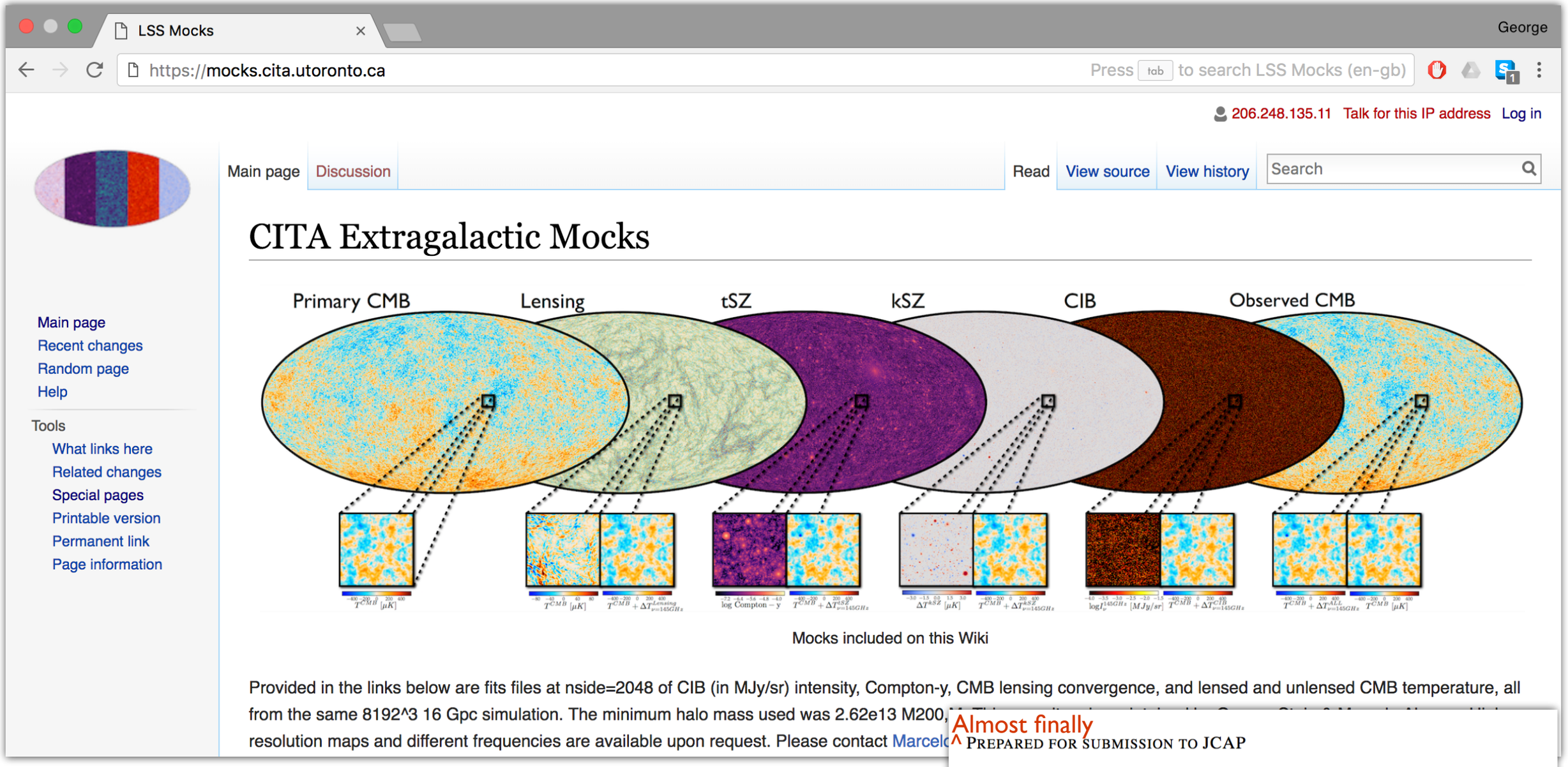
The WebSky Suite of Extragalactic CMB Mocks

