ASTR615 HW#4

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Problem 2

We perform a simulation of a cluster with Kroupa IMF.

Mass distribution

We implement in all of our simulations the Kroupa IMF:

$$\phi(m) \propto \begin{cases} m^{-1.3} & (0.08M_\odot < m < 0.5M_\odot) \\ 0.5\, m^{-2.3} & (0.5M_\odot < m < 100M_\odot) \end{cases} \tag{1}$$

after doing transformation we get

$$m = \begin{cases} -\dfrac{0.566179}{\sqrt[3]{1.7987 - x}\,(x^3 - 5.39611x^2 + 9.70599x - 5.81939)} & (0 < x < 0.760707) \\ \dfrac{0.166558}{(1.00024 - x)^{10/13}} & (0.760707 < x < 1) \end{cases} \tag{2}$$

Initial setup

The cluster is a specially uniformly distributed sphere with a radius of 1. The inital velocities are from a Gaussian distribution with a dispersion correspondent to a virial ratio of $\alpha \sim 0.4$. A virial ratio $\alpha < 0.5$ implies the system is bounded. The velocity dispersion crossing time is $t \approx 0.08$, so we use a step size of 0.001, i.e. 80 steps per course time.

0.1 Video

The video of this specific setup is *simulations/cluster03.mp4*.