A Massive Star Odyssey, from Main Sequence to Supernova
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Synthetic high-resolution line spectra of star-forming galaxies below 1200 Å, based on *FUSE* spectral libraries of hot stars

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Abstract. We have generated far-UV stellar libraries using spectra of hot stars in the Galaxy and the Large and Small Magellanic Clouds. These libraries were implemented into the stellar population synthesis codes STARBURST99 and LAVALSB and used to compute synthetic spectra of star-forming galaxies. Model spectra for galaxies are presented and variations of the hot star photospheric and wind profiles are discussed. This poster summarizes the work of Robert *et al.* (2002).

1. *FUSE* spectral libraries

Four far-UV libraries of OB and WR stars have been created from the large data pool of the *Far-Ultraviolet Spectroscopic Explorer* (*FUSE*) satellite. The *FUSE* atlasses of hot stars in the Galaxy and Magellanic Clouds by Pellerin *et al.* (2002) and Walborn *et al.* (2002) describe the absorption lines and P-Cygni profiles formed in hot star atmosphere and winds.

The solar metallicity library contains 168 stars (WR, O3 to B3). The LMC ($\sim 0.3\,Z_\odot$) and SMC ($\sim 0.1\,Z_\odot$) libraries include 50 and 34 stars (WR, O3 to B0), respectively. A hybrid LMC+SMC library was also created where the H_2 contribution from the Magellanic Clouds was removed based on the work of Tumlinson *et al.* (2002). The libraries cover the wavelength range from 1000.3 to 1182.7 Å (using data from the SiC1A and LiF2A detectors) with a resolution of 0.127 Å, and S/N $\simeq$ 30 per resolution element. In the libraries, stars with the same spectral type calibration have been combined to increase the S/N and an interpolation in temperature or luminosity has been done to create important missing spectral groups.

2. Synthetic spectra for star-forming regions

The far-UV libraries have been implemented in the population synthesis codes STARBURSTS99 (Leitherer *et al.* 1999) and LAVALSB (Dionne & Robert 2002).

