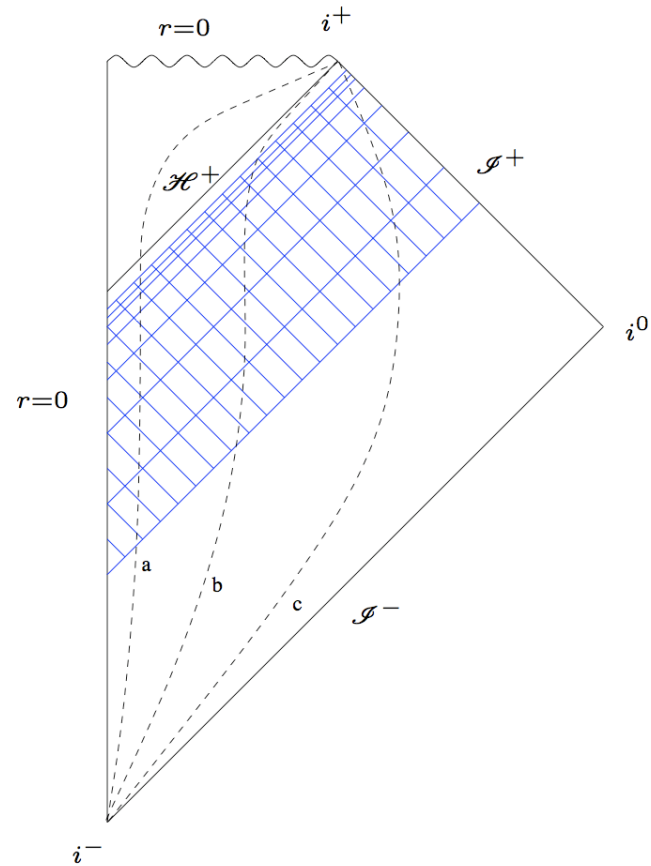


# GLOBAL VERSUS LOCAL ASPECTS OF CRITICAL COLLAPSE

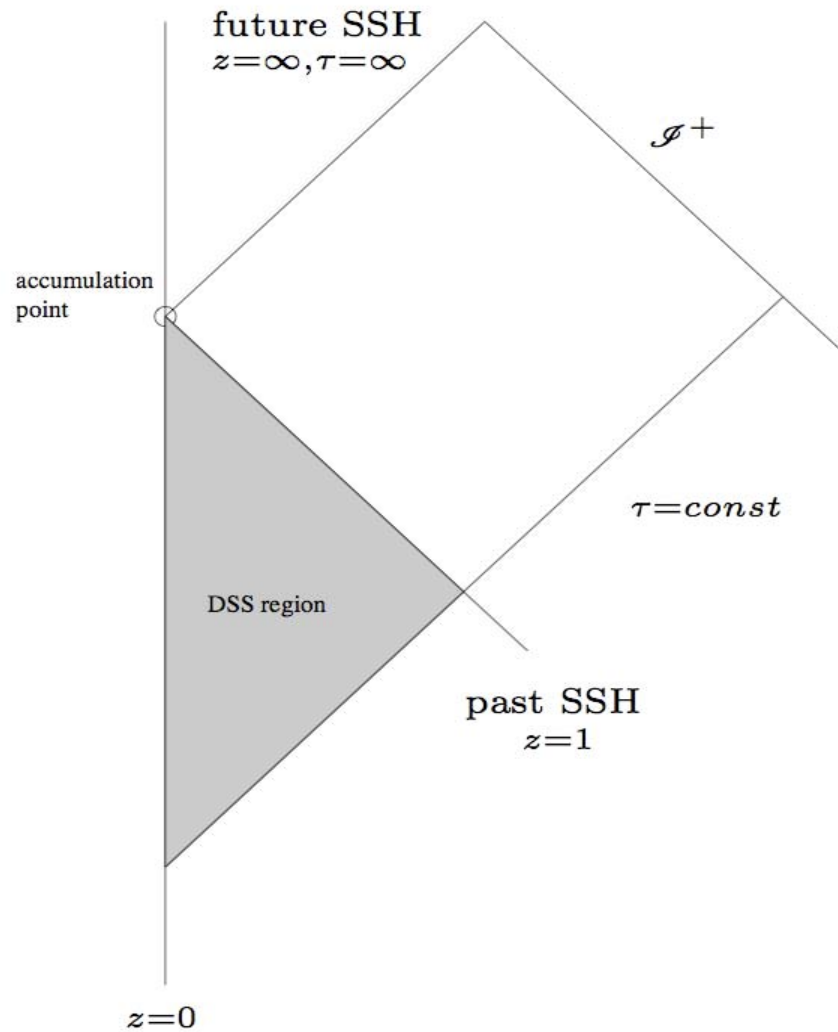
Work in collaboration with M. Puerrer and S. Husa

