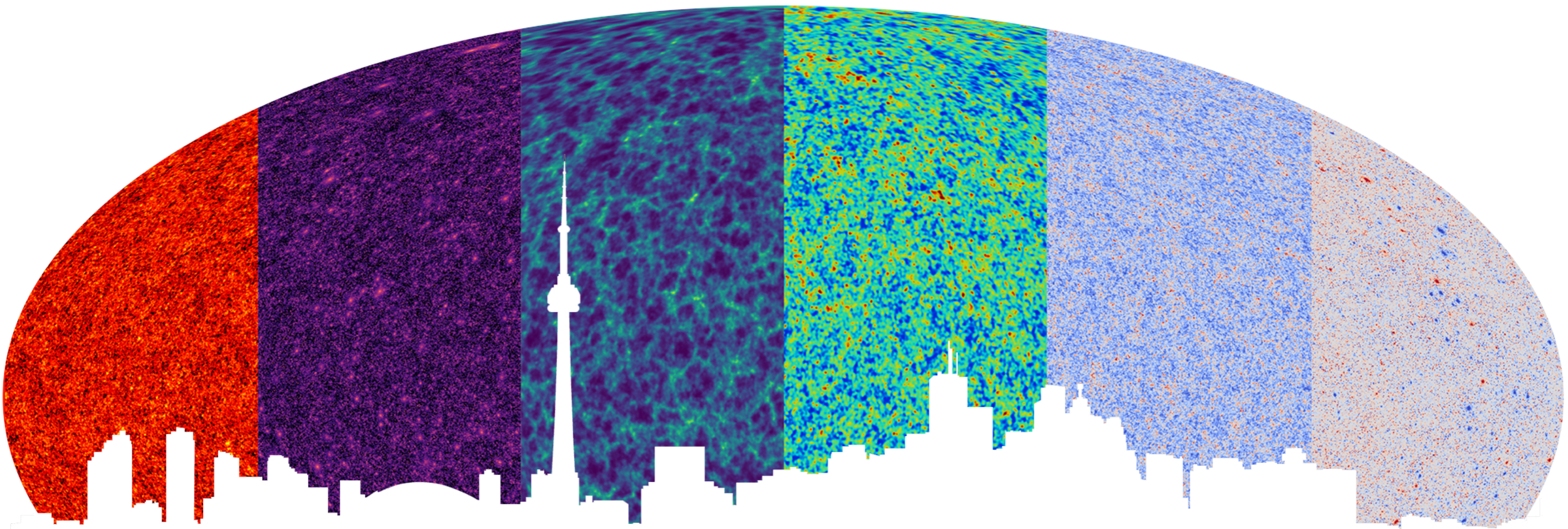


# CITA Extragalactic Simulation Group

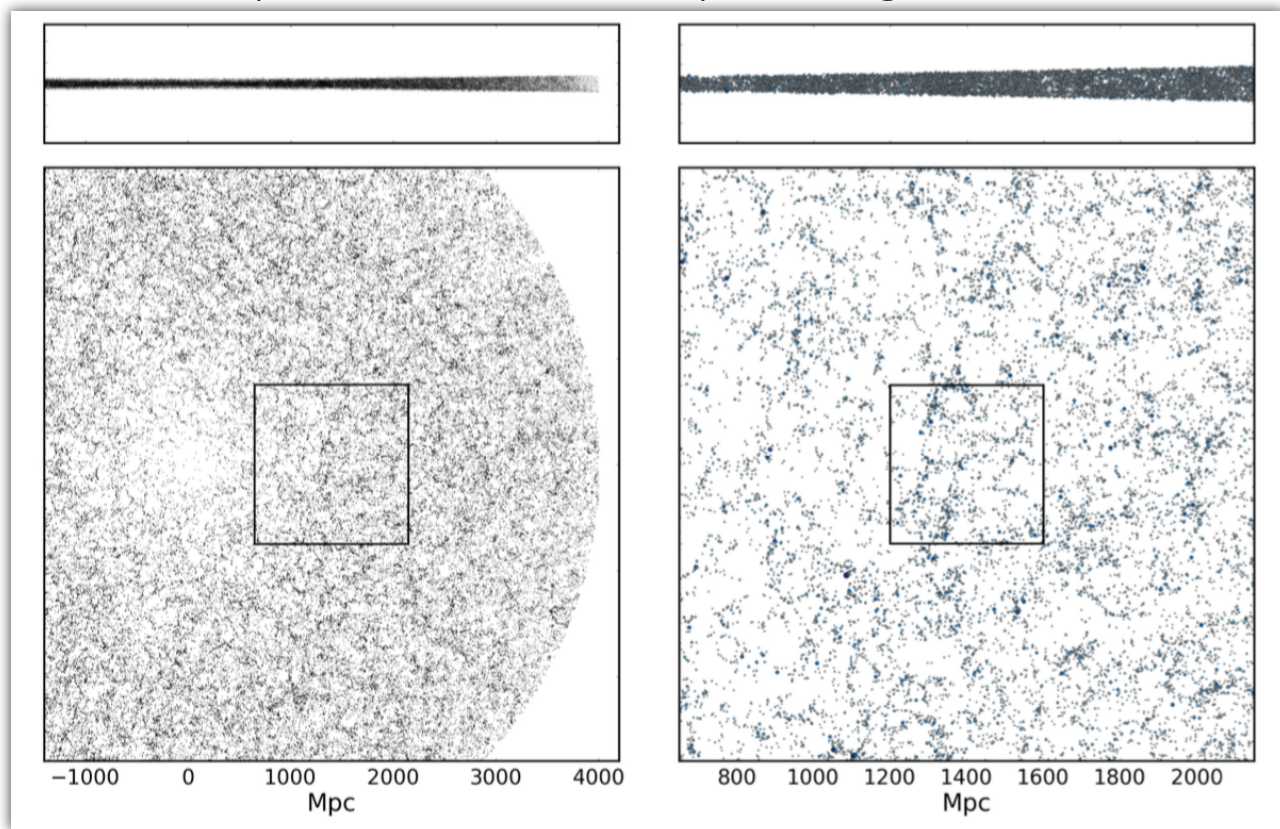
George Stein, Dick Bond, Marcelo Alvarez, Alex van Engelen,  
Nick Battaglia, Louis Pham





