Gas in the first galaxies:

Predictions from linear Theory

Vs

Simulations

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Aim: Gas fraction at high-z

Estimate the minimum halo mass

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1. of which baryon overdensities can still grow (pressure VS gravity)

Linear theory

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Simulations

Linear theory

1. The filtering mass

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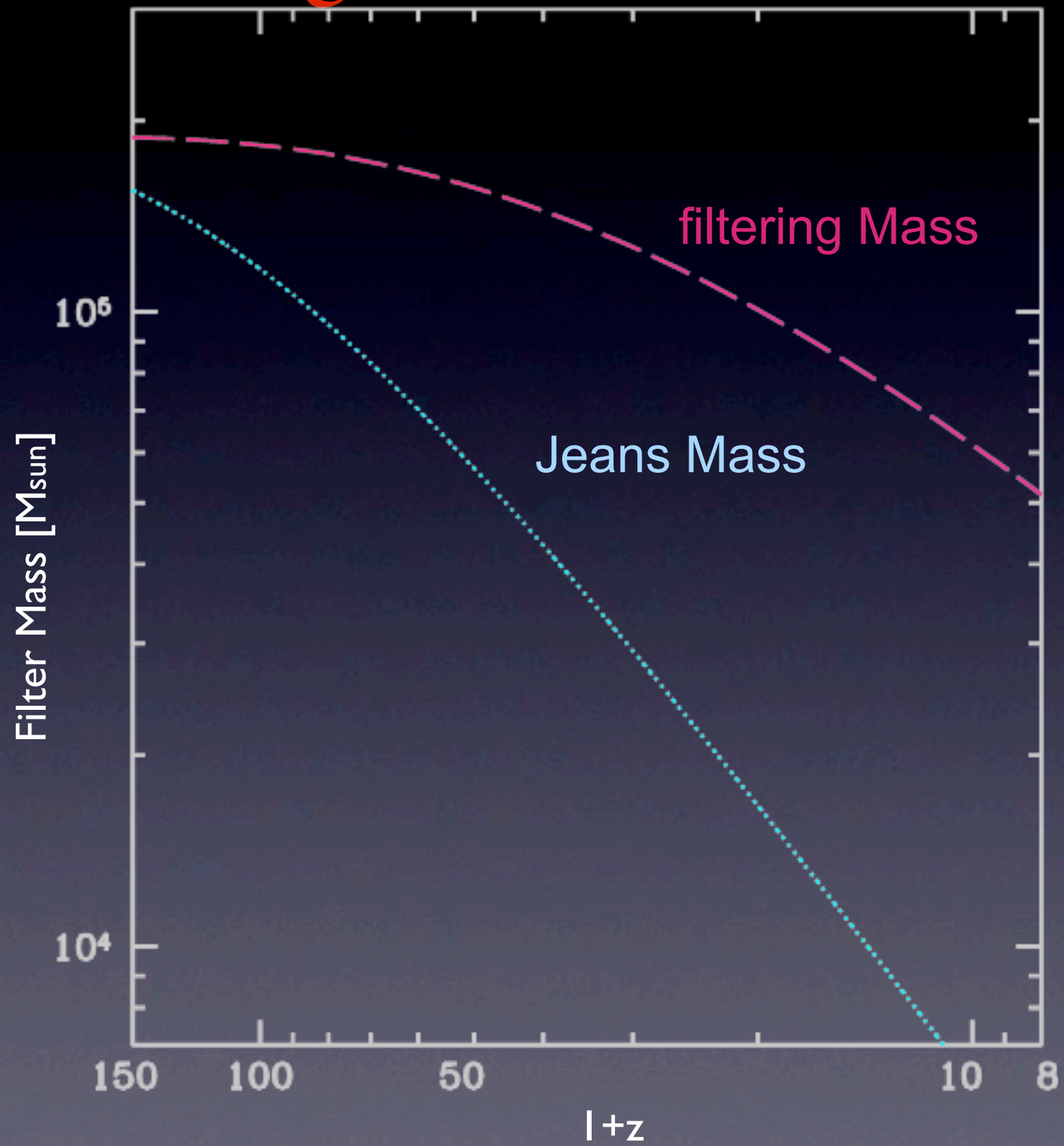


