Evolutionary Population Synthesis

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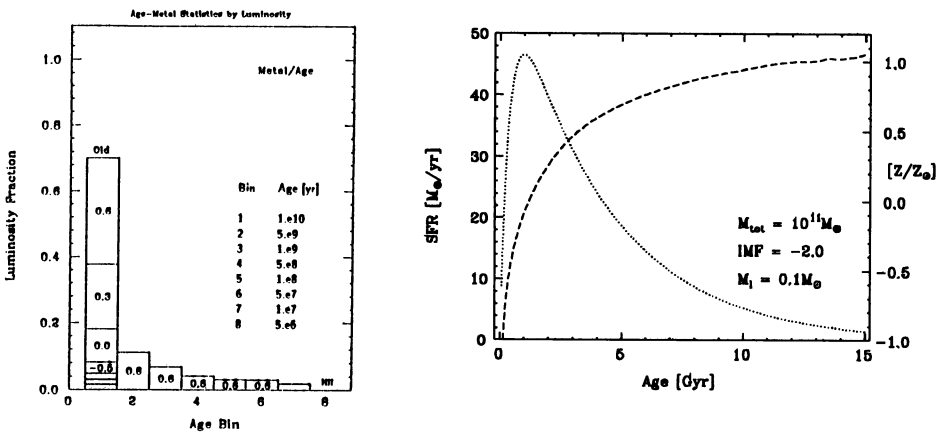
Abstract Based on the population synthesis results[1] for the nuclear region of the elliptical galaxy NGC5044, possible theoretical Age Metallicity Relations (AMR) have been derived, reproducing the stellar luminosity distribution over age A and metallicity Z. A self-consistent method, used to constrain the star formation history and chemical evolution of a galaxy directly from its spectrum (i.e. from 3000 - 10000 Å) is presented. This method is predominantly based on the modelling of stellar luminosity contributions obtained by spectral decomposition methods with those theoretically calculated using a conventional galactic evolution model, incorporating a parametrised Star Formation Rate (SFR) and Initial Mass Function (IMF). Related model parameters were constrained by minimizing the χ^2- test defined by the corresponding luminosity distributions.

Results Preliminary model results are presented for the nucleus of NGC5044 and discussed with respect to the uniqueness of the derived SFR history (and AMR) and to the general properties of the applied method. In the left figure below we show the obtained stellar MS-luminosty distribution over age and metallicity based on the decomposition[1] of galactic absorption lines and continua using a base of star clusters covering a wide range in A and Z ($[Z/Z_\odot]$ indicated inside bins). The dominant part (i.e. ≈70%) of the stellar population present in the nucleus is found to be old, i.e. older than 10 Gyr, and has a metallicity $[Z/Z_\odot] = +0.6$. Furthermore, no significant young (i.e. $A<10^7$yr) stellar population is likely to be present, in agreement with specific emission line intensity ratios (see further Goudfrooij & Van den Hoek, this conference).



The global star formation history found for NGC5044 and the resulting AMR (dashed curve) as a function of galactic age are shown in the right figure above. The solution shown has been derived after ≈3000 minimalisation iterations[2]. Only a limited range of possible SFR histories, constraining the effective parameter-space of the double exponentional SFR, as well as the adopted power law IMF (and lower mass limit), has been found acceptable to model the stellar population distribution over A and Z, confirmed by the small number of possible solutions. Further promising results will be presented in due course.

[1]Results were obtained with an early version of the population synthesis model developed by Bica & Alloin (1986) see further e.g. Bica, E. & Alloin, D. 1986, A&A 162, p. 21, Bica, E. 1988, A&A 195, p. 76, and Bica, E., Alloin, D. and Schmidt, A.A. 1989, A&A 228, p. 23. [2]The effective parameter grid consists of more than $>10^7$ combinations!

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