# Halo Catalogue

\* Many Peak Patch Full-sky catalogues available

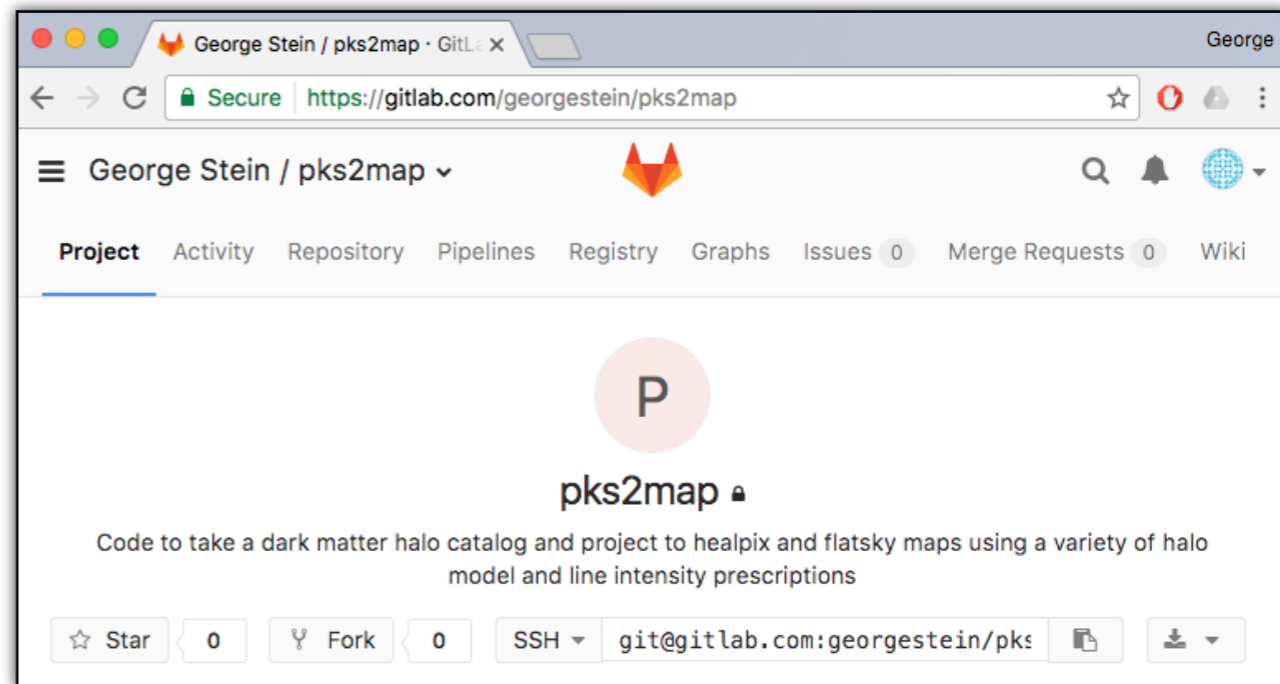


Validated with N-body at HMF+2point+visual

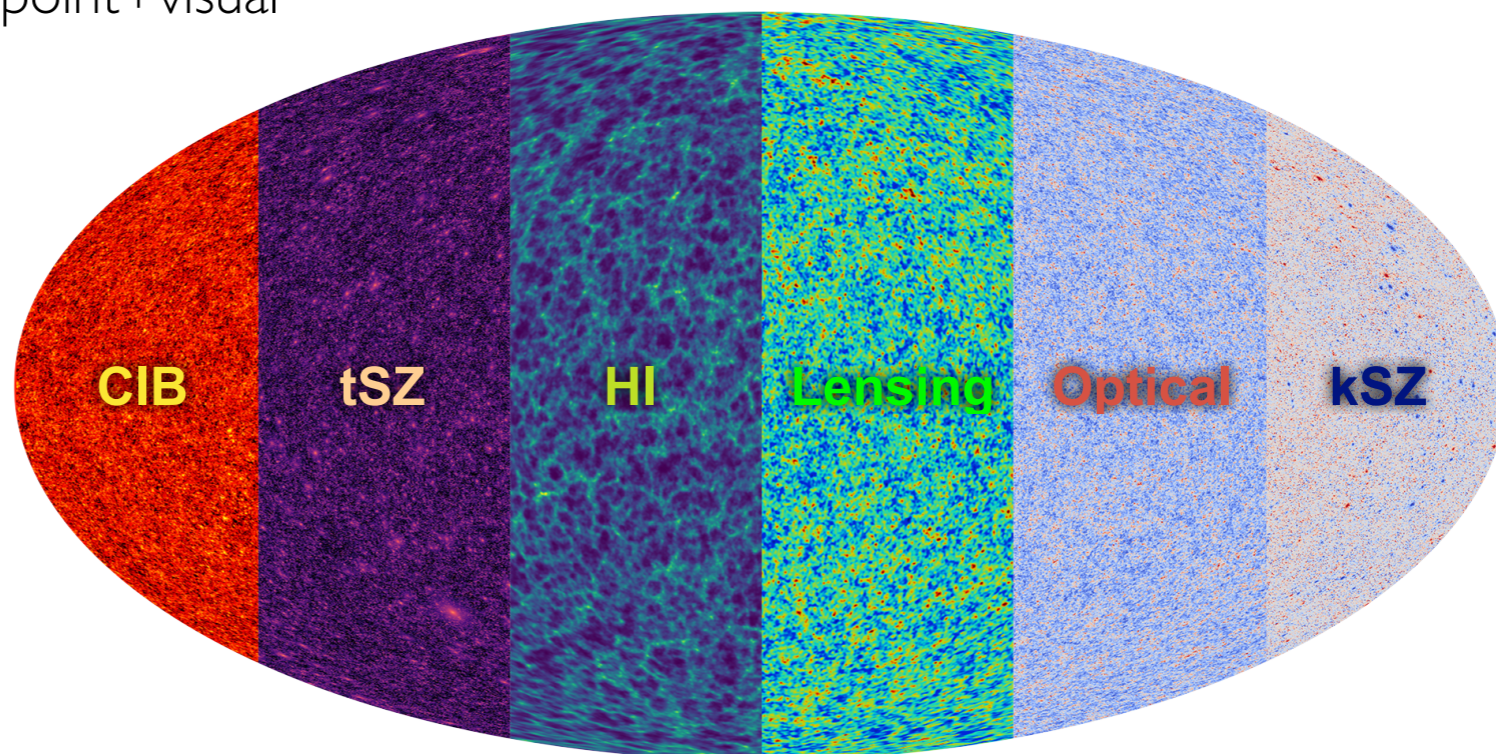
+

# Mapmaking Code

\* Available to the collaboration  
see Marcelo or George



=



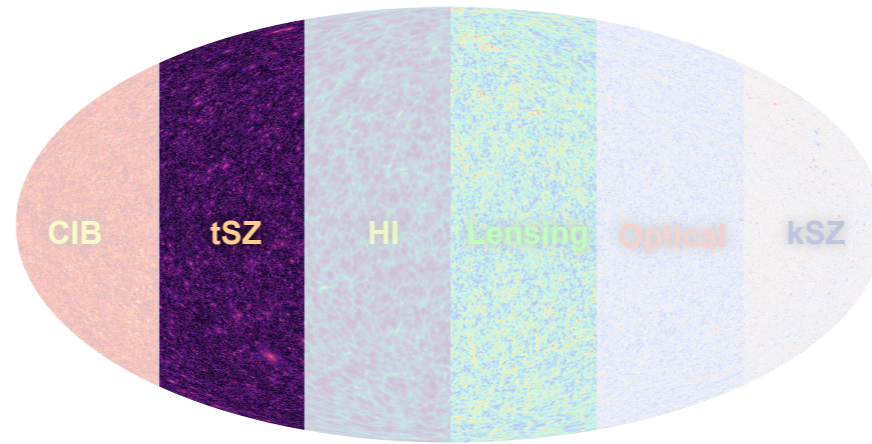
cross correlations automatically included!





