NUMERICAL INVESTIGATION OF THE DENSITY DISTRIBUTION OF STARS AND THE DISPERSION OF VELOCITIES IN SPIRAL GALAXIES

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We use a three–component model of a spiral galaxy, given by (Huang et al., 1979):

1. An outer halo with a gravitational potential of the form

$$\Phi_h(R) = \frac{-GM_1}{\sqrt{R^2 + b_1^2}}. \tag{1}$$

where $R^2 = x^2 + y^2 + z^2$, $M_1 = 1.2 \times 10^{11} M_\odot$ and $b_1 = 1.1$ Kpc.

2. A nucleus, with a gravitational potential given by

$$\Phi_n(R) = \frac{-GM_0}{\sqrt{R^2 + b_0^2}}. \tag{2}$$

where $M_0 = 1.1 \times 10^7 M_\odot$, and $b_0 = 0.61 \times 10^{-2}$ Kpc.

3. A self–gravitating disk containing N stars. The density distribution in the z–direction is assumed to be:

$$\rho(r, z) = \frac{\alpha}{2}\sigma(r)\exp(-\alpha|z|). \tag{3}$$

where $\alpha = 2.1$ Kpc^{-1} is the equivalent semi–thickness of the galaxy, and $\sigma(r)$ is the surface density. We consider three different initial expressions for $\sigma(r)$:

   i. A Toomre (1963) disk.
   ii. A uniform distribution.
   iii. An exponential distribution.

The model is covered with a cubic mesh which is divided in $32 \times 32 \times 8$ cells. We use 20,000 particles to simulate the stars in the disk. The evolution of the disk is followed by means of the Particle-Mesh method.

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