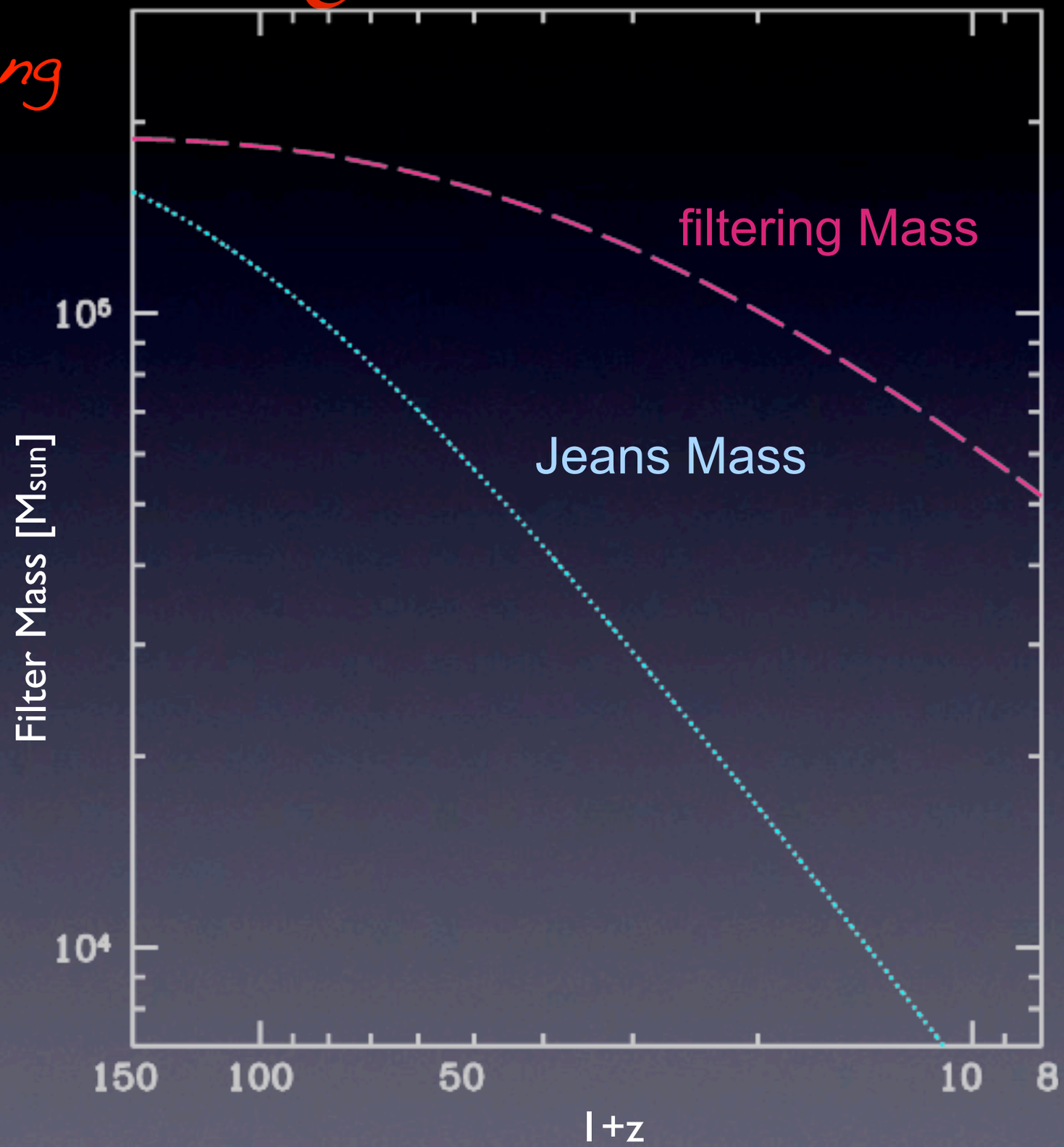
Gnedin & Hui 1998

Gnedin 2000

Linear theory

1. The filtering mass

Include complete heating history:



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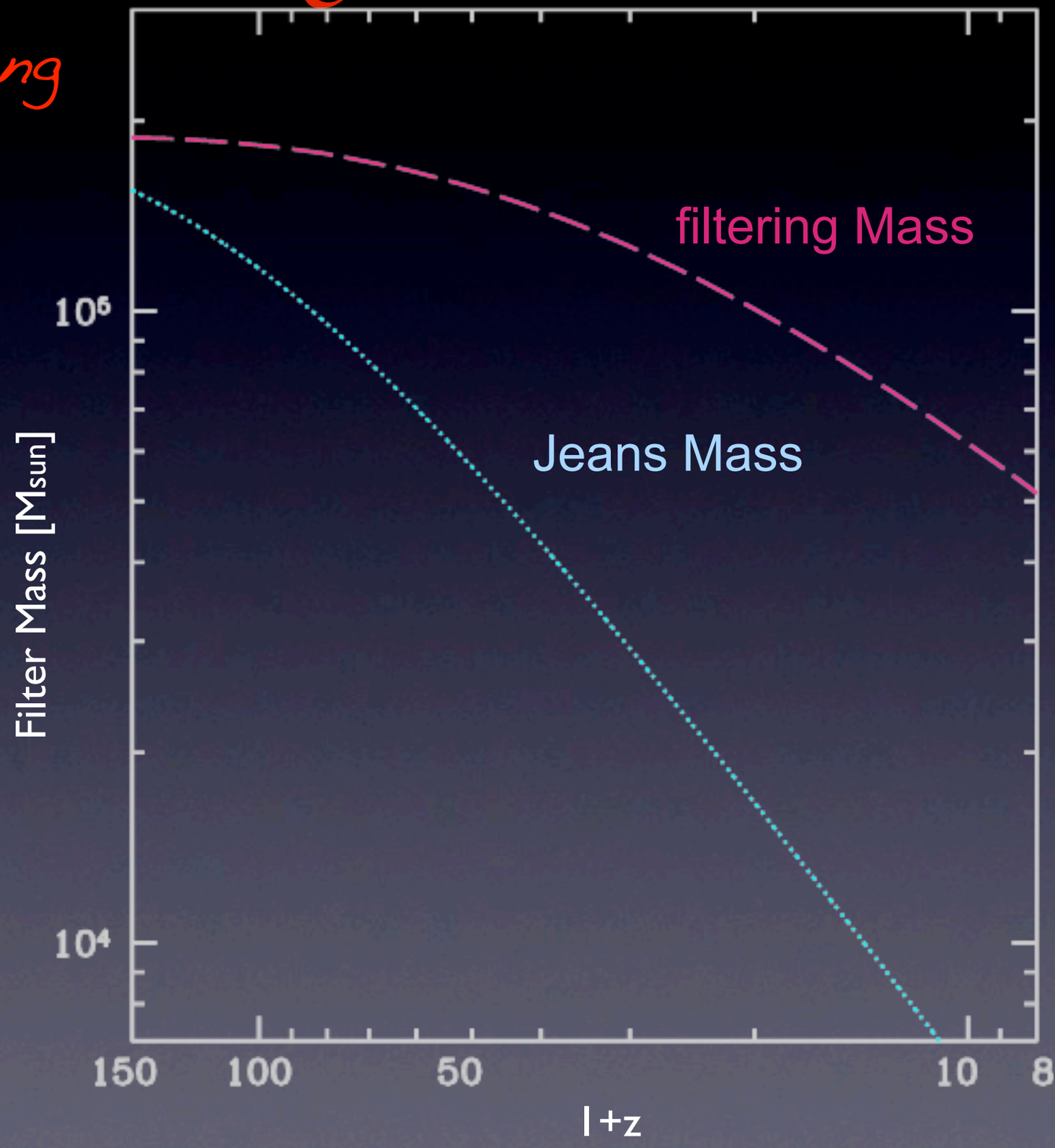
Linear theory

1. The filtering mass

Include complete heating history:

- ✓ baryons overdensties are smooth compare to the dark matter

$$\delta_b \not\equiv \delta_{dm}$$



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- ✓ specially varying speed of sound

