

Stellar populations in HII galaxies

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Abstract. We analyse the stellar content of a large number of HII galaxies based on the continuum and absorption features of their spectra using population synthesis methods, in order to gain information about the star formation histories of these objects. We find that all galaxies of our sample contain an old stellar population (≥ 1 Gyr) that dominates the stellar mass, and in a great majority of these, we also found evidence for an intermediate-age population ≥ 100 Myr apart from the presently bursting, ionizing young generation $\leq 10^7$ yrs.

1. Introduction

HII galaxies show strong emission line spectra typical of star forming regions, but usually also a continuum contribution, which is mostly of stellar origin, and often contains signatures of young/intermediate populations, and/or old populations. As these galaxies do not contain enough gas to have kept up the present star formation rate (SFR) for more than 1 Myr, they cannot have been formed in one continuous star forming process (at least not at the present rate).

In this work, we use the continua and certain absorption features of HII galaxy spectra to analyse their stellar content and gain information about their star formation histories. The data basis is a catalogue of about 200 intermediate resolution, high signal-to-noise spectra from 110 HII galaxies in the range of 3700 to 7500 Å, observed with the 1.52 m telescope at the European Southern Observatory (ESO) within the agreement between Brazil and ESO. Many of the galaxies were observed in several apertures, centered on different star forming knots, and are thus represented by more than one spectrum. For more details about the catalogue, see Kehrig et al. (2004).

2. The Method

We defined a set of spectral indices (an index quantifying the slope of the continuum, and five indices inspired by LICK indices (Worthey 1994), and calculated, for each spectrum, the composite synthetic stellar population that best reproduces its indices. These composite populations were assumed to be made up of two single stellar populations (SSPs): an old one of age 5 Gyr and $[\text{Fe}/\text{H}] = -1.5$, and one of young or intermediate age (the "young+intermediate population"), with $[\text{Fe}/\text{H}]$ fixed at the $[\text{O}/\text{H}]$ values of the gas as determined from the emission lines by Cuisinier, Telles & Kehrig (2004) and an age in the range from 1 to 500 Myr, to be determined in this work. The other parameter we determined is the mass ratio between the two populations $M_{y+i}:M_o$, for which we allowed values from 0:1 (only an old population) to 1:0 (only a young+intermediate one). The SSPs were taken from two different SSP libraries: "Starburst", from STARBURST99 (Leitherer et al. 1999) including nebular continuum emission; and "BC99", produced using the Bruzual & Charlot (1993) code, implementing the Padova 2000 isochrones Girardi et al. (2000) and the new BaSeL 3.1 stellar library Westera et al. (2002). By performing

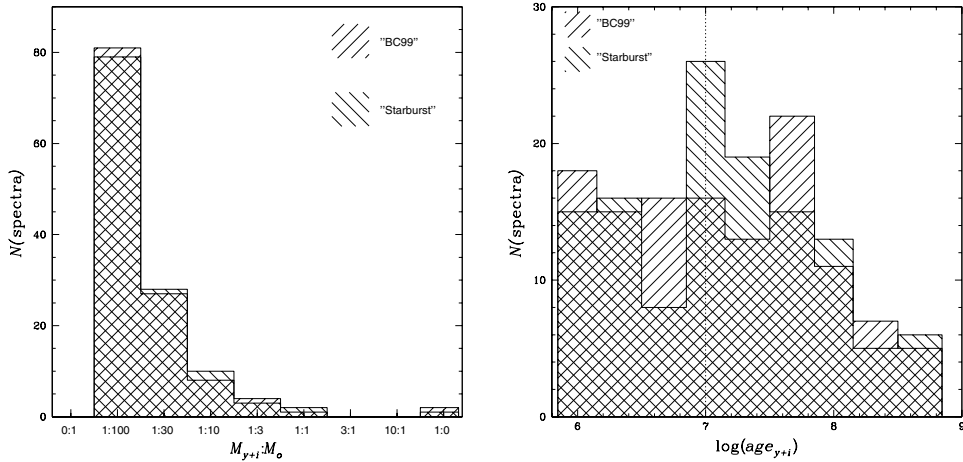


Figure 1. Histograms of the best fitting mass ratios between the two populations (left panel), and of the young+intermediate ages age_{y+i} (right panel).

the fits using two different libraries and comparing the results, we can determine the reliability of these results.

3. Results and Conclusions

In *all* galaxies of our sample, we detected an old, underlying population, *generally dominating the stellar mass by a large factor* (left panel of figure 1). In *most* spectra, we also found evidence for an *intermediate age population* (e.g. ≥ 5 Myr), too old to be identified with the young, ionizing generation (right panel of figure 1). We conclude that any realistic modeling of the stellar content in HII galaxies and subsequent derivation of their physical and evolutionary properties must take into account the presence of *at least three populations* (a young, an intermediate and an old one). Another point that is evident from figure 1 is, that the solutions found using the two libraries agree well, which gives us confidence in the reliability of the results. For a more detailed description of this work, see Westera *et al.* (2004).

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