# Mapmaking from a Halo Catalogue

## Step 1:

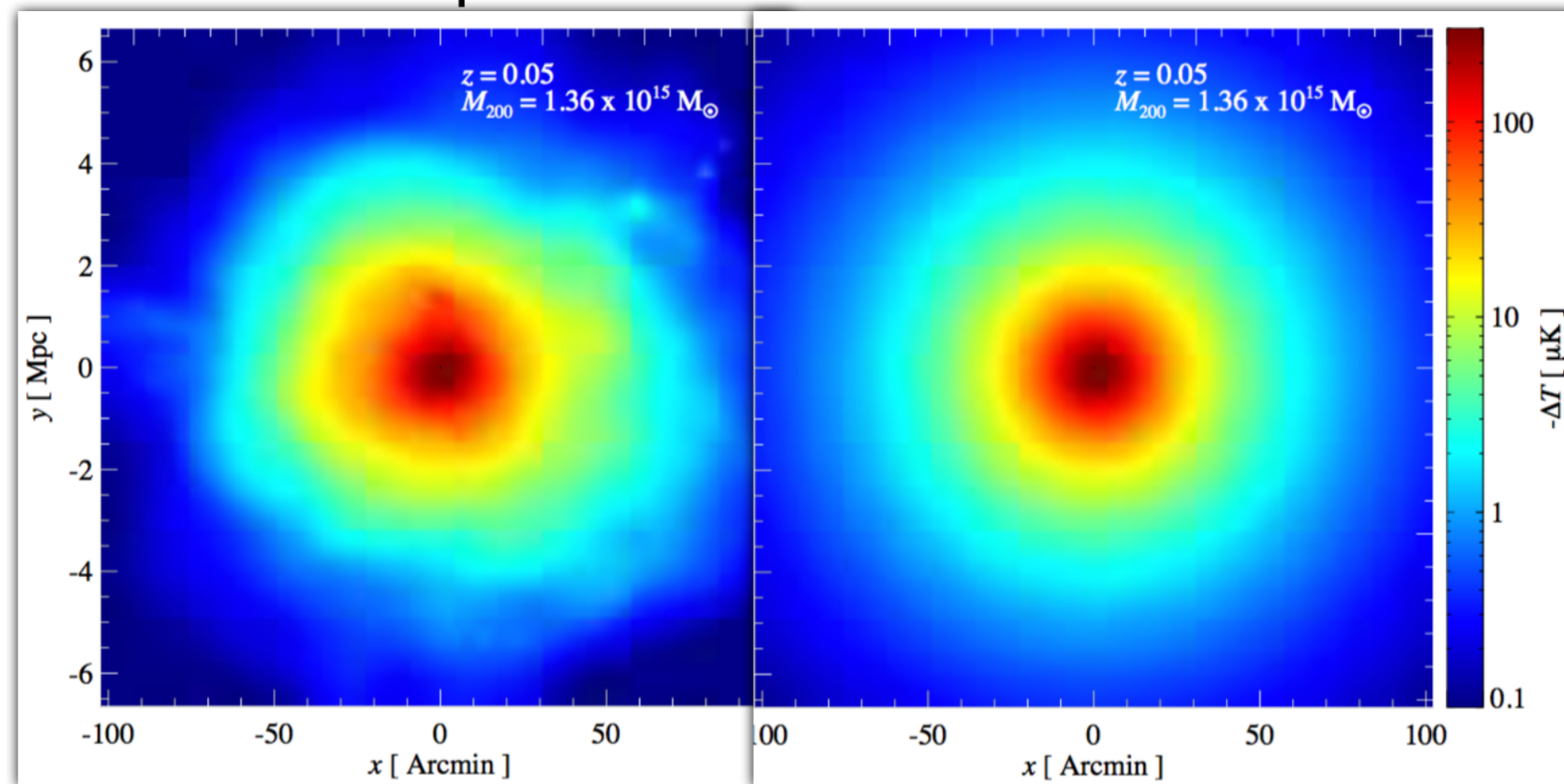


*Battaglia, Bond,  
Pfrommer,  
Sievers (2012)*

### Temperature decrement at 30GHz

Perform measurements in a high resolution hydrodynamical simulation:

- Stack clusters in  $M, z$
- Fit observable  $f(x|M, z)$  to generalized NFW profile  
ie.  $f(x) = \text{Pressure, gas, mass}$
- Need to explore stochastic fluctuations



$$f(x|M, z) = f_0(M, z) \left( \frac{x}{x_c} \right)^\gamma \left[ 1 + \left( \frac{x}{x_c} \right)^\alpha \right]^{-\beta}$$