$$c_s(r) \not= const$$

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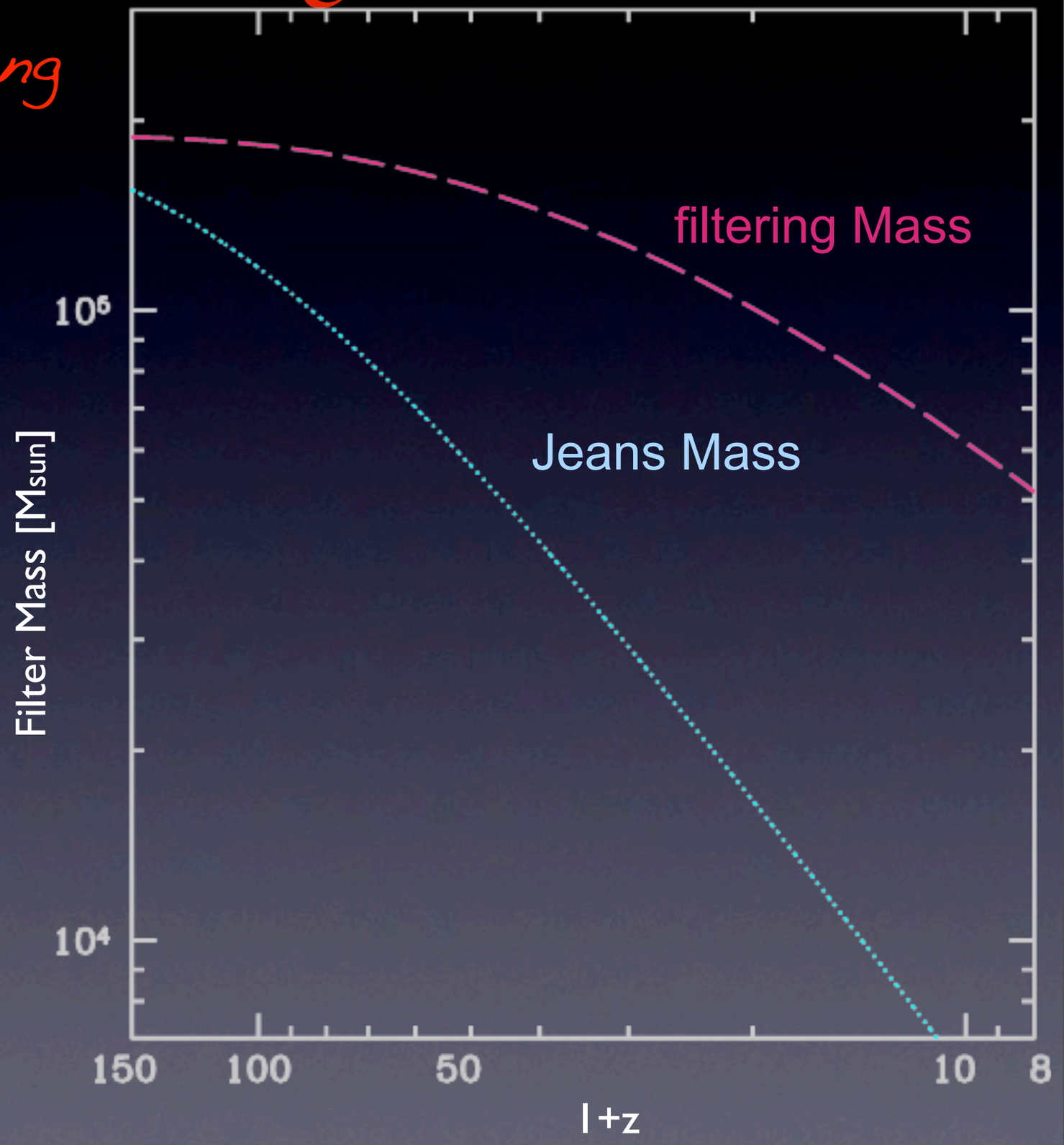

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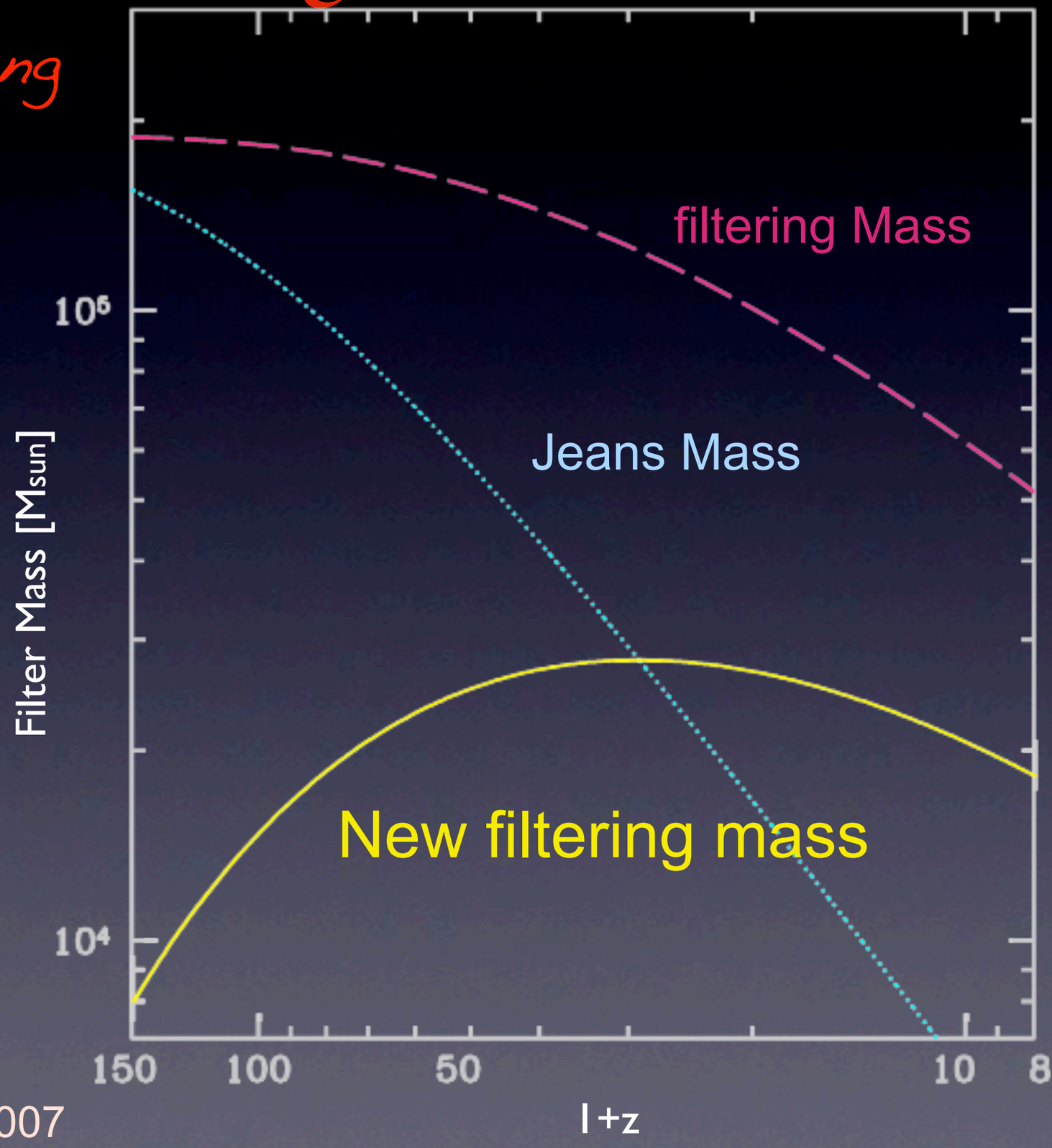

