

ESCAPE RATE

- In 2d, flux at energy E is

$$\oint p_y dy \propto (E - E_{crit})$$

(cf. Mackay, *Phys. Lett. A*, 145, 425, 1990)

$$\Rightarrow \text{escape time scale} \propto (E - E_{crit})^{-1}$$

- In 3d escape time scales as $(E - E_{crit})^{-2}$

(Fukushige & Heggie, 2000, *MNRAS*, 318, 753)

POST SCRIPT : ESCAPE & RELAXATION

[ref: Baumgardt]
astro-ph/0012330

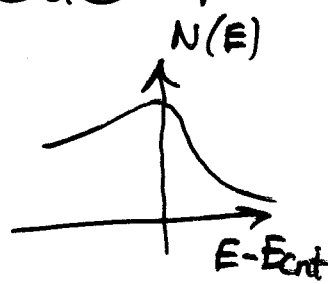
Let $N(E)$ = number of stars per unit energy
 $E > E_{\text{crit}}$

Include

- escape on timescale $t_e \propto (E - E_{\text{crit}})^{-2}$
- diffusion in energy, timescale t_r

Evolution of $N(E)$:

$$\frac{\partial N(E)}{\partial t} = \frac{E_{\text{crit}}^2}{t_r} \frac{\partial^2 N}{\partial E^2} - \frac{1}{t_e} N$$



Assume equilibrium

$$\frac{E_{\text{crit}}^2}{t_r (E - E_{\text{crit}})^2} \sim \frac{1}{t_e}$$

$$\text{But } t_e \propto (E - E_{\text{crit}})^{-2}$$

$$\Rightarrow (E - E_{\text{crit}}) \propto t_r^{-1/4}$$

$$t_e \propto t_r^{1/2}$$

$$\text{Escape rate} \sim \frac{1}{t_e} \int_{E > E_{\text{crit}}} N(E) dE$$

$$\sim \frac{N_* (E - E_{\text{crit}})}{t_e}$$

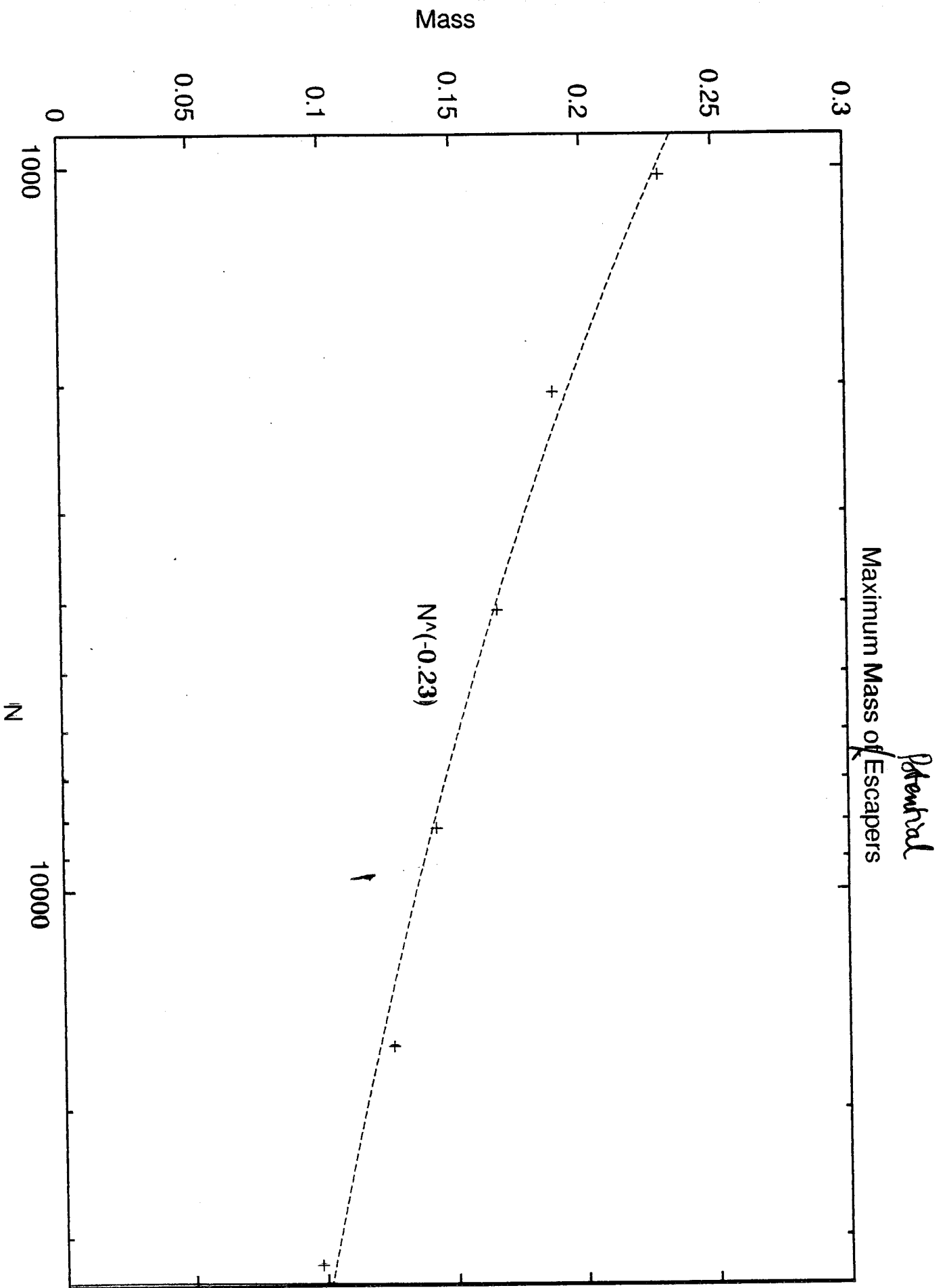
where N_* = total number of cluster members

