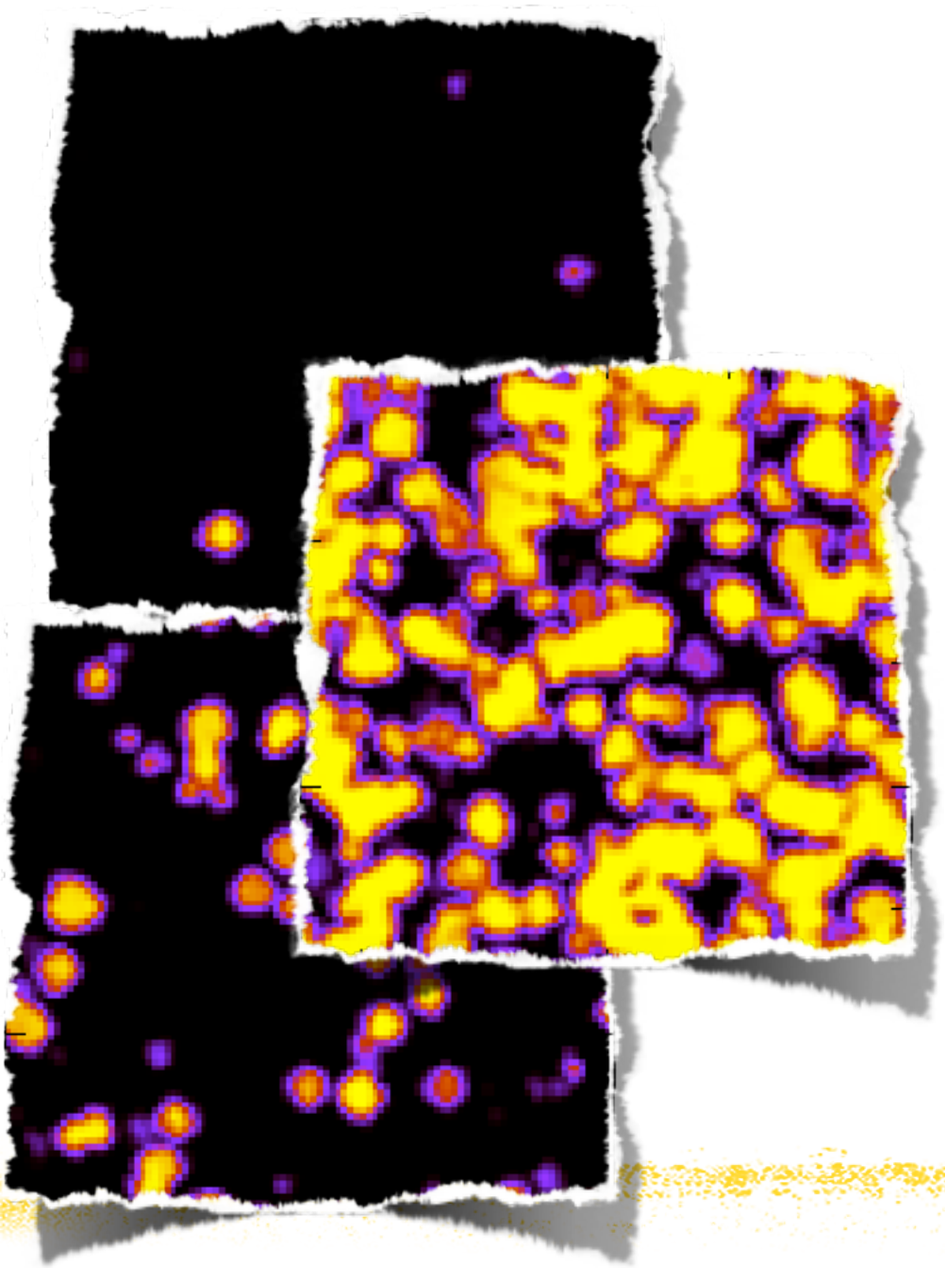


THE 21-CM SIGNAL DURING THE EoR: FULL MODELIZATION OF THE LY-ALPHA PUMPING

Paola Di Matteo (GEPI/LERMA, Obs. de Paris)
S. Baek, B. Semelin, F. Combes (LERMA, Obs. de Paris)
Y. Revaz (EPFL, Lausanne)

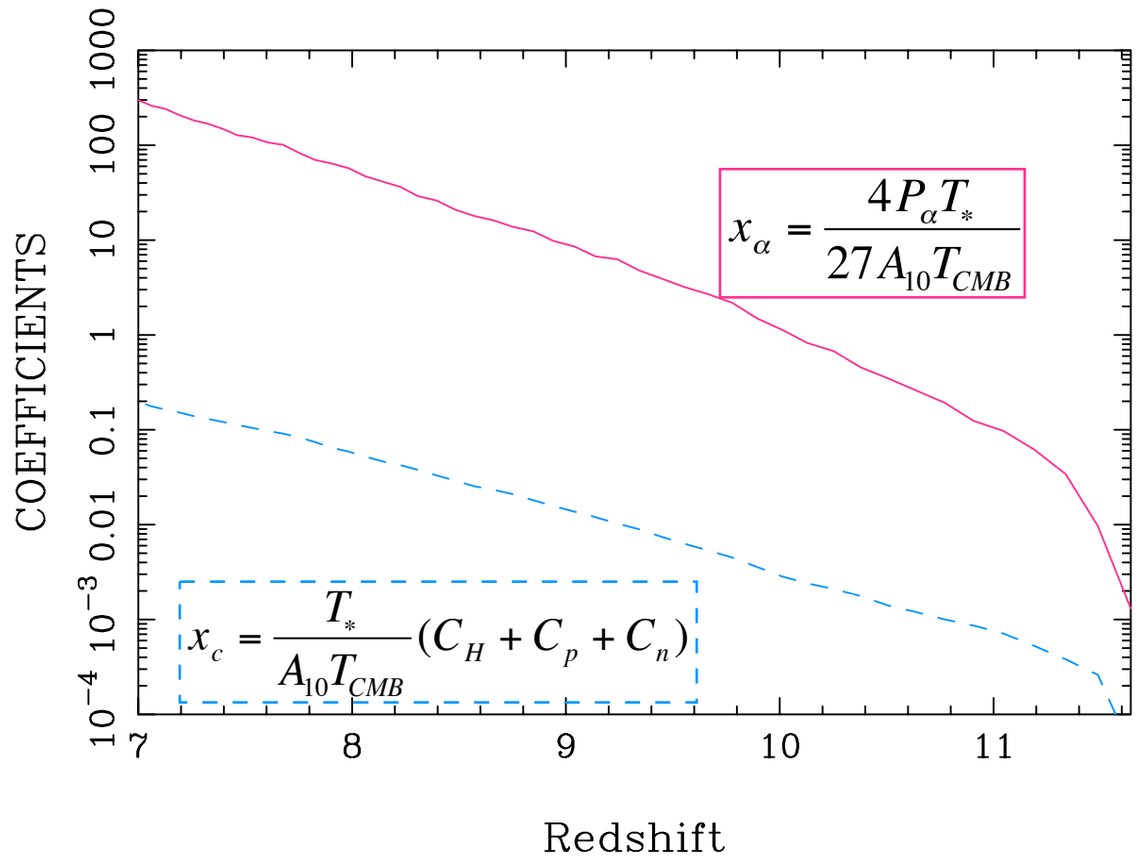
THE 21-CM SIGNAL

$$\delta T_b = 28.1 mK x_{HI} (1+\delta) \left(\frac{1+z}{10}\right)^{1/2} \frac{T_s - T_{CMB}}{T_s}$$

$$T_s^{-1} = \frac{T_{CMB}^{-1} + x_c T_K^{-1} + x_\alpha T_C^{-1}}{1 + x_c + x_\alpha}$$

collisions

local flux of Ly-alpha photons



THE 21-CM SIGNAL

$$\delta T_b = 28.1 mK x_{HI} (1+\delta) \left(\frac{1+z}{10}\right)^{1/2} \frac{T_s - T_{CMB}}{T_s}$$

- $T_s \sim T_k >> T_{CMB}$: no absorption regime
- homogeneous Ly-alpha flux (Gnedin & Shaver, Santos et al. 2007)

Full modelization of the Ly-alpha flux and how the results compare with previous approximations

THE SIMULATIONS...

LICORICE

- 3D Monte-Carlo ray-tracing scheme for radiative transfer
- adaptive grid based on the particle distribution

(see Baek's poster)

Tree-SPH Gadget2 for dynamical simulations

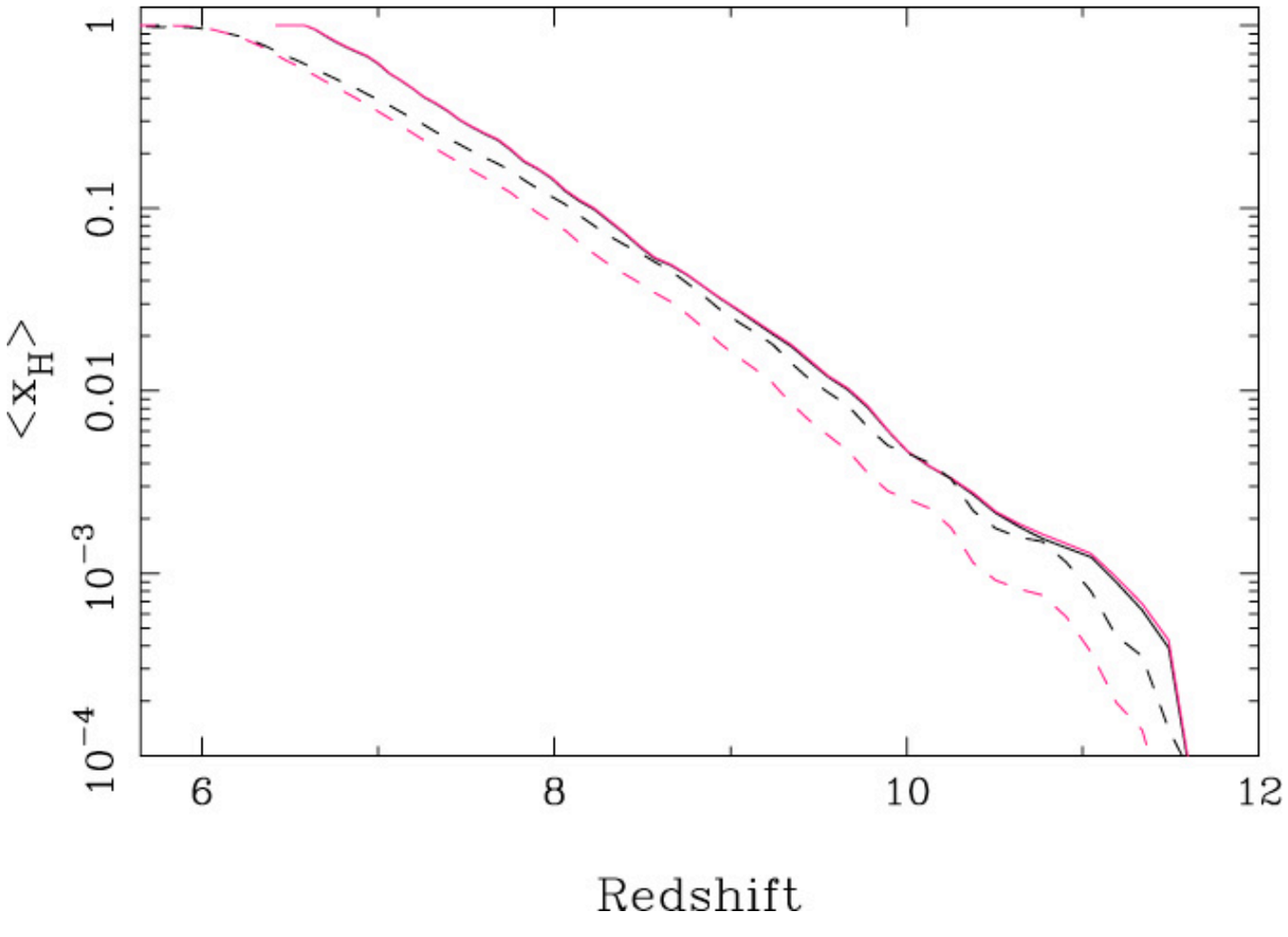
THE SIMULATIONS...