Naoz & Barkana 2005

Gnedin & Hui 1998

Gnedin 2000

Naoz & Barkana 2007

Initial conditions (ICs)

Linear theory → Simulations

- Complete heating
- c_s=const
- $\delta_b = \delta_{dm}$

Naoz, Yoshida & Barkana 2010

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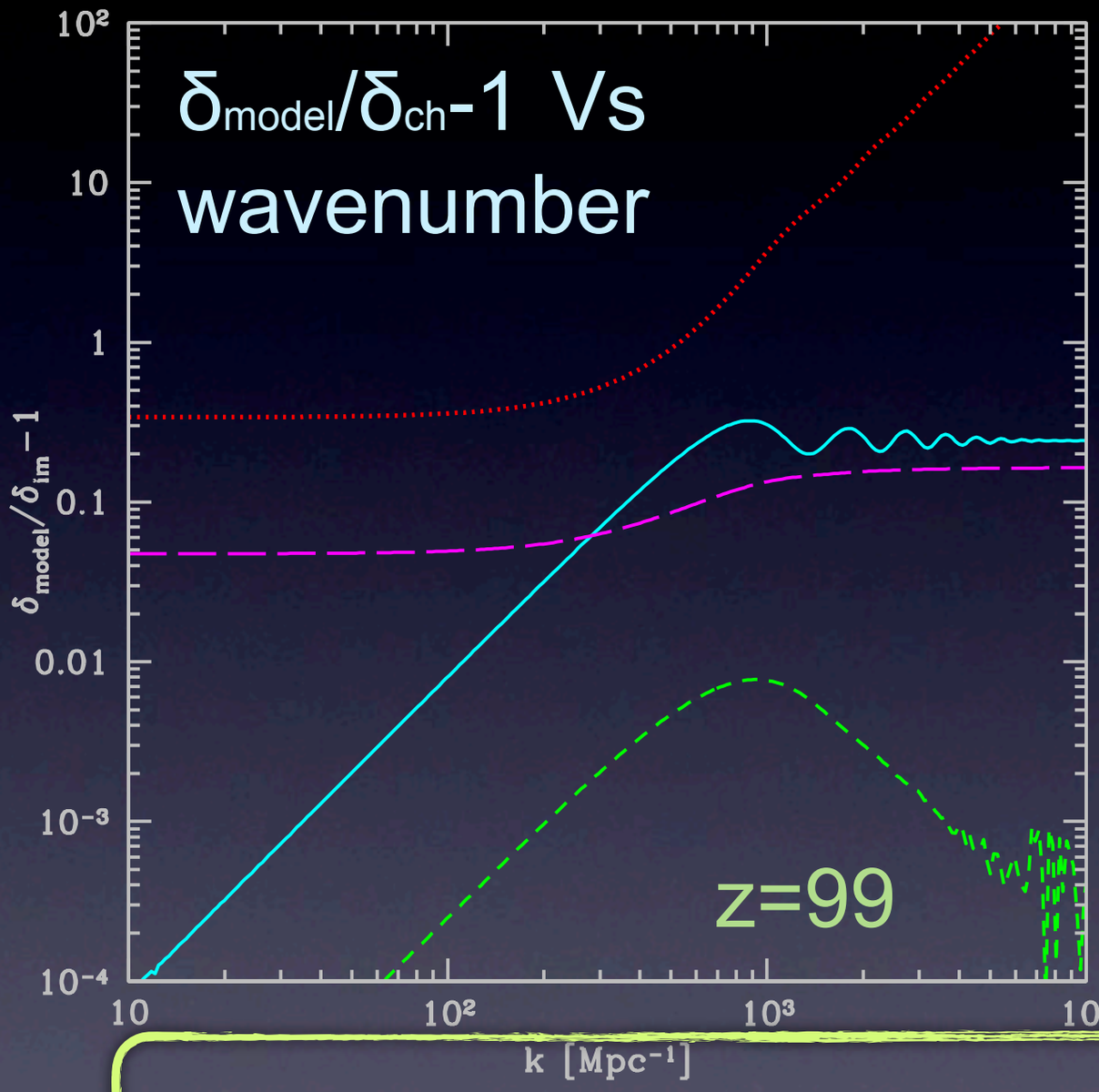
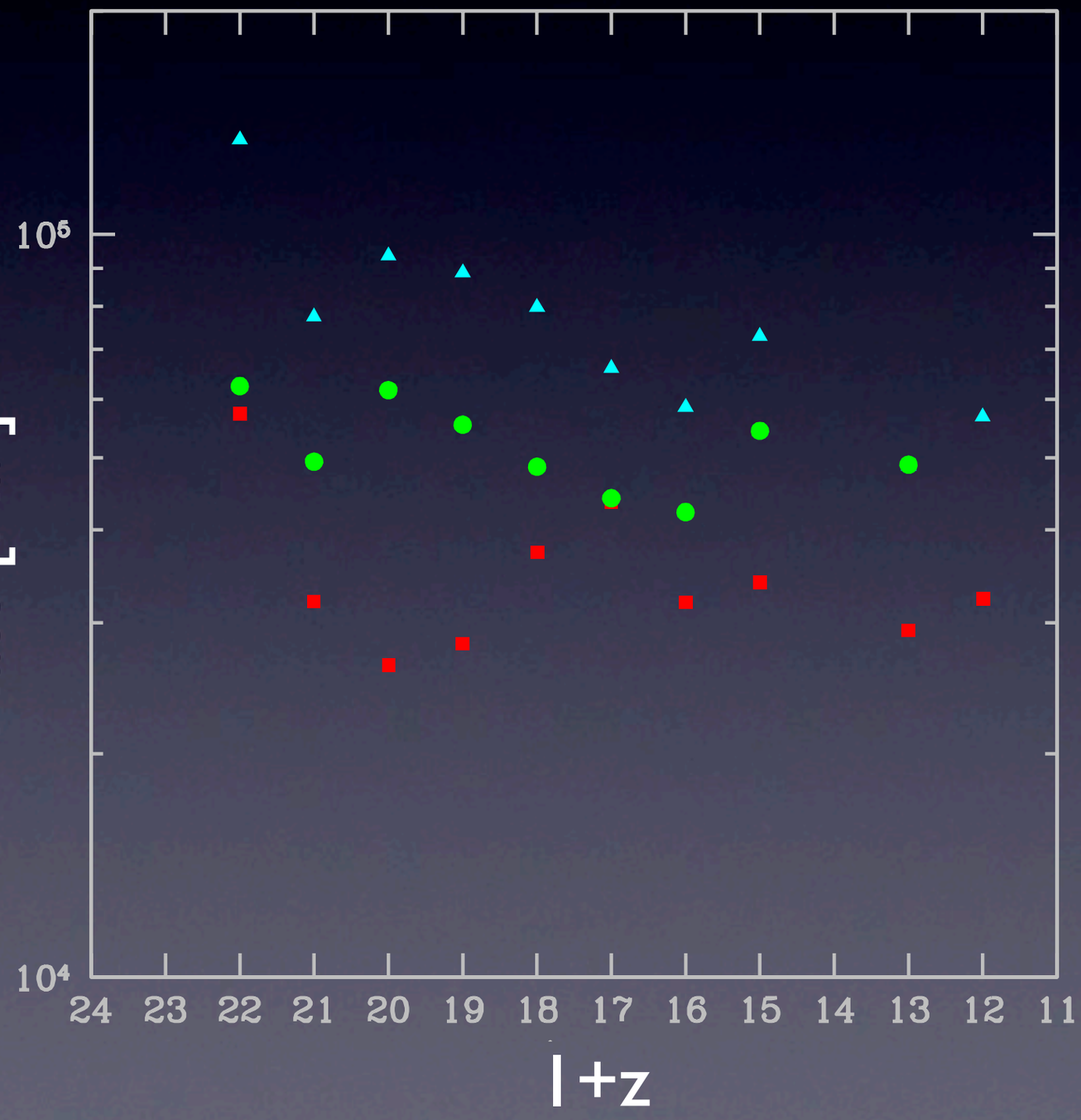