Paris, Nov. 2006

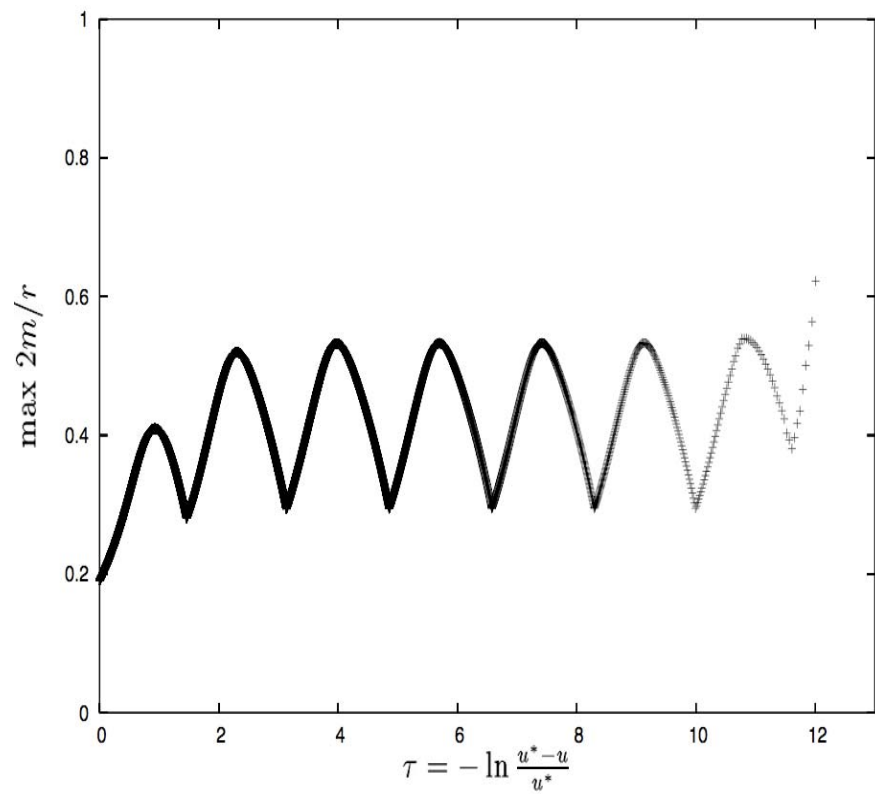
# CHARACTERISTIC EVOLUTION ON COMPACTIFIED SPACETIME



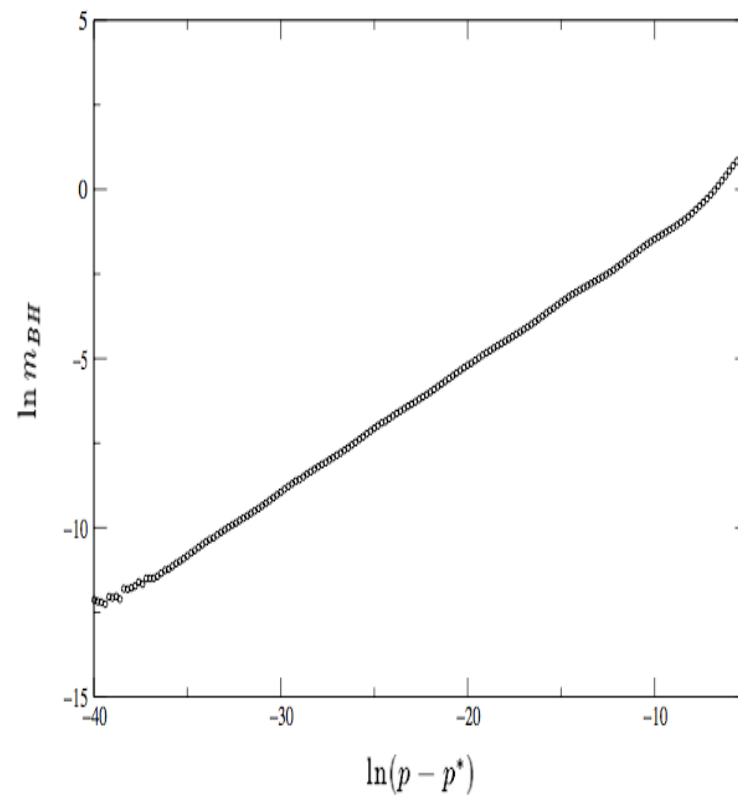
# CRITICAL COLLAPSE SCENARIO



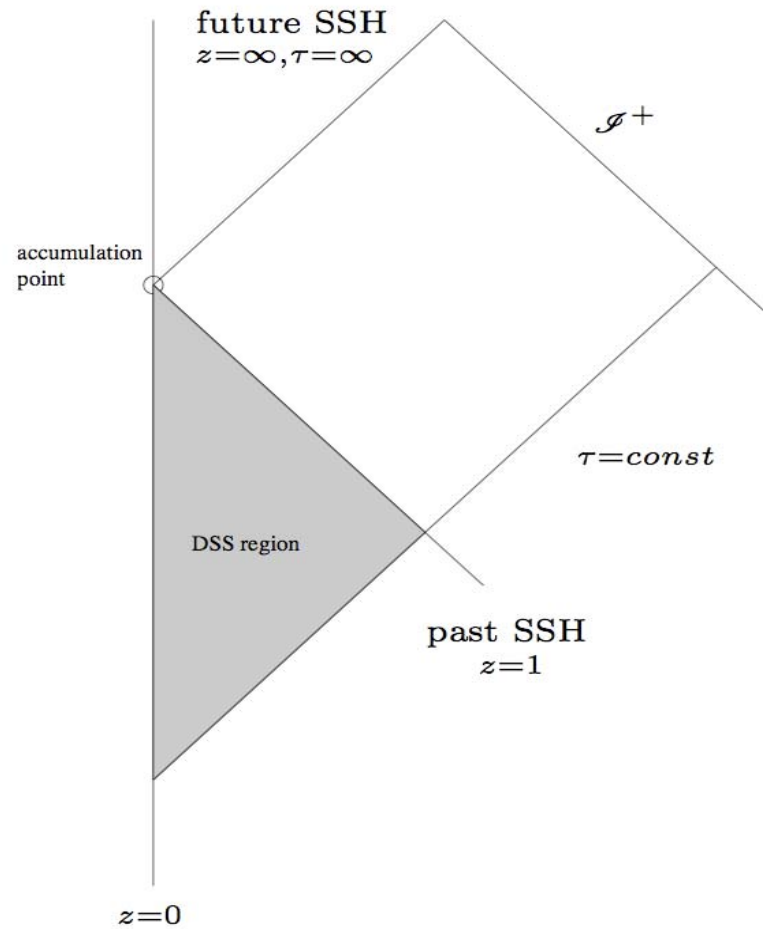
# LOCAL DSS BEHAVIOR



# MASS SCALING



# EXPONENTIAL DECAY OF MASS FUNCTION



## BONDI COORDINATES

$$ds^2 = -e^{2\beta(u,r)} du \left( \frac{V(u,r)}{r} du + 2dr \right) + r^2 (d\theta^2 + \sin^2 \theta d\varphi^2)$$

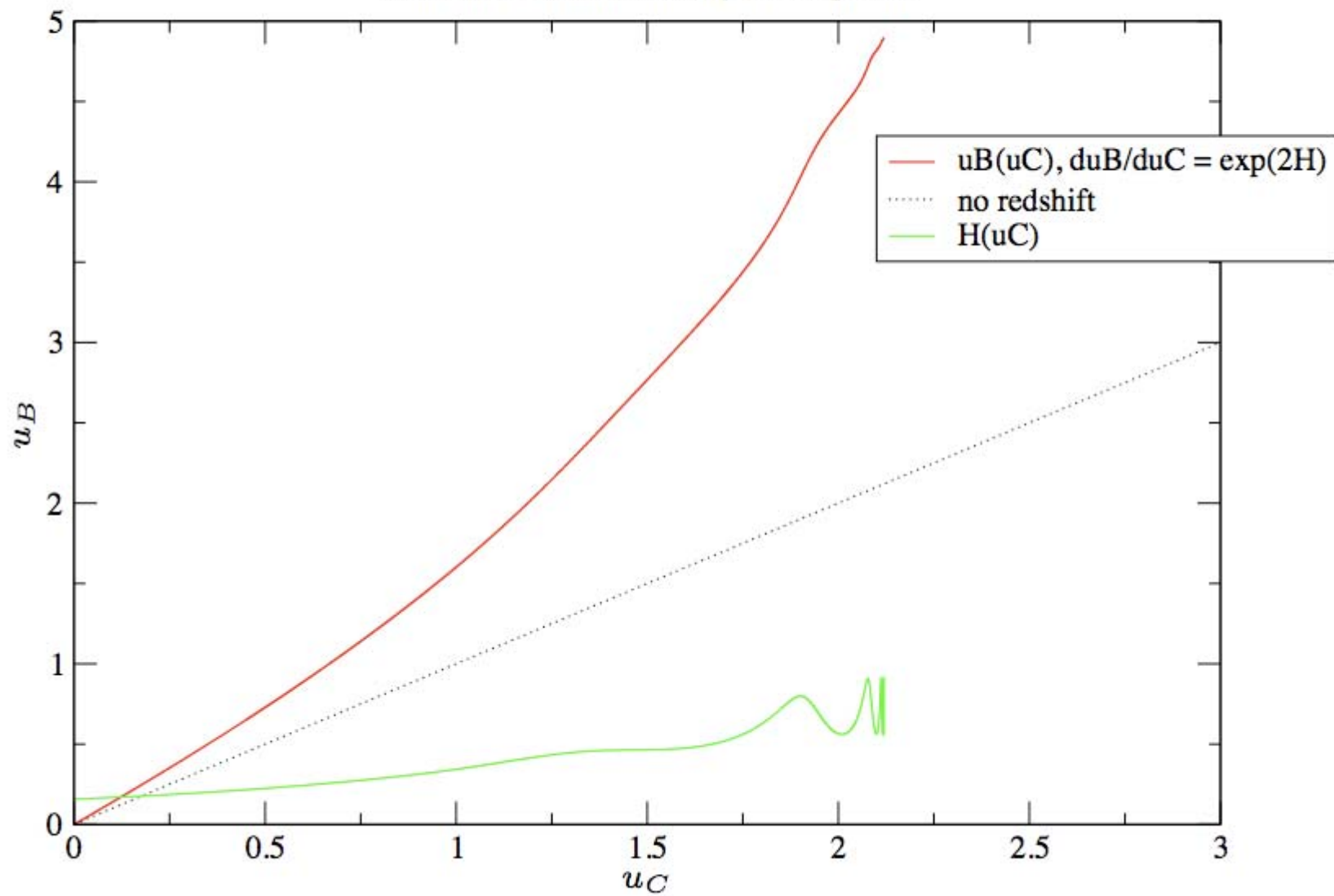
Relation between Bondi and central retarded time