$$x \equiv r/R_\Delta$$

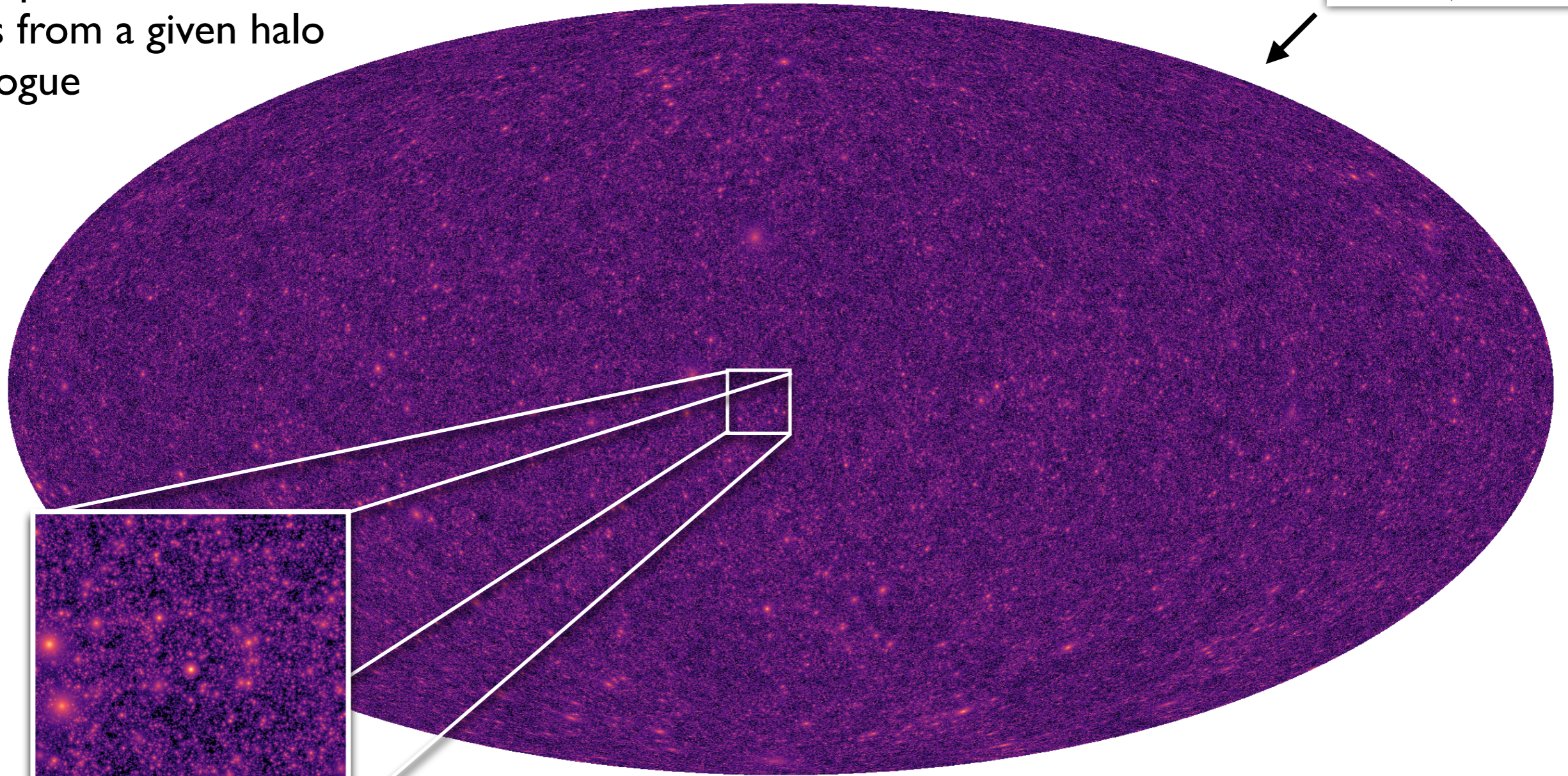
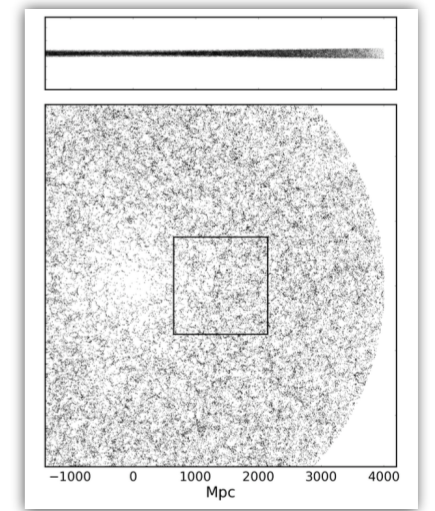
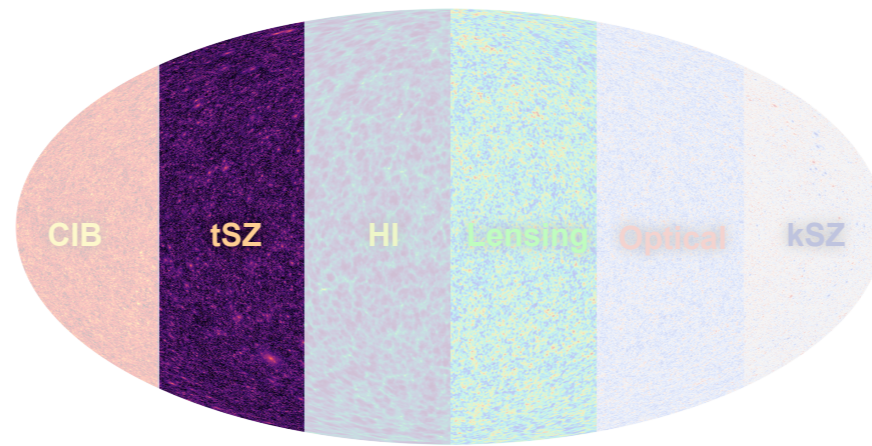