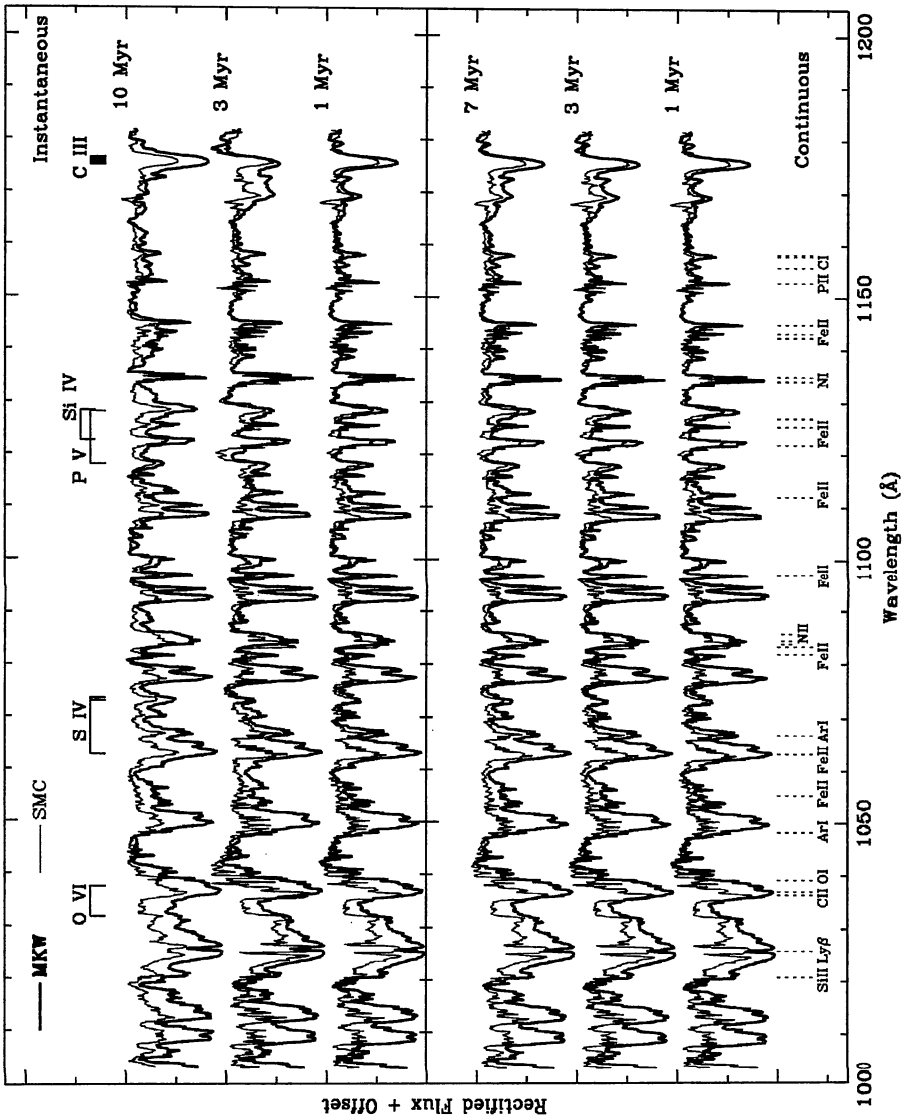

Figure 1. Instantaneous and continuous burst of star formation. Models using a Salpeter IMF ($\alpha = 2.35$) with the cut-off masses $M_{low} = 1\,M_\odot$ and $M_{upp} = 100\,M_\odot$ are shown for two metallicities (Milky Way: thick lines; Small Magellanic Cloud: thin lines) at three ages. The most important wind lines from hot stars are indicated at the top. Interstellar lines (but not from H_2) are indentified at the bottom.

Stars form according to a specified star-formation rate and initial mass function (IMF). The stellar evolution is defined by the Geneva groups tracks (prior to rotation). Spectra from a library, at the corresponding metallicity of the tracks,

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are assigned based on the $T_{\rm eff}$ and $\log g$ calibration of Schmidt-Kaler (1982). Featureless stellar atmosphere models (from Lejeune, Cuisinier & Buser 1997, and Schmutz, Leitherer & Gruenwald 1992) are used to flux calibrate the library spectra and to represent missing spectra of cooler stars.

Figure 1 shows synthetic far-UV spectra for various bursts of star formation. Strong wind profiles of C III λ1176, O VI $\lambda\lambda$1032, 1038, P V $\lambda\lambda$1118, 1128, and S IV $\lambda\lambda$1073, 1074 are predicted when O supergiants stars are present in the stellar population, *i.e.*, $\sim$3 Myr. These wind signatures are stronger at higher metallicity. In the instantaneous cases, the wind profiles quickly disappear after 5 Myr, when photospheric absorption from B-type stars dominate the models. Because the solar metallicity library do not include stars cooler than B3, the lines predicted for an instantaneous star-forming region are not useful to determine the age when the region is older than $\sim$ 15 Myr. At subsolar metallicity, the libraries do not include stars cooler than B0, therefore the line models for an instantaneous star formation are only useful before $\sim$ 10 Myr. When stars form continuously, an equilibrium between stellar birth and death is reached at $\sim$10 and 100 Myr for O- and B-type stars, respectively. Continuous models at solar metallicity are all identical after $\sim$10 Myr. Without B-type star spectra in the subsolar library, line models for an age $>$ 10 Myr are not useful anymore to reveal the age of a stellar population. For ages greater than the library completeness limit, only the theoretical atmosphere models are available to produce at least a correct absolute value of the far-UV flux. Not shown here, the IMF slope and upper-mass limit also influence the line profile at young ages.

The far-UV spectroscopic features from hot stars can provide important clues on the star-formation history of local and high-redshift galaxies.

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