$$\beta(u,r) = H(u) - \frac{\pi c^2(u)}{r^2} + O(r^{-3})$$

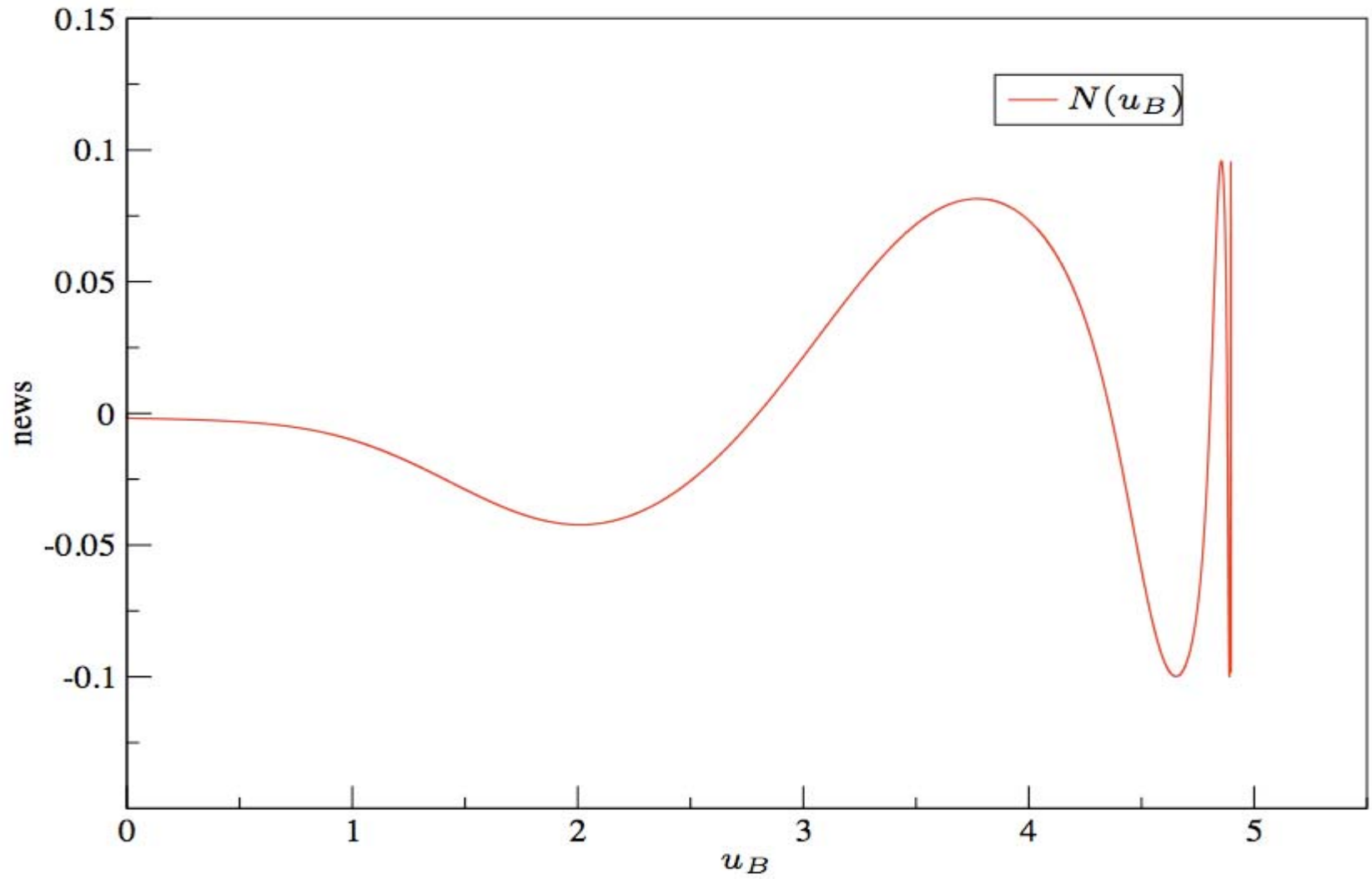
$$\frac{du_B}{du_C} = e^{2H(u)}$$

# Relation between Bondi and central time

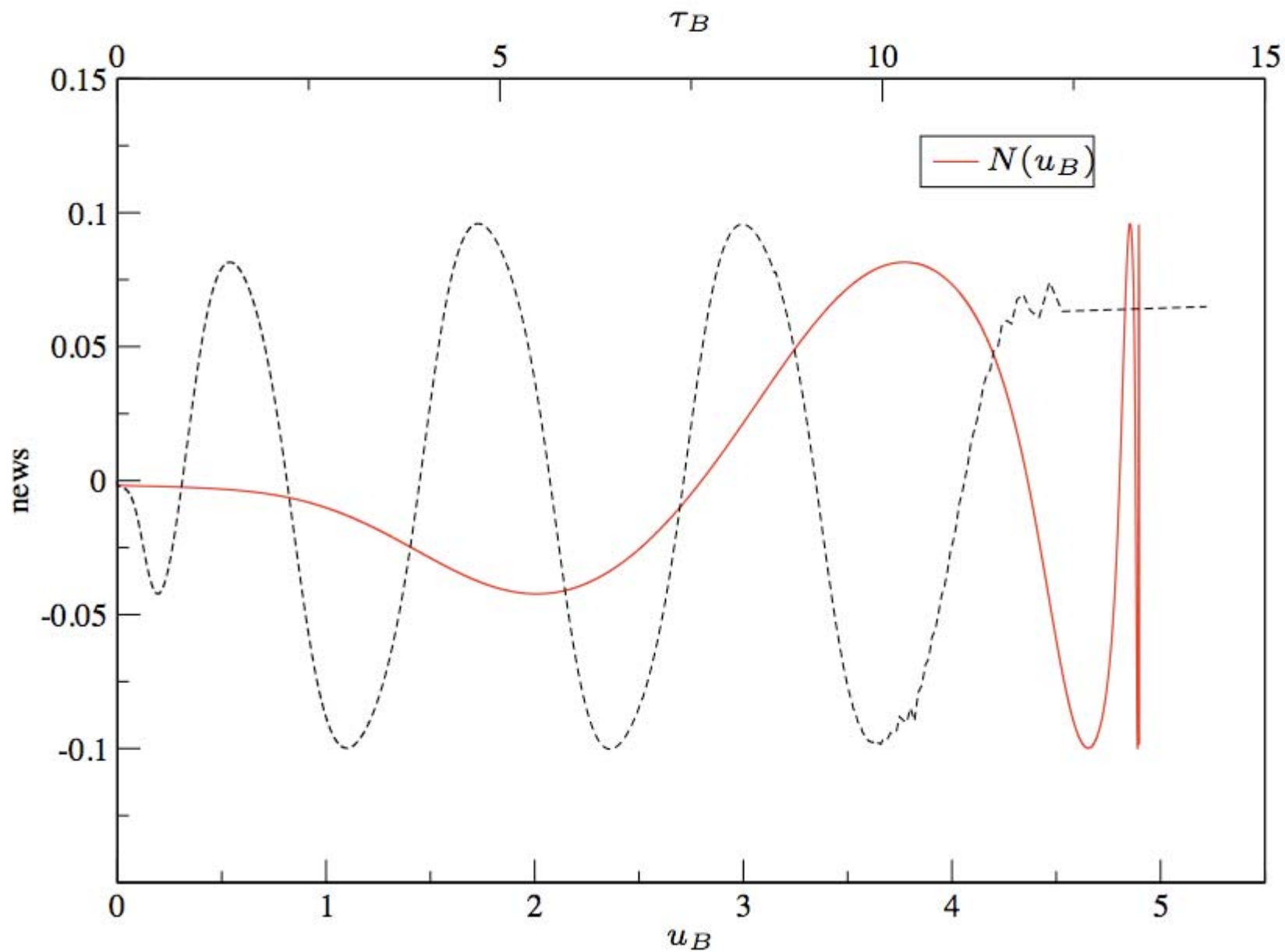
nearcritical evolution using 10000 points