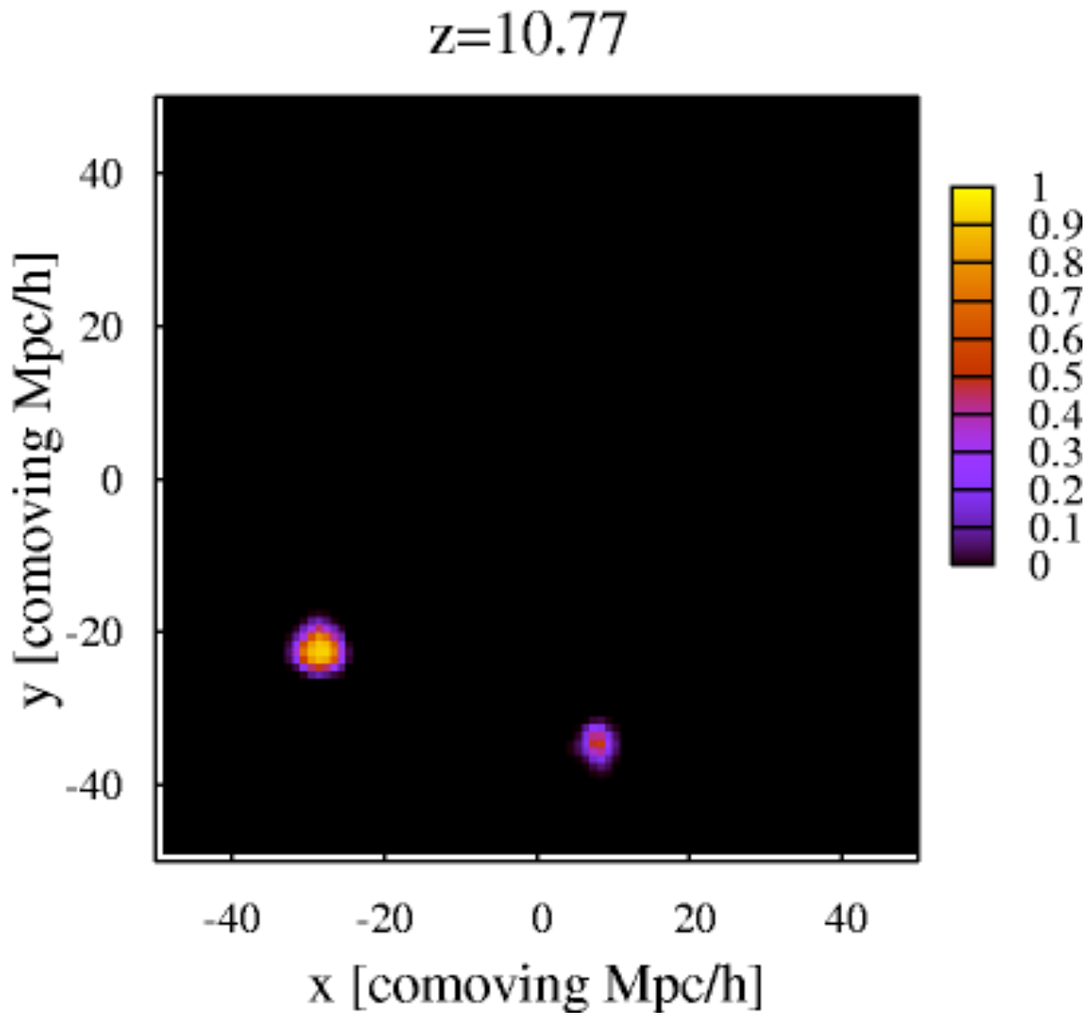
ID simulation	L [h^{-1}Mpc]	m_{DM} [h^{-1}Msun]	m_{gas} [h^{-1}Msun]
S20	20	2.6×10^7	5.5×10^6
S100	100	3.2×10^9	6.9×10^8

$N=2 \times 256^3$ (gas particles+dark matter)

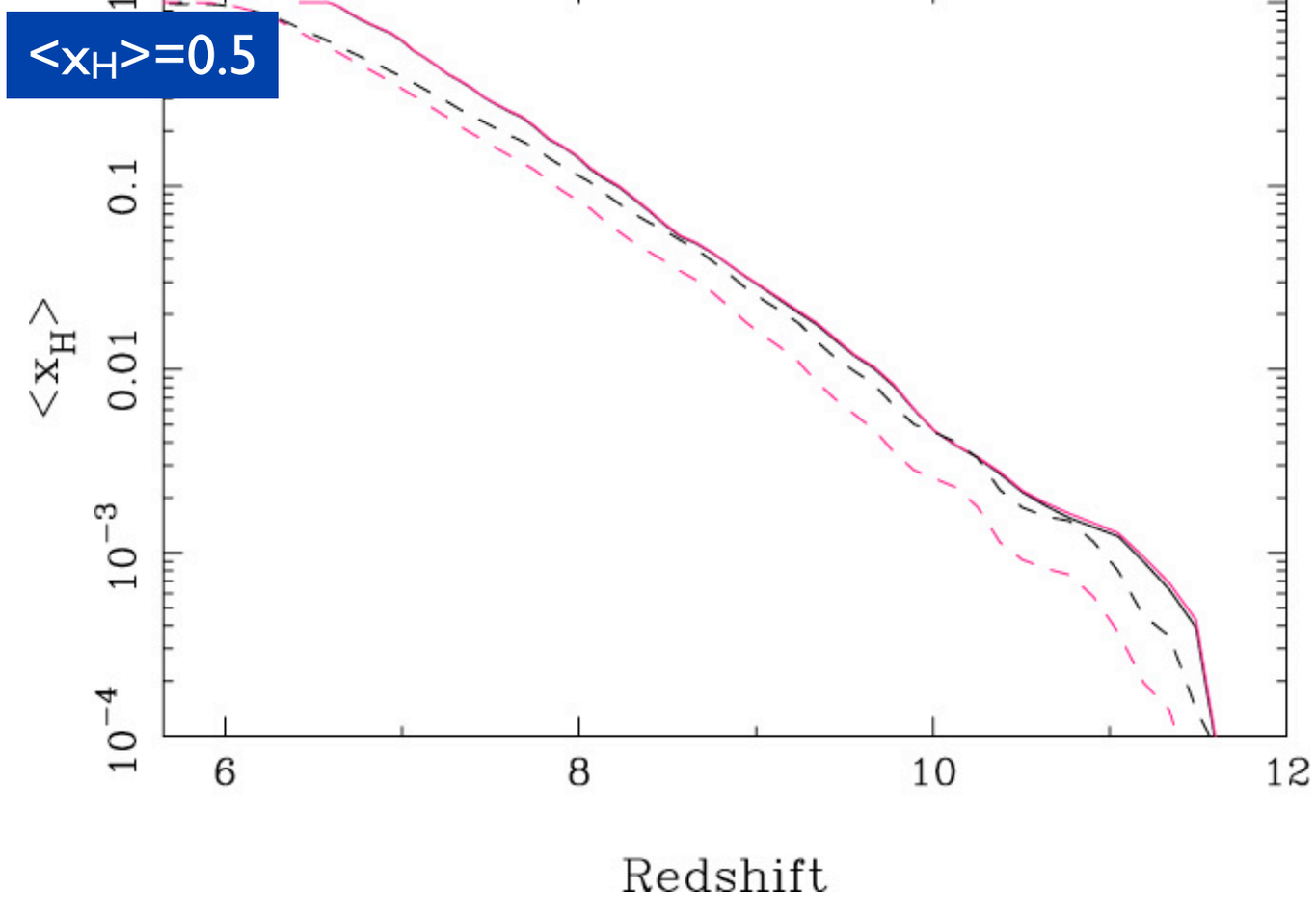
WMAP3 cosmology

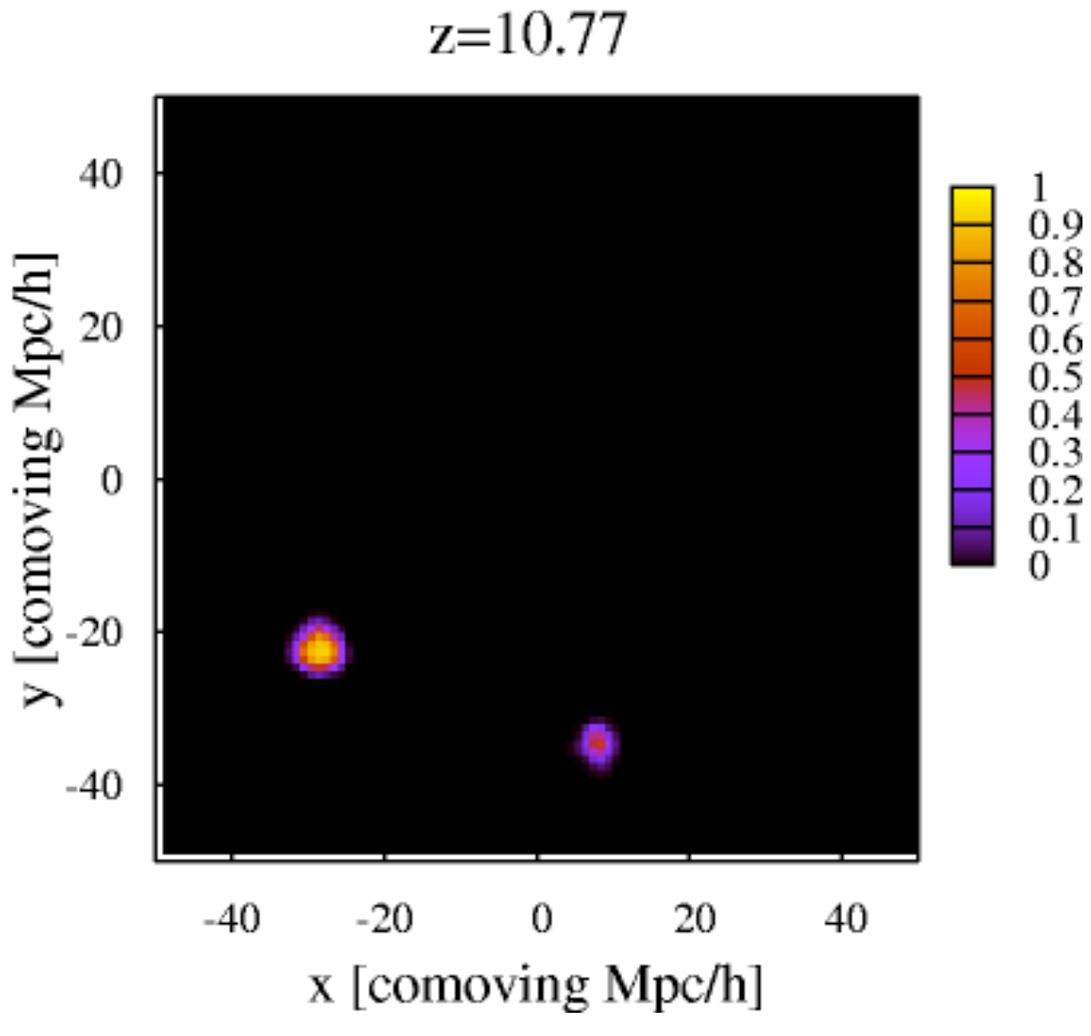
THE IONIZATION FRACTION





THE IONIZATION FRACTION





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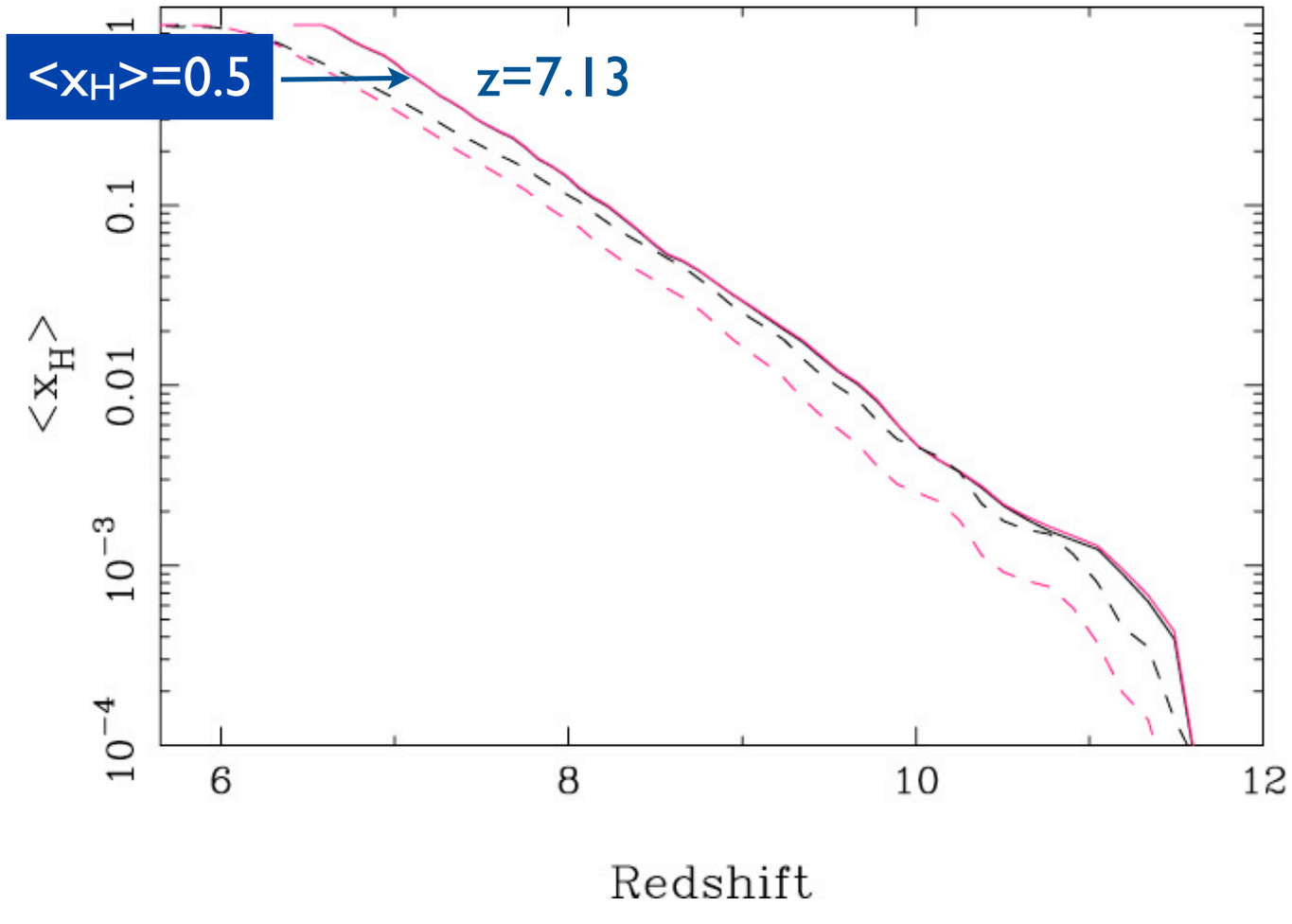