# Mapmaking from a Halo Catalogue

## Step 2:

Paste profile onto dark matter halos from a given halo catalogue



log Compton-y

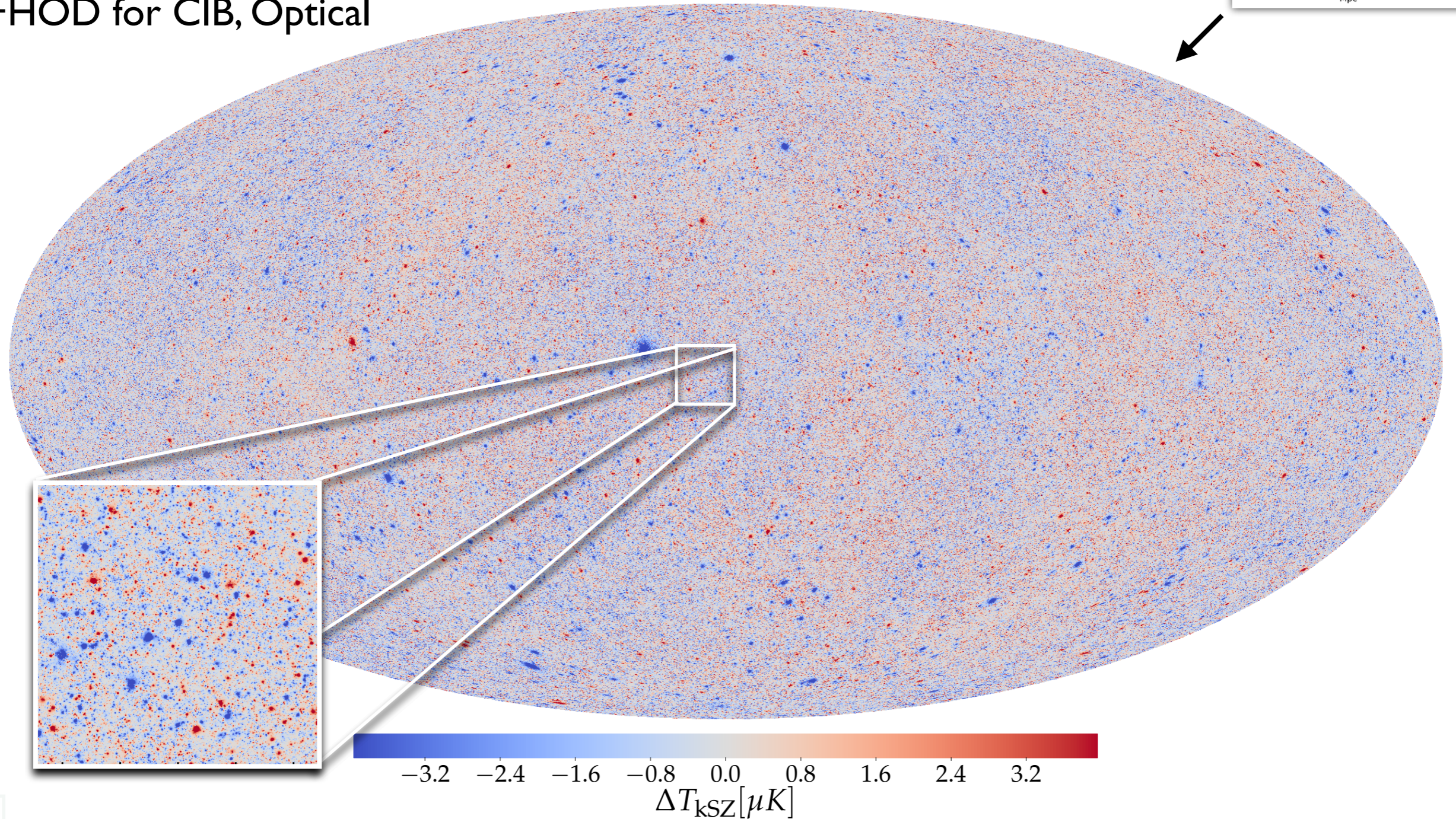
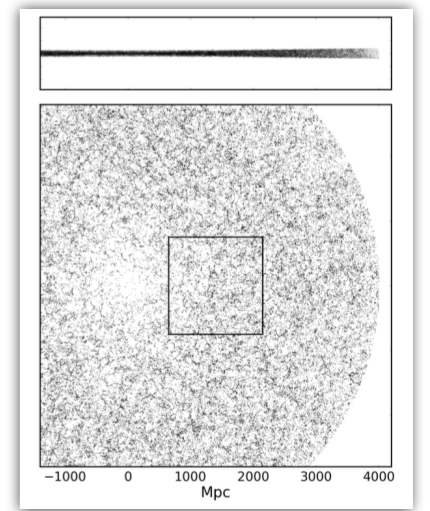
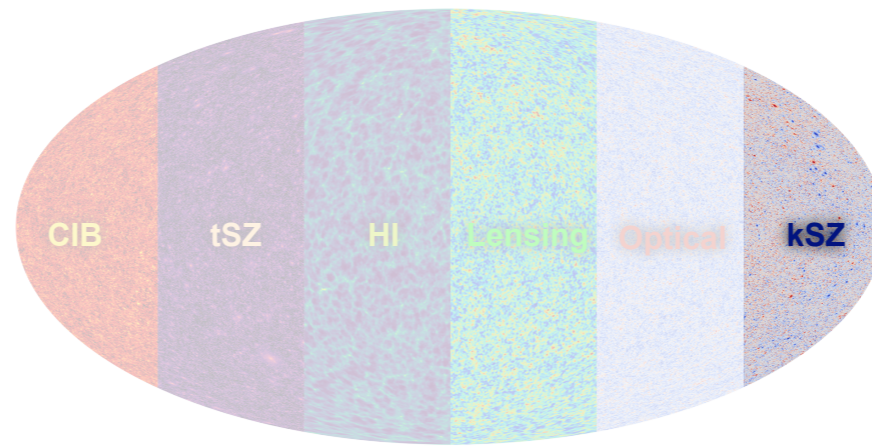




# Mapmaking from a Halo Catalogue

## Step 2:

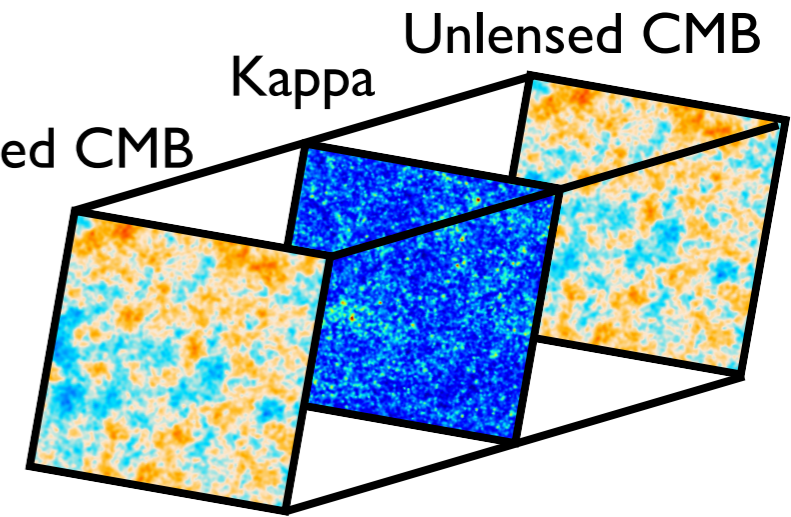
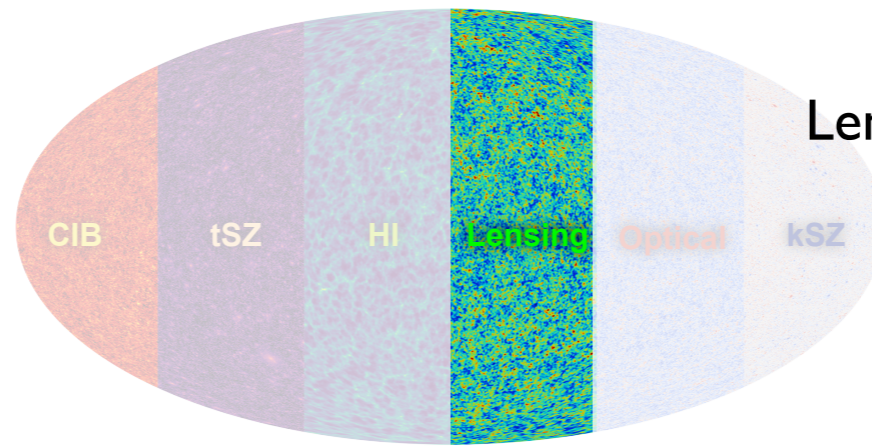
Same for kSZ, Kappa  
+HOD for CIB, Optical





