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Stellar Populations in Barred Galaxies

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Abstract. We developed an iterative technique to better characterize stellar populations and the central activity of barred galaxies using evolutionary synthesis codes and OASIS data. The case of NGC 5430 is presented here. Our results are reinforcing the role played by the bar and nuclear structures for the evolution of galaxies.

Keywords. galaxies: spiral, galaxies: stellar content, galaxies: bulges, galaxies: evolution

1. Introduction

The assemblage of the components of a galaxy is a puzzling but important subject. Among the key elements, a large scale bar is believed to be an efficient way to drive gas toward the central kiloparsecs of the galaxy (Norman *et al.* 1996). This may trigger star formation or turn on the central engine (Haan *et al.* 2009). Interactions, mergers, or cosmic filaments are considered to play a role in the accretion of gas and its flow process as well (Combes 2008). One way to deepen our understanding of these phenomena is to study in details the content of galaxies.

We used the spectro-imager OASIS at the CFHT and WHT to describe the stellar populations in the central region of 8 galaxies. We developed an iterative technique to separate the flux from two stellar populations, a young population (<15 Myr) and an old underlying one (see Cantin *et al.* 2009 for more details). In summary, the young population is characterized by comparing the equivalent width of Hα and Hβ with starburst models from LavalSB (Dionne & Robert 2006). The old population is studied using absorption lines (e.g. Mg_2, FeI) and models of Gonzalez Delgado *et al.* (2005). The iterative process takes into account the flux and line indicators from one population while studying the other one. It allows us, for example, to isolate the absorption component in Hβ and therefore get more accurate age and mass estimates. Reliable uncertainties, within the models considered, are obtained using Bayesian statistics.

2. NGC 5430

NGC 5430 is a nearby (42 Mpc) SB(s)b starburst galaxy. While continuum flux images show a double peak structure, a nuclear spiral/ring is clearly seen from the emission lines (Fig. 1). The extinction map indicates a dust lane located between the emission knots, and oriented along the galaxy large scale bar. With the iteration technique we find a gas metallicity close to $3\,Z_\odot$. The emission regions L1 and L2 are only 6.2 ± 0.8 Myr. The old population distribution is more uniform. It was formed over a long period of time, between 700 Myr and 4 Gyr. It has a much lower metallicity ($0.4 \pm 0.2\,Z_\odot$ on average) than the gas and is barely dominating the stellar mass. The regions L1 and L2 are typical HII regions based on the emission line ratios. A weak signature from a Seyfert or LINER is possibly present in the galaxy nucleus. Emission typical of composite regions (Kewley *et al.* 2006) is also found far from the nucleus. New data obtained with SpIOMM (a Fourier transform spectro-imager; Drissen *et al.* 2008) is confirming a high ratio

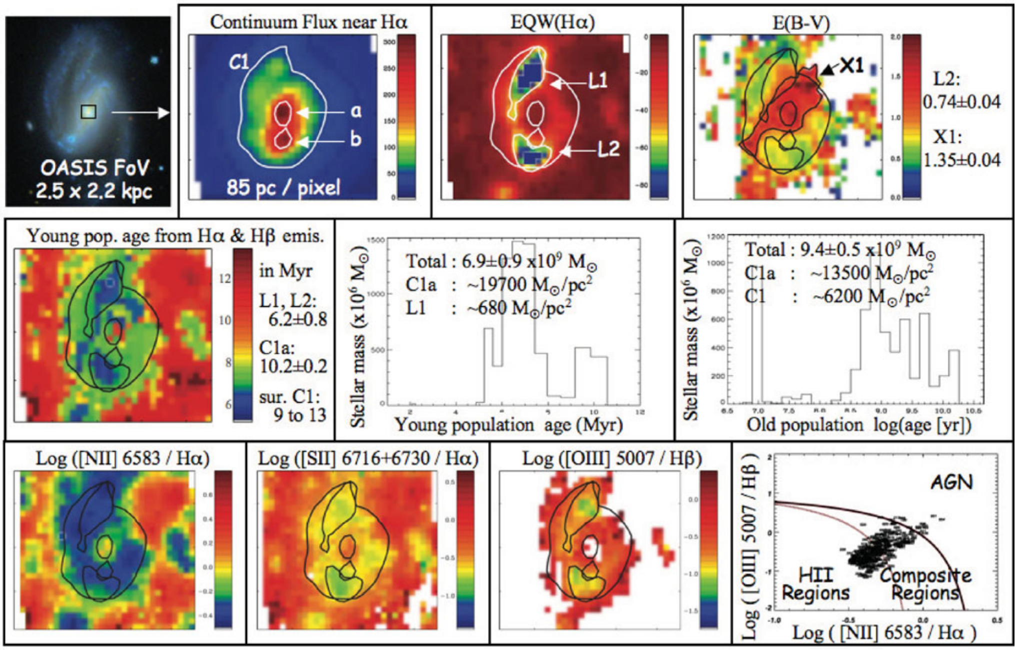

Figure 1. OASIS data for the central region of NGC 5430. Contours C1, a, and b refer to the continuum flux, contours L1 and L2 to the emission lines, and X1 to the extinction.

[NII]/Hα in the galaxy disk and is showing many HII regions along the galaxy bar with an age near 7 Myr.

3. Conclusions

For most galaxies in our sample, we find: 1) star forming knots of age 5-10 Myr distributed in a nuclear bar, spiral, or ring; 2) a peculiar dust distribution; 3) an underlying old (0.1-5 Gyr) generation of stars with a metallicity lower than the gas; and 4) in most cases, a non thermal activity, either from the composite or the LINER type and not necessarily restricted to the nucleus. We see relations between the star forming knots morphology, the dust distribution, the variation in the gas and stellar populations abundance, along with the galaxy large scale bar orientation. These relations confirm the importance of the bar for the galaxy evolution. Furthermore in late type spirals, secular evolution, as defined by Kormendy & Kennicutt (2004), has been proposed to rearrange the material from the disk and build up a pseudobulge. It has been described as a slow process, either internal or environmental. This could be a simple scenario, involving here the galaxy bar, to explain the different stellar populations seen in our study.

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