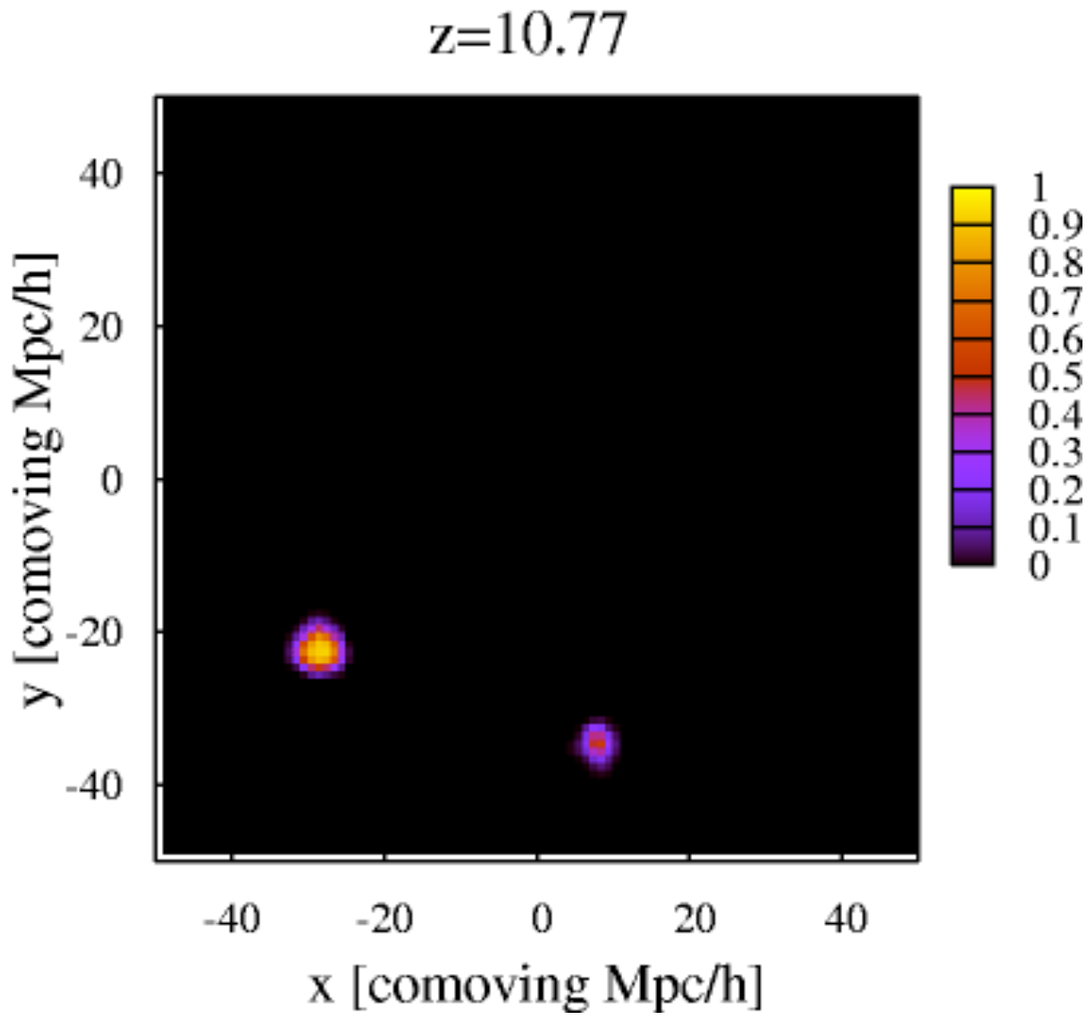

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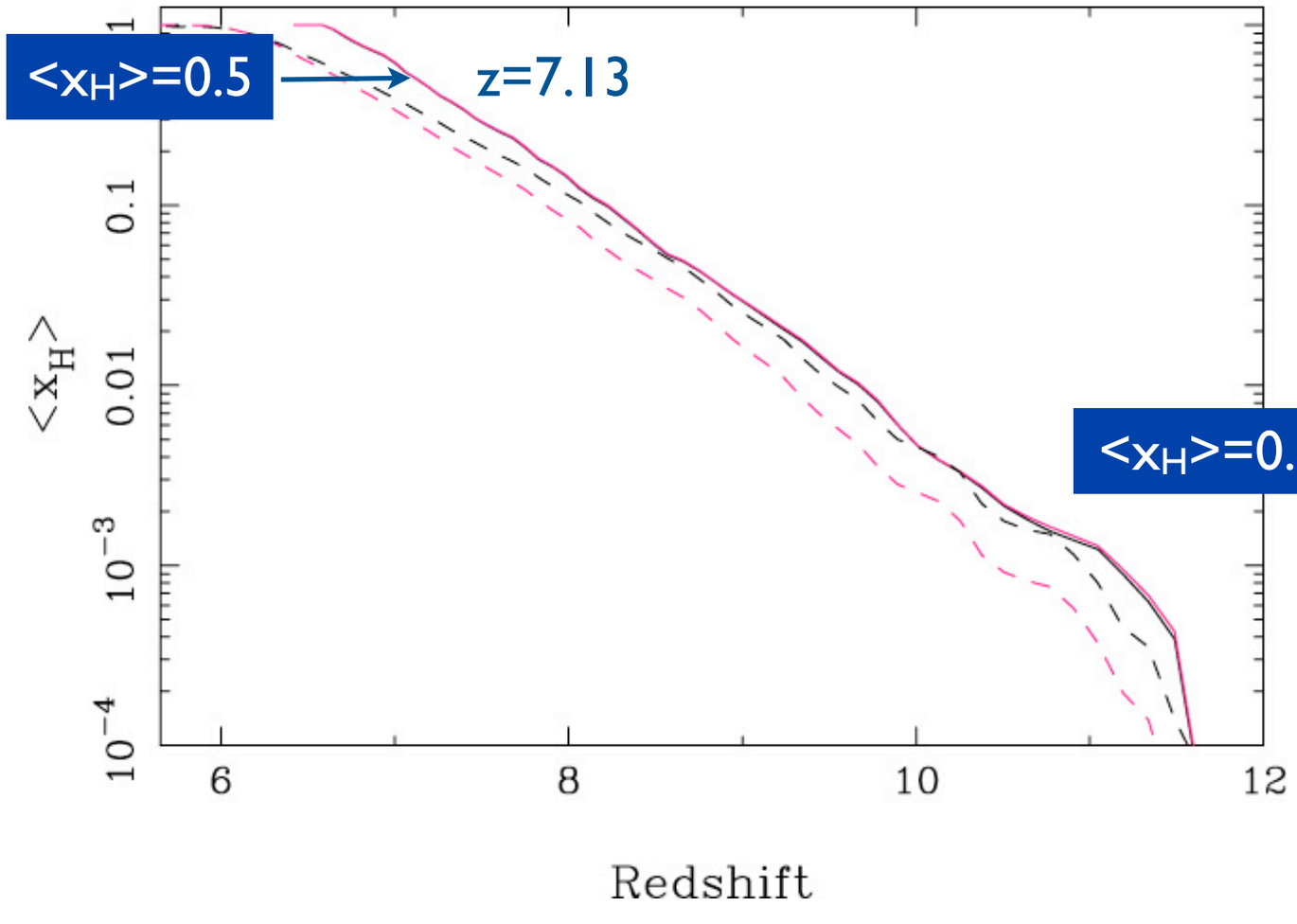

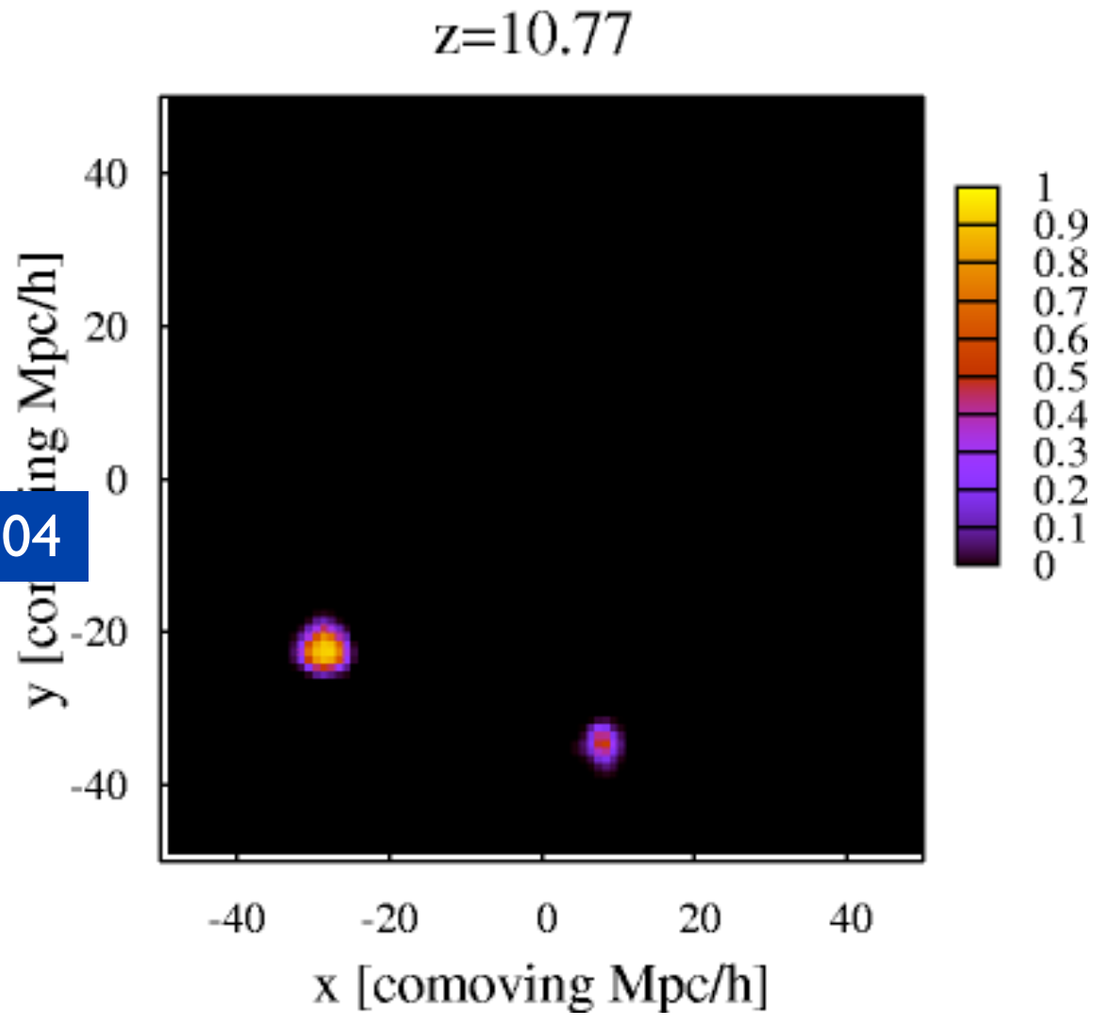

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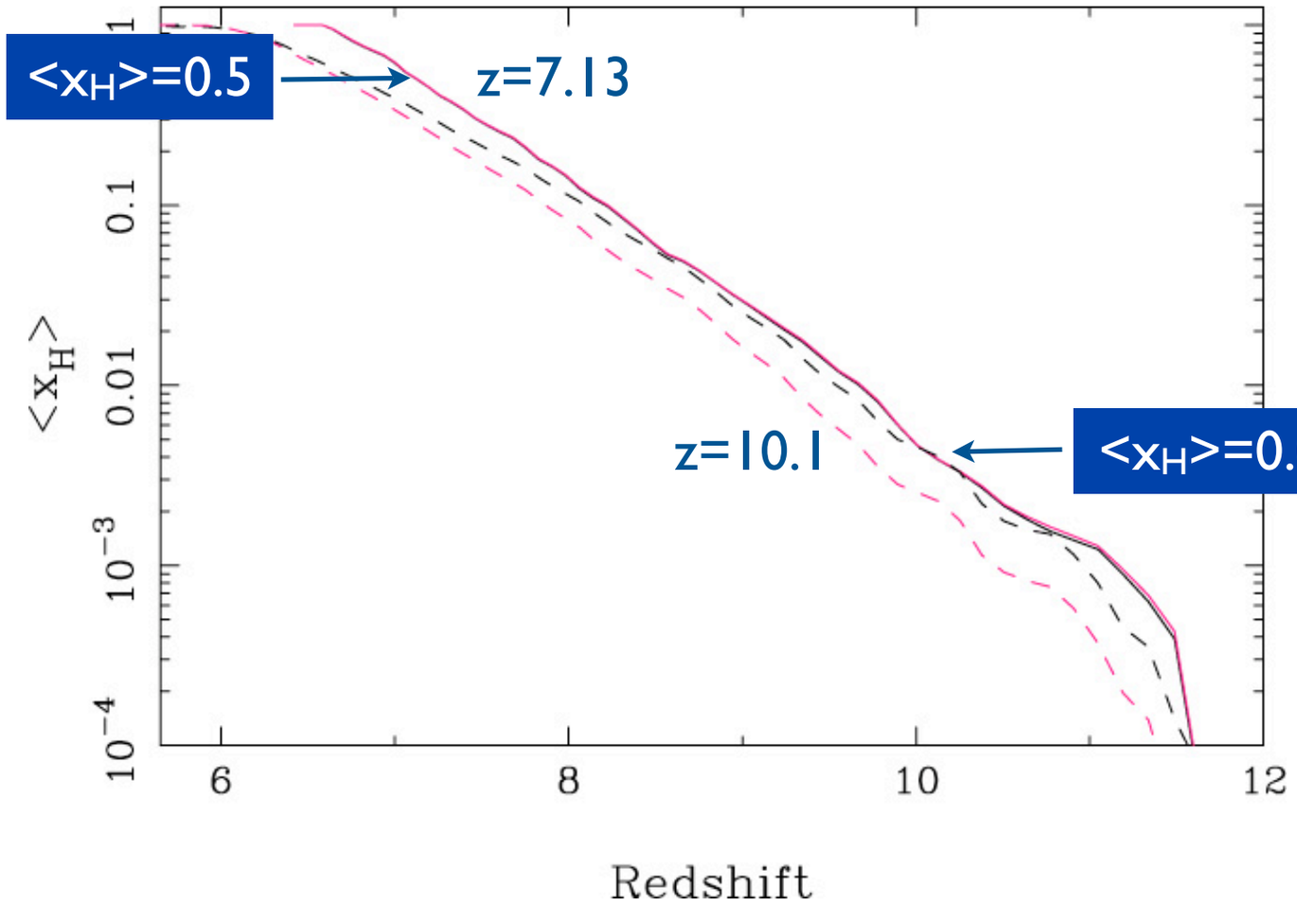

