ABSTRACT

We present a new set of theoretical evolutionary synthesis models, PopStar. This grid of Single Stellar Populations covers a wide range in both, age and metallicity. The models use the most recent evolutionary tracks together with the use of new NLTE atmosphere models for the hot stars (O, B, WR, post-AGB stars, planetary nebulae) that dominate the stellar cluster’s ionizing spectra. The results of the models in VO format can be used through VOSpec.

Key words: Virtual Observatory; Synthesis; Spectra; Spectral Energy Distributions; SED; H-R Diagram.

1. MODELS DESCRIPTION

We have used the synthesis code by García-Vargas et al. (1998), updated by Molá & García-Vargas (2000) and newly revised now. The basic grid is composed by Single Stellar Populations (SSP) for five different IMFs: two based on Salpeter power law (Salpeter 1955), with mass range 0.85 - 120 M⊙, and 0.15 - 100 M⊙, respectively, and those of Ferrini et al. (1990), Kroupa (2002) and Chabrier (2003) functions, with masses between 0.15 and 100 M⊙. These models do not include binaries either mass segregation. The isochrones are those from Bressan et al. (1998) for 6 different metallicities: Z = 0.0004, 0.001, 0.004, 0.008, 0.02 and 0.05. The age coverage is from logt = 5.00 to 10.30, with a variable time resolution which is Δ(logt) = 0.01 in the youngest stellar ages. The WC and WN stars are identified in the isochrones according to their surface abundances.

The atmosphere models are from Lejeune et al. (1997) with an excellent coverage in effective temperature, gravity and metallicities, for stars with T_eff ≤ 25000 K. For O, B and WR we have taken the NLTE blanketed models by Smith et al. (2002) at 5 different metallicities. There are 110 models for O-B stars, calculated by Pauldrach et al. (2001), with 25000 K < T_eff ≤ 51500 K and 2.95 ≤ log g ≤ 4.00, and 120 for WR stars (60 WN and 60 WC), from Hillier & Miller (1998), with 30 000 K ≤ T* ≤ 120000 K and 1.3R⊙ ≤ R* ≤ 20.3R⊙ for WN, and with 40000K ≤ T* ≤ 140000 K and 0.8R⊙ ≤ R* ≤ 9.3R⊙ for WC. T* and R* are the temperature and the radius at a Roseland optical depth of 10. To assign an appropriate model to each WR star, we use the relationships among opacity, mass loss and velocity wind: dτ = −κ(r)(r)dr, where κ(r) = −0.2(1 + X_H) and X_S, the H surface abundance, is taken as 0.2 for WN and 0.0004, 0.001, 0.004, 0.008, 0.02 and 0.05. The age coverage is from logt = 5.00 to 10.30, with a variable time resolution which is Δ(logt) = 0.01 in the youngest stellar ages. The WC and WN stars are identified in the isochrones according to their surface abundances.

2. VO PRODUCTS

We provide the SED in the VO standard: λ (in Å) and L_λ (in ergs^{-1}Å^{-1}) Spectra can be selected by IMF type, age and Z and can be managed with the VOSpec tool. We have produced the HR diagram files covering the whole grid in age and metallicity. At the moment, there is not a specific VO access protocol for such files. However, we have produced VO tables that can be used with some VO tools like Topcat. A detailed description of the models and the products is available at the webpage http://www.fractal-es.com/SEDmod.html, where the files can be downloaded.
3. CONCLUSIONS

We have computed a new grid of SEDs with updated isochrones and atmosphere models in a wide range of age and metallicity. The use of NLTE blanketed models produce SEDs with less hard ionizing photons, able to explain the observed emission line spectrum in low excitation high metallicity H II regions without changing the IMF parameters. Previous models [García-Vargas et al., 1995] could not explain these observations without eliminating the more massive stars artificially (with a flatter IMF, a lower value of the upper mass limit or using the standard IMF but considering the large clusters divided in small less massive sub-cluster with a low probability of forming very massive stars). H-R Diagrams are available as VO tables. The resulting SEDs are in VO format accessible through SSAP protocol and can be managed with VOSpec.

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