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Stellar populations of local infrared-selected galaxies

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Abstract. The stellar populations of 849 local infrared-selected galaxies from SDSS and IRAS (including 419 star-forming galaxies, 326 composite galaxies, 35 Seyfert 2s, and 69 LINERs in 4 spectral classes) are studied by using STARLIGHT. Among the 4 spectral classes, the importance of young populations decreases from star-forming, composite, Seyfert 2 to LINER; and Seyfert 2 and LINER are more metal-rich; ULIGs (ultra luminous infrared galaxies) & LIGs present the youngest populations among 3 infrared luminosity bins; and normal galaxies are more metal-rich. The dominant contributors to masses are all old populations.

Keywords. galaxies: evolution, galaxies: stellar content, infrared: galaxies

1. Introduction

Understanding the overall stellar population in galaxies is a crucial tool for unveiling the star formation and evolution of galaxies. Infrared-detected galaxies are one of the most interesting objects in the Universe and are related to the major star-forming process. We selected a large local sample of infrared-detected galaxies from SDSS optical spectra and IRAS infrared observations to study their stellar populations.

2. Sample and spectral synthesis results

We utilize a sample of 849 local infrared-selected galaxies from cross identifying between the main galaxy sample of SDSS DR4 and IRAS PSCz, and use the software STARLIGHT (Asari *et al.* 2007; Cid Fernandes *et al.* 2005) to fit the spectral absorptions and continua to study their stellar populations. The templates are the simple stellar populations (SSPs) from Bruzual & Charlot 2003 (BC03) and spectra of star clusters. We further divided our sample into several sub-samples by two methods: 1) four spectral classes by using their emission-line ratios (Baldwin *et al.* 1981, BPT): 419 star-forming galaxies, 326 composite galaxies, 35 Seyfert 2s, and 69 LINERs; 2) three infrared luminosity bins (Elbaz *et al.* 2002): 299 ULIGs & LIGs ($L_{IR}/L_{\odot} > 10^{11}$), 451 starbursts ($10^{11} > L_{IR}/L_{\odot} > 10^{10}$), and 99 normal galaxies ($L_{IR}/L_{\odot} < 10^{10}$).

Throughout our synthesis, we use the Padova 1994 tracks (Alongi *et al.* 1993), the Chabrier (2003) IMF, the CAL reddening law (Calzetti *et al.* 1994), and 45 SSPs from BC03 (15 ages: 1Myr ~ 13Gyr, 3 metallicities: 0.2, 1.0, 2.5 $Z_{\odot}$). We further arrange the 15 ages of SSPs into 3 age bins: young with age $\leqslant 5 \times 10^8 yr$, old with age $\geqslant 1 \times 10^{10} yr$, and intermediate-age populations with ages between these two. Fig. 1 shows the spectral fitting results for 4 spectral classes. We find that the importance of young populations decreases from star-forming, composite, Seyfert 2 to LINER, and LINER and Seyfert 2 are more metal-rich. Similar conclusions have been reached by Schawinski *et al.* (2007),

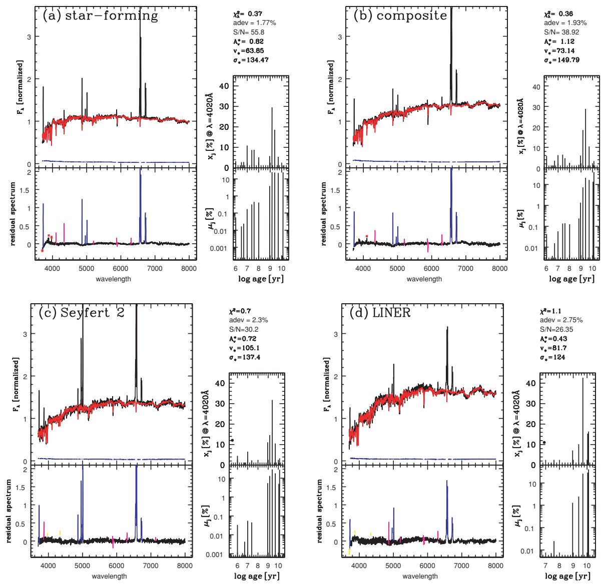

Figure 1. The spectral fitting results of 4 spectral classes: (a) star-forming galaxies (top-left 4 panels); (b) composite galaxies; (c) Seyfert 2s and (d) LINERs. In each class, top-left panel: observed spectra (black line), synthesis spectra (red line), and error spectra (green line); bottom-left panel: residual spectra (black line) and mask regions (color lines and points); the fraction of light (top-right) and of mass (bottom-right) associated to each age of 15 SSPs.

Stasińska *et al.* (2008) and Cid Fernandes *et al.* (2009). As for the different infrared luminosity bins, ULIGs & LIGs present the youngest populations, and normal galaxies are more metal-rich. However, the dominant contributors to mass are old stellar populations in all sub-samples. Additionally, we also use 15 spectra of star clusters with different ages and metallicities given in Bica & Alloin (1986a,b) to re-fit the combined spectra of each sub-sample, and draw consistent conclusions (see details in Chen *et al.* 2009).

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