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



Almost finally

^ PREPARED FOR SUBMISSION TO JCAP

The WebSky Suite of Extragalactic CMB Sky Simulations

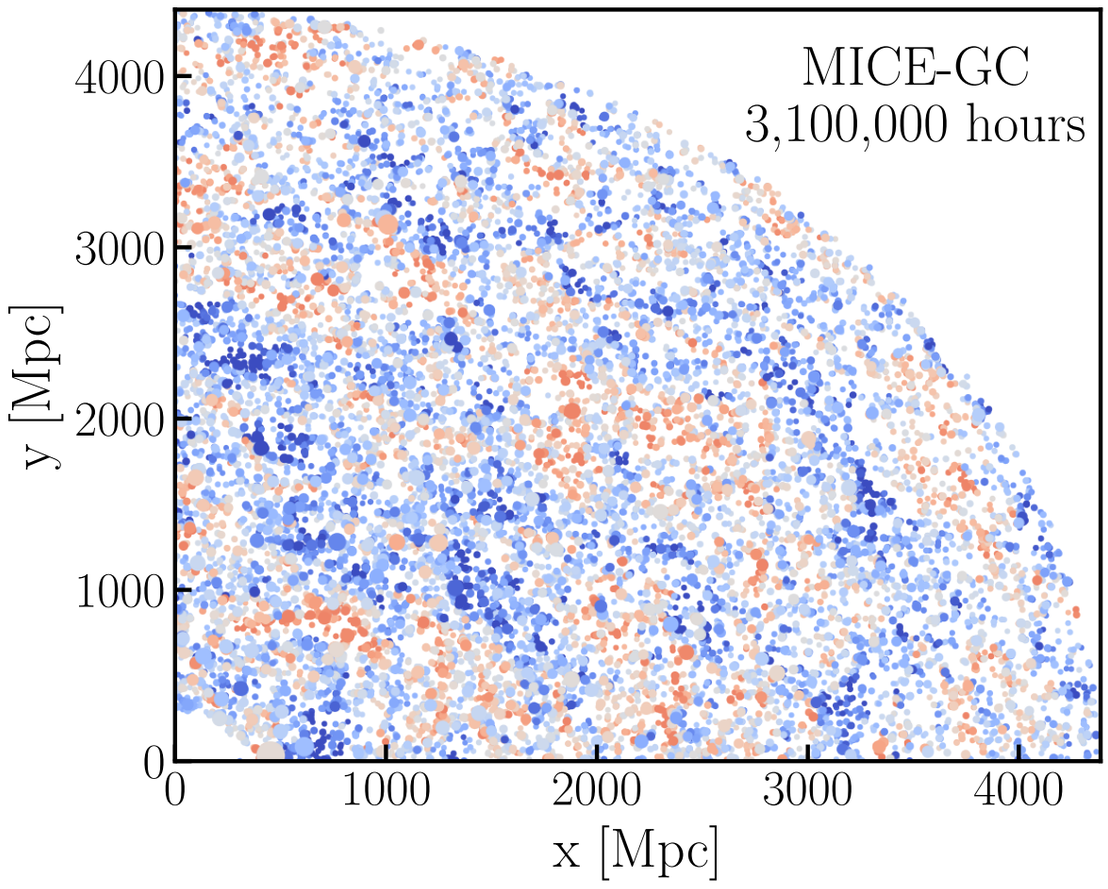
M. A. Alvarez,[a,1] J. R. Bond,[b] G. Stein,[b] A. Bahmanyar,[b] N. Battaglia,[c] A. Hajian,[b] L. Pham,[b] A. van Engelen[b]