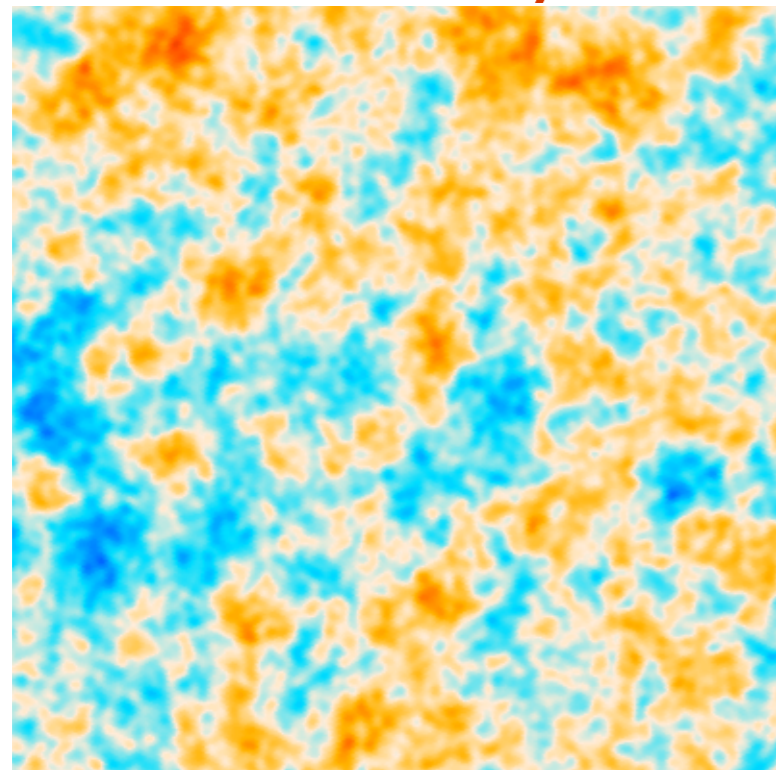
# Weak Lensing

Louis Pham, Alex van Engelen, George Stein, Marcelo Alvarez, Dick Bond

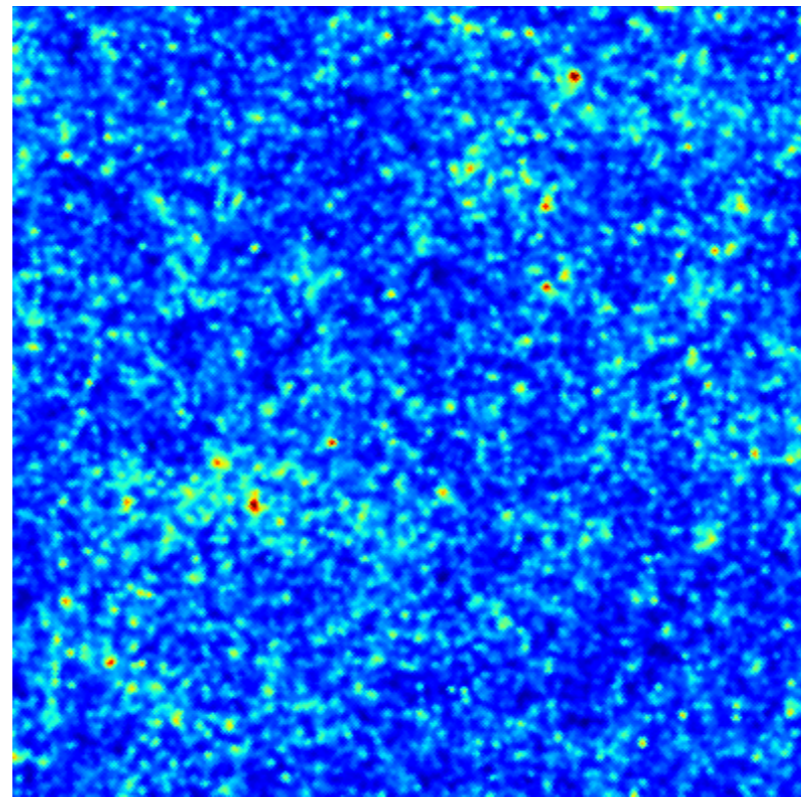


Full Sky Kappa Map from Peak Patch Sims

Unlensed CMB  
Preliminary



Kappa



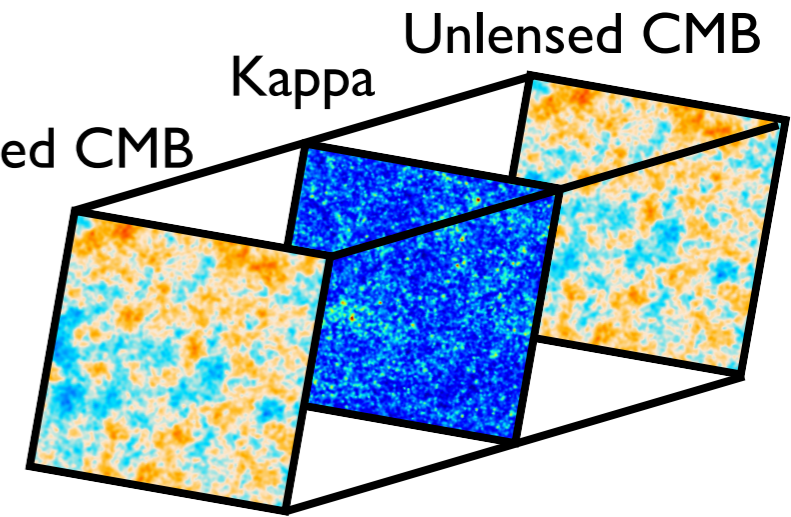
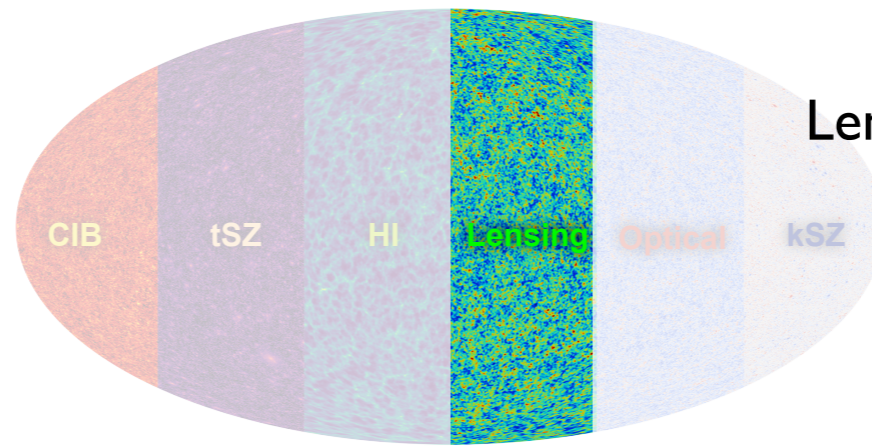
10 deg