$$\Rightarrow \text{Mass loss time scale is } \frac{t_e}{E - E_{\text{crit}}}$$
$$\propto t_r^{3/4}$$

$$\text{Also, no. of potential escapers} = \int_{E > E_{\text{crit}}} N(E) dE$$

$$\propto N_* (E - E_{\text{crit}})$$

$$\therefore \text{fraction of potential escapers} \propto (E - E_{\text{crit}})$$
$$\propto t_r^{-1/4}$$
$$\propto N_*^{-1/4}$$



Halo enrichment by disrupted globular clusters

5

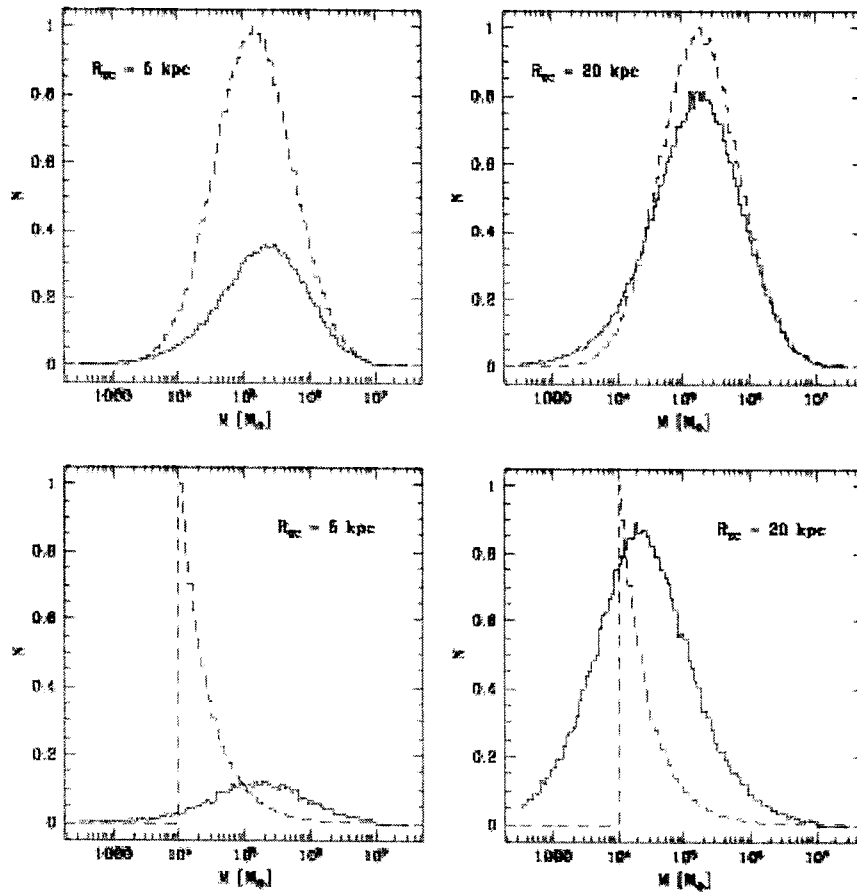


Figure 2. Mass functions of globular clusters for two galactocentric distances. The top panels show the evolution of a gaussian initial mass function, the bottom panels that of a power-law distribution. The dashed lines show the initial distributions, the solid lines the final ones.

