Journal of Physics: Conference Series

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To cite this article: Banafsheh Shahzamanian *et al* 2012 *J. Phys.: Conf. Ser.* **372** 012072

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Abstract. For the purpose of analyzing the spectral evolution of stellar population, we derive spectral energy distributions of simple stellar population in different ages from GALAXEV. Then, from stellar populations spectra, physical parameters are obtained for observational spectra of galaxies in the wavelength range from 3200 Å to 9500 Å. We use spectral data of Coleman and Wu for plotting the spectra of four types of galaxies. These observational data are combined and averaged from different sources; also they are extrapolated to high redshifts. In addition, we plot 16 synthesized spectra by considering Salpeter Initial Mass Function (IMF), exponential and constant Star Formation Rate (SFR) and solar metallicity for all spectra. Comparing the observational spectra with stellar population spectra, we analyze the age distribution for elliptical, irregular and two types of spiral field galaxies and obtain age and time scale parameters for each.

1. Model description

Bruzual, Charlot (2003) [hereafter BC03] evolutionary model is used for computing the spectral evolution of stellar populations at ages between $1\times10^{5}yr$ and $2\times10^{10}yr$ at a resolving power($\frac{\Delta\lambda}{\lambda}$) of 2000 for a wide range of metallicities. Also, the spectral evolution across the larger wavelength range from 91Å to 160μm at lower resolving power can be computed. Isochrone synthesis method has been used for evaluating the spectral evolution of stellar populations. BC03 stellar population synthesis model consists of two components: stellar evolution prescription (Padova 1994 Library, Padova 2000 Library, Geneva Library) and stellar spectral library (BaSeL, STELIB, Pickles). The mass distribution functions in BC03 model are Salpeter and Chabrier. [1, 2, 3]

1.1. GALAXEV

GALAXEV is a library of evolutionary stellar population synthesis models computed using the isochrone synthesis code of BC03. We computed the Spectral Energy Distributions (SEDs) of Stellar Populations in different ages by using this library.

2. Data Analysis

We used spectral data of Coleman,Wu and Weedman (1980) for plotting the four types of field galaxies spectra. Observational mean data are extrapolated to high redshifts. These data are empirical data from various sources that have been combined and averaged. In Figure 1, we

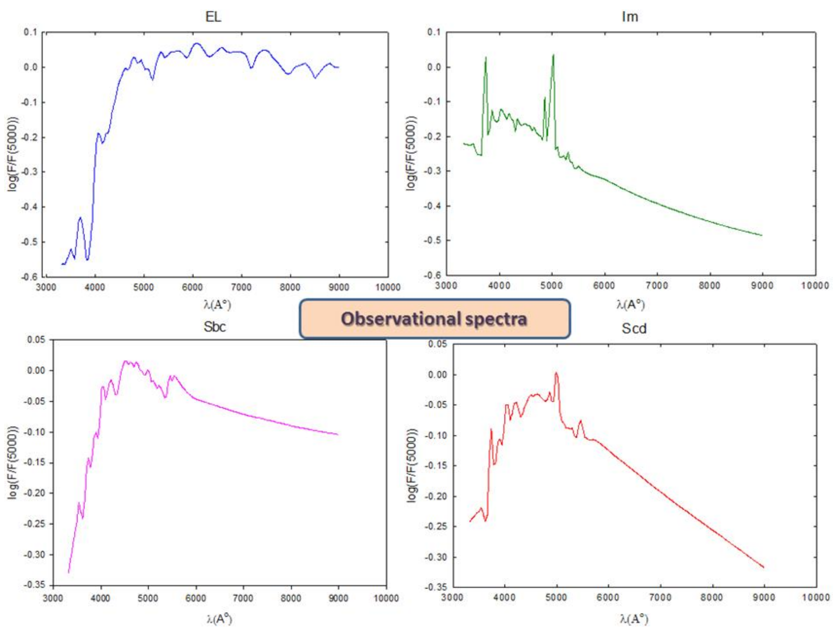

Figure 1. Observational spectra for four types of field galaxies.

plotted four empirical spectra obtained from empirical data. In these plots, we made the flux of galaxy dimensionless according to its flux in 5000 Å.

