When did the first star form in the Universe?

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star formation

- star formation in local universe is complicated involving metals, radiation backgrounds, magnetic fields
- traditionally people have argued that it is less complicated to model the formation of the the first population of stars in the Universe (but it is definitely not simple)
- However, it is more straightforward to predict which dark matter halos formed the first stars.

Structure formation

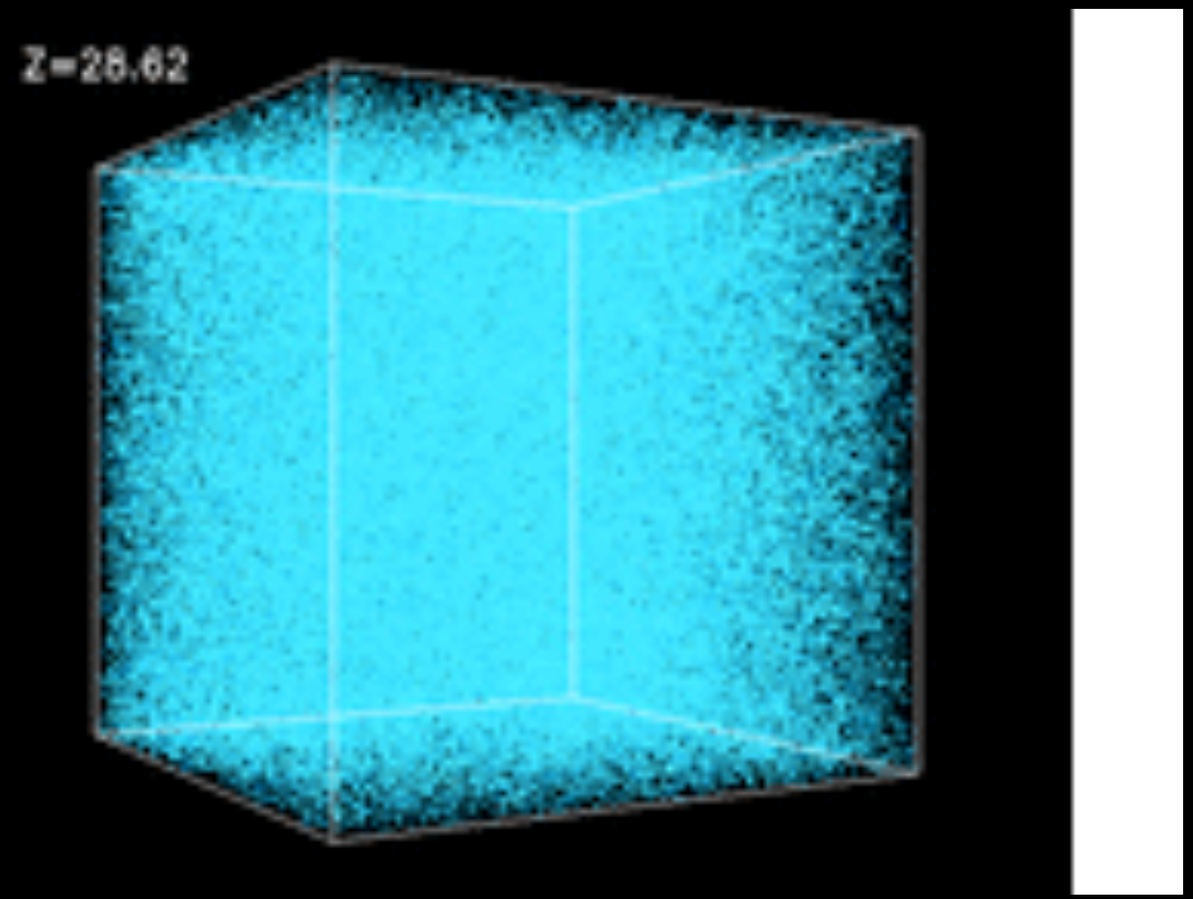
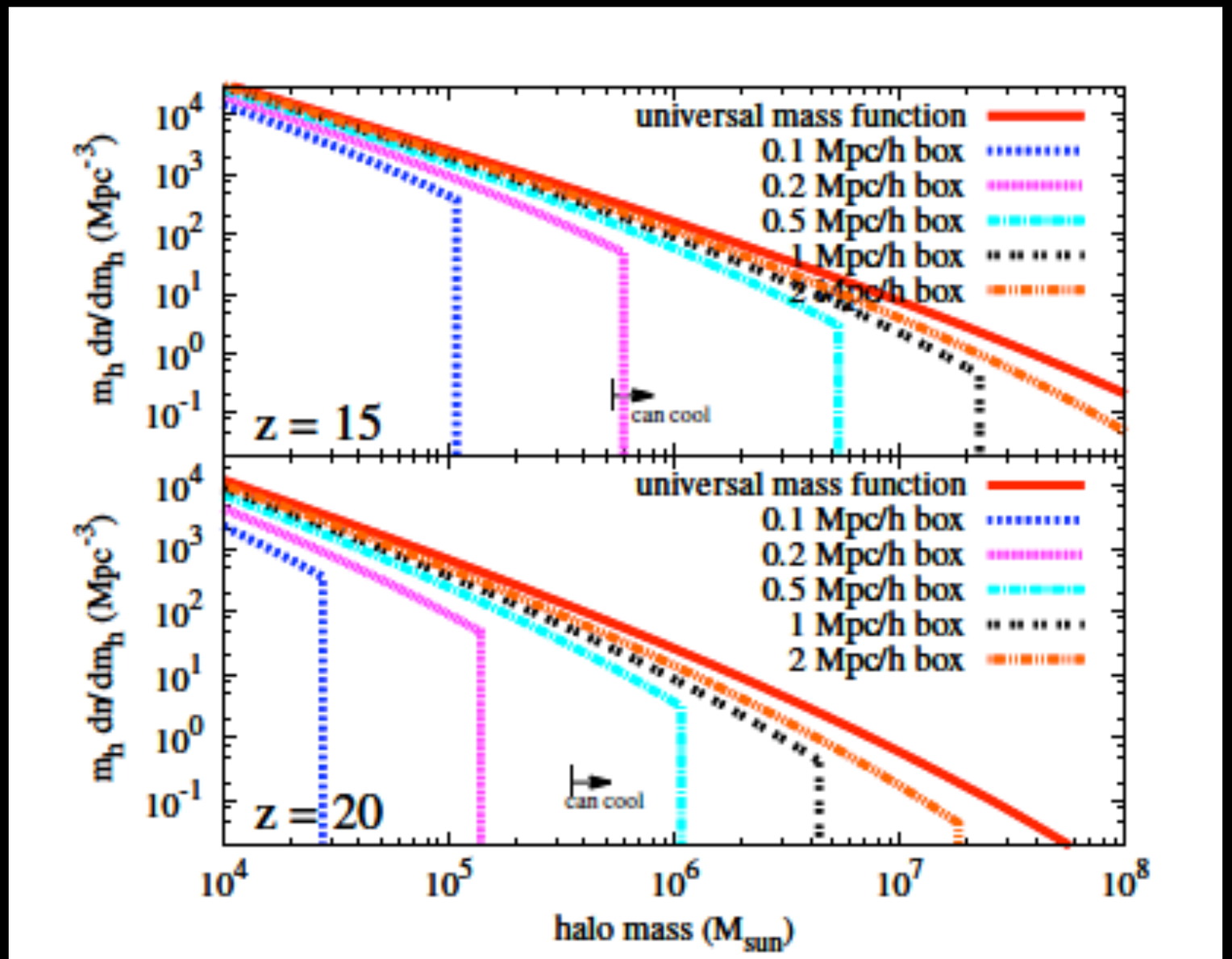