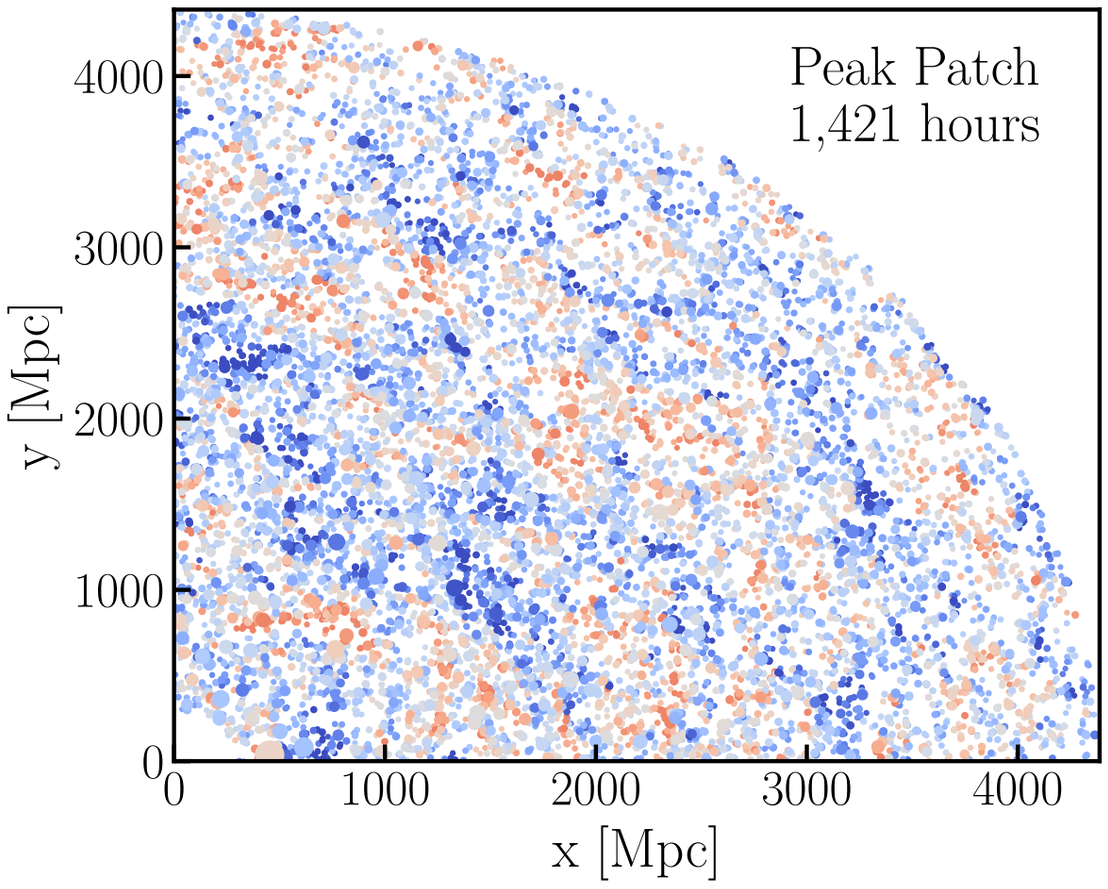
Paper Imminent

Halo Catalogue

* Many Peak Patch Full-sky catalogues available

z < 1.4 light-cone validation (3Gpc/h, 4096^3 particles)
size ∝ halo radius
colour ∝ peculiar velocity

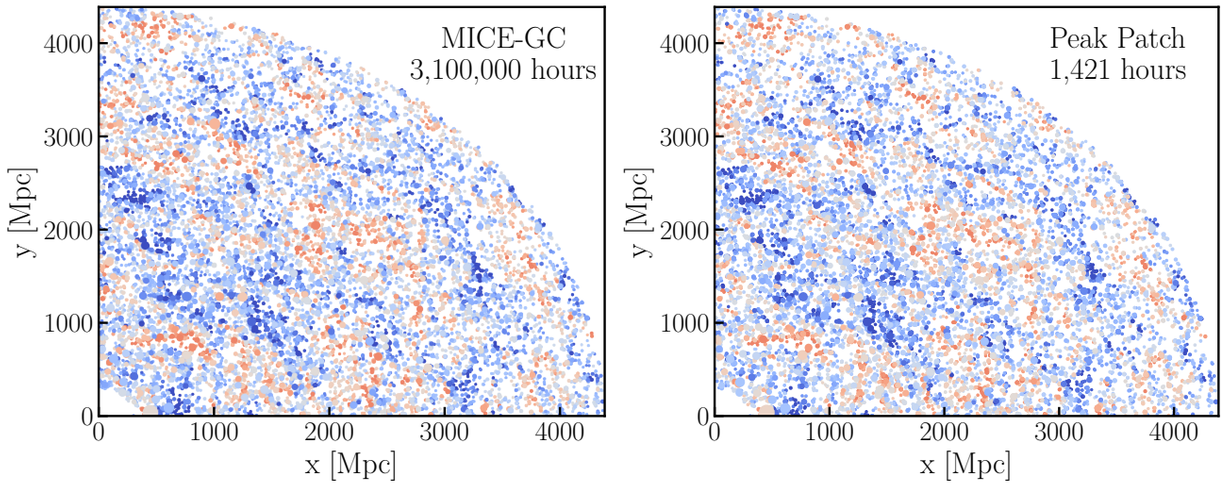




Validated with N-body at HMF+2point
+covariance+visual

Halo Catalogue

* Many Peak Patch Full-sky catalogues available



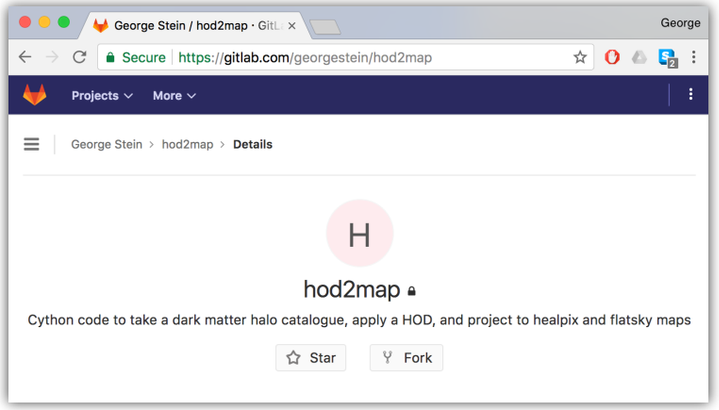
Validated with N-body at HMF+2point +covariance+visual

