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ANALISYS OF THE LUMINOSITY-STELLAR MASS-METALLICITY RELATION IN COSMOLOGICAL SIMULATIONS

M. E. De Rossi,[1,2] P. B. Tissera,[1,2] and C. Scannapieco[1,2]

In this work, we study the Luminosity-Metallicity Relation (LMR) and the Stellar Mass-Metallicity Relation (MMR) by using chemo-dynamical simulations in a cosmological scenario, which allow the description of the non-lineal growth of structure together with the chemical enrichment of baryons.

The simulations have been performed by employing the chemical GADGET-2 (Scannapieco et al. 2005). We assume a ΛCDM cosmology ($\Omega = 0.3, \Lambda = 0.7, \Omega_b = 0.04$ and $H_0 = 100h$ km s^{-1}Mpc^{-1}, $h = 0.7$), which leads to a hierarchical assembly of structure.

Galactic properties are estimated at the optical radius, defined as the one which encloses 83 % of the baryonic mass of the system. Colors and magnitudes of simulated galaxies are calculated by applying population synthesis models (see De Rossi et al. 2006, in preparation).

Our results predict a tight correlation between oxygen chemical abundance and luminosity for galactic systems up to $z = 3$. Metallicity decreases with the absolute magnitudes of simulated galaxies in a linear way consistently with observational trends (e.g. Tremonti et al. 2004). Moreover, the simulated LMR evolves with redshift in such a way that at a given oxygen abundance systems are ~ 3 mag brighter at $z = 3$ than local ones, in good agreement with observations (e.g. Kobulnicky et al. 2003).

The simulated MMR shows a similar trend to that found by Tremonti et al. (2004) for SDSS galaxies but with a displacement of ~ -0.25 dex in the zero point. This discrepancy may be associated to the fact that the SDSS explores only the central regions of galaxies leading to an overestimation of their mean metal abundance. On the other hand, at lower masses simulated systems are more enriched than observed galaxies which could probably be due to the lack of efficient supernova energy feedback in our numerical model.

The metallicity of simulated galaxies tends to increase with stellar mass in a non-linear way. We have determined a characteristic stellar mass $M_c \sim 10^{10.2} M_\odot h^{-1}$ above which the MMR gradually flattens. This characteristic mass seems to be independent of redshift and segregates two galactic populations with different astrophysical properties (Tissera et al. 2005). It is worth mentioning that M_c agrees with the characteristic mass for galaxy evolution previously reported by Kauffmann et al. (2003), Tremonti et al. (2004) and Gallazzi et al. (2005). According to our results, systems with stellar masses greater than M_c have suffered important merger events and formed approximately half of their present stellar mass at $z > 2$. At lower redshifts these objects have small fractions of left over gas. Low mass systems form their stars in a more passive way or by rich gas mergers at lower z, leading to a stronger correlation between stellar mass and chemical abundance.

Thus, we conclude that the features of the MMR may be linked to the hierarchical aggregation of structure in a ΛCDM cosmology and, hence, its study could reveal important clues about how galaxies are assembled.

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[1]Instituto de Astronomía y Física del Espacio, Casilla de Correos 67, Suc. 28, 1428, Ciudad de Buenos Aires, Argentina (derossi@iafe.uba.ar).

[2]Consejo Nacional de Investigaciones Científicas y Técnicas, CONICET, Ciudad de Buenos Aires, Argentina.