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Hα plumes or arms associated with the nucleus of NGC 7020

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Abstract. We imaged the galaxy NGC 7020 with Gemini and GMOS-S interference filters centered on the Hα emission line and nearby continuum in order to detect and quantify the HII regions. Among about 200 HII regions, we detected two Hα emitting plumes or arms emerging from the galactic nucleus which, together with the nuclear emission, might indicate a process of feedback from the central region.

Keywords. Galaxy: disk, Galaxy: center, Galaxy: nucleus, ISM: HII regions

1. Ongoing work and Results

NGC 7020 is a weakly barred spiral with two symmetrical condensations or *ansae*, at the vertices of a regular hexagon, stretched along the line of the nodes and centered on the nucleus at a radius of ∼7.1 kpc (Fig. 1 Left).

This hexagon was explained by Patsis *et al.* (2003) as 6:1 resonant stellar orbits resulting from an almost square bar potential and finely tuned Jacobi energies. Orbits with 4:1 resonances also result in such conditions, which we also detected centered on the nucleus with a mean distance of ∼3.5 kpc. Stellar continuum isodensities of these structures are shown in green in Fig. 1 Right, superimposed on an image showing the pure Hα emission.

NGC 7020 Hα emission has already been studied by Buta (1990), Wozniak *et al.* (1995) and Crocker *et al.* (1996). This is located in an outer ring of 33 kpc mean diameter and also in the inner disc inside the hexagon including the nucleus itself. Curiously, NGC 7020 exhibits widespread star-forming activity in its inner disc, which originated in a highly perturbing phenomenon. The star formation is superposed on remarkable ring structures that are formed from highly constrained resonant stellar orbits in barred spiral galaxies as described by Patsis *et al.* (2003). In order to map the HII regions and determine their epoch of formation, we took images with the Gemini Multiobject Spectrograph (GMOS-S) attached to the Gemini South telescope with the G0136 and G0137 interference filters, centered on the Hα line and adjacent continuum. This allows us to study HII region ages from the equivalent width of the Hα emission line (Dottori 1981; Leitherer *et al.* 1999).

HII region detection was done with SExtractor (Bertin & Arnaut 1996). We detected approximately two hundred HII regions. The most intense regions in the internal disk are the nucleus itself and two plumes or arms that extend ∼1 kpc on both sides of the nucleus. Fig. 1 Right, shows that the emission in the inner disk is weaker than that of the outer ring.

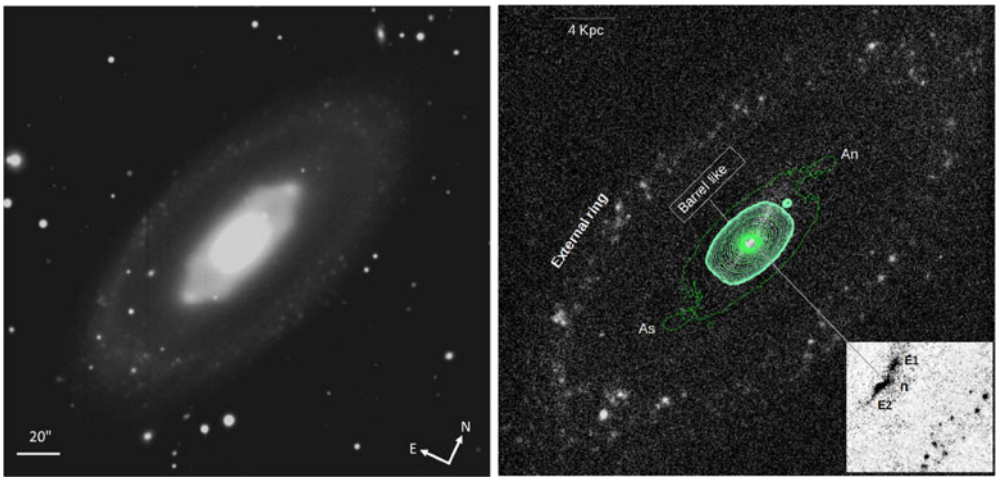

Figure 1. Left: NGC 7020 red continuum image observed with GMOS-S at Gemini, depicting the hexagonal and barrel like brightness levels of the bar, corresponding to 6:1 and 4:1 resonances respectively. Right: NGC 7020 continuum subtracted Hα emission. Green isophotes trace the continuum distribution, the fainter isophote is inside 6:1 resonance and embraces the ansae (An and As). Towards the nucleus the barrel-like 4:1 resonances appear. The inset shows the Hα ejecta (E1 and E2) originating at the nucleus (n). $1'' = 206$ pc

Concluding Remarks. We detected two Hα emitting plumes or arms with $\sim$1 kpc extents. They seems to emerge from the nucleus approximately in the N-S direction. If the Hα emission is produced by ionizing stars, the age deduced for all of them including that from the nucleus is $\geqslant$10 Myr, but the figure would be different if the ionization of the plumes or arms is not of stellar origin. We are processing spectroscopic observations to study the kinematics and origin of these structures.

References

Bertin, E. & Arnouts, S. 1996, *AAS*, 117, 393B
Buta, R. 1990, *ApJ*, 356, 87
Crocker, D., Baugus, P. & Buta, R. 1996, *ApJS*, 105, 353
Dottori H. A. 1981, *ApSS*, 80, 267
Leitherer, C., Schaerer, D., Goldader, J. D., *et al.* 1995, *ApJS*, 123, 3
Patsis, P. A., Skokos, C., & Athanassoula E. 2003, *MNRAS*, 346, 1031
Wozniak, H., Friedli, D., Martinet, L., *et al.* 1995, *AAS*, 111, 115

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