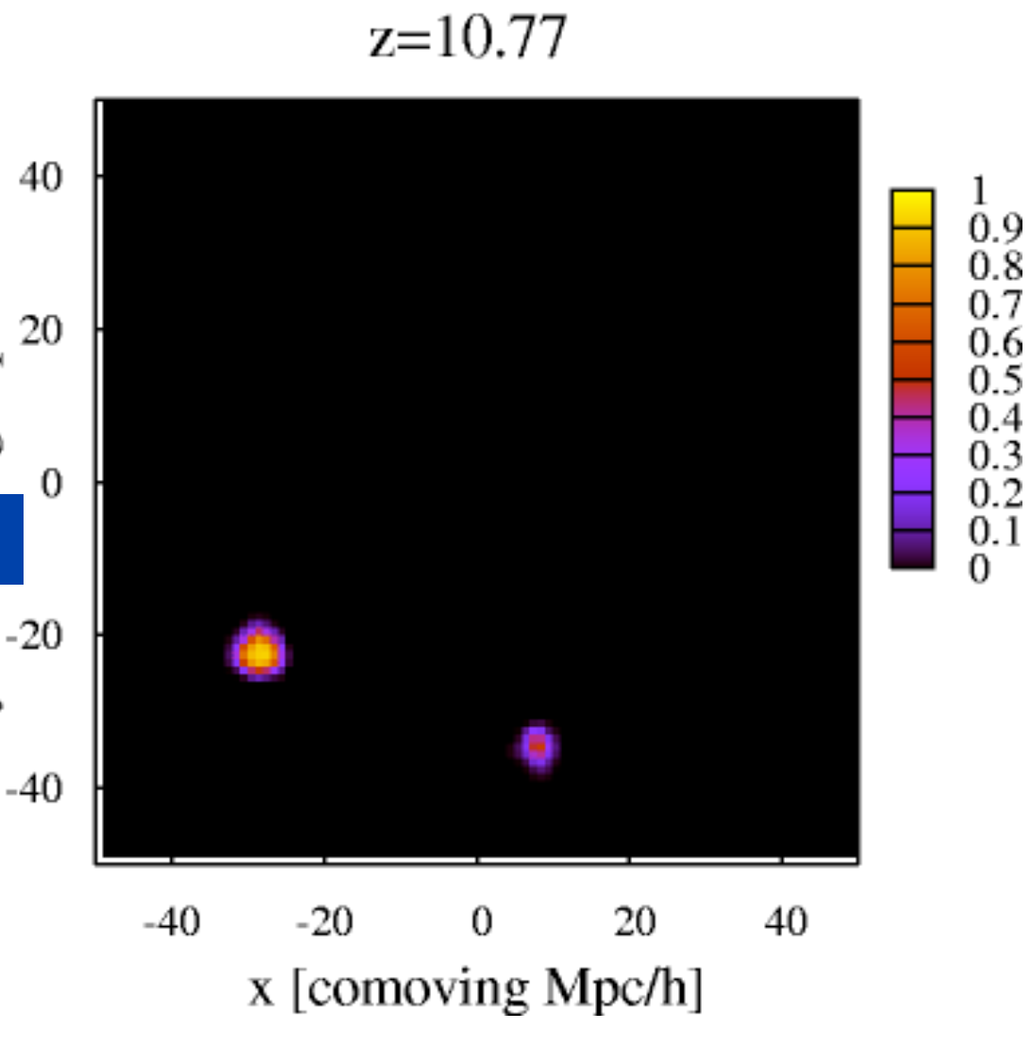

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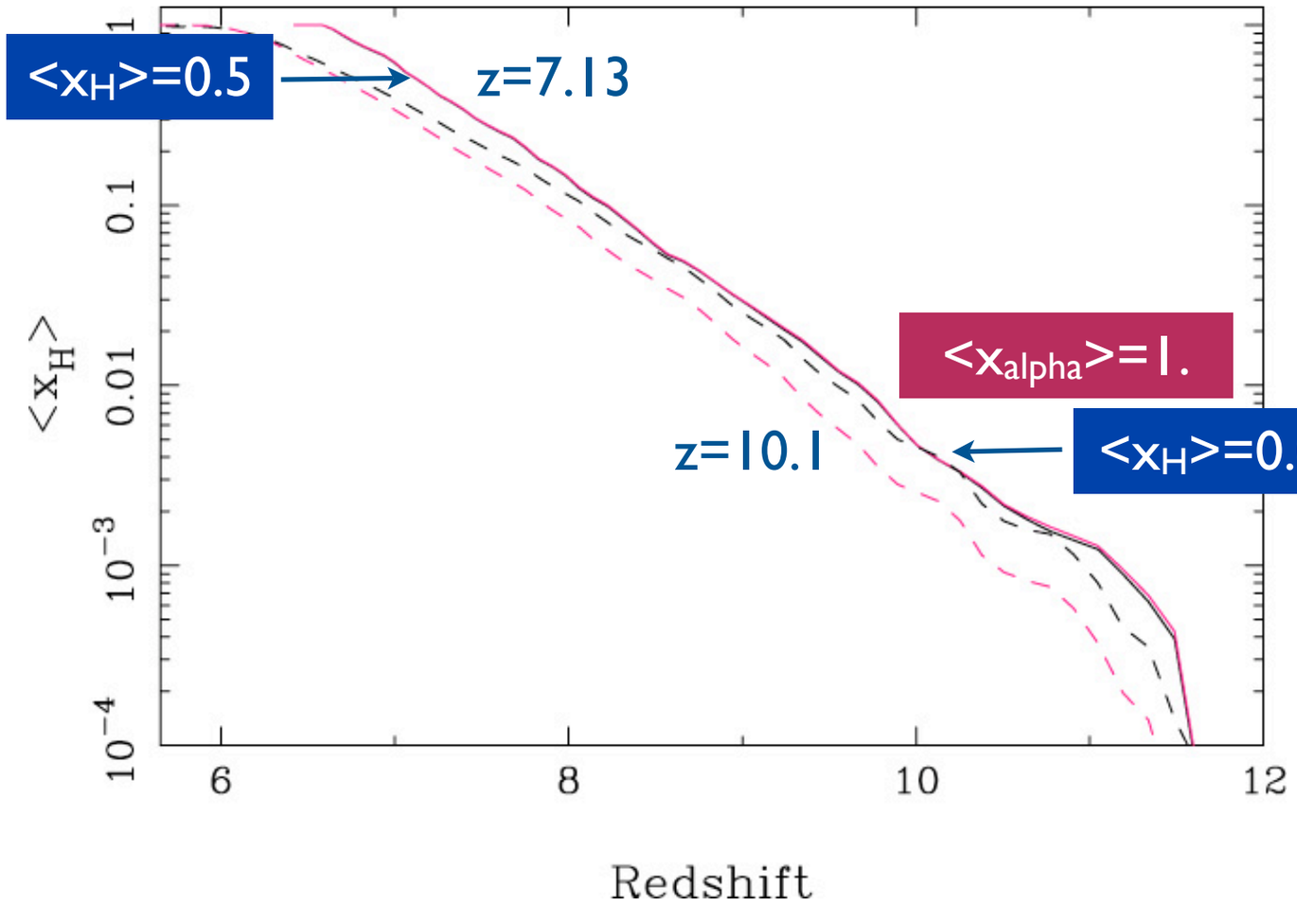
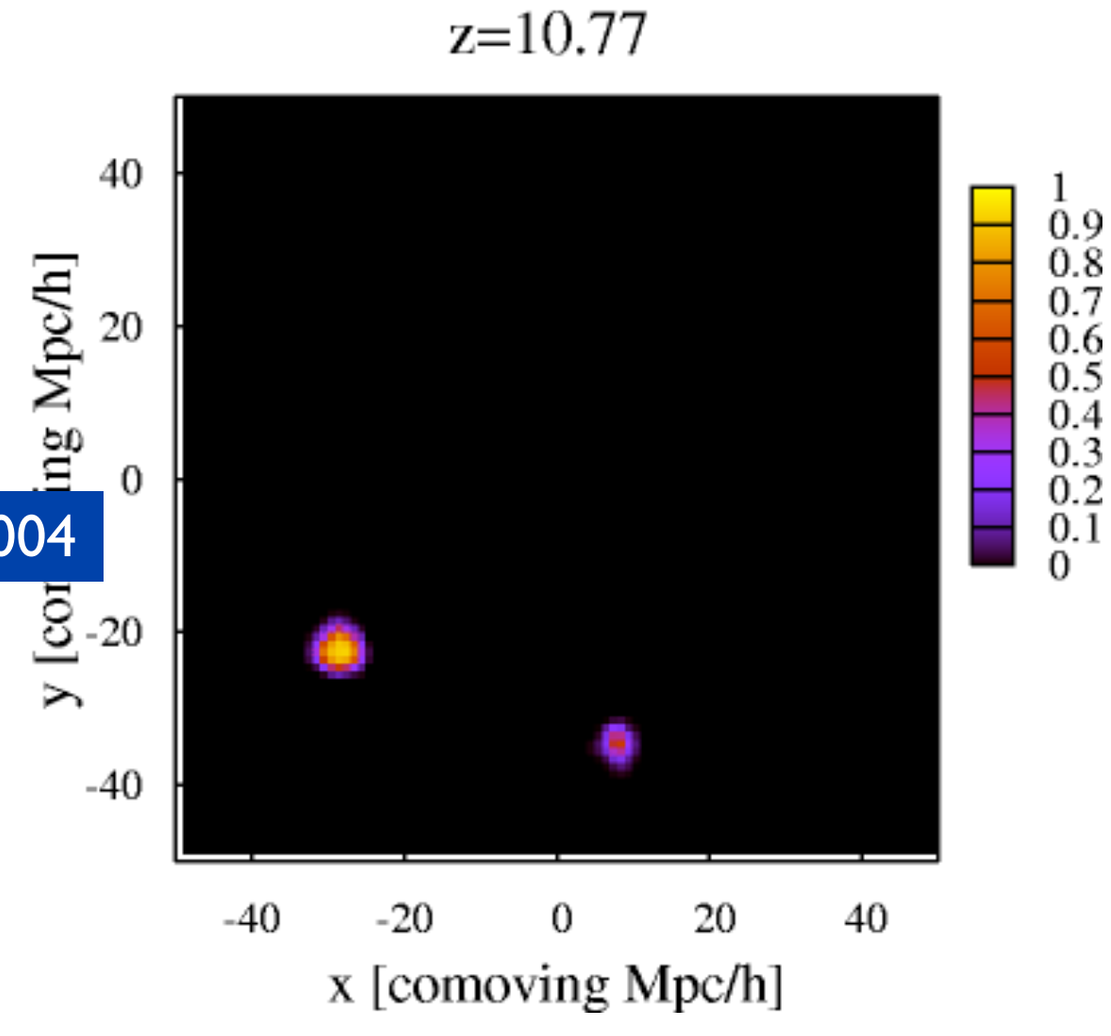
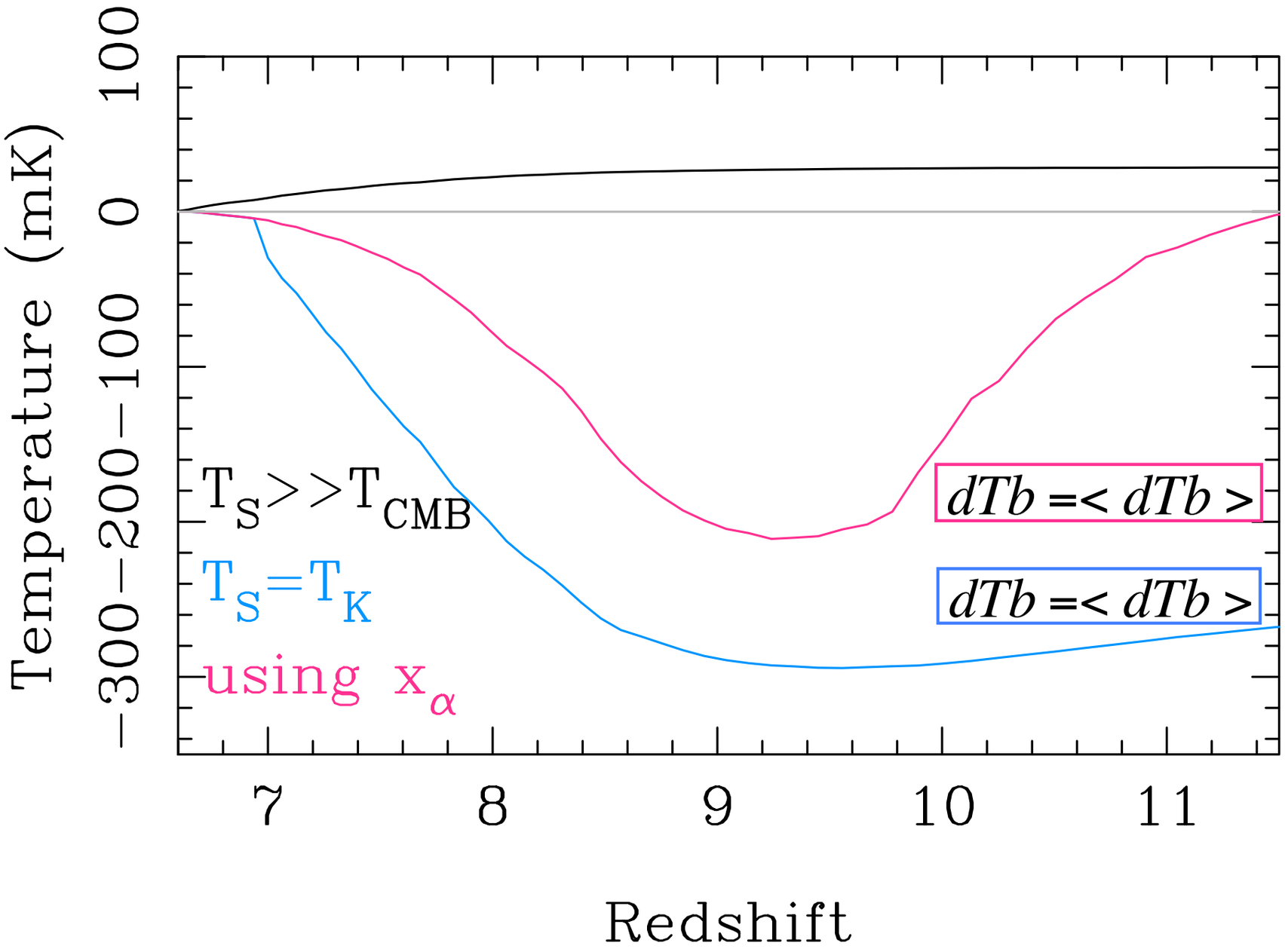
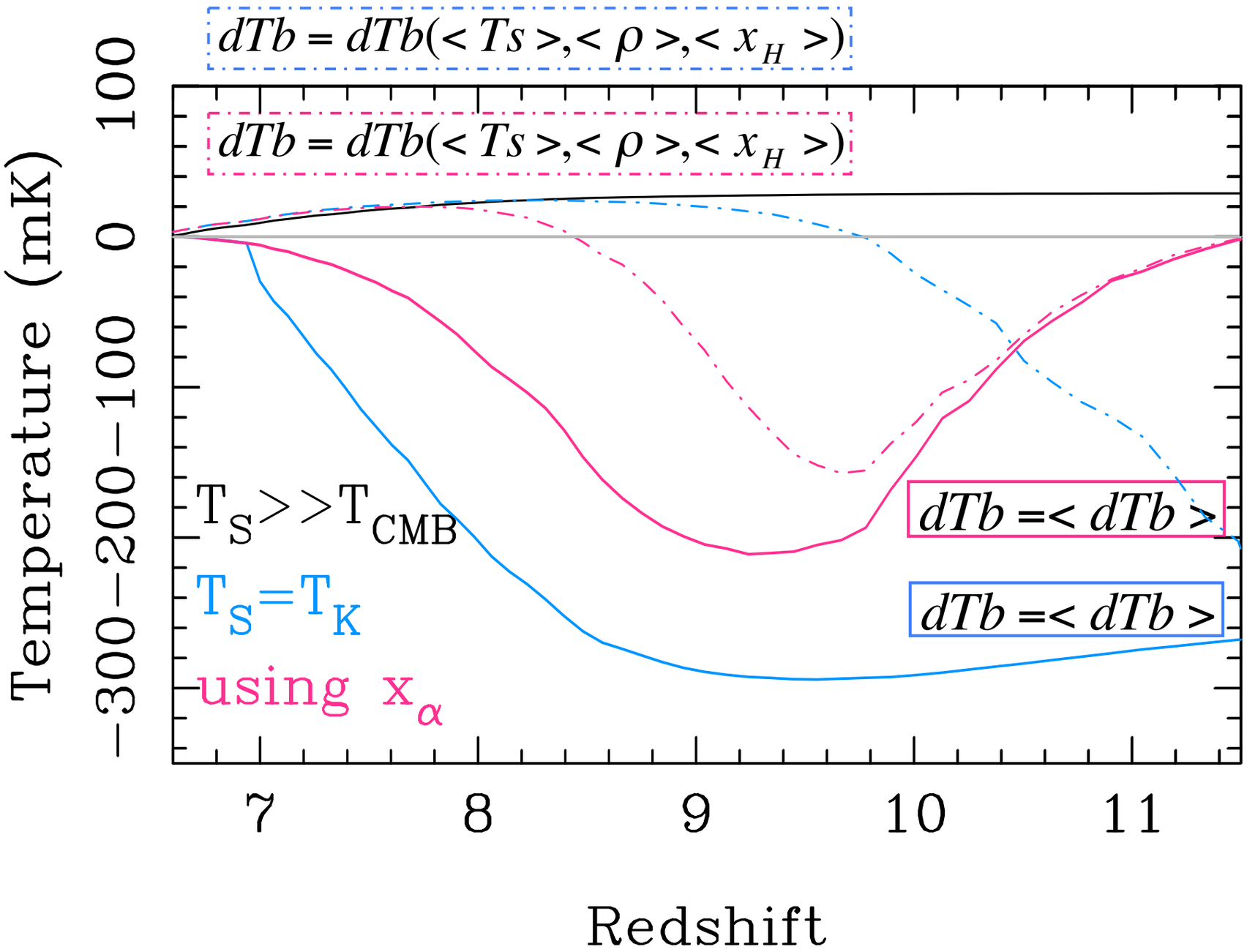