$\delta_b = \delta_{dm}$	c_s
Dark Matter	Dark Matter
Gas	Gas

Simulations

The characteristic mass

- Complete heating
- c_s=const
- $\delta_b = \delta_{dm}$



Naoz, Yoshida & Barkana 2010

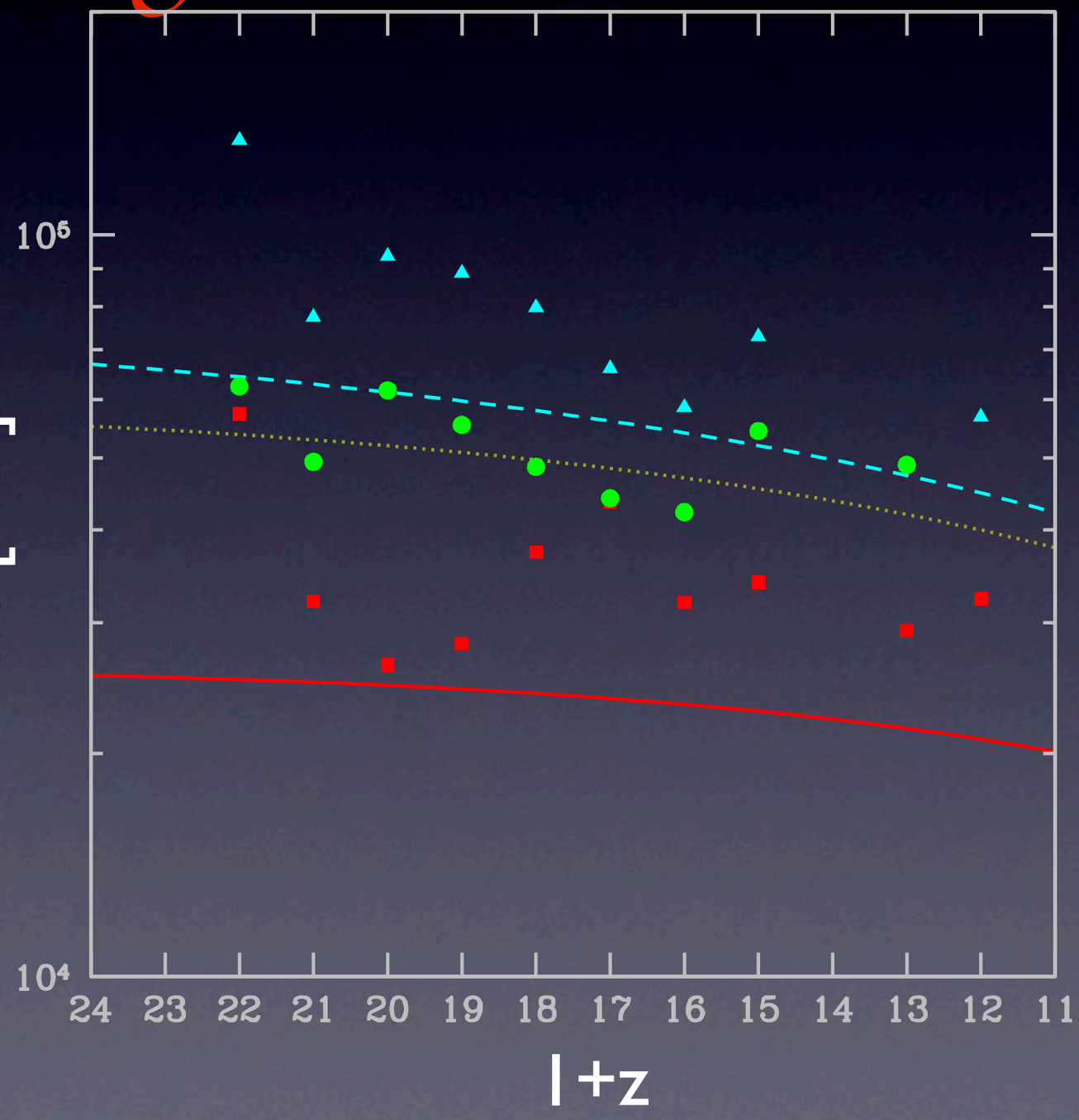
The characteristic mass + filtering mass