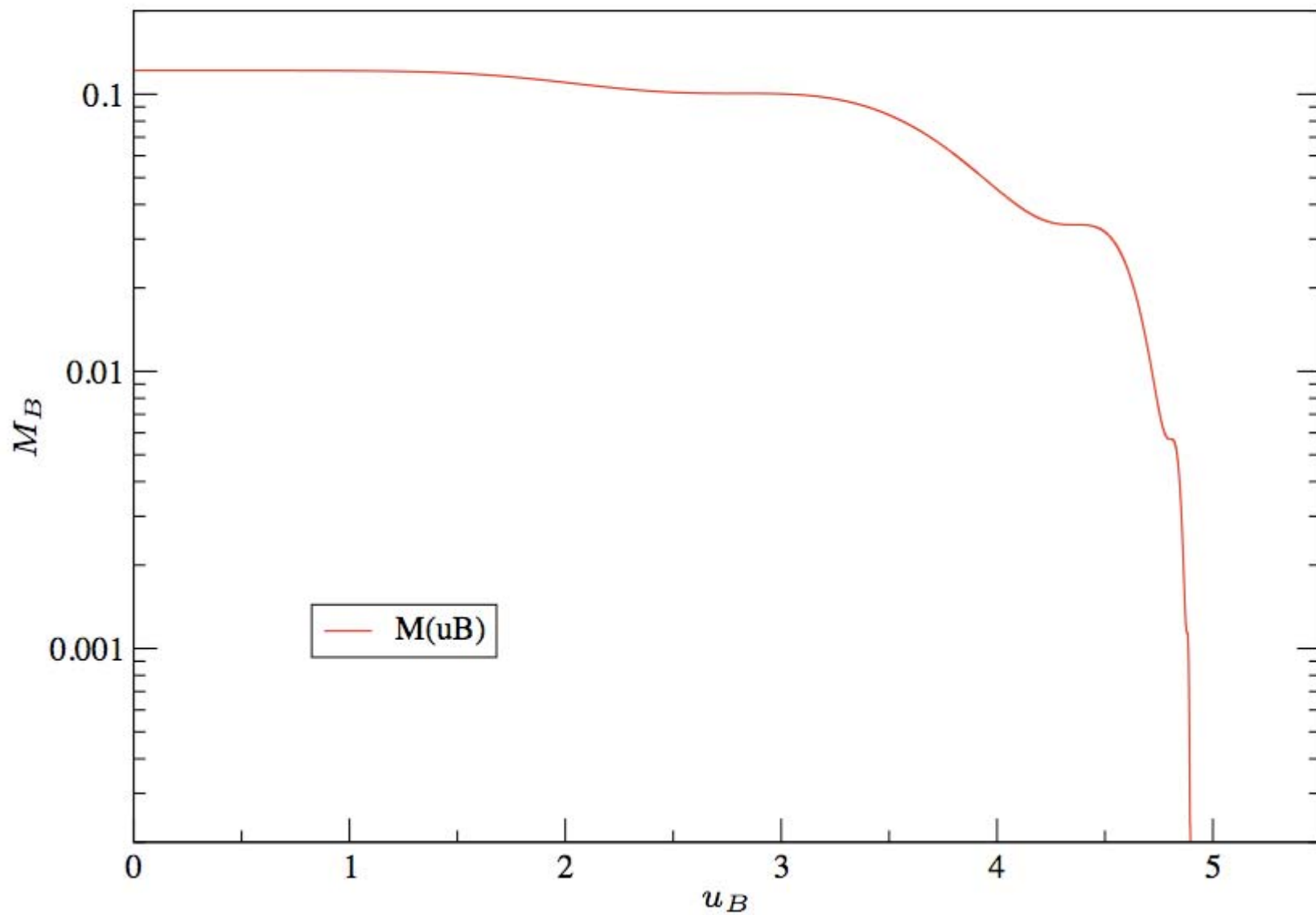
# NEWS IN BONDI TIME



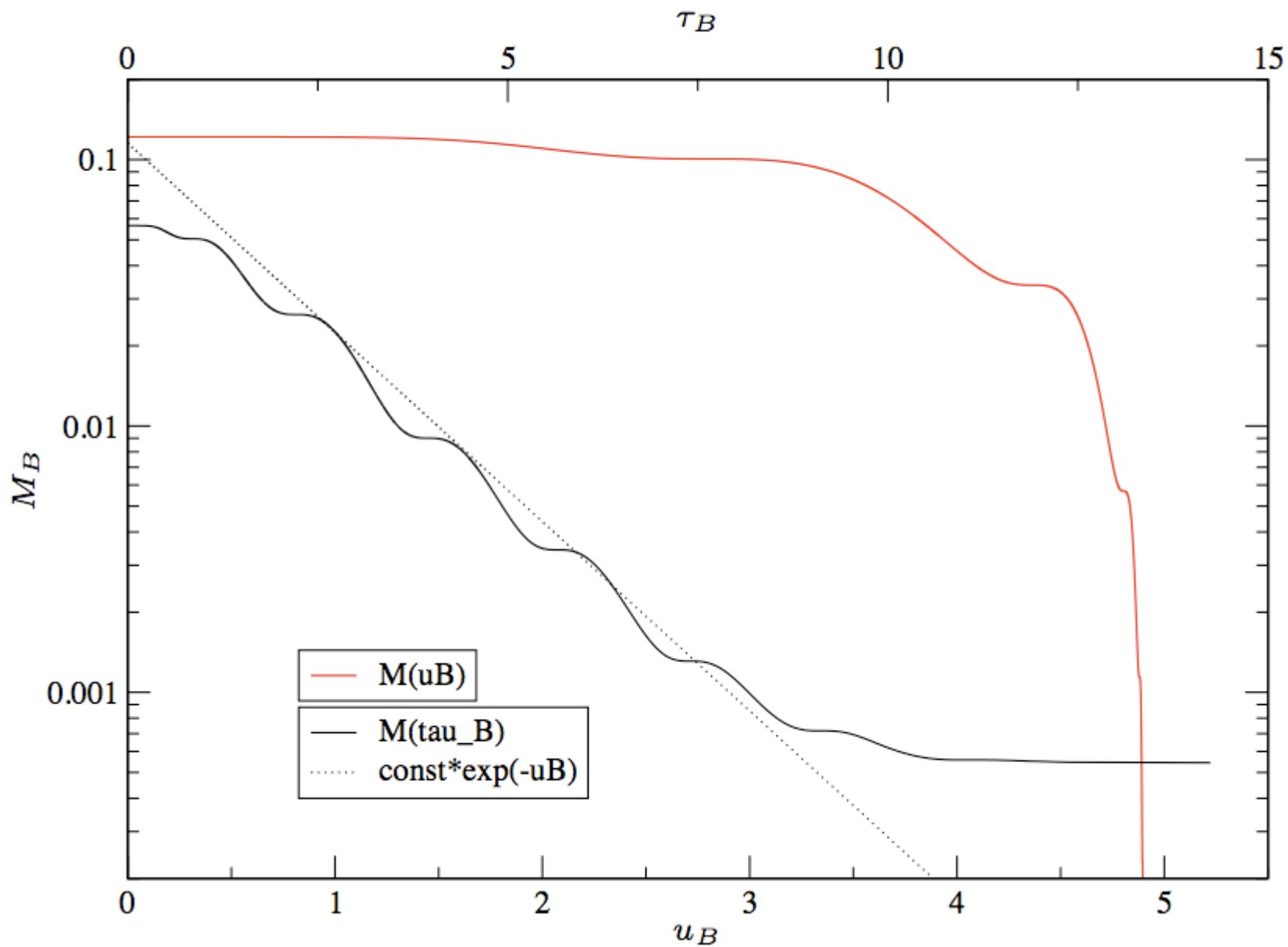
# DSS in the news function



# DSS in the Bondi Mass



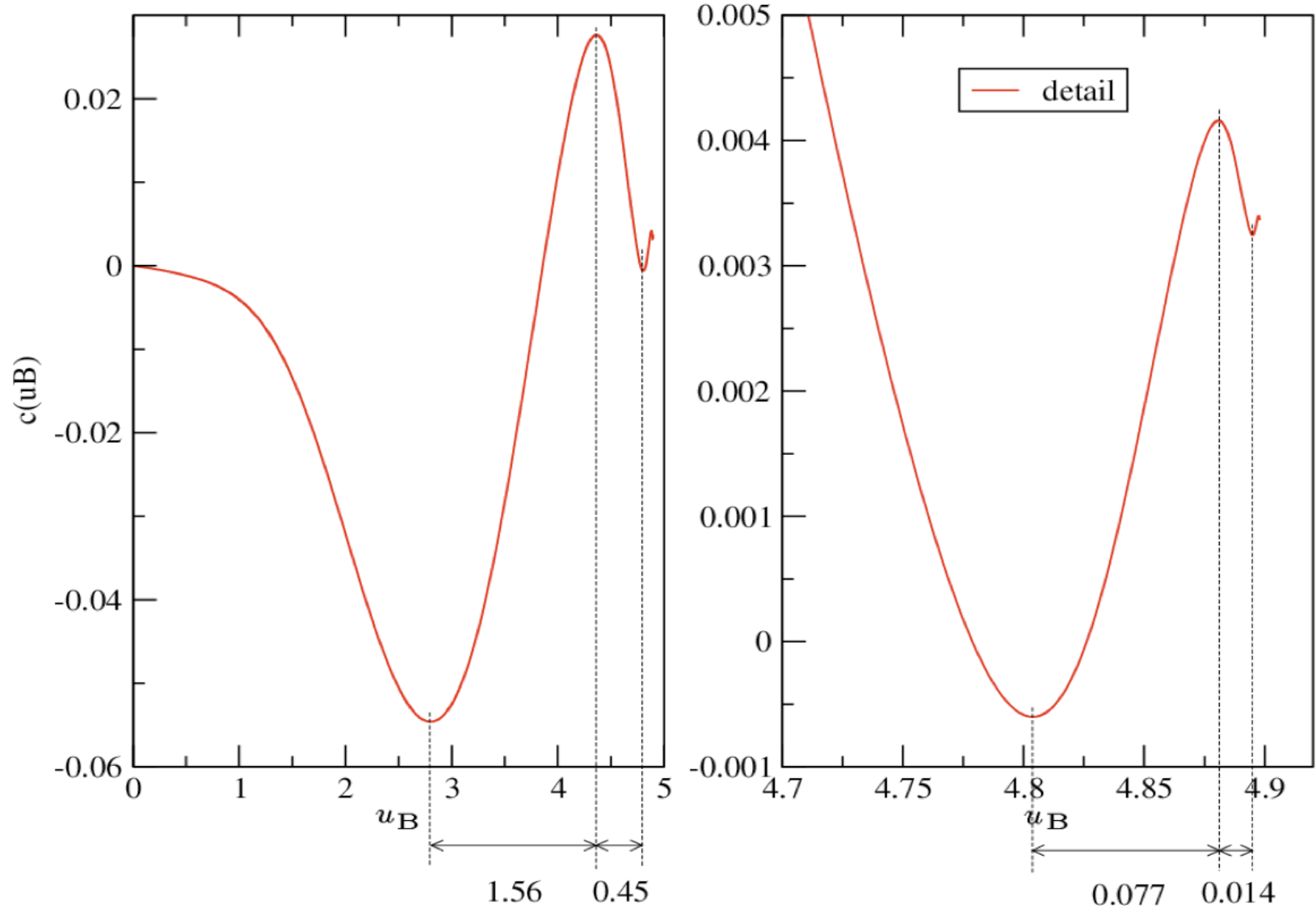
# DSS in the Bondi Mass



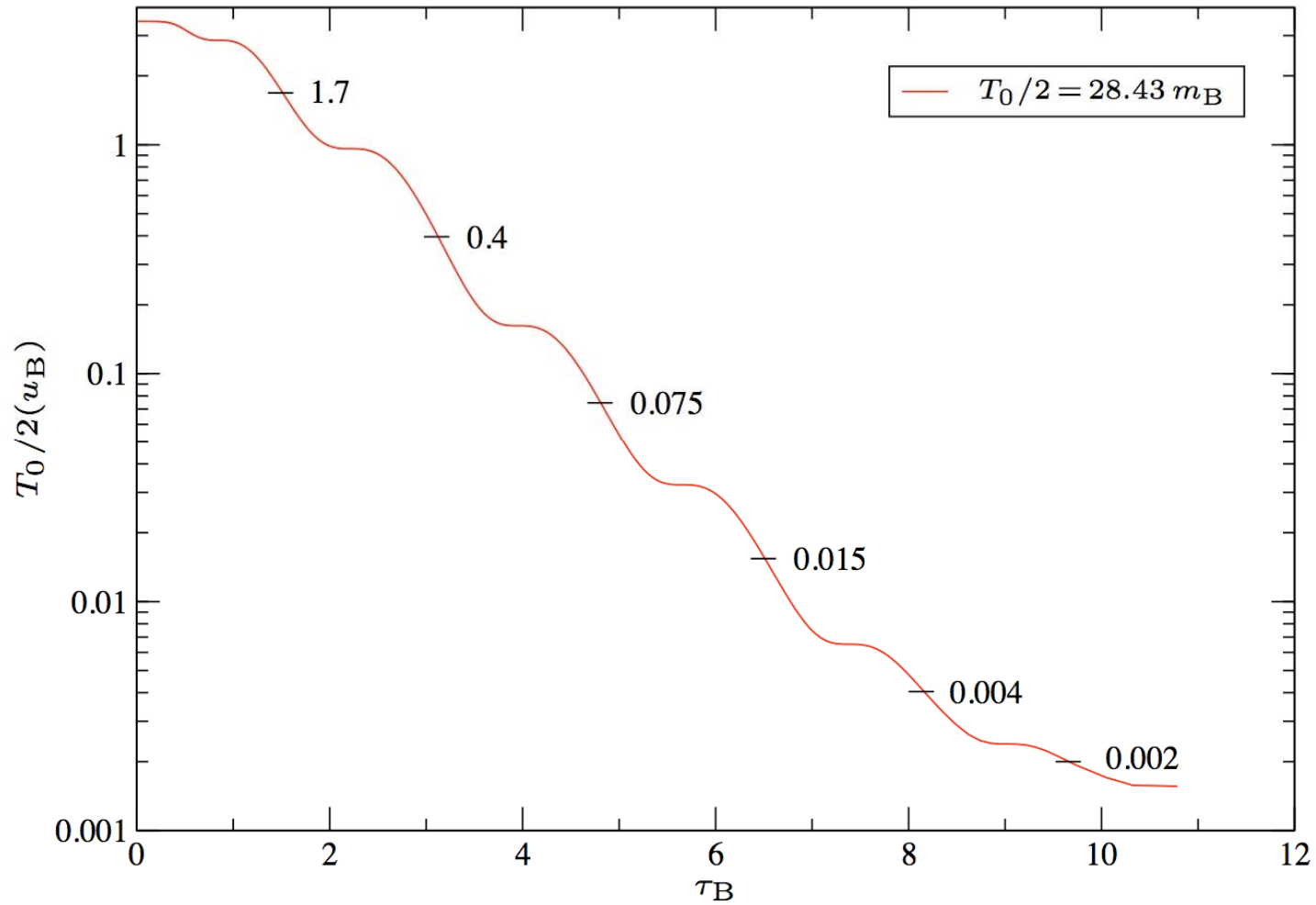
# QUASINORMAL MODES

- Excitations of black holes or compact objects; radiation boundary conditions
- Linear perturbation on fixed background
- Damped oscillations
- In our case:  $l = 0$ ,  $n = 0$  mode for scalar perturbations on a Schwarzschild black hole
- Period depends linearly on the background mass