Image coordinate system expands with Universe.

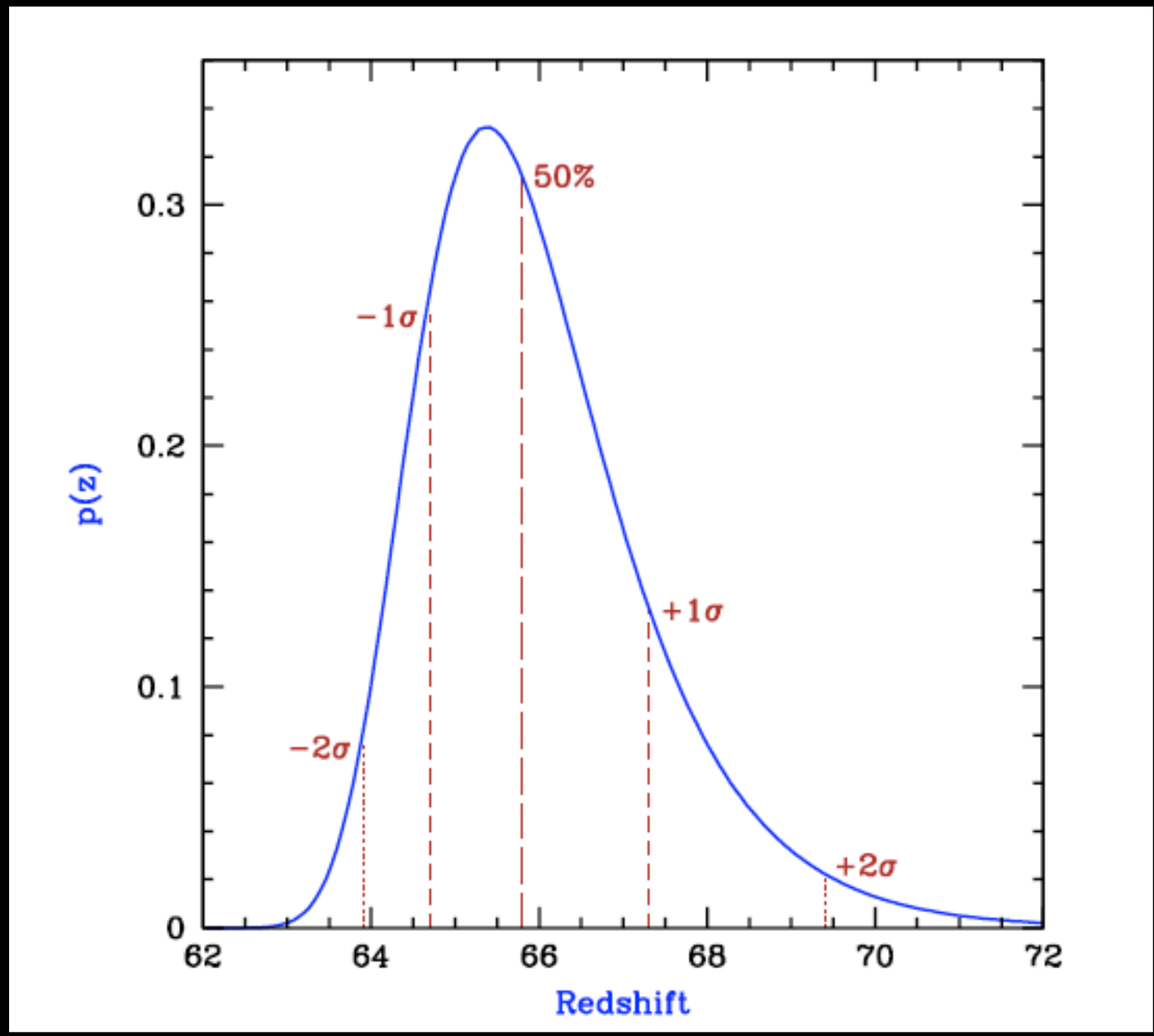
from these type of simulations we can estimate when 1st stars formed



200 Myr

180 Myr

There has been a previous estimate for when 1st star formed in observable universe.



