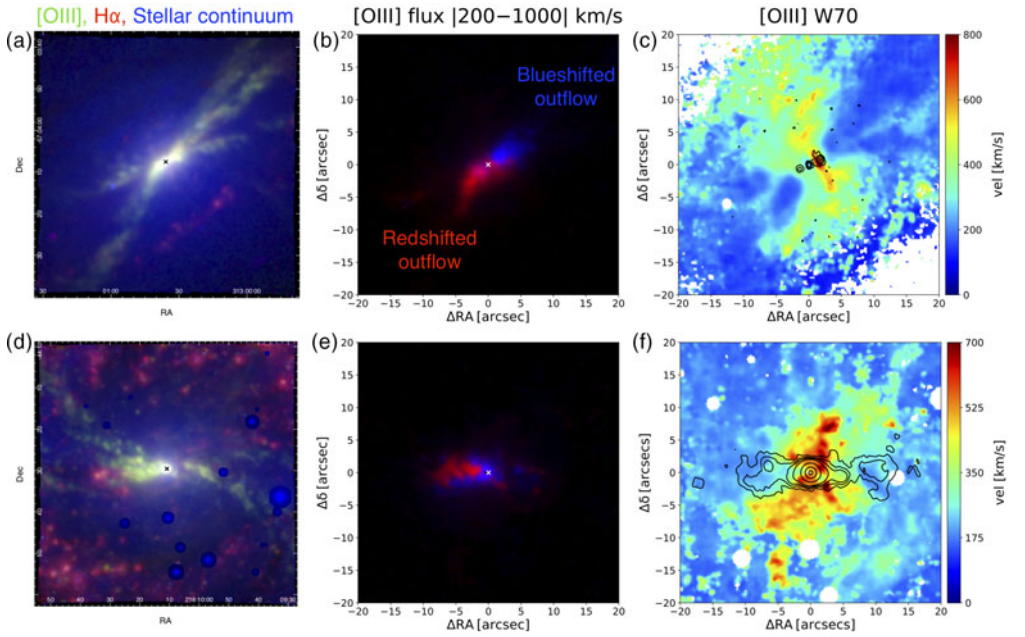

Figure 1. VLT/MUSE maps of IC 5063 (top) and NGC 5643 (bottom). a) and d) Flux maps of ionised gas, [O III]λ5007 (green) and Hα (red), and stellar continuum (blue). b) and e) Bulk of the high-velocity outflow, traced by the flux of [O III] line profile integrated in the velocity range $\pm|200-1000|$ km/s (blue if approaching, red if receding) with respect to the stellar velocity in each spaxel (to exclude contributions from gas rotating in the disc). c) and f) [O III] W70 line velocity width map (i.e difference between the 85th- and 15th-percentile velocities of the line profile), with radio jet contours superimposed, ATCA 17.8 GHz from Morganti *et al.* (2007) for IC 5063, 8.4 GHz VLA from Leipski *et al.* (2006) for NGC 5643.

our sample, NGC 1068 and NGC 1386. We note that all the four mentioned galaxies host a low-power radio jet with low inclinations to galaxy disc.

3. Discussion and Conclusions

We have shown MUSE emission-line maps of two nearby Seyfert galaxies from our MAGNUM survey, which - together with two other sources of the sample - exhibit enhanced line velocity widths perpendicularly to their low-power radio jets and ionisation cones, indicative of turbulent/outflowing motions. A similar phenomenon has been reported in other recent works also in galaxies hosting jets lying low onto the galaxy disc (e.g. Shin *et al.* 2019). This suggests that the jets, through the interaction with the gas in the disc, are responsible for generating the observed perpendicular turbulence/outflow. Moreover, our results confirm that not only powerful jets in "radio loud" objects (e.g. Nesvadba *et al.* 2008) are capable of affecting the gas in the host, but also low-power jets residing in "radio quiet" galaxies, as indicated by recent works (e.g. Jarvis *et al.* 2019).

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