CLUSTER ON OVAL GALACTIC ORBIT

- Two destruction mechanisms

1. Relaxation: $t_r \propto N t_{cr}$

2. Bulge shocking: $\propto t_{cr}$

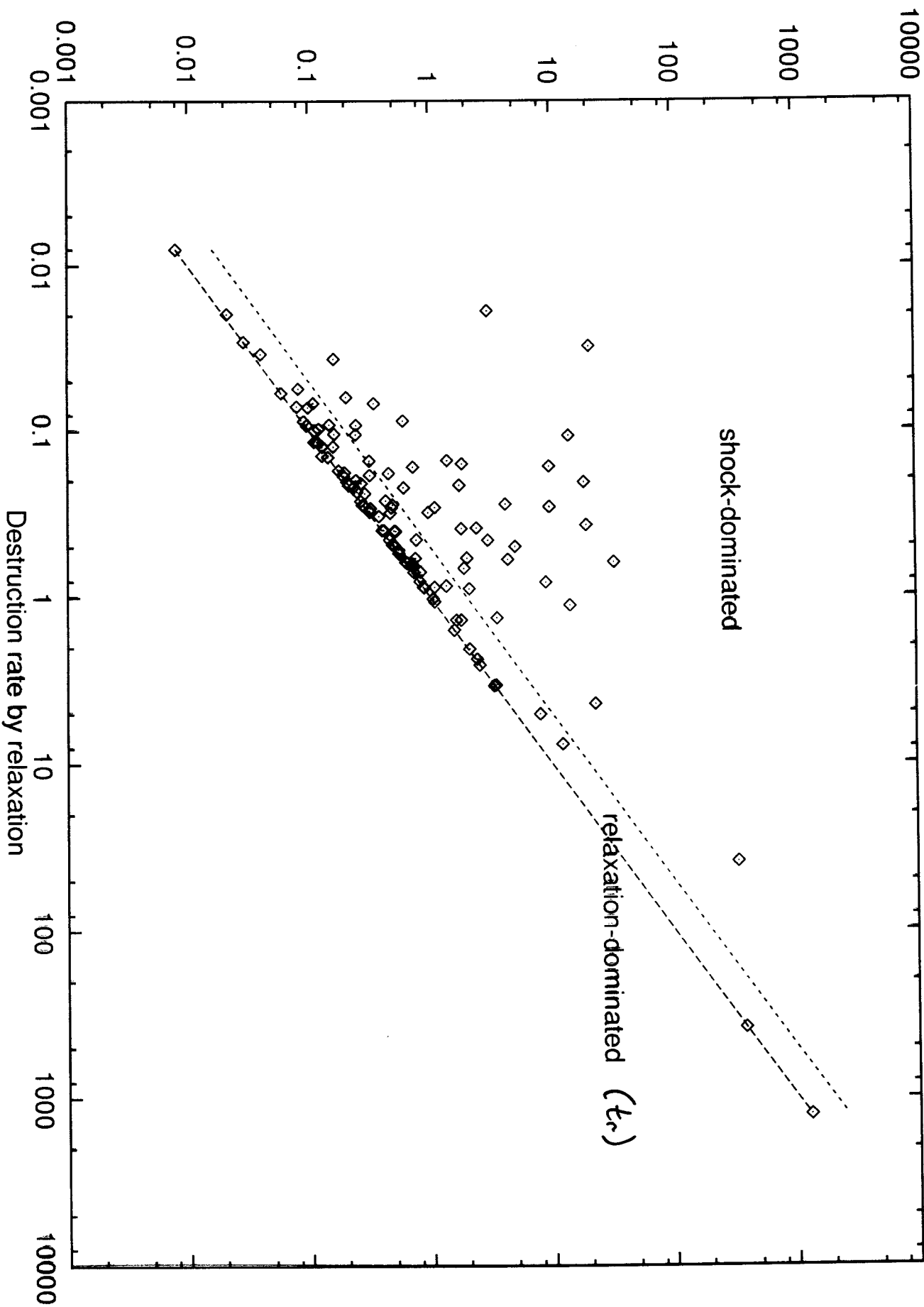
- Problems

1. Scaling

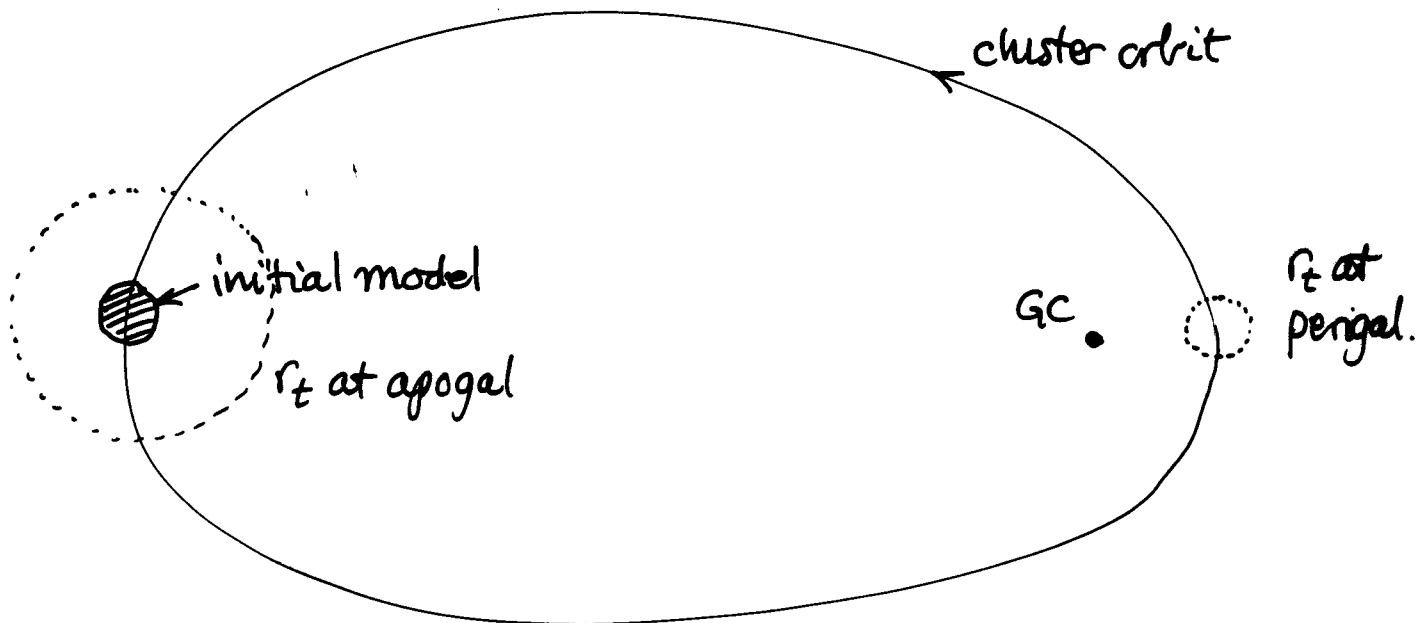
2. Which dominates?

