PHOTOMETRIC PROPERTIES OF STAR CLUSTERS WITH YOUNG OR MIXED AGE STELLAR POPULATIONS

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SUMMARY

- The main goal of this work is to present and discuss the synthetic photometrical properties of stellar clusters resulting from the PopIII code.
- Colors in Johnson and SDSS systems, line and H II luminosities and equivalent widths, and ionizing region sizes have been computed for a wide range of metallicities Z = 0.0001, 0.0004, 0.001, 0.0008, 0.02 and 0.05, and ages, from 4.15 Myr to 28 Gyr (in Mollá et al., 2008, Paper I).
- Emission lines are shown in Marín-Manjón et al. (2016, Paper II). We have calculated the contribution at the U, B, V, R, I, and Z Johnson filters and the g, r, i, and z SDSS filters, respectively.
- We have included the contributions of the emission lines to the integrals of CLOUDY, we get the intensities of the optical emission lines.
- Some intense emission lines fall in the Johnson and SDSS broad band filters. The contribution depends on the filter transmission curve and the redshift, which places a given line in a different wavelength within the passband.
- We have calculated the contribution at z=0 in the U, B, V, R, I, and Z Johnson filters and the g, r, i, and z SDSS filters, respectively.
- We have created the models of emission lines in the magnesium I opacity peak at 1.7μm.
- The contribution of iron to the line luminosity is calculated.
- The contribution of the emission lines to the broad band colors is shown in Fig. 3 for different cluster metallicities Z.
- The equivalent width of Hα is shown in Fig. 4 for different Zs.
- The luminosity of Hα is represented in the top (with different colors) and for the same metallicities Z.
- The color-color diagrams change considerably.
- The position of young SSP populations in a color-color diagram changes considerably.
- The contribution of the emission lines to the color-color diagrams: points go out of the mass-metallicity plane each time that a burst of star formation takes places falling in a region impossible to reach in any other way.
- The position of young SSP populations in color-color diagrams changes considerably.

HII REGIONS PROPERTIES: SIZES AND Hα LUMINOSITIES

CONTRIBUTION OF EMISSION LINES TO BROAD BAND FILTER COLORS

PHOTOMETRIC PROPERTIES OF STAR CLUSTERS WITH MIXED STELLAR POPULATIONS

We have mixed two populations, young (t < 10^6 yr) and old (t > 10^6 yr): the resulting colors are quite different than the ones synthesized without the emission lines contribution.

Fig.7: Colors for the youngest clusters (age=10Myr) are greatly modified.
- Hα keeps its influence over the R and i bands until almost 20 Myr for the lowest metallicities.
- The position of young SSP populations in color-color diagrams changes considerably.

Fig.9: Resulting colors as a function of age (left). EW(Hα) vs metallicity for young populations (top) and young plus old (bottom) panels, respectively, for which the old stellar population age and metallicity and the metallicity of the young one are defined as labeled.
- In each panel the evolution with the age of the young population is given for different metallicities of the old stellar populations as given by F/Mass old pop./Mass young pop.

Fig.10: Color vs EW(Hα) cyan and grey dots represent the SSP results without and with emission lines. Solid lines are results for mixed stellar populations with F = 1000 and F = 1. Data are from Martín-Manjón et al. (2010). Galaxies Mrk 279 and Mrk 177 are well fitted with $F = 10^4$ or $F = 10$, but Hubble needs a high proportion of underlying old stellar population to explain the red colors with high EW(Hα).