RevMexAA (Serie de Conferencias), **17**, 145–145 (2003)

Galaxy Evolution: Theory and Observations (Cozumel, Quintana Roo, México, 8-12 April 2002)
Editors: Vladimir Avila-Reese, Claudio Firmani, Carlos S. Frenk & Christine Allen

THE STAR FORMATION RATE OF GALAXIES. SPH SIMULATIONS OF ISOLATED TRIAXIAL COLLAPSING SYSTEMS

P. Mazzei[1] and A. Curir[2]

We performed smooth particle hydrodynamic (SPH) simulations including star formation and self-consistent chemo-photometric evolutionary population synthesis (EPS) predictions from far-UV to 1 mm, of isolated collapsing triaxial systems. The dependence of the system evolution on some parameters so far unexplored, such as the total mass, initial geometry, dynamical state of the collapsing halo and the effects of different baryonic to dark matter (DM) mass ratios has been investigated. We find important connections between dark and luminous matter.

The initial configuration, i.e. the density distribution, the spin parameter, λ (Barnes & Efstathiou, 1987), the triaxiality ratio, τ (Warren et al. 1992), of the halo as detached by the Hubble flow in a CDM scenario, is built up as described in Curir & Mazzei (1999); τ =0.58 is our fiducial value but also the effect of a slightly oblate halo (τ=0.45) and a prolate halo (τ=0.84) has been investigated. Several simulations with the same value of λ, 0.058 our fiducial value, have been performed; however different λ values are also considered to give insight into the role of the dynamical state of the halo on the evolution of the baryonic matter. The initial number of particles ranges between 2000 to 20000 with $N_{DM} = N_{gas}$. The system is evolved up to 15 Gyr, the final number of particles ranges from 10000 to 200000 (Mazzei & Curir, 2002, in prep). By constraining the system to the same initial density, we find that the star formation rate (SFR) depends both on M_{tot} and on the dynamical state of the halo whose initial geometry influences the results further. For a given value of the M_{bar}/M_{tot} ratio, 0.1 our fiducial value, in the more massive halos the star formation (SF) onset arises before and the SFR achieves higher values than in the less massive ones (Fig.1, panel a: $M_{tot} = 500$, dot-dashed line, $M_{tot} = 20$ dashed line, $M_{tot} = 10$ continuous line); simulations with higher λ (Fig.1 panel c, dashed line) and/or higher τ (Fig.1 panel b: dashed line $\tau = 0.84$, dot–dashed line $\tau = 0.45$) show a delayed onset of the SF which achieves lower values than in the fiducial case. Therefore, inside prolate halos less favorable conditions to the SF occur. After 15 Gyr the more massive systems with fiducial M_{bar}/M_{tot} ratio are elliptical-like, the less massive ones are spiral-like as far concerning colours, luminosities, morphologies of stars as well as dynamical and physical properties of the residual gas. Moreover, for a given M_{tot}, the lower the DM mass the stronger the burst of star formation (Fig.1 panel d) so that by increasing M_{bar}/M_{tot} the final galaxy properties are elliptical-like. Spiral galaxies arise only in systems with $M_{tot} \leq 10^{12} m_\odot$ and inside a short range of M_{bar}/M_{tot} values around 0.1. Thus we find that the properties of the whole system lead the SFR and the evolution of the baryonic matter.

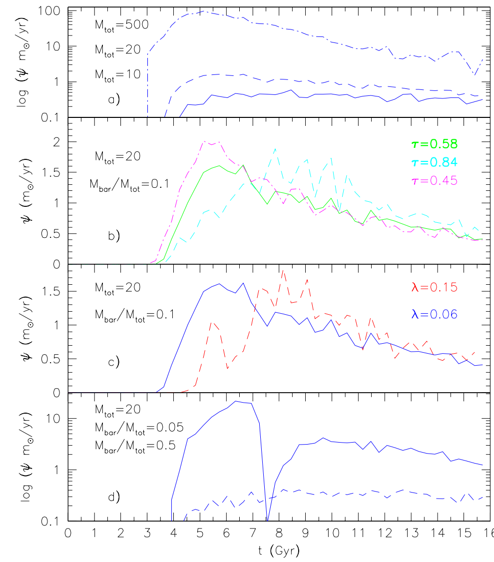

Fig. 1. The time behavior of the SFR, ψ, for a given M_{bar}/M_{tot} ratio (0.1), panel a,b, and c and and for a given M_{tot}, panel d.

[1]INAF, Osservatorio Astronomico, Vicolo dell'Osservatorio 5, 35122, Padova, Italy (mazzei@pdastro.it).
[2]INAF, Osservatorio Astronomico, strada Osservatorio 20, 10025, Pino Torinese, Torino, Italy

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