+

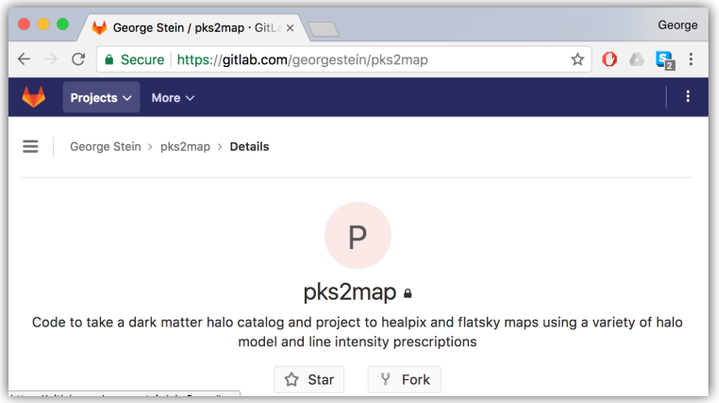
Mapmaking Codes

*Available to the collaboration

stochastic
HOD model



continuous density
&
pressure profiles



apply to each halo and project along the line of sight

Halo Catalogue

* Many Peak Patch Full-sky catalogues available

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

+

Mapmaking Codes

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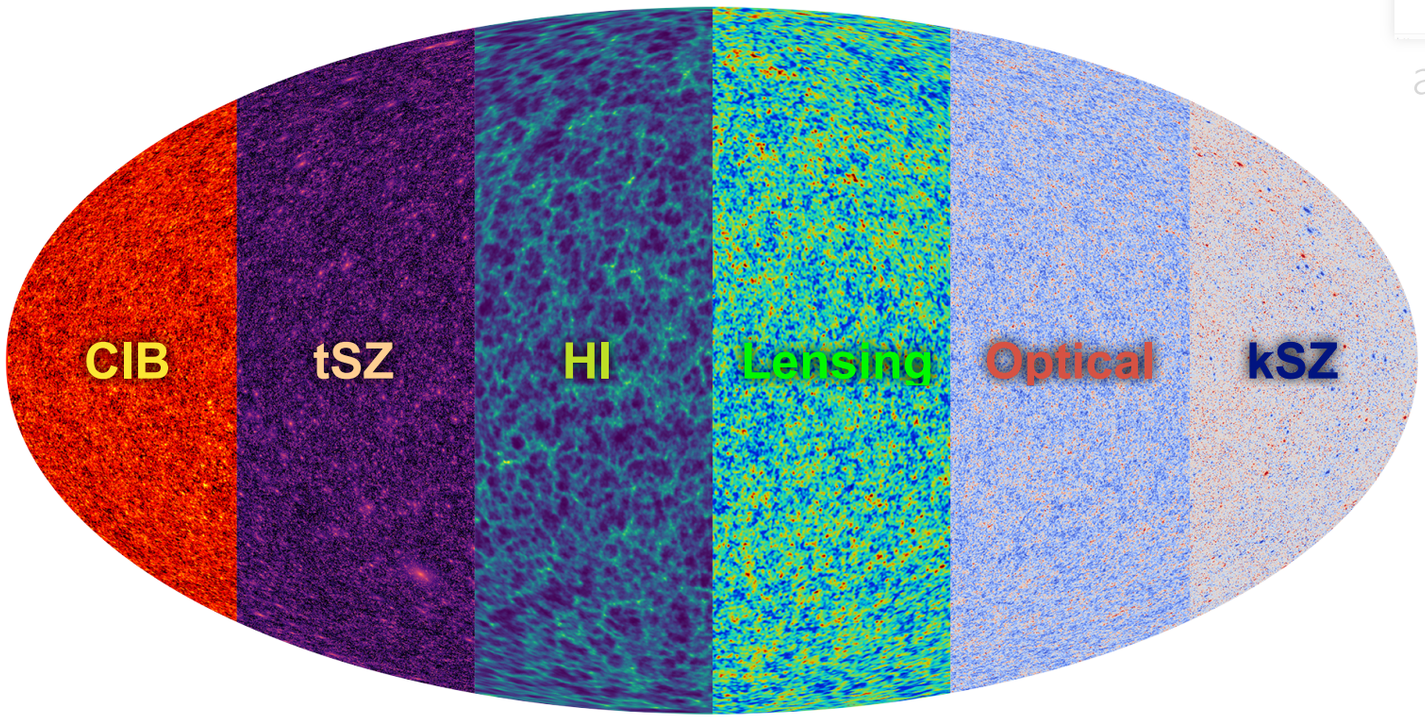
stochastic HOD model

continuous density & pressure profiles

apply to each halo and project along the line of sight

=



cross correlations automatically included!