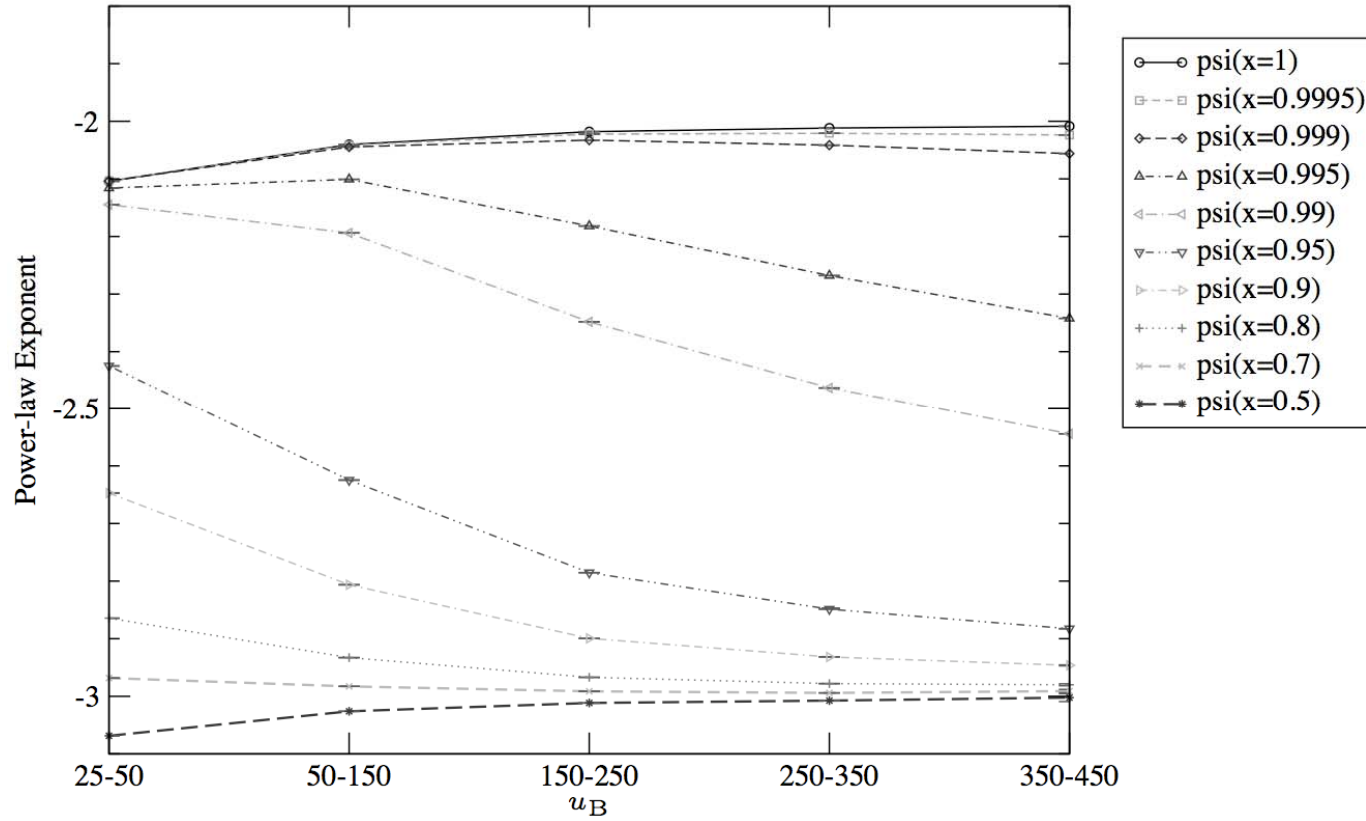
# QUASI NORMAL RINGING



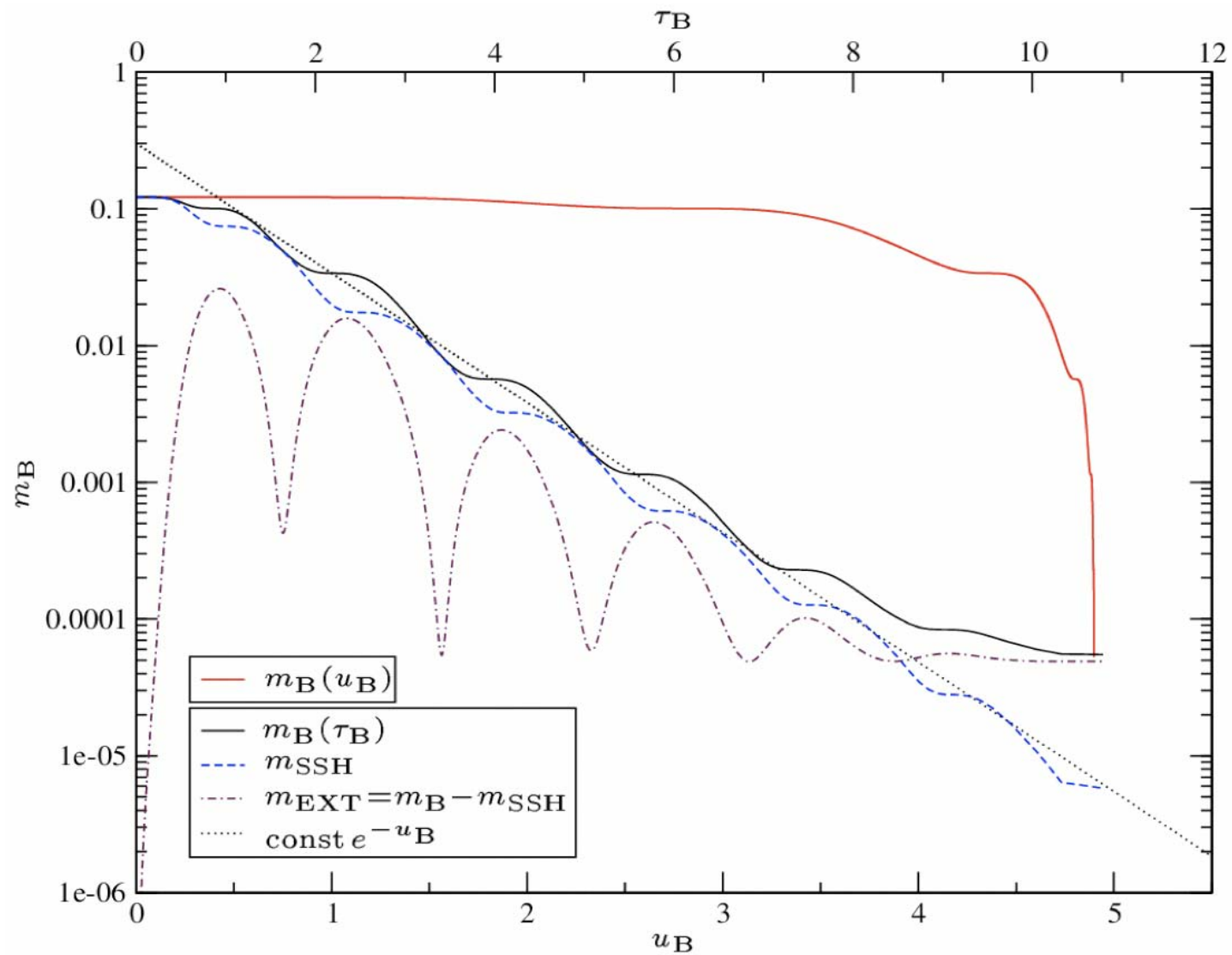
# QNM half periods



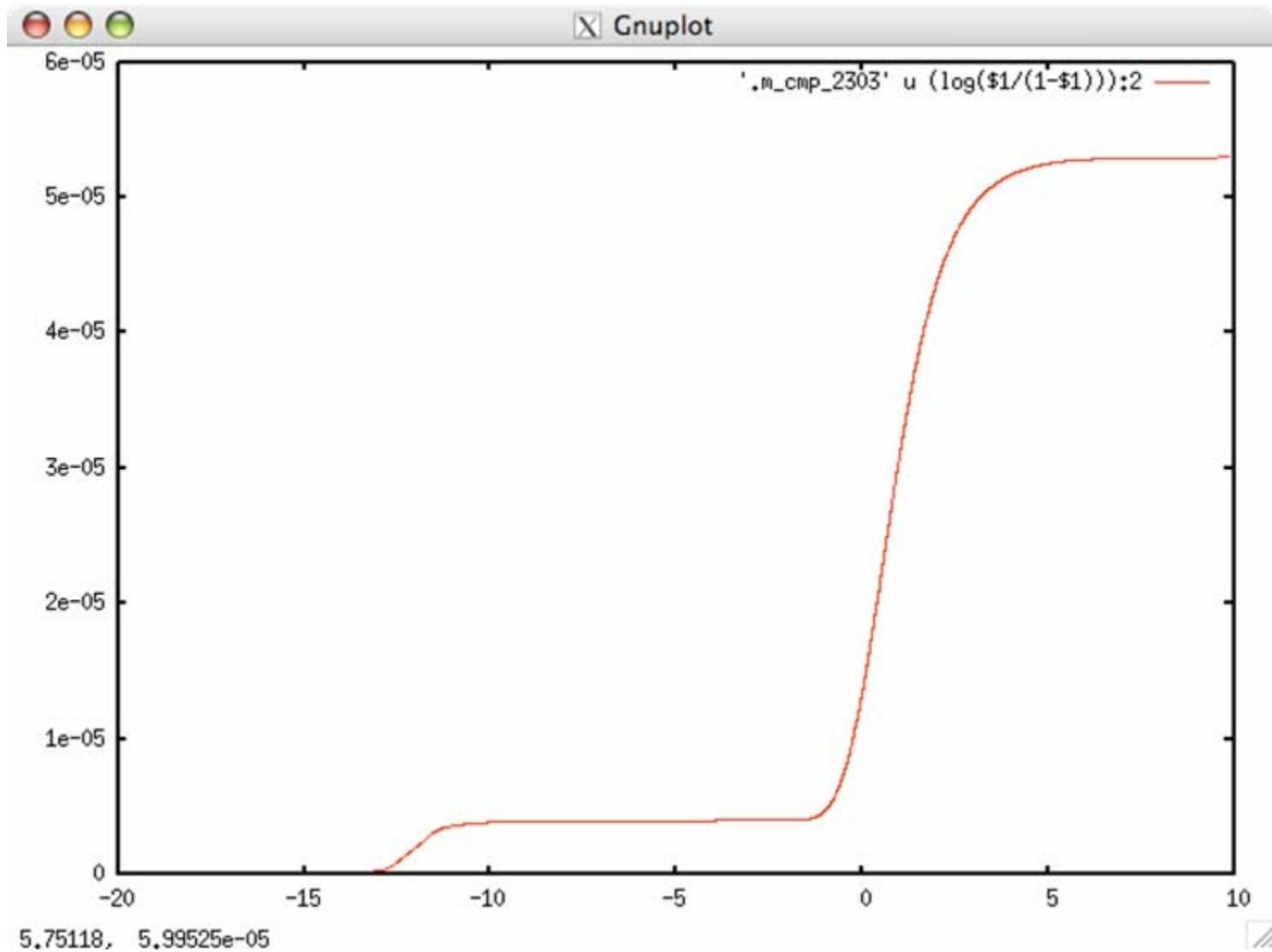
# TAILS



# BONDI VERSUS SSH MASS

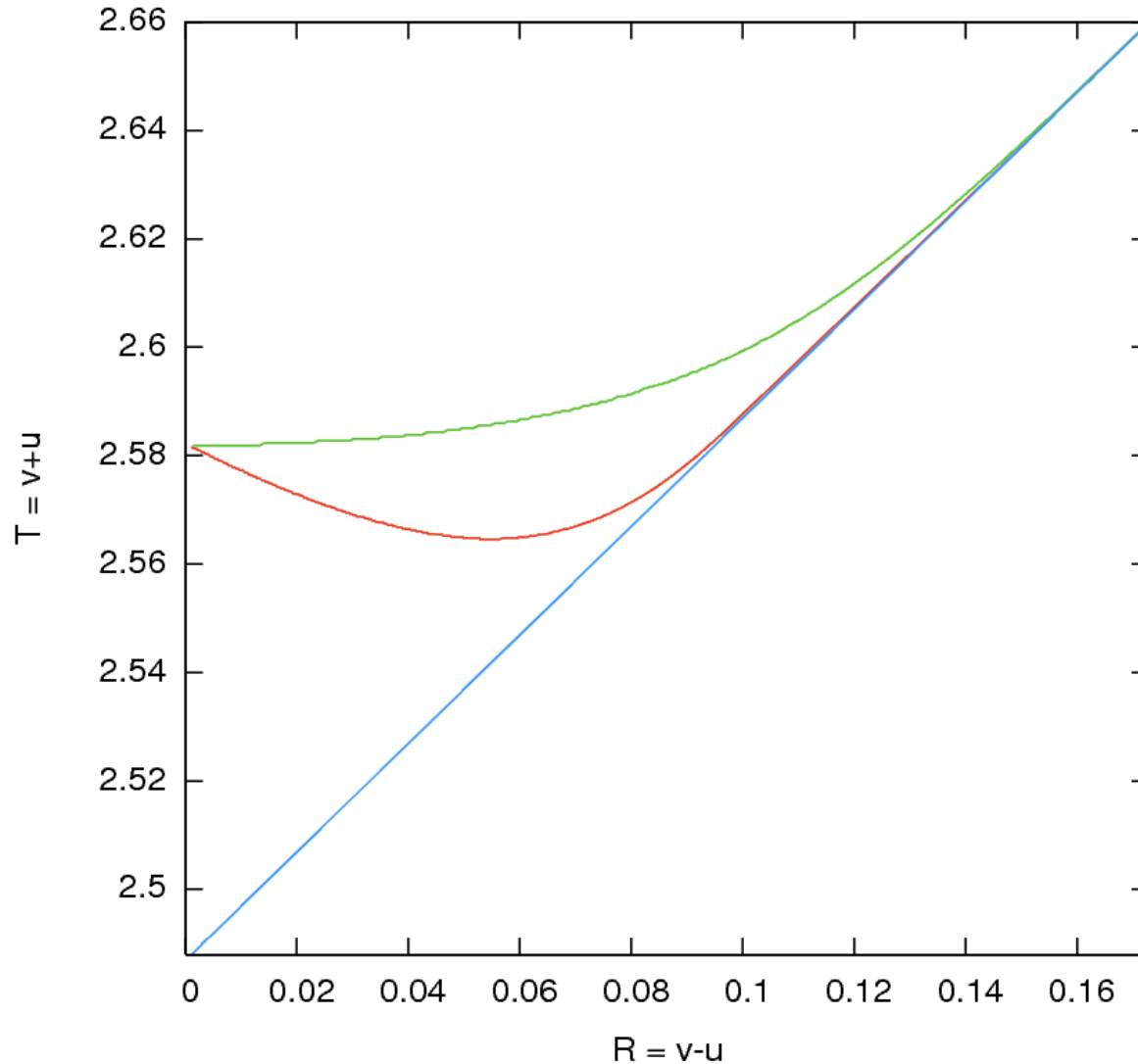


