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Photometric properties of stars clusters with young or mixed age stellar populations

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Abstract

The main goal of this work is to present and discuss the synthetic photometrical properties of stellar clusters resulting from the PopStar code. Colors in Johnson and SDSS systems, Hα and Hβ luminosities and equivalent widths, and ionizing region size, have been computed for a wide range of metallicities $Z = 0.0001, 0.0004, 0.004, 0.008, 0.02$ and 0.05, and ages, from 0.1 Myr to 20 Gyr in Mollá, García-Vargas, & Bressan (2009, MNRAS, 398, 451). Emission lines are shown in Martín-Manjón et al. (2010, MNRAS, 403, 2012). Now we calculate colors with the emission lines contribution to the broad band color, so colors include stellar and nebular components, plus the emission lines following the evolution of the cluster and the region geometry in a consistent way. We compare the Single Stellar Populations contaminated and uncontaminated colors (in both Johnson and SDSS systems) and show the importance of emission lines contribution when photometry is used as a tool to characterize stellar populations. With these models we may determine the physical properties of young ionizing clusters when only photometrical observations are available and these correspond to the isolated star forming regions, subtracted the contribution of the underlying population In most cases, however, the ionizing population is usually embedded in a large and complex system, and the observed photometrical properties are the result of the combination of both the young star-forming burst and the host-underlying older population. The second objective of our work is therefore to provide a grid of models for nearby galaxies able to interpret mixed regions where the separation of young and old population is not possible or reliable enough. We obtain a set of PopStar Spectral Energy Distributions (available at PopStar site and also in VO) and derived colors for mixed populations where an underlying host population is combined in different mass ratios with a recent, metal-rich ionizing burst. These colors, together with other photometrical parameters, like Hα radius of the ionized region, and Balmer lines equivalent width and luminosity allow to infer the physical properties of star-forming regions without any spectroscopic information. For details and a complete set of tables and figures see Mollá, García-Vargas, & Martín-Manjón (2012, MNRAS, submitted).