Halo Catalogue

* Many Peak Patch Full-sky catalogues available

+

Mapmaking Codes

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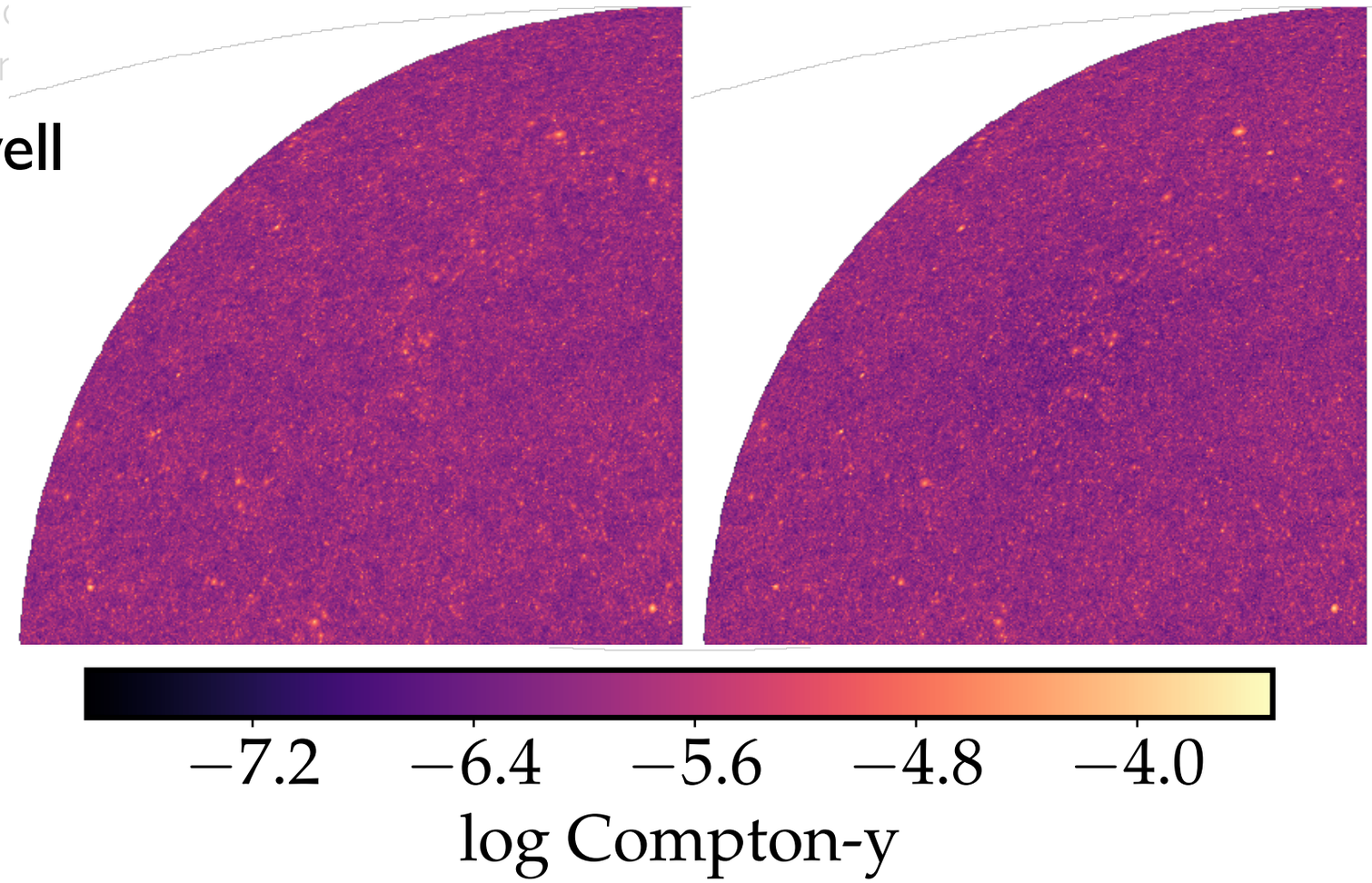
stochastic
HOD model

Validated with N-b
+covariar

o and project
e of sight

Mocks match very well with N-body



Halo Catalogue
* Many Peak Patch Full-sky catalogues available

+

Mapmaking Codes
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The WebSky Suite of Extragalactic CMB Mocks