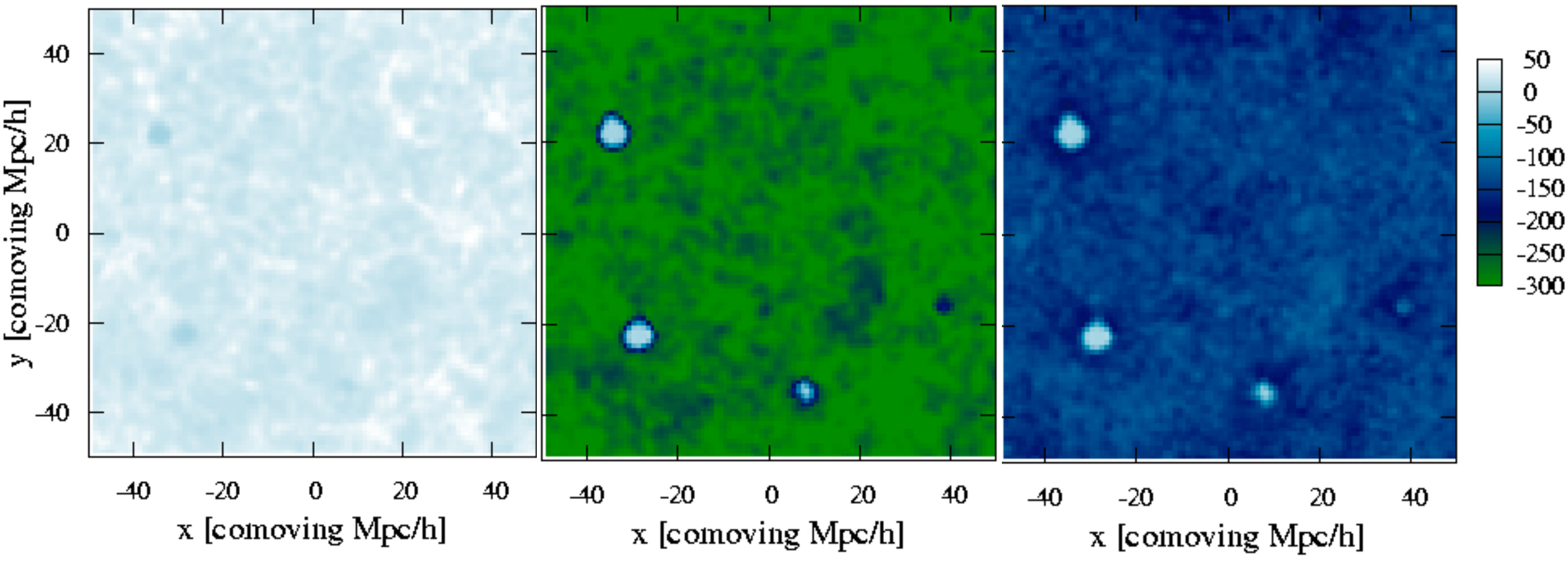
THE DIFFERENTIAL BRIGHTNESS TEMPERATURE



THE DIFFERENTIAL BRIGHTNESS TEMPERATURE

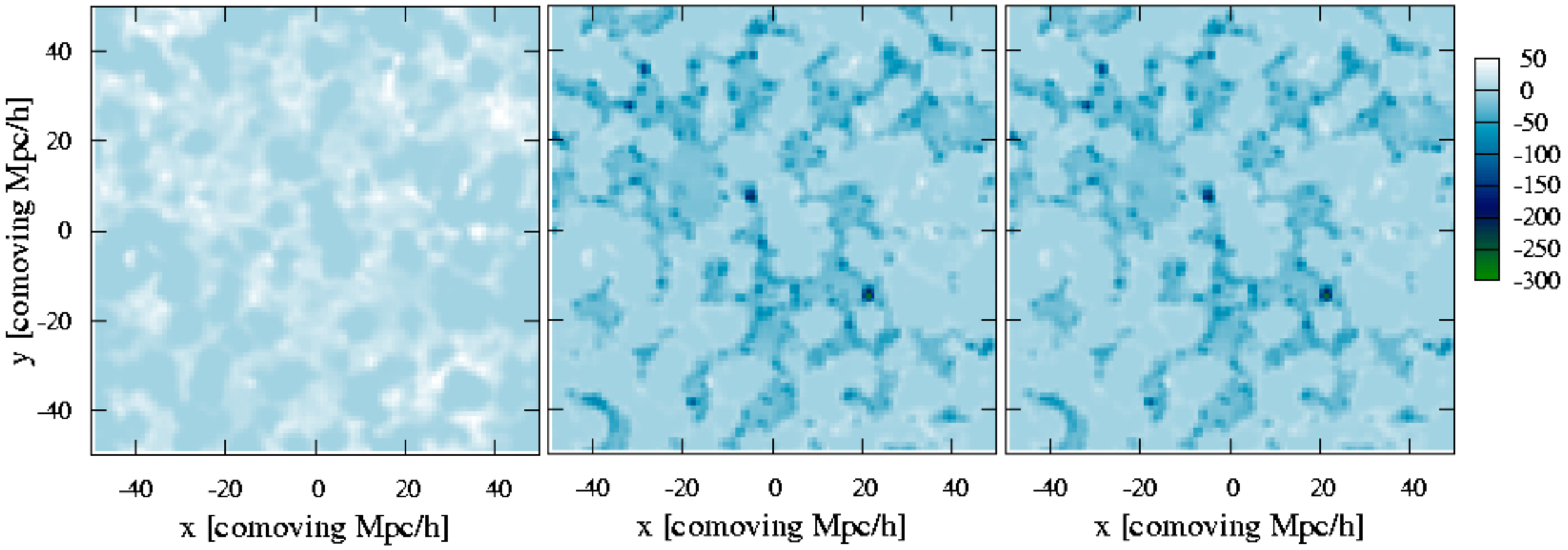


THE DIFFERENTIAL BRIGHTNESS TEMPERATURE: SOME MAPS



z=10.1: <xalpha>=1, <xH>=0.004

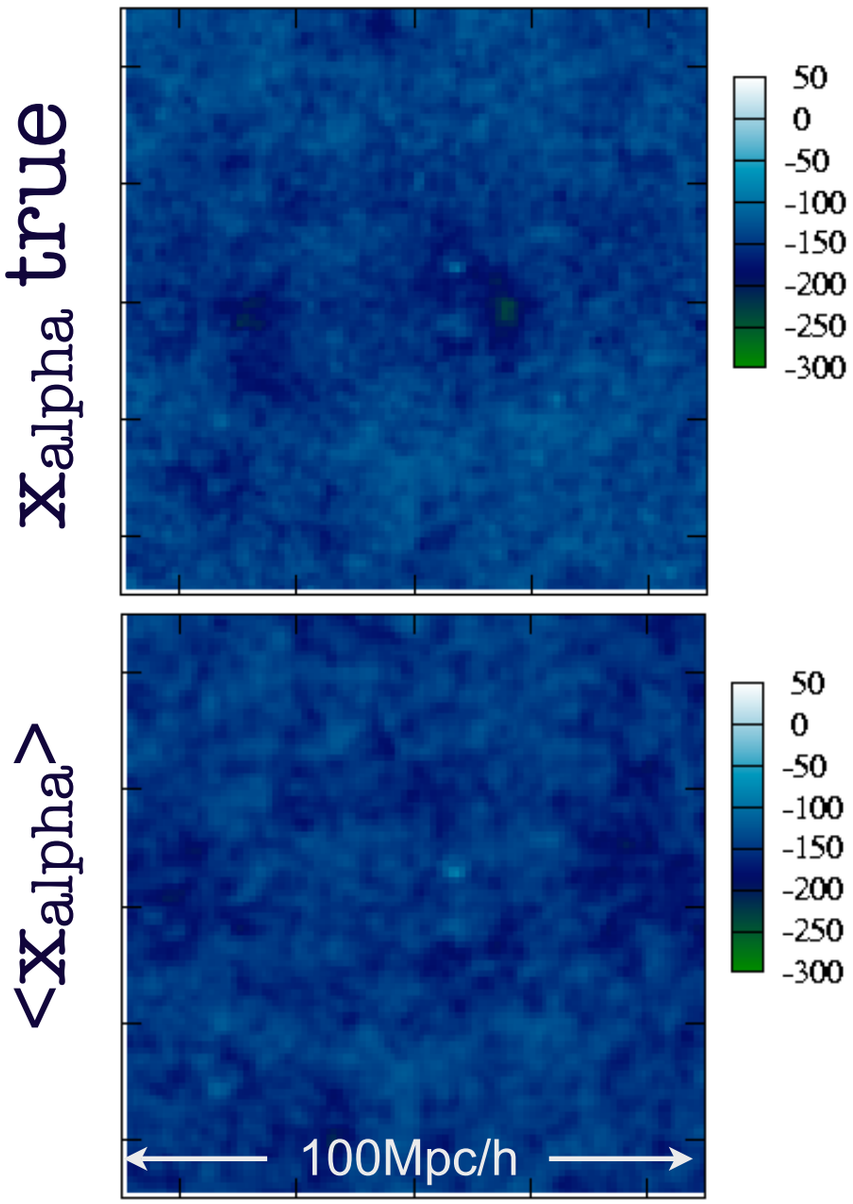
THE DIFFERENTIAL BRIGHTNESS TEMPERATURE: SOME MAPS



z = 7.13: <xH>=0.5

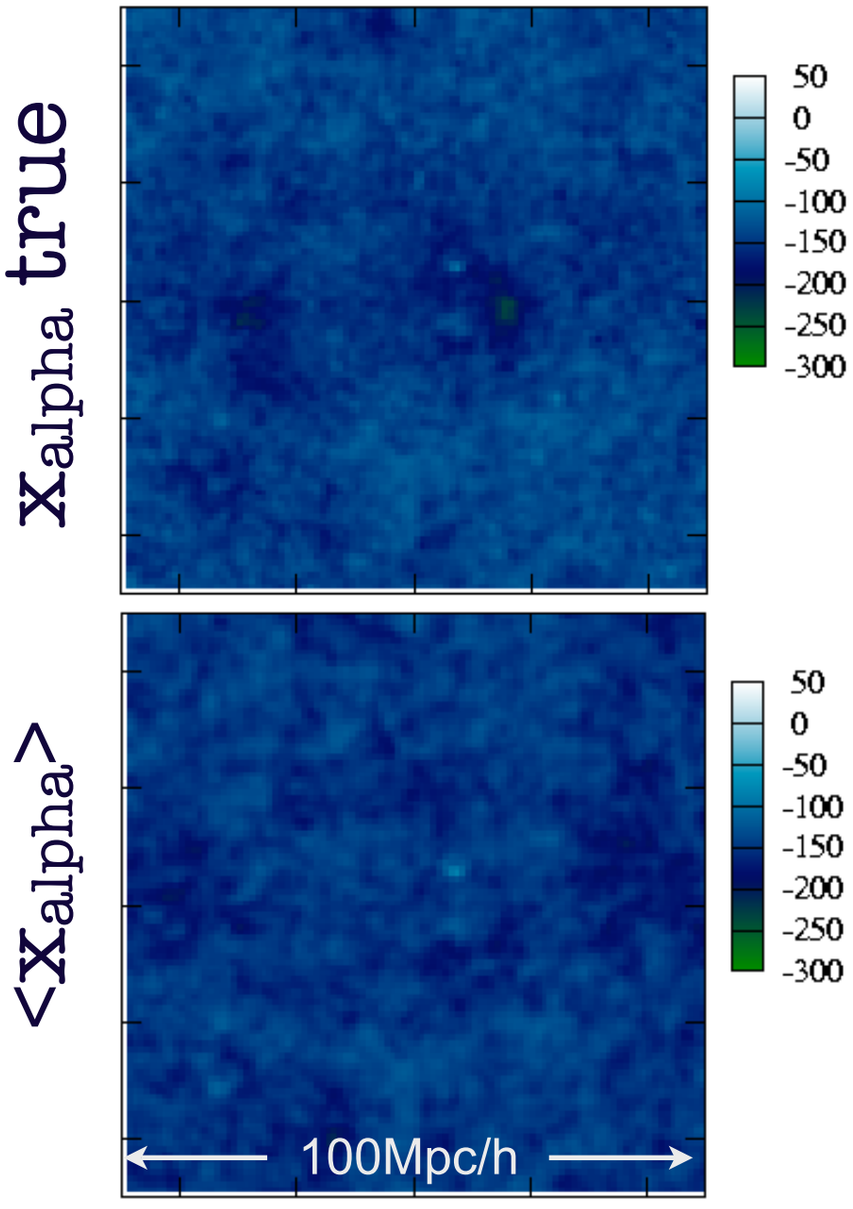
X_{ALPHA} TRUE AND $<X_{ALPHA}>$: A COMPARISON

