RevMexAA (Serie de Conferencias), **17**, 89–89 (2003)

SPECTRAL EVOLUTION OF GALAXIES INCLUDING NEBULAR EMISSION. MODELS FOR NORMAL STAR FORMING GALAXIES

P. Panuzzo[1,2], A. Bressan[3], G. L. Granato[3], L. Silva[4], and L. Danese[1]

We present the implementation of nebular emission modelling into our spectrophotometric GRASIL for SED of dusty galaxies (Silva et al. 1998, Bressan et al. 2002, Silva et al. this conference), and its application to normal star forming galaxies (Panuzzo et al. 2002, A&A, submitted).

The emission spectrum from a single H II region depends on the SED of the ionizing star cluster and on the properties of the excited gas. The dependency on the ionizing SED can be accurately defined by a suitable combination of only three parameters: the number of ionizing photons for H I, He I and O II ($Q_{\rm H}$, $Q_{\rm He}$, and $Q_{\rm O}$). We computed libraries of emission lines models with CLOUDY (Ferland 1996) for different values of the metallicity and density of the gas, as function of $Q_{\rm H}$, $Q_{\rm He}$ & $Q_{\rm O}$. The computed lines are 48 H and 6 He I recombination lines, and 59 metal nebular lines. To obtain the line intensities of a galaxy, we interpolate in the libraries, with $Q_{\rm H}$, $Q_{\rm He}$, and $Q_{\rm O}$ corresponding to the actual SED of its stellar populations.

We computed a set of models of disk galaxies and compared it with a sample of normal star forming galaxies (Buat et al. 2002) to analyze the link between gas and star extinction. We confirm (Fig. 1) a lack of correlation between the attenuation in Hα (from Balmer decrement) and the attenuation in UV band derived from the ratio $F_{\rm FIR}/F_{\rm UV}$ (Buat et al. 1999). This is due to the interplay between the timescale of ionizing and UV radiation, and the escape time, τ_{esc} (the typical time for young stars to escape from molecular clouds). We found also (Fig. 2) that $A_{\rm UV}$ correlates quite tightly with $F_{\rm FIR}/F_{\rm UV}$. Models point out that the age-selective extinction can produce an underestimation of $A_{\rm H\alpha}$, affecting the estimation of SFR from Hα. Moreover, a relevant part of UV radiation from young stars in these galaxies is not absorbed, and the variations in escape time produce a relevant change in IR emission. For this reason the FIR estimator is not as good for normal star-forming galaxies as for starbursts.

[1]SISSA, Via Beirut 4, I34014, Trieste, Italy.
[2]panuzzo@sissa.it.
[3]INAF, Osservatorio Astronomico di Padova, Italy.
[4]INAF, Osservatorio Astronomico di Trieste, Italy.

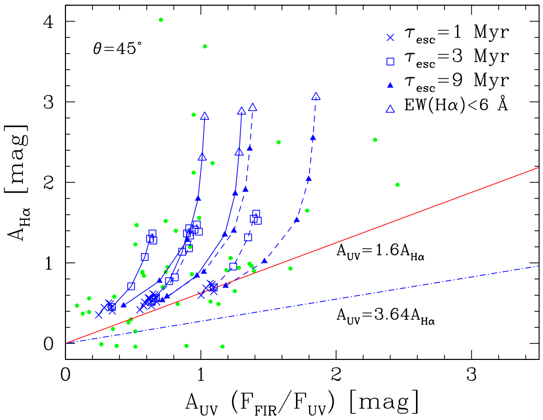

Fig. 1. $A_{\rm H\alpha}$ vs $A_{\rm UV}$ estimated from the $F_{\rm FIR}/F_{\rm UV}$ ratio. Different paths correspond to different SF history and τ_{esc} values; along the path it varies the optical thickness. Filled circles are data from Buat et al. 2002.

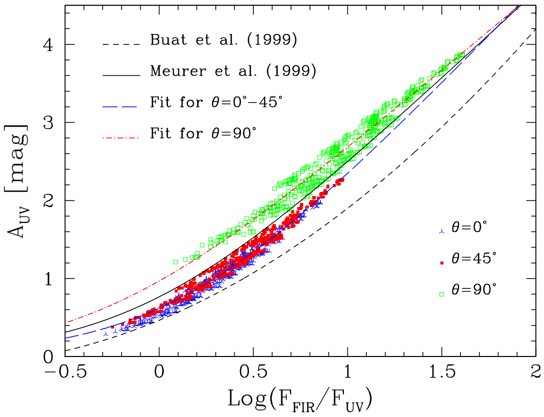

Fig. 2. $A_{\rm UV}$ extracted from the models vs $F_{\rm FIR}/F_{\rm UV}$ for different inclinations respect to the line sight.

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