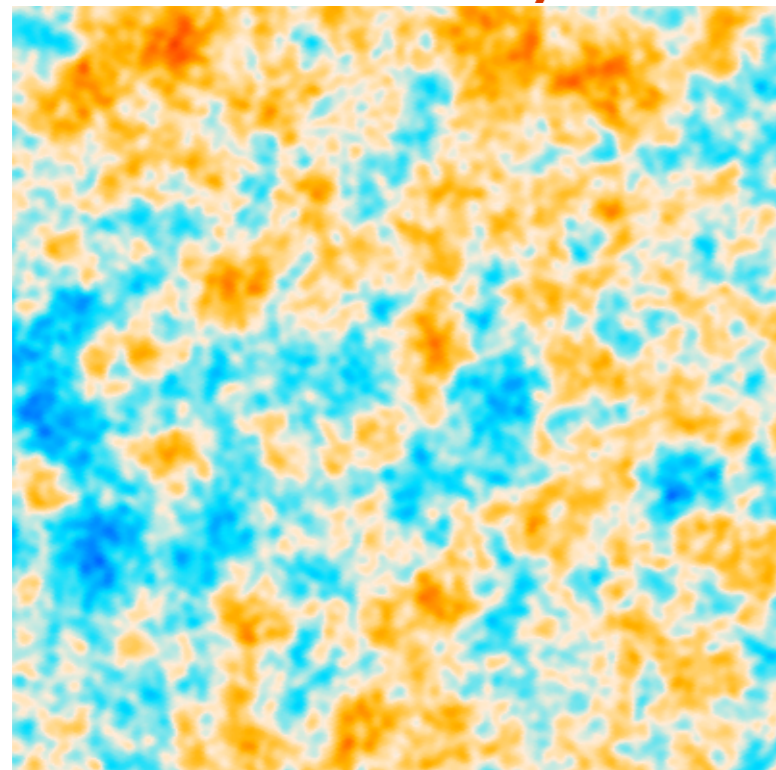
# Weak Lensing

Louis Pham, Alex van Engelen, George Stein, Marcelo Alvarez, Dick Bond

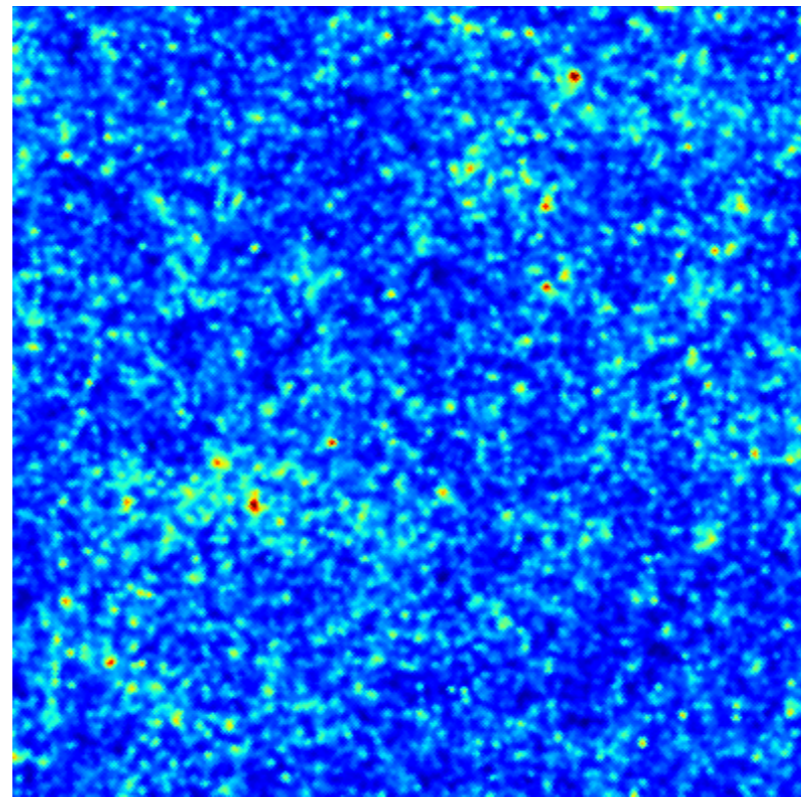


Full Sky Kappa Map from Peak Patch Sims

lensed CMB  
Preliminary



Kappa



10 deg

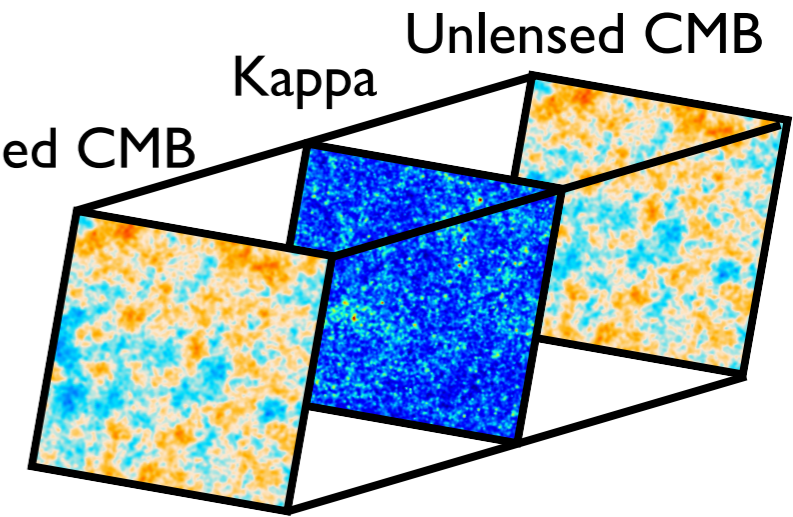
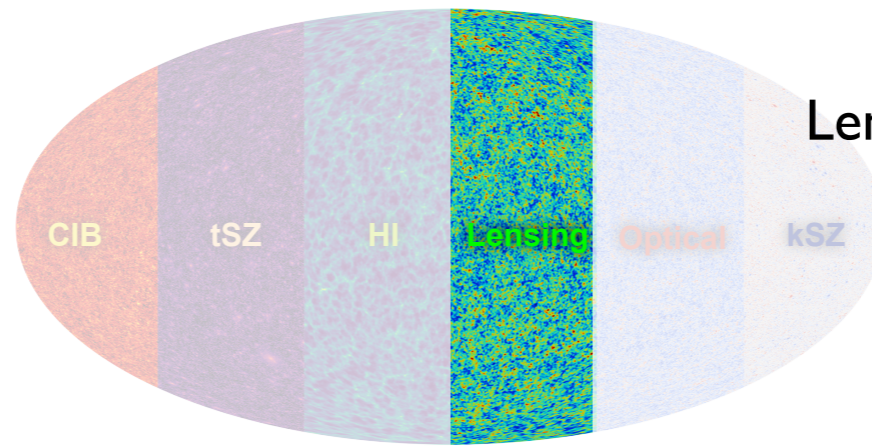
-560  $\mu K$  560