dTb maps

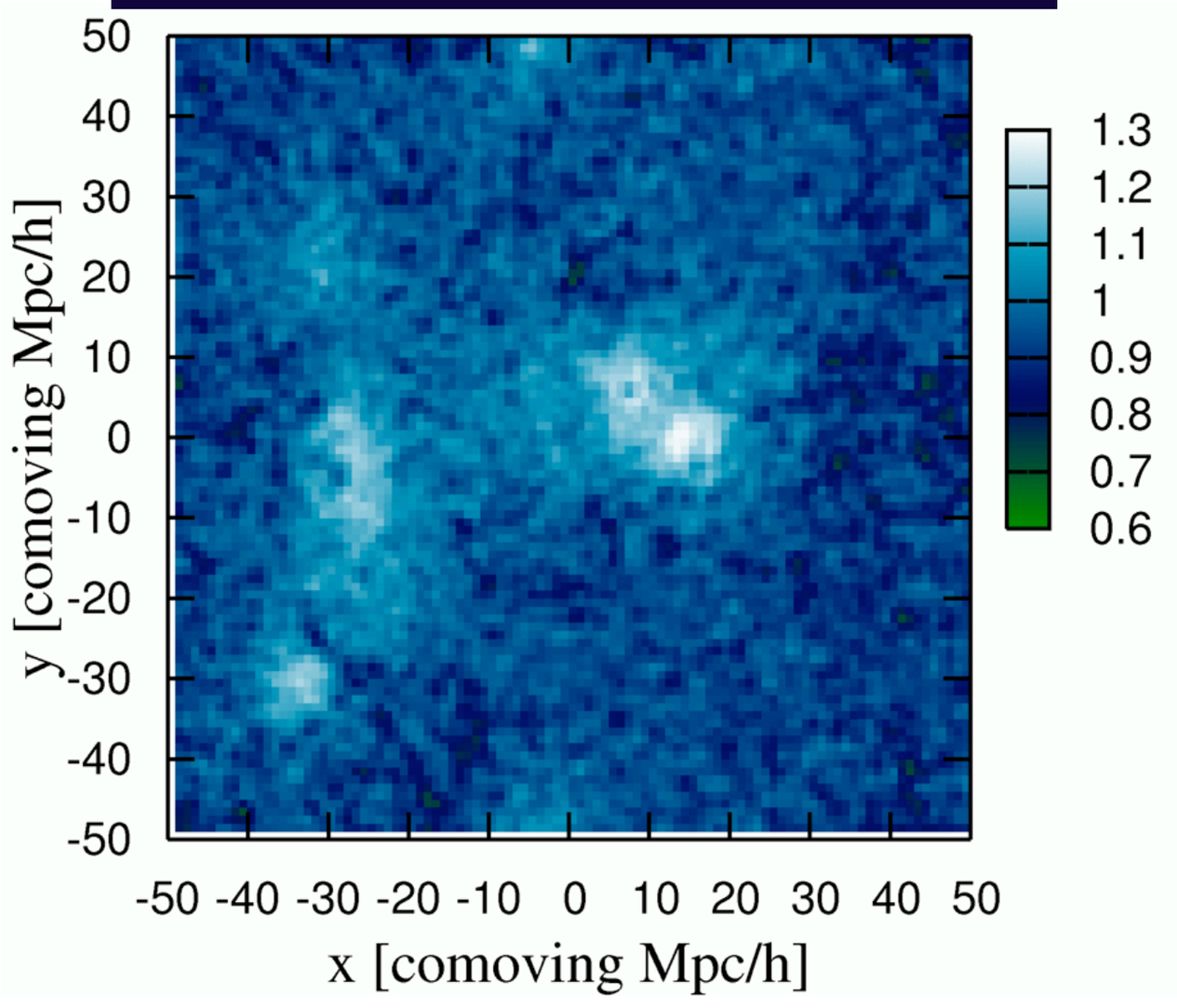


X_{ALPHA} TRUE AND $<X_{ALPHA}>$: A COMPARISON

dTb maps

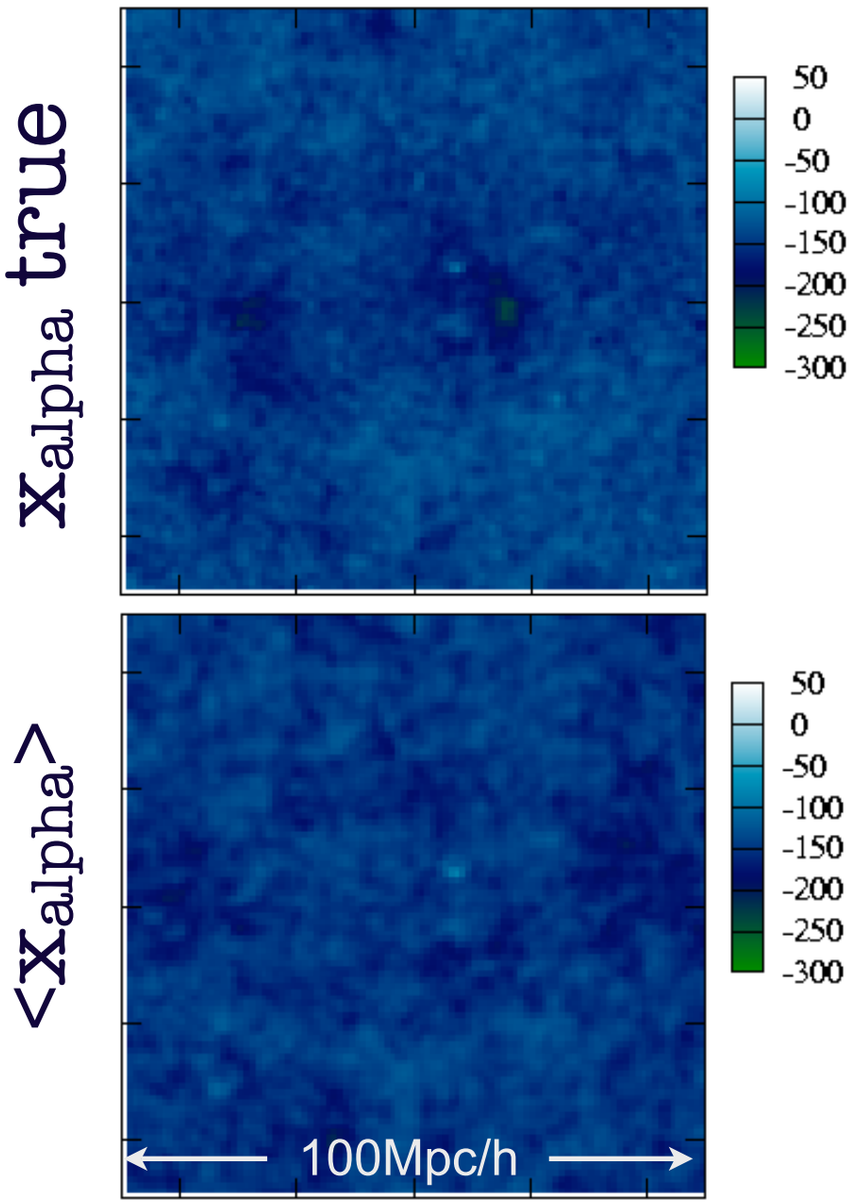


$dTb_{xalpha,true}/dTb_{<xalpha>}$

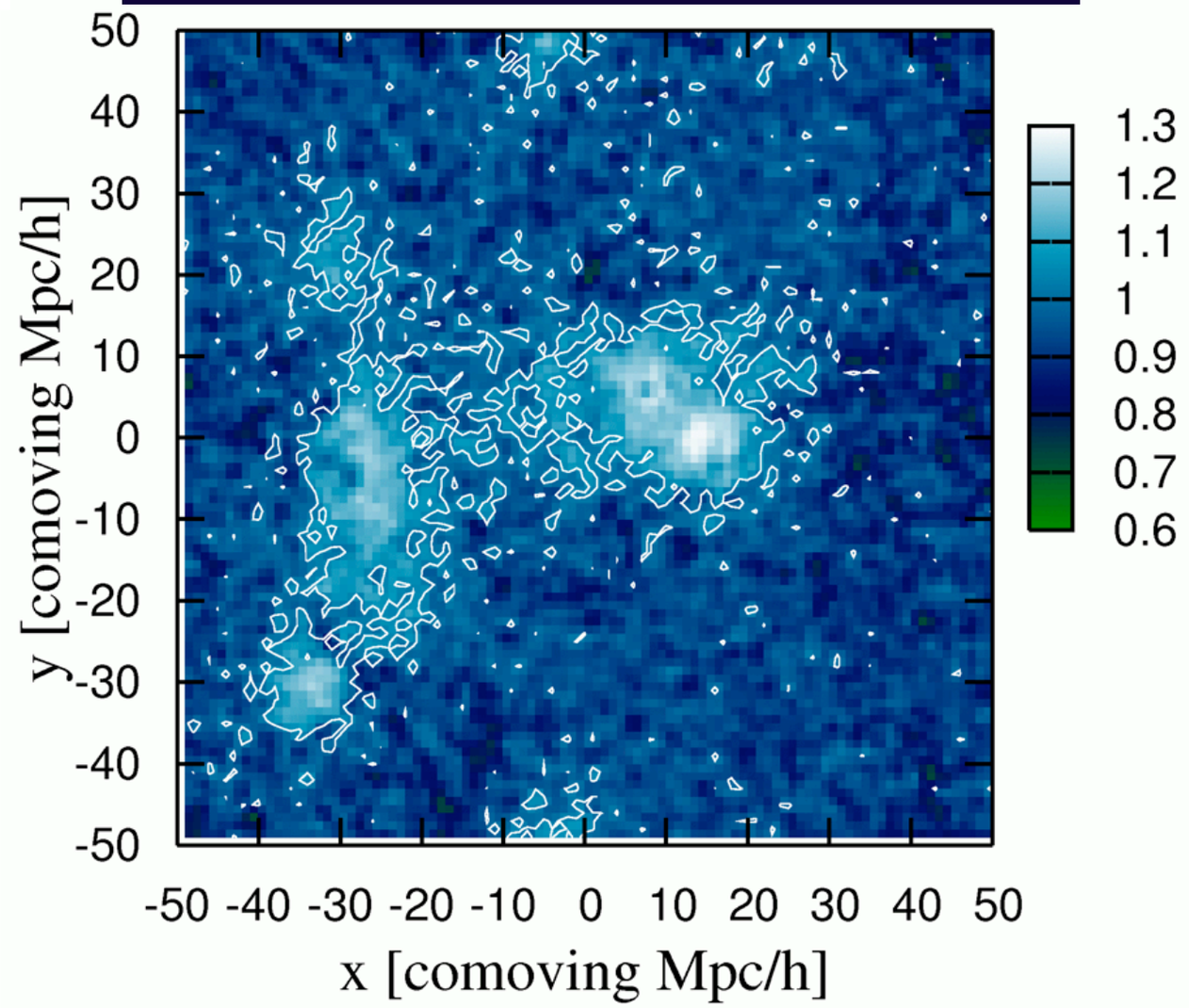


X_{ALPHA} TRUE AND $<X_{ALPHA}>$: A COMPARISON

dTb maps

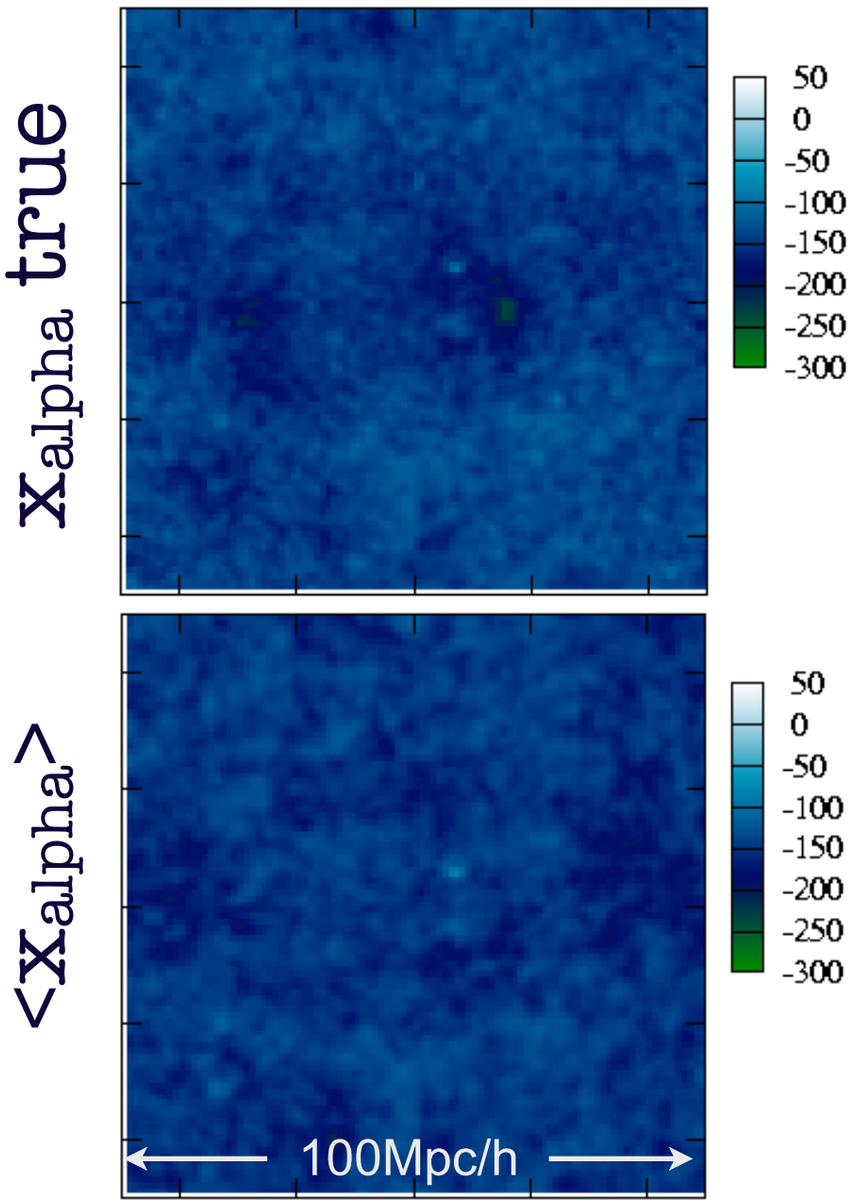


$dTb_{xalpha,true}/dTb_{<xalpha>}$

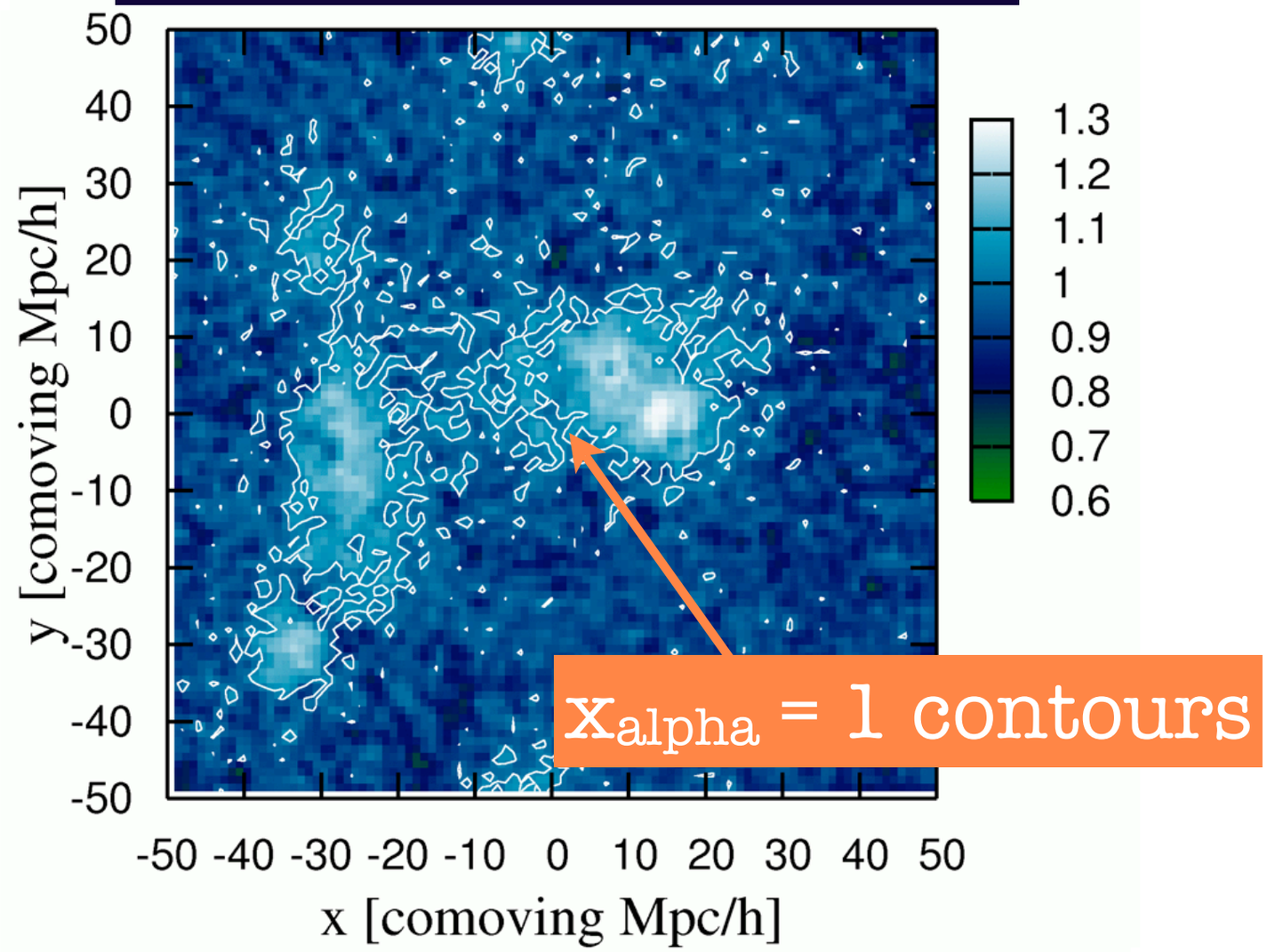