z=70, universe was 28 Myr old

z=64, universe was 32 Myr old

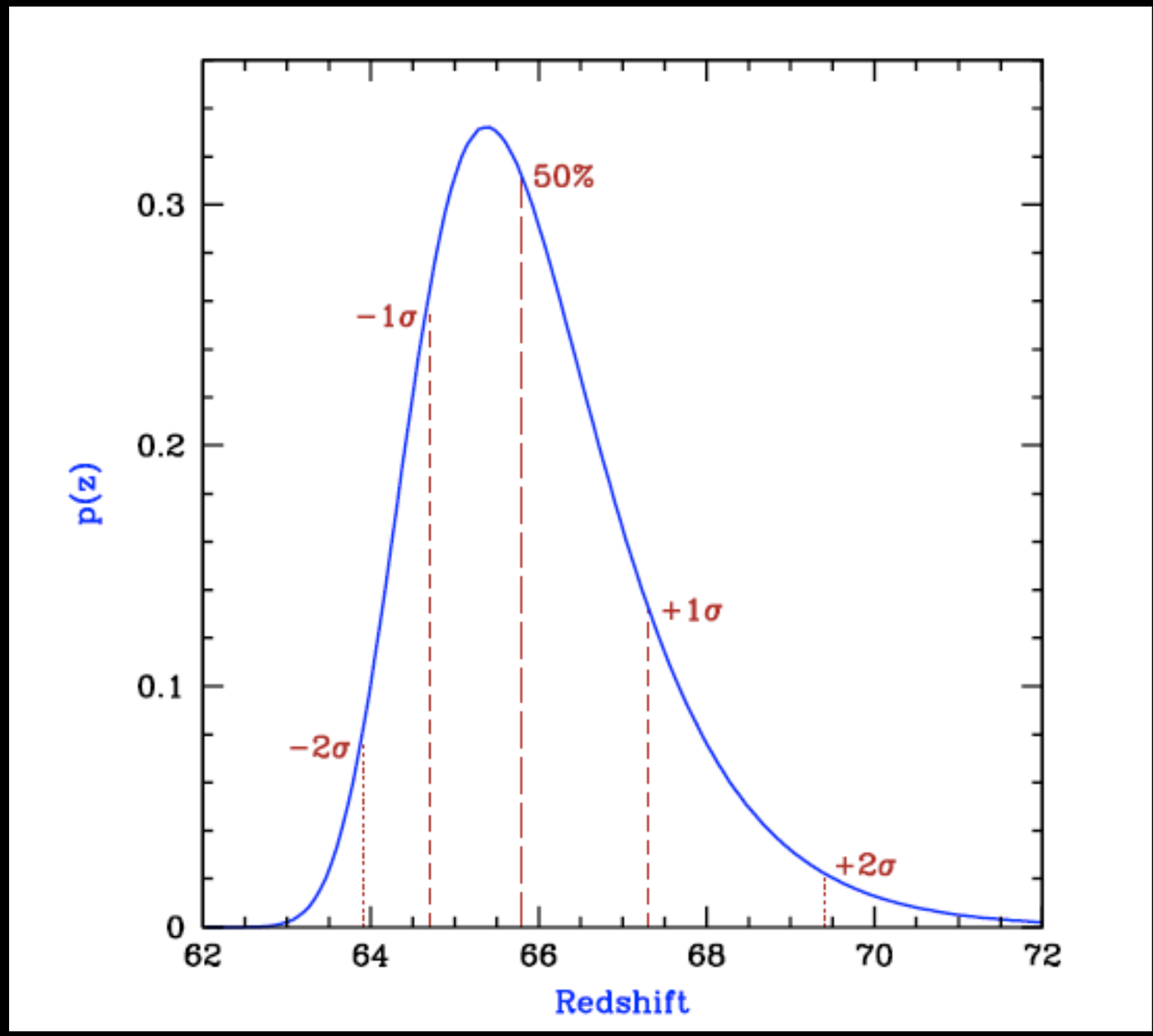
$$\langle N \rangle(z) = \int_z^{z_{\max}} n(M_{\min}(z'), z') \frac{dV}{dz'} dz' ,$$

Naoz & Barkana 2006

There is room for improvement

1. don't know halo mass function at these z
   - there is a trick to measure mass function at these z
2. cooling times are long
3. how halo mass that can cool evolves with redshift is complicated
4. baryons fall into less deep potential wells than had been thought
5. uncertainties in initial conditions/ background cosmology

The project is to make a better prediction for this probability distribution



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We also can try to predict when the first 10^4 $M_\odot$ in stars formed per Mpc^{-3}