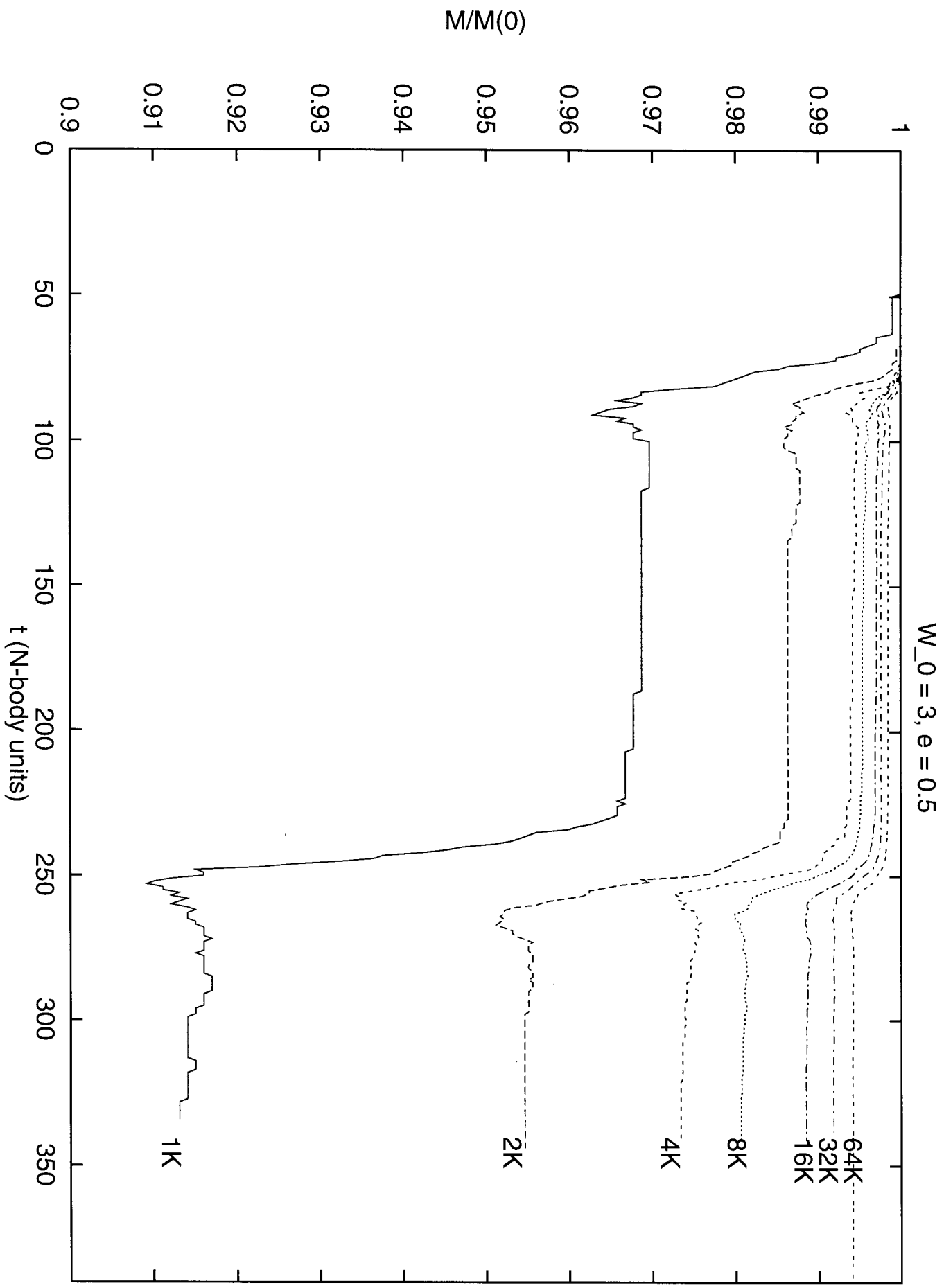
Total destruction rate

Destruction rates: Gnedin & Ostriker (ApJ 474, 223, 1997)