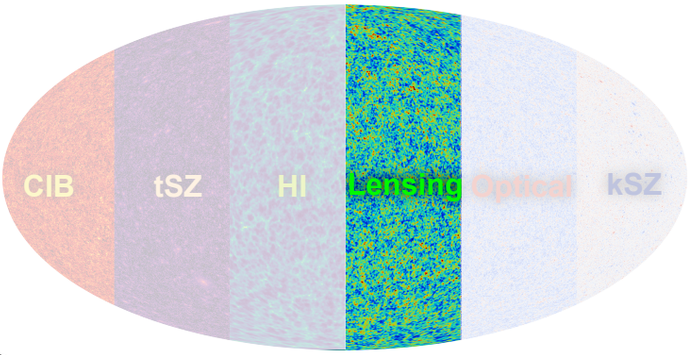
Fullsky, $z < 4.5$ light-cones

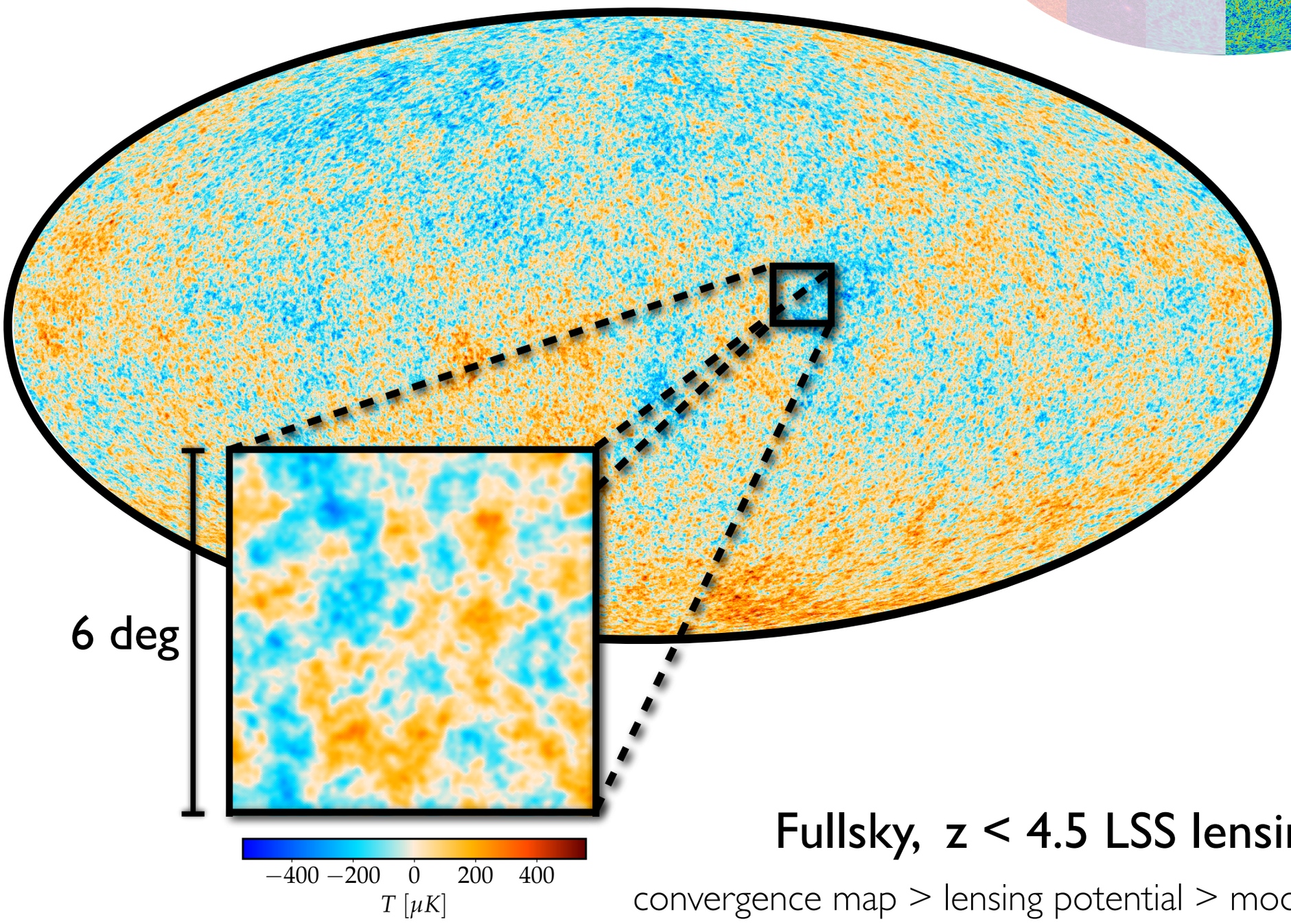
16Gpc, 8192^3 particles

$M_{halo} > 2.6 \times 10^{13} M_{sun}$

