consistently for a particular effective equation of state.

2.1. *The halos*

We modeled the dark matter mass distribution with the Hernquist profile (Hernquist 1990),

$$\rho_h(r) = \frac{M_{\rm dm}}{2\pi}\frac{a}{r(r+a)^3}\,, \qquad (1)$$

where r is the radial distance, and $M_{\rm dm}$ is the dark matter mass. Two remarks can be made about the shape of this profile: (i) In the inner parts of the galaxy it agrees with the profile given by the Navarro, Frenk, & White (1996, henceforth NFW) fitting formula. (ii) Its faster than r^{-3} decline causes the total mass to converge, allowing the construction of isolated halos without the need of an *ad hoc* truncation. The a parameter is related to the scale radius r_s of the NFW profile by:

$$a = r_s\sqrt{2[\ln(1+c) - c/(1+c)]}\,, \qquad (2)$$

where $c = r_{200}/r_s$ is the concentration parameter, r_{200} is the radius at which the enclosed dark matter mean density is 200 times the critical value (where the critical density is $\rho_{\rm crit} = 3H^2/8\pi G$). We have set $c = 9$.

2.2. *The disk*

We modeled gas and star disk components with an exponential surface density profile (in the radial direction of the galactic disk, R) the scale of length being R_0,

$$\Sigma_g(R) = \frac{M_g}{2\pi R_0^2}\exp(-R/R_0)\,, \qquad (3)$$

$$\Sigma_*(R) = \frac{M_*}{2\pi R_0^2}\exp(-R/R_0)\,, \qquad (4)$$

so that the total mass of the disk is $M_d = (M_g + M_*) = m_d M_{\rm tot}$, where m_d is a dimensionless parameter (fixed in this work to $m_d = 0.041$), and $M_{\rm tot}$ is the total mass of the galaxy, incuding the dark matter halo (i.e. $M_{\rm tot} = M_d + M_h$, where M_h is the mass of the halo). The vertical mass distribution of the stars in the disk is specified by the profile of an isothermal slab with a constant scale height H. The 3D stellar density in the disk is hence given by,

$$\rho_*(R,z) = \frac{M_*}{4\pi\, H\, R_0^2}\,\mathrm{sech}^2\left(\frac{z}{2H}\right)\exp\left(-\frac{R}{R_0}\right)\,. \qquad (5)$$

In all models, H/R_0 was fixed to 0.2 whereas the relative content of gas in the disk (the rest of the disk mass is in stars) was set to 0.35. On the other hand, the disk spin fraction (the fraction of the total angular momentum in the disk), was set, as is customary, to the value of m_d. These values are typical of low-mass galaxies (e.g., Springel et al. 2005).

2.3. *Vertical structure of the gas disk*

The vertical structure of the disk at the beginning of the simulation is computed self-consistently with the halo and stellar disk components as follows. At $t = 0$ the gaseous disk has uniform temperature (fixed to 1000 K). Consider the vertical structure of the gas disk in hydrostatic equilibrium:

$$\frac{\partial\rho_g}{\partial z} = -\frac{\rho_g^2}{\gamma P}\frac{\partial\Phi_T}{\partial z}\,, \qquad (6)$$

where, $\Phi_T = \Phi_h + \Phi_d$ is the total gravitational potential (Φ_h and Φ_d are the halo and disk gravitational potentials, respectively). For a given Φ_T, the solution of this equation is constrained by the condition

$$\Sigma_g(R) = \int \rho_g(R,z)dz\,, \qquad (7)$$

where $\Sigma_g(R)$ is the gaseous surface mass density (see also equation 3). One can obtain the vertical distribution by integrating equation (6), with a central density value at the midplane ($z = 0$) and an effective equation of state of the form $P = P(\rho)$, see Springel et al. (2005). The starting value for the density is guessed, then adjusted in an iterative scheme until the desired surface density (equation 3) is recovered. This process is repeated for different radii to obtain an axisymmetric gas density distribution.

2.3.1. *Cooling*

For the non-adiabatic cases, we adopt the cooling functions computed in collisional ionization equilibrium (CIE) by Sutherland & Dopita (1993). The energy loss per unit mass of the gas is given by,

$$\left(\frac{du}{dt}\right)_{\rm cool} = -\frac{\Lambda_{\rm net}(\rho,T)}{\rho}\,. \qquad (8)$$

We must note that the cooling function we used in our models assumes solar abundances. However, the kind of galaxies treated in this paper should be less metallic and thus the cooling should be lower. For the less metallic galaxies the results would be shifted from our radiative models to the adiabatic ones.