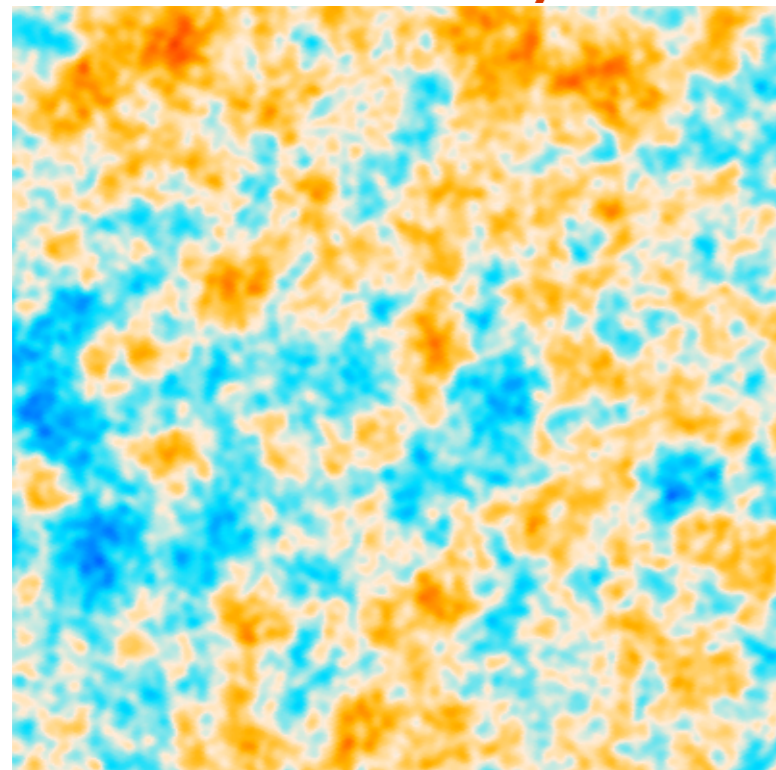
# Weak Lensing

Louis Pham, Alex van Engelen, George Stein, Marcelo Alvarez, Dick Bond

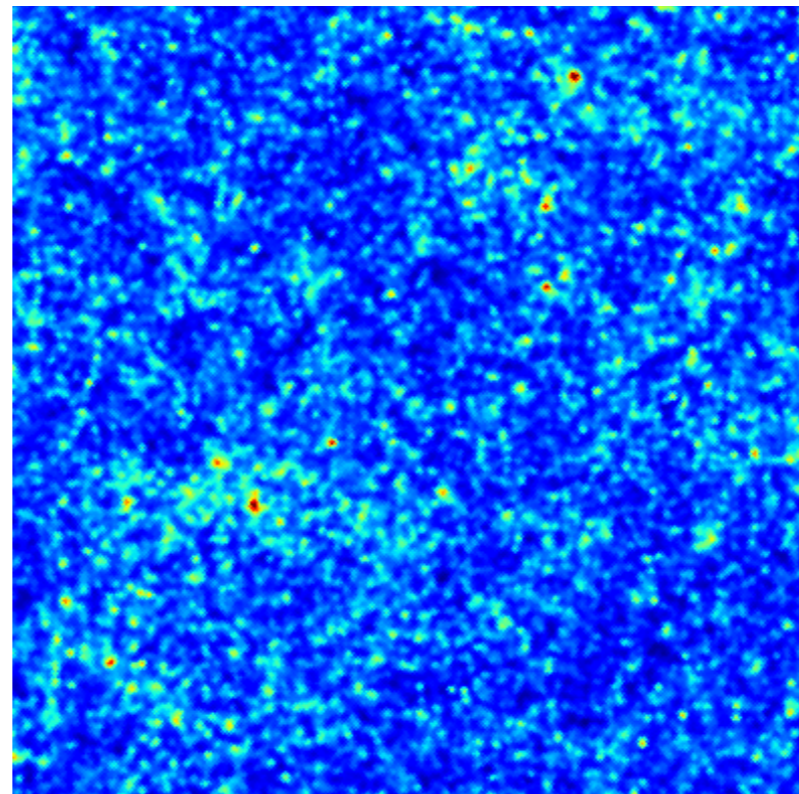


Full Sky Kappa Map from Peak Patch Sims

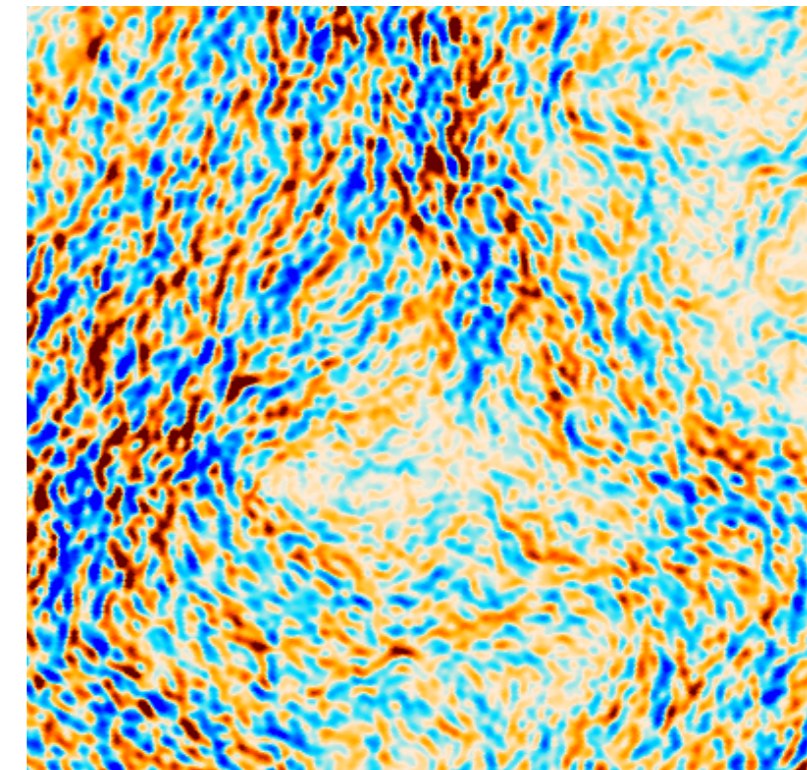
lensed CMB  
Preliminary



Kappa



Difference Map  
lensed - unlensed



-560  $\mu K$  560

10 deg

-25  $\mu K$  25





# Next Steps:

Octant runs to target higher redshifts ( $z < 4.6$ )

2LPT for field particles

- Available by end of month

## Available Products:

\*see Marcelo or George

### Halo catalogues & maps

- 320 fullskies ( $M > 2 \times 10^{13} M_{\text{sun}}/h$ ,  $z < 1.25$ )

NERSC /project/projectdirs/cmbs4/extra-galactic/halo\_catalogues

### Mapmaking code

- tSZ, kSZ, Kappa, CIB, Optical, HI, CO, +++

}

Alvarez et al. in prep

Sims being used for AdvACT, SO, SMB-S4, Euclid, LSST, CHIME, COMAP, CCAT-p, ...



Modular Code - builds upon any given halo profile/table & halo catalogue

- Hackathon