~10,000 compute hours each

Unlensed CMB

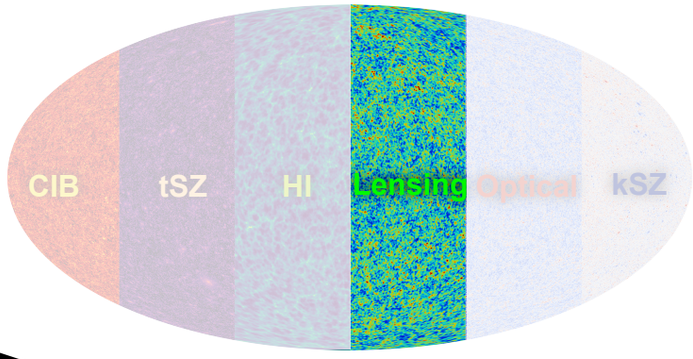


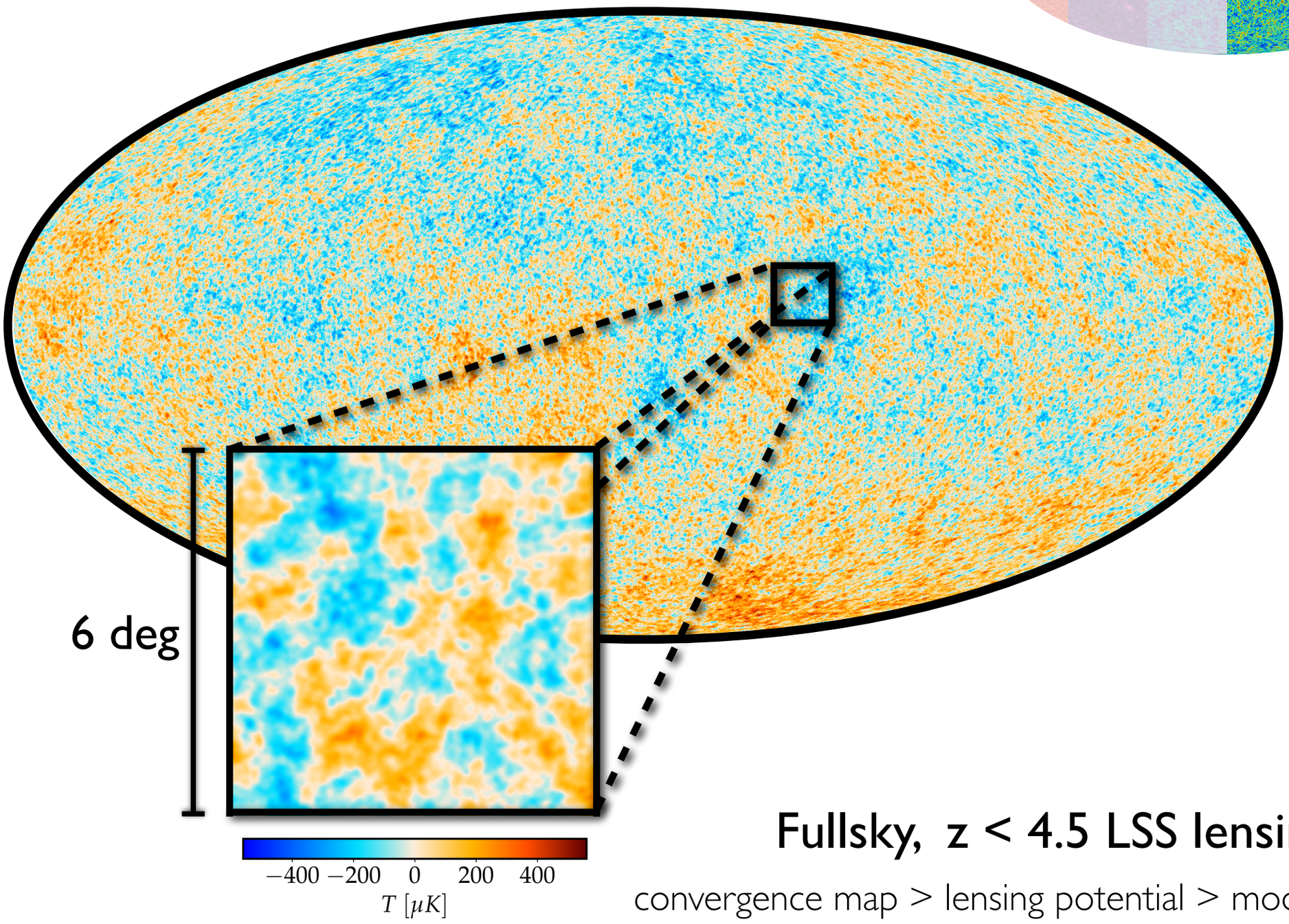


Fullsky, z < 4.5 LSS lensing

convergence map > lensing potential > modified lenspix