# MASS FUNCTION



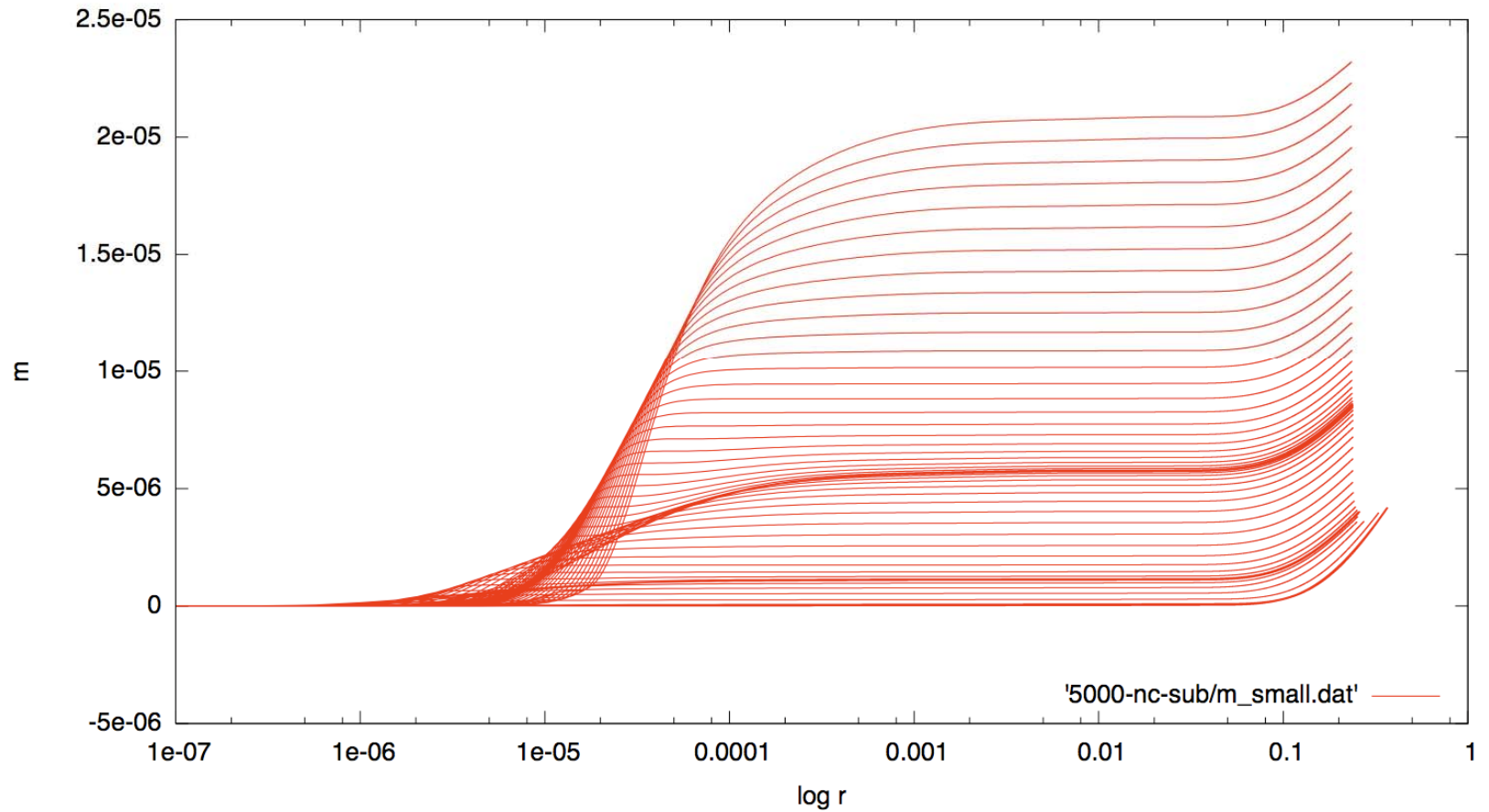
# HORIZON PENETRATING CODE

locus of AH [red] and outermost gridpoint [green] EH [blue]  
5000 gp 3+1 sssf v\_max = 2 Garfinkle\_MR Tue Sep 26 2006



