NUMERICAL SIMULATIONS OF THE CHEMICAL EVOLUTION OF GALAXIES USING TREECODE-SPH

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Using an SPH-Treecode which has been modified to include star formation and heavy element synthesis we are investigating the chemical evolution of galaxies from within an overall picture of galaxy formation. Our aim is to understand which chemical properties of galaxies can be explained using a simple collapsing model with star formation.

Our initial conditions are a uniform density sphere with Poisson noise in solid body rotation, and a mass of $2.5 \times 10^{12} M_{\odot}$. Nine tenths of this mass is in the form of dark matter, one tenth is gaseous. This collapses down to form a gas disk of radius $\sim$ 12 kpc. The star formation rate is given by a Schmidt Law, $SFR = k\rho_g^n$, where $1 \leq n \leq 2$ and the heavy element synthesis is modelled under the assumption of instantaneous recycling. We study the effects of varying the constant k and index n in the Schmidt Law. This enables us to vary the relative sizes of the star formation and dynamical timescales. To perform the simulations we use 5000 gas particles, 5000 dark matter particles, and we typically form 7000 star particles.

Our initial results show that:

- These initial conditions can lead to the formation of disk galaxies which have surface density profiles which are well described by an exponential distribution. The typical scale length for the disk is $\sim$ 3.5 kpc.
- For a Schmidt Law of index $n = 1$, no abundance gradients are formed, in accordance with the work of Edmunds and Greenhow 1995.
- For a Schmidt Law of index $n = 1.5$, abundance gradients are formed, but they are shallower ($\sim -0.02\, dex\, kpc^{-1}$) than those typically observed in disk galaxies ($\sim -0.08\, dex\, kpc^{-1}$).

Edmunds M. G., Greenhow R. M., MNRAS 1995, 272, 241

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