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Gas kinematics and stellar archaeology of the Seyfert galaxy NGC 5643

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Abstract. In this work we derive stellar archaeology and kinematics of the central 400 pc of NGC 5643. The star formation history (SFH) reveals nuclear contribution of stellar populations older (20% older than 3.5 Gyr) and younger (60% younger than 320 Myr) as compared to the circumnuclear region. The [OIII] 5007 $\AA$ kinematics reveals the eastern ionization cone with an outflow (-60 km/s $\leqslant$ v $\leqslant$ 120 km/s).

Keywords. Active Galatic Nuclei, Outflows, Stellar Populations

1. Introduction

NGC 5643 is an almost face-on SAB(rs)c and Seyfert 2 galaxy. Some works obtained evidence of a double-sided ionization cone (Morris *et al.* 1985, Schmitt *et al.* 1994 and Cresci *et al.* 2015) almost in the bar direction (PA = 90°). Other works suggest that the cone region is tilted with respect to the galaxy plane (Schmitt *et al.* 1994, Simpson *et al.* 1997) and Cresci *et al.* (2015) found a western dust structure that may be connected to the dust lane of the bar.

The work of Cresci *et al.* (2015) suggests a blueshifted outflow of [OIII] 5007 $\AA$ on the East side of the nucleus. In contrast, Menezes *et al.* (2015), using Spectrograph for Integral Field Observations in the Near Infrared (SINFONI) data show that $Br\gamma$ presents a redshifted outflow in the central 200 pc.

This research is conducted in the context of the Deep IFS View of Nuclei of Galaxies (DIVING^{3D}) project, a survey of galactic nuclei of the southern hemisphere using optical integral field spectroscopy (IFS) and high spatial resolution (Steiner *et al.* this proceedings). The first goal of the present work is to map the distribution and kinematics of highly excited gas that can reveal the ionization cone of the active galactic nucleus (AGN) and possible outflowing components. We aim also to model the stellar populations present in the nuclear and circumnuclear regions, deriving the star formation history (SFH).

The observations were carried out in the Gemini South telescope with the Gemini Multi-Object Spectrographs (GMOS) in integral field spectroscopy with one-slit mode (5" × 3.5"). The data cube covers 4800−6800$\AA$ with a resolution of 1.3 $\AA$ at 5850 $\AA$. The data treatment was conducted with the methods developed by our group (Menezes *et al.* 2019).

The stellar populations were modeled with the spectral synthesis code STARLIGHT (Cid Fernandes*et al.* 2005) using 200 MILES (Vazdekis *et al.* 2010) simple stellar populations (SSPs) with 50 ages (63 Myr−17.78 Gyr) and 4 metalicities (Z = 0.19, 0.40, 1.00, 1.66). The stellar fit was subtracted to obtain the pure emission line cube.

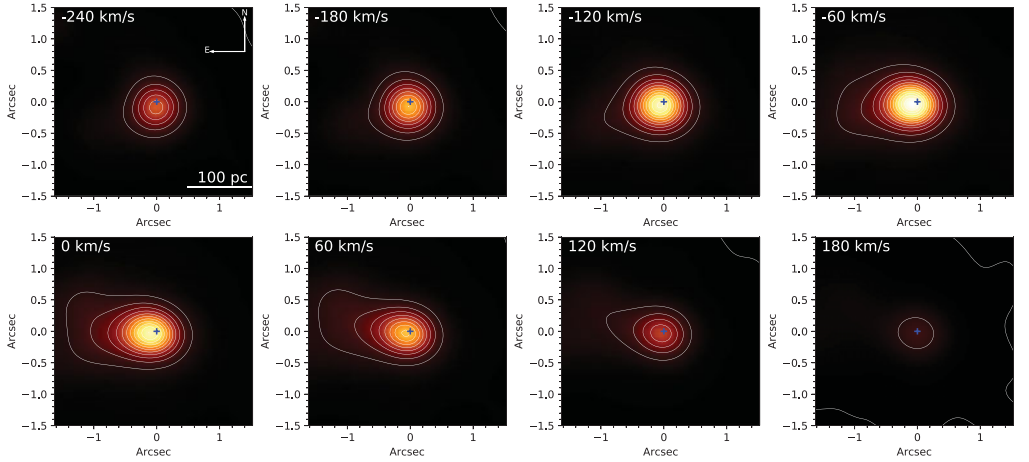

Figure 1. Channel maps of [OIII] 5007 $\mathring{A}$ in the range 5003−5010 $\mathring{A}$.

To study the gas kinematics we constructed channel maps of the [OIII] 5007 $\mathring{A}$ emission line (Figure 1). We also compare the outflowing maps with the near infrared counterpart (Menezes *et al.* 2015).

2. Results

The derived SFH indicates that the circumnuclear region does not present significant star formation younger than 500 Myr and older than 3.5 Gyr. In the nuclear region, about 20% of the stellar populations are in the range 3.5−8 Gyr. Younger populations were found in the nuclear region, with a 60% contribution of SSPs younger than 320 Myr.

A one-sided ionization cone is revealed towards the East (close to PA = 90^o) - see Figure 1, but the West side cone probably is obscured by a dust structure clearly shown in Cresci *et al.* (2015). An extended emission of [OIII] is located close to the rest frame and in redder wavelengths, suggesting the existence of an outflow (-60 km/s $\leqslant$ v $\leqslant 120$ km/s). Menezes *et al.* (2015) found a similar outflow in $Br\gamma$ with velocities $v < 187 km/s$.

3. Conclusions

• The [OIII] 5007 $\mathring{A}$ reveals the East ionization cone; the West side is probably obscured by a dust structure; in the [OIII] emission line kinematics we found an outflow (-60 km/s $\leqslant$ v $\leqslant 120$ km/s) also seen in the kinematics of the $Br\gamma$ (Menezes *et al.* 2015);

• From the stellar spectral synthesis we show that the nuclear region presents older (20% older than 3.5 Gyr) and younger (60% younger than 320 Myr) populations when compared to the circumnuclear region.

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