STELLAR POPULATION MODELS OF DISTANT RADIO GALAXIES

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1. Introduction

Stellar populations of high redshift radio galaxies (**HzRG**) (z up to 4.2) are the oldest stellar systems known, that is the ones formed at the earliest cosmological epochs. Therefore they are the best objects for providing us with information about the epoch of galaxy formation. The information on the stellar populations in HzRG are obtained from the study of their Integrated Spectral Energy Distribution (**ISED**) which are gathered both from spectra and integrated magnitudes. The most common approach for the interpretation of colors and spectral features of the energy distribution of galaxies is the Evolutionary Population Synthesis (**EPS**), which has been introduced for the first time by Tinsley in 1972. EPS models have often been used in the past to interpret the ISED of HzRG (Chambers & Charlot 1990; Lilly & Longair 1984; di Serego Alighieri et al. 1994) in order to draw conclusions on the age of the stellar populations and therefore on the epoch of galaxy formation. The results are sometimes conflicting and a number of very recent EPS models have become available (Bressan et al. 1995; Bruzual & Charlot 1993; Buzzoni 1989; Guiderdoni & Rocca-Volmerange 1987): we are therefore analysing the differences between the various EPS models with the aim of assessing their suitability to study the stellar population at early epochs. The EPS models assume for stars a given Initial Mass Function (**IMF**) as well as a Star Formation Rate (**SFR**). Then one can compute the number of stars with given mass present in the galaxy as a function of time. The position of each star in the HR diagram is determined by means of

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the isochrones, which are calculated from stellar evolutionary models. The ISED of a galaxy is obtained from the superposition of the spectra of single stars obtained from a stellar spectral library. Thus these models describe the galaxy ISED as a function of the time, giving a complete evolutionary picture.

2. Discussion

The key ingredients of the EPS models available at present are: 1) the assumption for the IMF, the SFR and chemical composition; 2) the library of evolutionary tracks used to calculate isochrones in the HR diagram; 3) the library of stellar spectra adopted to derive the ISED.

We want to stress that the quality of an EPS model depends primarily on the quality and completeness of the library of evolutionary tracks derived from stellar models and the technique adopted to calculate isochrones in the HR diagram.

Analysing the various EPS models, we verify that everyone uses different libraries mainly because these do not extend over the desired range of mass, chemical parameters, and evolutionary phases. Since the libraries of evolutionary tracks differ in the basic input physics, this way of proceeding can be dangerous because it may alter the relative number of stars present in different evolutionary stages, and hence give rise to spurious effects on the final ISED. Moreover it must be emphasized that a crucial point of these models is the choice of the stellar birthrate ($dN = \Psi(t, Z)\Phi(M)dtdM$), for which the theoretical argument is until now a debated question.

We compare, here, the models of Bruzual & Charlot (1993), used until now to model the stellar component of HzRG, with the most recent models of Bressan et al. (1995). We find that: 1) Bressan's models have a larger contribution from red stars in the near-IR by a factor of 2 - 3, decreasing with age; 2) the UV-rising branch is higher in Bressan's models by a factor of 4 at 10 Gyr (figure 1).

To understand these differences between the two models we have to take into account primarily that they were built using different libraries of evolutionary tracks.

The larger contribution from red stars present in the Bressan's models may come from the particular care with which the evolutionary sequences are explicitly calculated up to the late stages, namely the thermally pulsing regime of the asymptotic giant branch phase (TP-AGB) or the central C-ignition (as appropriate for the initial mass of the stars), with respect the semiempirical calculations to which Bruzual et al. were forced by the incompleteness of the tracks of Maeder & Meynet (1991) for the late evolutionary stages. The reason for the higher UV-excess in the Bressan's

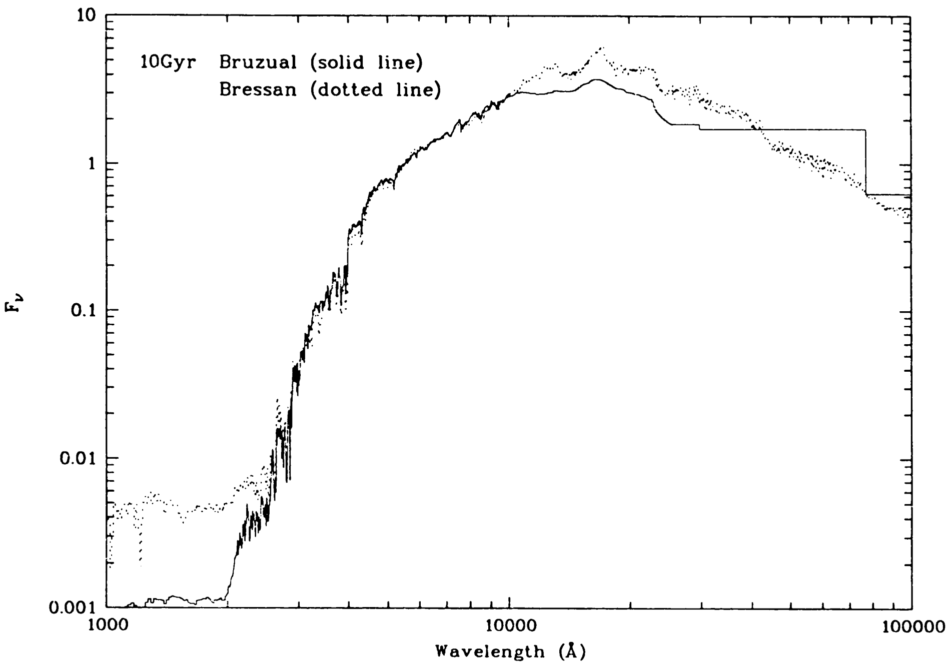

Figure 1. Comparison of the synthesis models of Bruzual et al.(1993) and of Bressan et al. (1995) for an age of 10 Gyr, with a Salpeter IMF and an Instantaneous Burst SFR. Notice the difference in the near-IR and UV fluxes discussed in the text.

models may be due to the different metallicity content, which is crucial for the UV emission, as discussed by Bressan et al. (1994). While Bressan et al. consider the chemical enrichment as a result of galactic evolution and the average value of the final metallicity is above solar (they also take into account the helium enrichment law $\frac{\Delta Y}{\Delta Z}$), Bruzual et al. consider only solar values both for the metallicity and helium content.

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