THE WOLF-RAYET AND O STAR CONTENT OF VIOLENT STARBURSTS

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New population synthesis models for starburst regions have been computed, with an emphasis on the W-R population and the output of ionizing photons.

Our models use Maeder's (1990, *A&AS* **84**, 139) latest evolutionary tracks which incorporate metallicity-dependent mass-loss rates. The most recent sets of model atmospheres, which consider the spherical extension of the envelope, NLTE and line-blanketing effects, are taken from Kudritzki *et al.* (1991, *Massive Stars in Starbursts*). Different values of the IMF slope and the lower and upper cut-off mass have been tested. Metallicities between $Z = 0.1Z_\odot$ and $Z = 2Z_\odot$ were considered. We also used small timesteps of the order of 10000 years.

Different durations of the burst were considered. This is particularly important in starburst galaxies where the hypothesis of an instantaneous burst is inconsistent with the size of the burst region. Adopting a burst duration of 5Myr (much smaller than the age of the parent galaxy but comparable to the lifetime of the most massive stars) we obtain, for example (figure 1), that the maximum WR/O ratio is smaller and that the W-R phase is stretched in time compared to the case of the instantaneous burst.

Some emission-line galaxies, especially at low metallicity, show the presence of narrow HeII 4686 emission (Campbell *et al.* 1986, *MNRAS* **223**, 811; Conti 1991, *Ap.J.*, **377**, 115) at a level of $F_{4686}/F_{H_\beta} \simeq$ 1-5%. Classical, hydrostatic model atmospheres clearly fail to reproduce such an emission. As shown in figure 2, the unified model atmospheres of Kudritzki *et al.* also fail to reproduce the observations (although there is an improvement with respect to the previous models). In the figure, different flux ratios are presented for different values of the IMF slope and the metallicity. The model predicts an increase of nebular 4686 emission during the W-R phase (starting around 3Myr), as well as an increase with metallicity and flatter IMF. On the contrary, the narrow 4686 line is observed in low-metallicity objects without W-R stars. The effect of dust has not been considered yet, but it is not expected to improve the situation. Other mechanisms (such as ionization by X-ray binaries, supernova explosions) may be invoked to produce the observed flux ratio.

FIGURE 1.

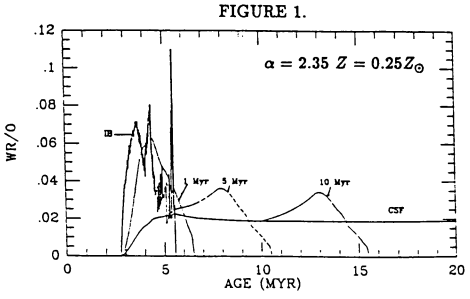
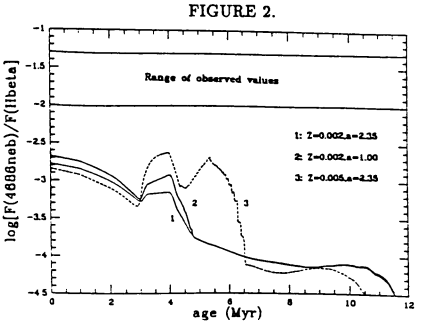


FIGURE 2.



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