Moreover, we plotted 16 synthesized spectra in Figure 2 by considering Saltpeter IMF, exponential and constant SFR, Padova1994 evolutionary prescription, Pickles spectral library and solar metallicity for all spectra. We have 12 spectra by considering exponential function of star formation and different time scales: $\tau = 1Gyr$,$4Gyr$,$15Gyr$. Also, we obtained four spectra by considering constant function of star formation and different ages: $t = 0, 1Gyr, 1Gyr$,$5Gyr$,$10Gyr$. In each plot of Figure 2, time scale is constant and the different colours show the different ages of stellar populations. In these plots, we made the flux of galaxy dimensionless according to its flux in 5000 Å.

3. Result

Comparing the observational spectra with the stellar population model spectra, we computed the age distribution of stellar population (t) and obtained the time scale parameter τ of Elliptical, Spiral and Irregular galaxies in a field region. In Table 1, the amounts of t and τ for each type of galaxy are shown. For fitting the model and observed spectrum the relation bellow (Mean Square Error) must be minimized:

$$R_K^2 = \sum_{i=1}^{N} [\Delta \log F_{\lambda_i}]^2 = \sum_{i=1}^{N} [\log F_\lambda^{obs}(\lambda_i) - \log F_\lambda(\lambda_i, t_k)]^2. \quad (1)$$

In this relation the first flux is the flux of observed spectrum in wavelength i and the second one is the flux of stellar population model in wavelength λ_i and age t_k.

4. Conclusion

The obtained time scale is similar to result of Kauffmann and Charlot (1998) for same types of galaxies. Having a shorter time scale in Elliptical galaxies in comparison with Spiral ones shows that they have experienced a short time of star burst in their early evolution. Also, we obtained

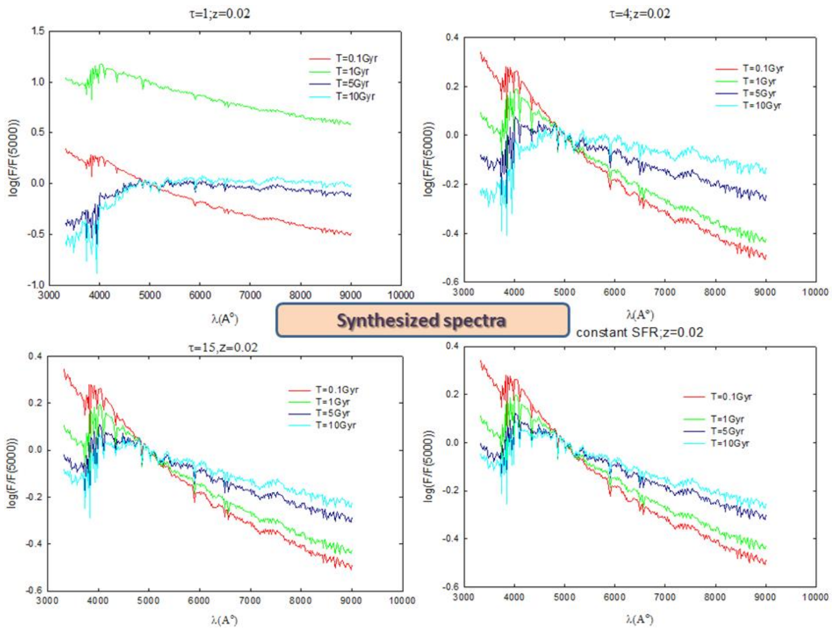

Figure 2. Synthesized spectra calculated by GALAXEV.

Table 1. Age distribution and time scale for different types of galaxies.

Type	$\tau(Gyr)$	$t(Gyr)$
Sbc	4	10
Scd	4	5

Type	$\tau(Gyr)$	$t(Gyr)$
El	1	10
Im	∞	5

the constant SFR for highly Irregular galaxies. Furthermore, we estimated the age of elliptical galaxies to be 10 Gyr, which shows this type of galaxies has old stellar populations. The age of irregular galaxies was found 5 Gyr, so they have intermediate stellar populations. For spiral galaxies we were not able to get a good estimation due to the lack of observational data.

References

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