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On the Recovery of Galaxy Properties from Spectral Fits

G. Magris C.[1], C. Mateu[1], G. Bruzual A.[2], and I. Cabrera[1,3]

[1]Centro de Investigaciones de Astronomía (CIDA), A.P. 264, Mérida 5101A, Venezuela
email: magris,mateu,cabrera@cida.ve

[2]Centro de Radioastronomía y Astrofísica, UNAM, A.P. 372, 58090, Morelia, México.
email:g.bruzual@crya.unam.mx

[3]Postgrado de Física Fundamental, Universidad de Los Andes, Mérida, Venezuela

Abstract. We show the results of a non-parametric, fully bayesian implementation of a spectral fitting algorithm, designed to calculate the main physical parameters that govern the galaxy assembly process. In this work, we present results from a statistical treatment of SED fitting that allows for easy recovery and visualization of the galaxy physical parameters .

Keywords. methods: data analysis; methods: statistical; galaxies: stellar content

1. Method Overview and Results

METHOD. Our fitting method is a new implementation of ***gaspex*** (Mateu 2001), which consists in modeling the target galaxy SED as a linear combination of a few SEDs, corresponding to simple stellar populations of arbitrary age and metallicity from the Charlot & Bruzual (2013, hereafter CB*) stellar population synthesis models. We use the Markov Chain Monte Carlo sampler ***emcee*** (Foreman-Mackey *et al.* 2012), which allows for easy fine-tunning of the chain parameters, to construct the posterior probability distribution function (pdf). To test the reliability of our fits, we choose an arbitrary subset of spectra generated with the CB* library . We add to the flux of the synthetic model SED random gaussian noise with a constant S/N ratio equal to 20. We assume uniform prior probability distribution functions in the model parameters: age t_i, mass weight a_i, and metallicity Z_i, of each simple stellar population in the posterior pdf $p(a,t,Z|Fobs) = \mathrm{Prior}(a,t,Z)\exp(-\chi^2/2)$. For each galaxy we compute the marginalized 1-D and 2-D posterior pdf, expectation value and confidence intervals for the explored physical parameters: total mass, mean mass-weighted-log(age), and mean $\log(Z)$. We also compute a bayesian estimate of the SFH, which we define as the mass expectation value as a function of log(age).

RESULTS. Our non-parametric model is capable of successfully recovering the star formation rate and total mass of galaxies with different histories of star formation. When metallicity distribution is correctly recovered, the bayesian spectrum yields residuals comparable to those obtained with the minimum χ^2 solution. Otherwise, the solution spectrum deviates in the UV.

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References

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