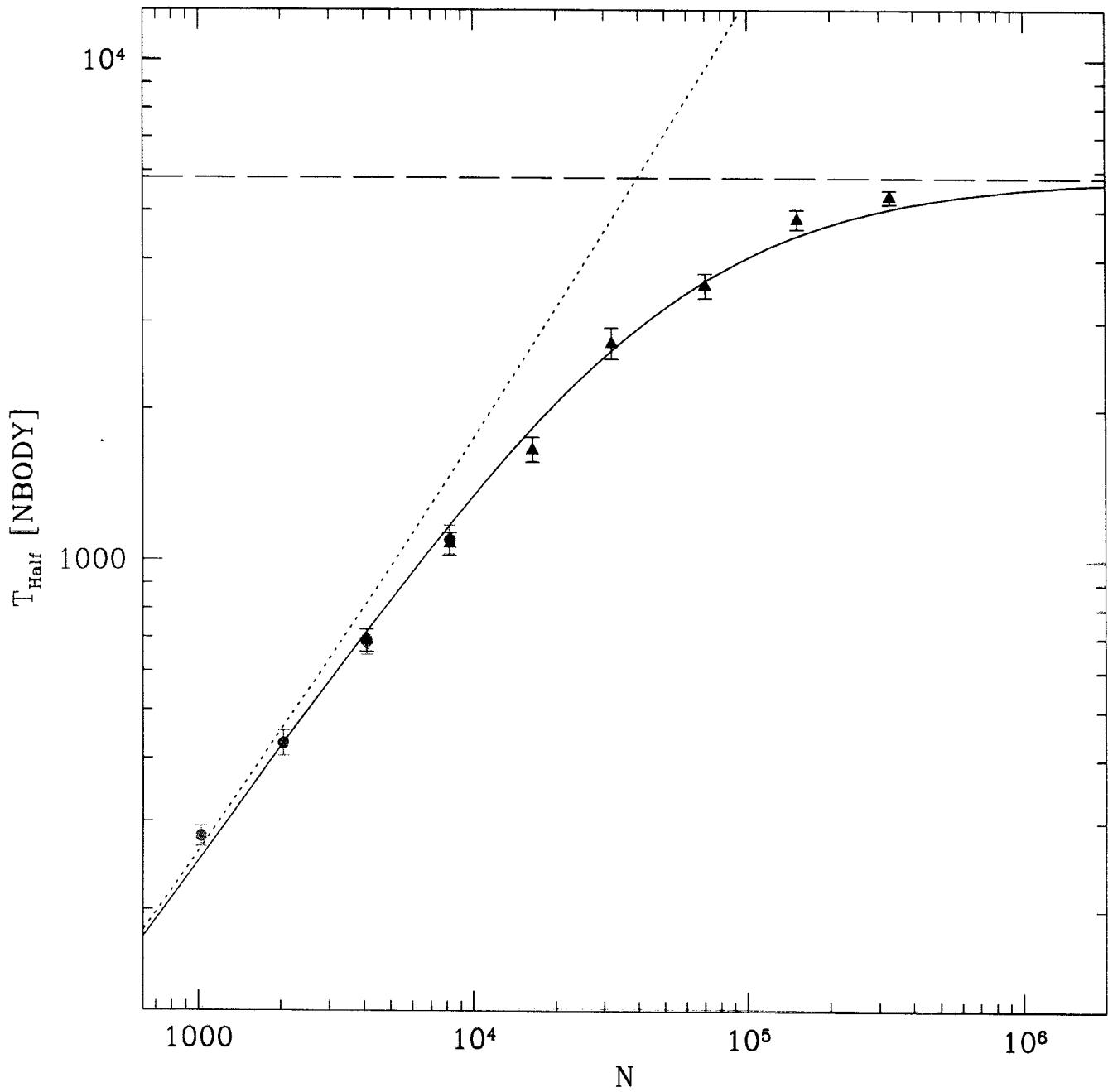


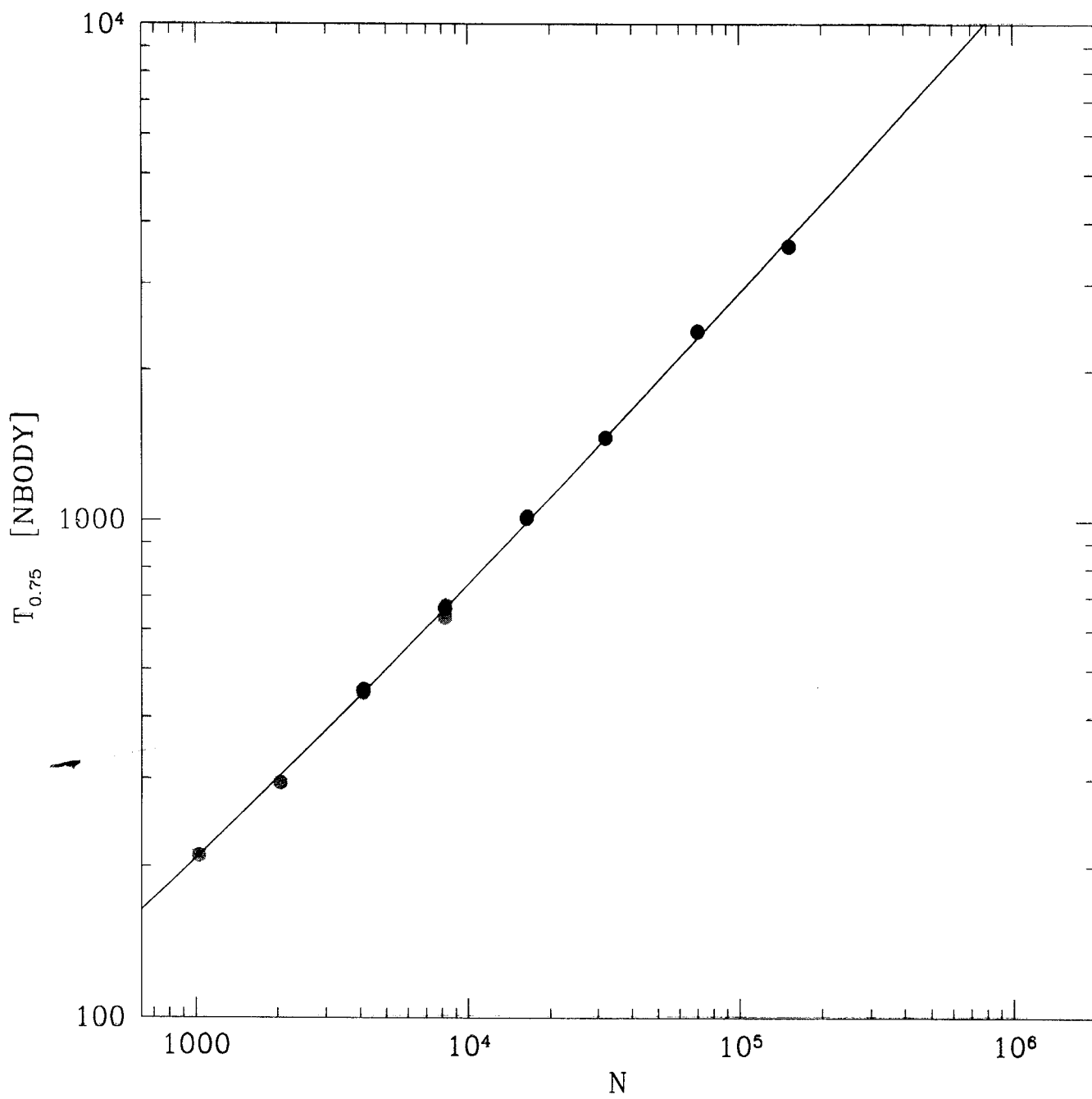
Baumgardt's model





1st few orbits





SUMMARY

1. Mass loss observed in extratidal extensions, heating of the halo
2. Mass loss influences stellar and cluster mass function
3. Isolated systems still problematic
4. Systems on circular orbits affected by escape time
5. Systems on oval orbits behave similarly, though theory lacking