Complete heating

c_s=const

curves are the filtering mass

Naoz, Yoshida & Barkana 2010



Simulations and Linear theory

The characteristic mass + filtering mass

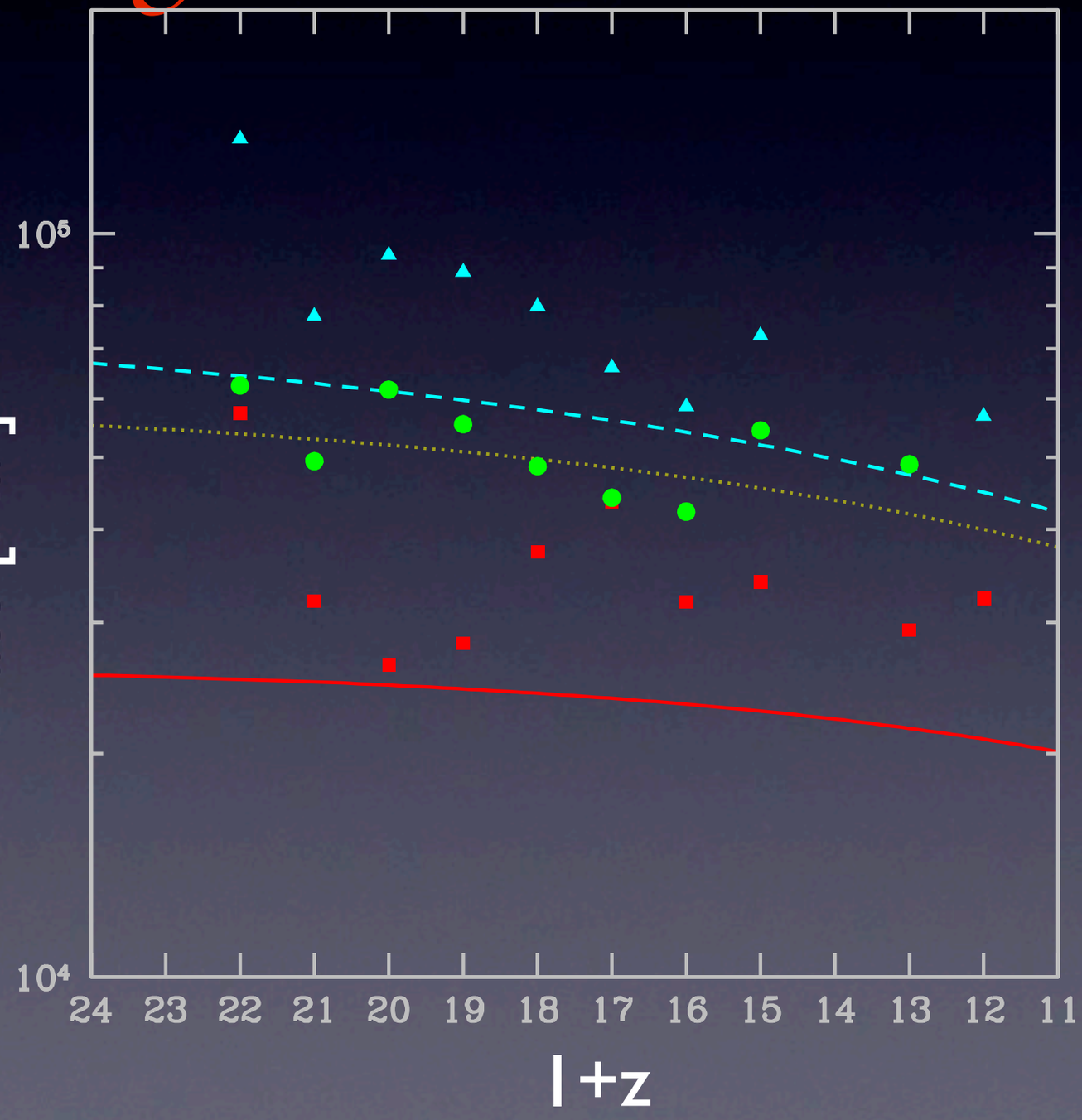
■ Complete heating

● c_s=const

▲ $\delta_b = \delta_{dm}$

curves are the filtering mass

Naoz, Yoshida & Barkana 2010



The punch-line

- Min mass for a halo to keep most of it's baryons during formation, before heating ~3×10^4 Msun

- Agreement between linear theory (filtering mass) and the mass that keeps most of it's baryons

- The min mass that keeps most of it's baryons is highly sensitive to ICs