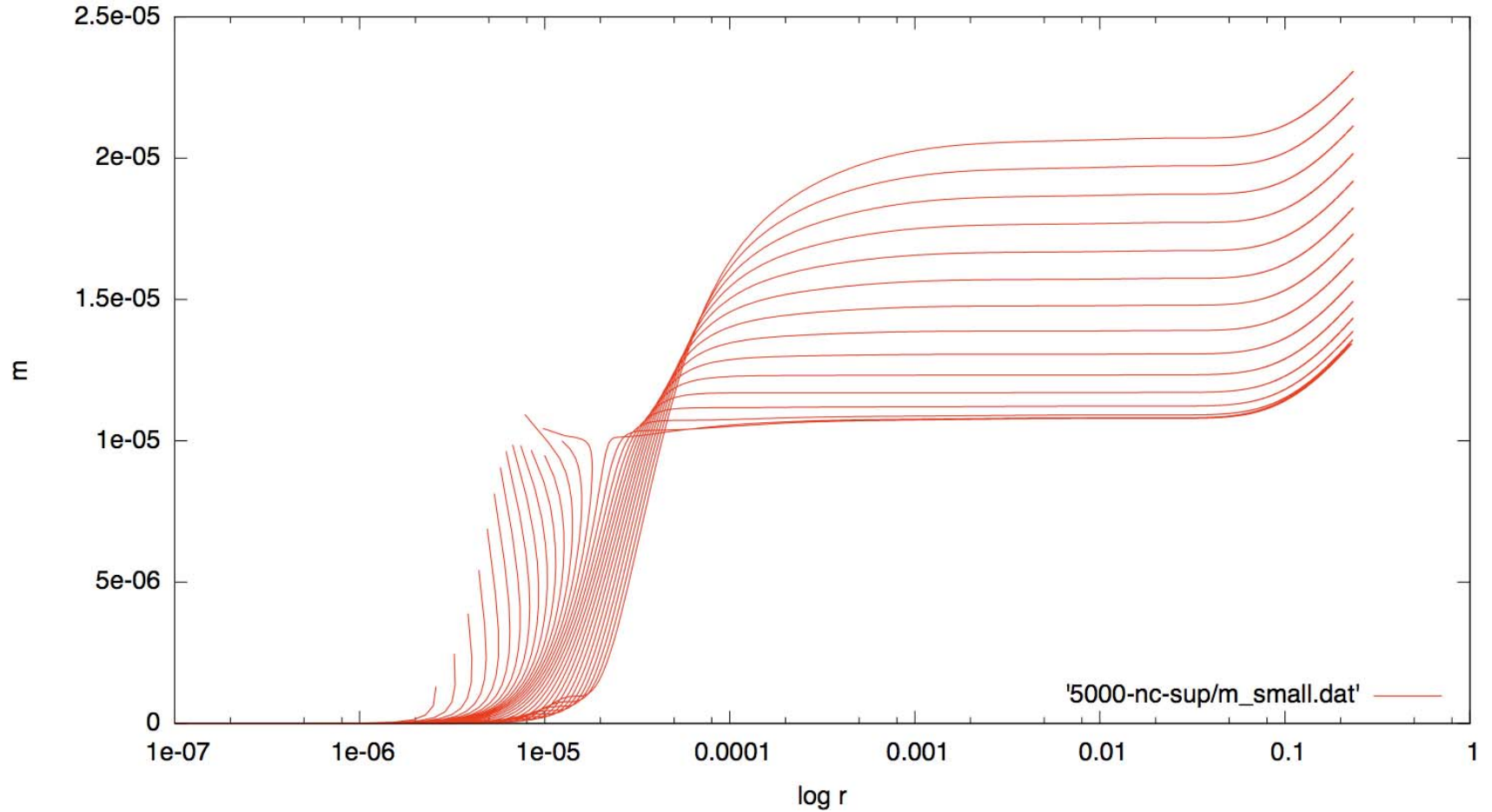
# SUB-CRITICAL EVOLUTION

3+1 sssf Garfinkle MR 5000 gp amp\_sup=0.081174343967691 sigma = 0.1 vcenter = 1 vmax = 2  
Wed Oct 4 2006



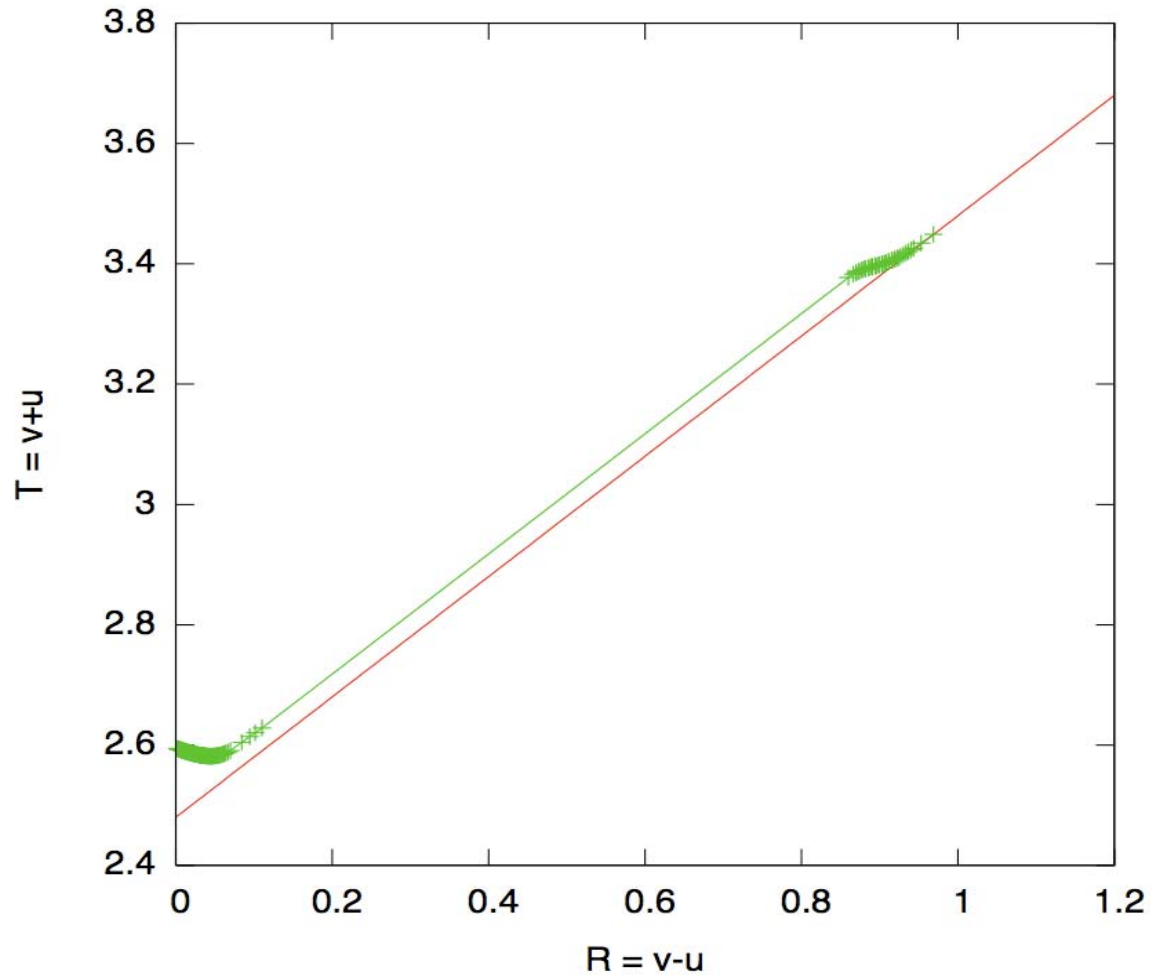
# SUPER-CRITICAL EVOLUTION

3+1 sssf Garfinkle MR 5000 gp amp\_sup=0.081174343967691 sigma = 0.1 vcenter = 1 vmax = 2  
Wed Oct 4 2006



# LATE TIME COLLAPSE

locus of AH, estimated EH  
3+1 sssf 1000gp double Gaussian ID  
p1=0.081179095 center1=1 sigma1=0.1 amp2=0.1 center2=2 sigma2=0.1 v\_max=3  
Mon Oct 30 12:49:08 CET 2006



# HORIZON FORMATION

3+1 sssf Garfinkle MR 5000 gp amp=0.081174343967691 sigma = 0.1 vcenter = 1 vmax = 2  
Tue Oct 3 2006

