Physics of Galaxies 2019/2020

Computational Assignment

The goal of this assignment is that you learn to compute the expected magnitudes of a galaxy template in different instrumental passbands. These expected magnitudes could be compared with a galaxy observed magnitudes in order to decide whether that template (characterised by a set of physical parameters) provides a good description of the galaxy spectral energy distribution (SED) or not.

You have to do the following:

1. Consider the galaxy spectral energy distribution (SED) model given to you by the tutors. This model has been generated with the code GALAXEV (see its manual: http://www.bruzual.org/bc03/doc/bc03.pdf) . This model corresponds to specific galaxy parameter values, which will be specified with the model. Your model corresponds to a Chabrier initial mass function and you should consider no internal dust extinction for your galaxy.

2. Read the stellar mass of your model galaxy from the GALAXEV output file containing this information (which will also be given to you by the tutors; see GALAXEV manual for details). Normalize the template such that it corresponds to the galaxy stellar mass that you were assigned by the tutors.

3. Obtain the transmission curves for the *Hubble Space Telescope (HST)* ACS F775W and WFC3 F160W filters from

svo2.cab.inta-csic.es/theory/fps/index.php?mode=browse&gname=HST&gname2=ACS_WFC

4. Write a computer code (in a programming language of your choice) to do the following:

4.a) convert your SED template in luminosity density units $L'_\lambda(\lambda')$ versus λ' to a template in flux density $f_\lambda(\lambda)$ versus λ at redshifts $z = 1$ and $z = 2.5$, using the relation:

$L'_\lambda(\lambda') = 4\pi\, d_L^2(z)\, f_\lambda(\lambda)\, (1+z)$,

where λ' is the rest-frame wavelength and λ is the observed wavelength. You

can obtain the value of $d_L(z)$ at the requested redshifts using the Cosmology Calculator

http://www.astro.ucla.edu/∼wright/CosmoCalc.html

assuming $H_0 = 70\,\mathrm{km\,s^{-1}\,Mpc^{-1}}$, $\Omega_\mathrm{M} = 0.3$ and $\Omega_\Lambda = 0.7$ (flat Universe). Be careful with the units!

4.b) compute the convolution integral of the obtained template $f_\lambda(\lambda)$ versus (observed) λ with the two filter transmission curves. As output, you should obtain the flux density of your templates in the two *HST* passbands. Convert these flux densities f_λ into f_ν and then into AB magnitudes.

5. Write your report, which should contain a maximum of 3 pages explaining all your steps (with your own words!), and quote clearly your finally obtained magnitudes for your template galaxy in the two *HST* filters. This report can contain plots (but text + figures should occupy a maximum of three pages). Use a font size of 11 pt (not smaller!). In addition, append a transcript of the code(s) you wrote for step 4.