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EVOLUTION MODELS FOR SPIRAL AND IRREGULAR GALAXIES

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Stars form, die and eject the elements created by stellar nucleosynthesis. Chemical evolution models are the tool used to interpret the elemental abundances in terms of star formation rate and of the gas dilution or enrichment processes in a region or galaxy. The evolutionary history gives the final state of the gas and stars. In this work we present an update of our grid of models (Mollá & Díaz 2005, MD05). We now modify the infall law, obtaining a slower time evolution, and better results for the gas and star formation radial distributions. This also changes the resulting radial gradient of abundances.

In MD05 we presented a grid of chemical evolution models depending on the galaxy total mass and on the efficiency to form molecular clouds and stars. The radial distributions of total mass were calculated by the Universal Rotation Curve from Persic, Salucci, & Stel (1996). Efficiencies to form molecular clouds and stars changed simultaneously, each set (ϵ_μ,ϵ_H) defined by a number N. A bi-parametric grid of 44 radial mass distributions, with maximum rotation velocities in the range [30–400] km s^{-1}, and 10 values of N, with efficiencies in the range [0–1], were calculated, giving the corresponding radial distributions of stars, gas, elemental abundances and star formation rates. These results reproduce adequately the data for the diffuse gas, the stellar profiles and the elemental abundances for the Milky Way Galaxy (MWG), for some individual nearby galaxies and also the generic observed trends. However, the radial distributions of molecular gas and star formation rate showed decreasing shapes in the inner disks at variance of data (Martin & Kennicutt 2001; Nishiyama, Nakai, & Kuno 2001). Therefore, we modify the model inputs (Mollá et al. in preparation) in order to search for final radial distributions in better agreement with observations. The new models are computed with the radial distributions of dynamical mass given by Salucci et al. (2007) in terms of virial masses. The collapse time-scale, which defines the infall rate of gas from the proto-

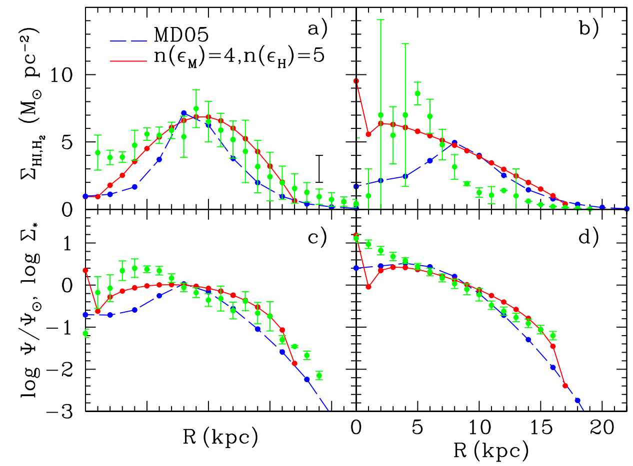

Fig. 1. Radial distributions of HI, H_2, SFR and stars surface densities for a MWG model –red solid line– compared with the old model from MD05 –blue dashed line– and with the data –green dots with error bars.

galaxy to form the disk, is taken as the value which produces a final ratio $M_{\rm disk}/M_{\rm dyn}$ as the obtained by Shankar et al. (2006). The collapse-time scale along the galactocentric radius is also constrained to obtain the observed disk stellar mass profiles, resulting smoother than in MD05. As a consequence, the infall rate along the redshift is lower and more constant along the whole evolution. By using these new inputs, we compute a new grid of models for virial masses in the range $[5\times 10^{10} - 10^{13}]$ M$_\odot$, which would correspond to rotation velocities $[42-320]$ km s^{-1}. By selecting the model with $M_{\rm dyn} = 10^{12}$ M$_\odot$ and intermediate efficiencies to form molecular clouds and stars as the one simulating a MWG-like galaxy, we obtain radial distributions in much better agreement with the data, in particular for the SFR and for H_2 at the inner disk regions, such as we may see in Fig. 1.

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