X_{ALPHA} TRUE AND $<X_{ALPHA}>$: A COMPARISON

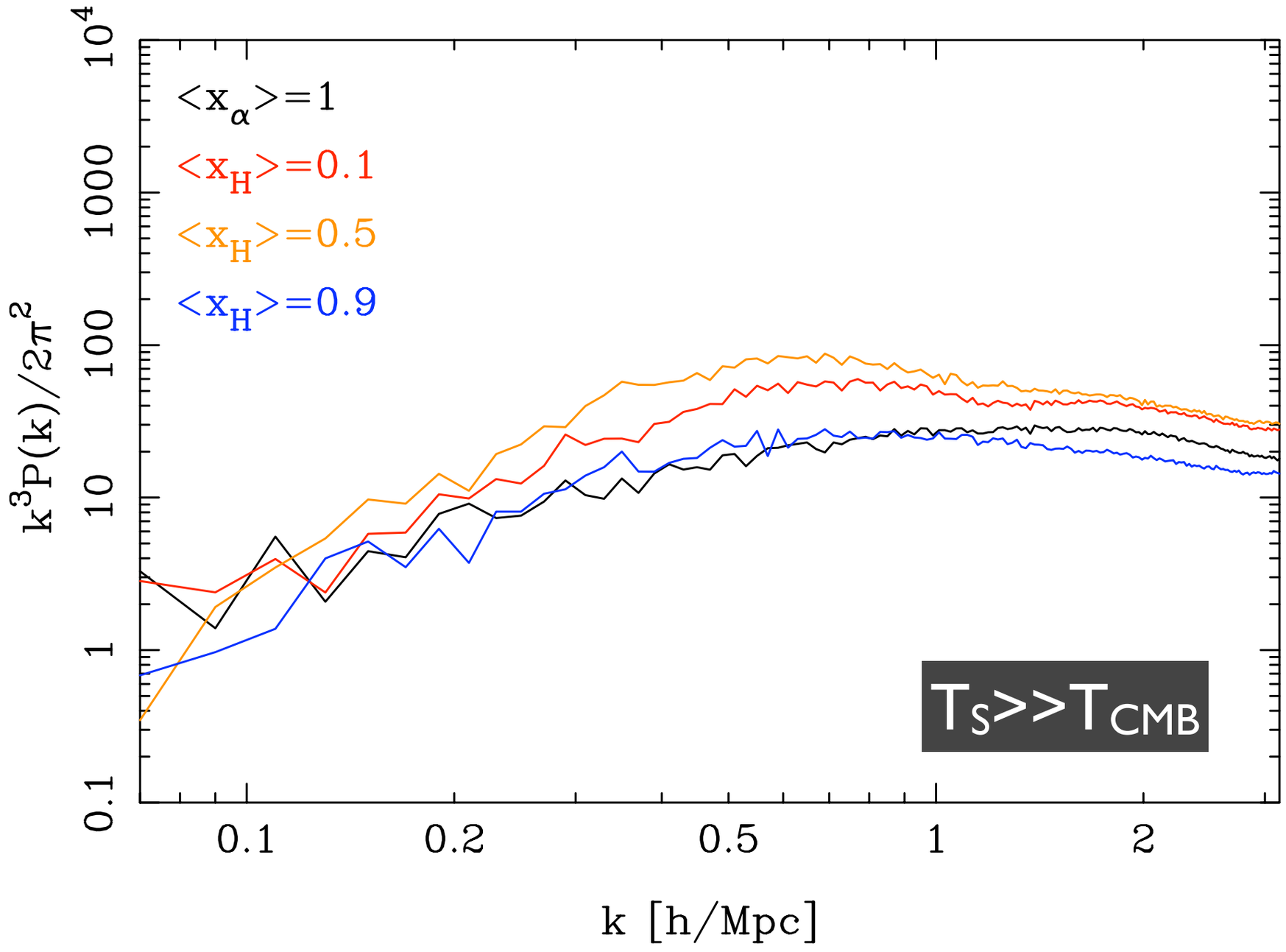
dTb maps



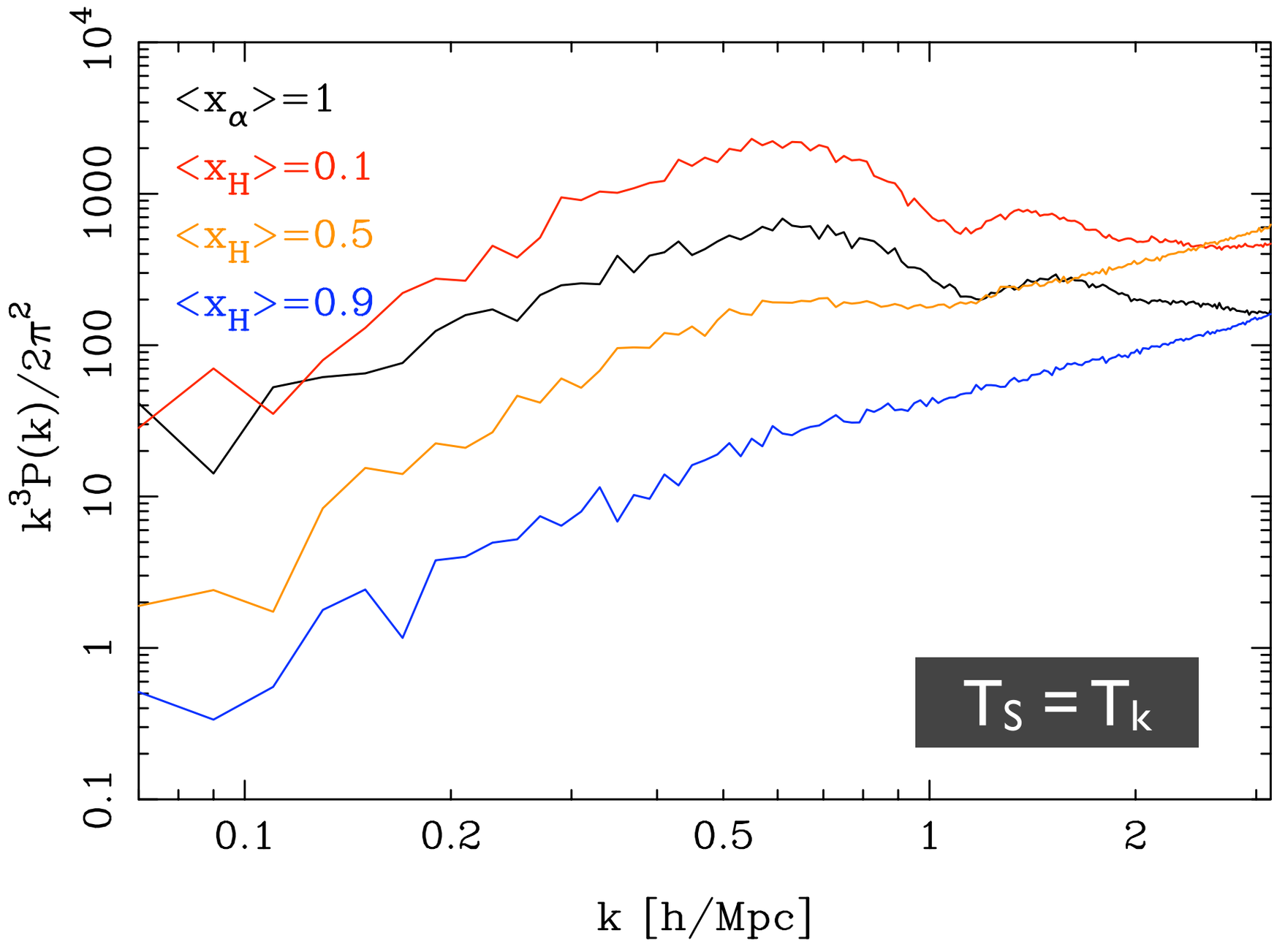
$dTb_{xalpha,true}/dTb_{<xalpha>}$



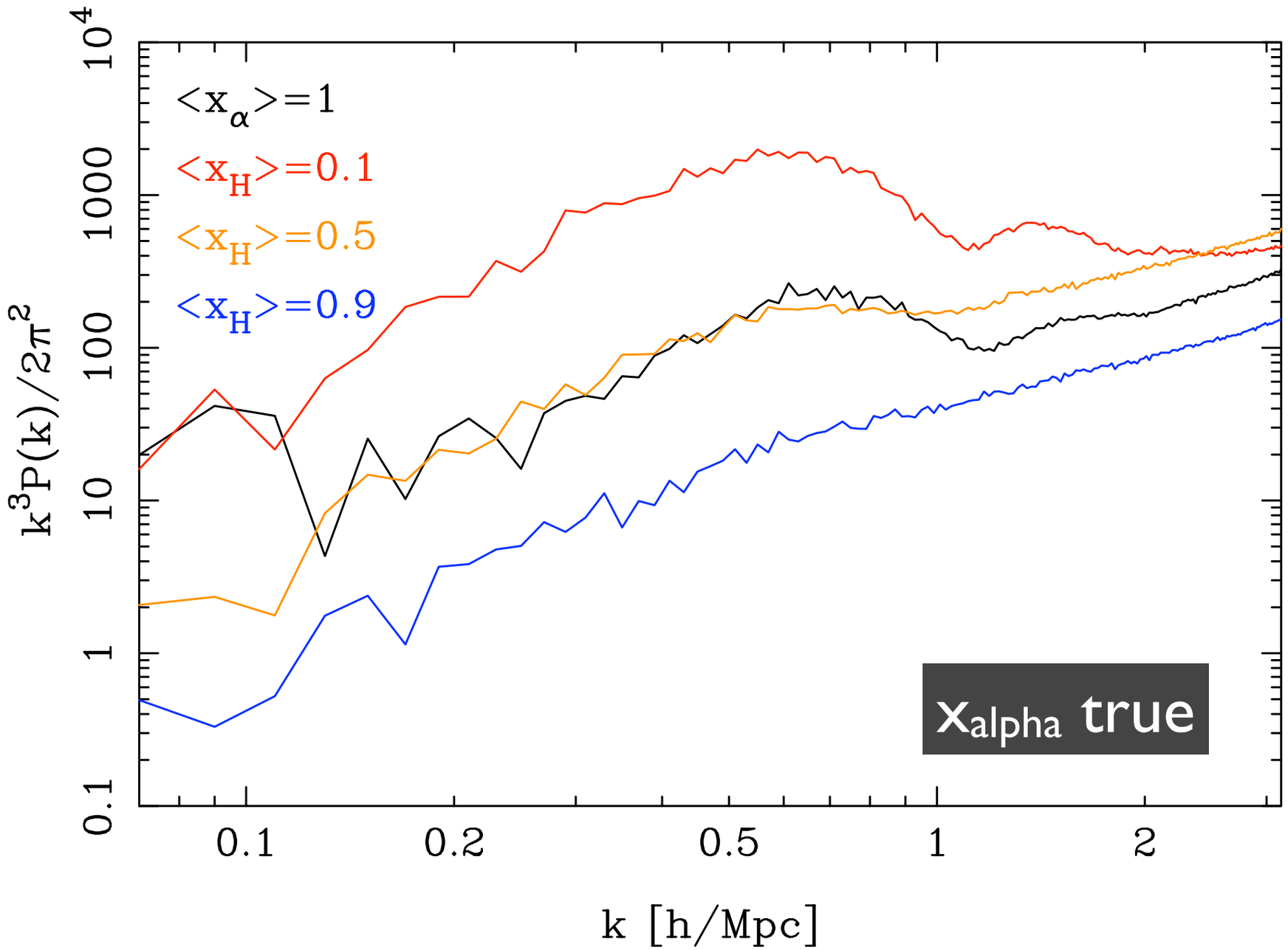
POWER SPECTRA OF THE 21-CM SIGNAL



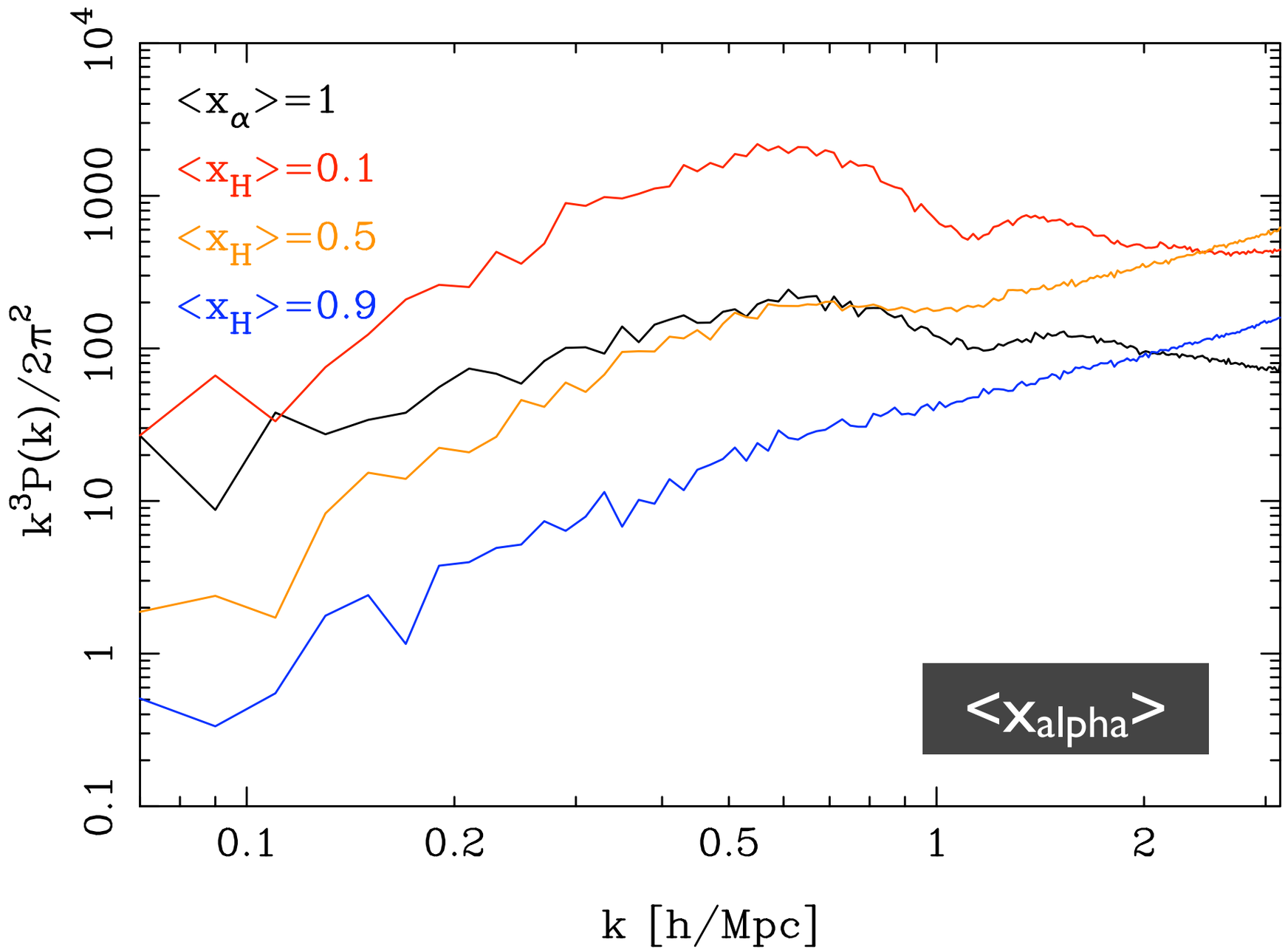
POWER SPECTRA OF THE 21-CM SIGNAL



POWER SPECTRA OF THE 21-CM SIGNAL



POWER SPECTRA OF THE 21-CM SIGNAL



CONCLUSIONS

First simulations of the EoR with full modelization of the Ly-alpha flux (Baek, Di Matteo, Semelin, Combes, Revaz, A&A, to be submitted)

- absolute values of the absorption phase lower than those found when adopting Ts=Tk
- different spectral feautures with respect to the $<x_{alpha}>$ case for high redshifts and small spatial scales

In the near future

- Effect of proper velocity gradients
- Influence of the nature of the first sources