Lensed CMB

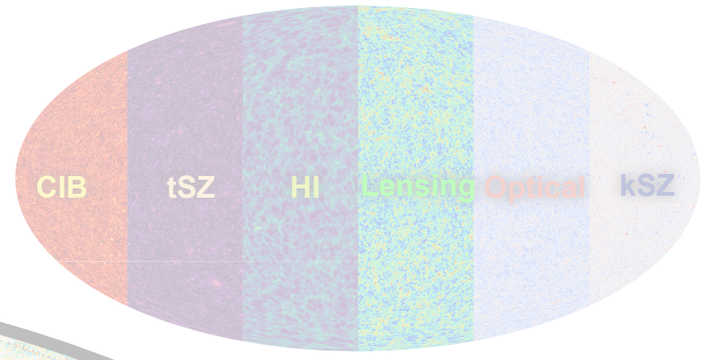


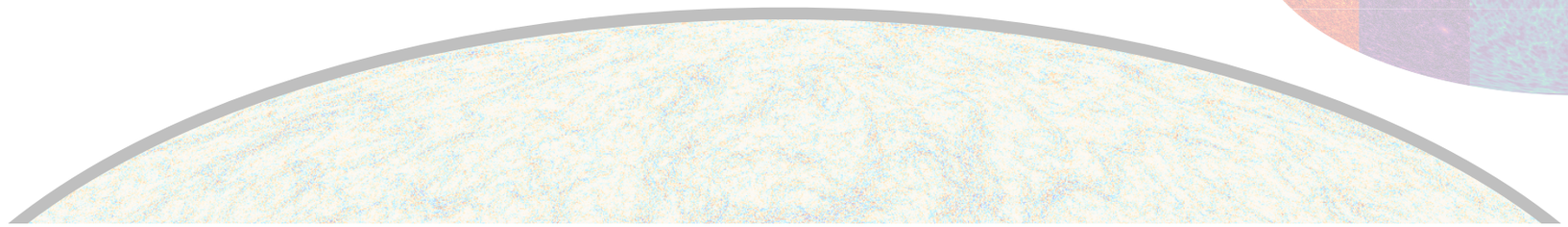


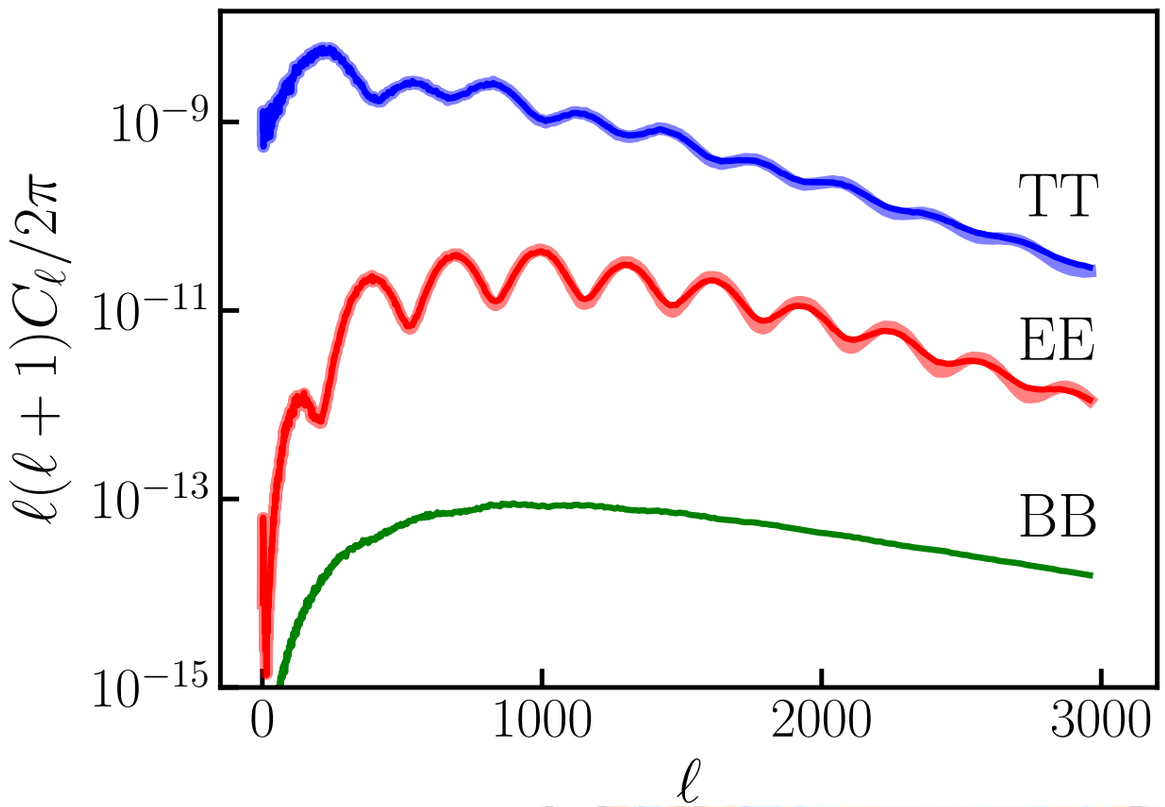
Fullsky, z < 4.5 LSS lensing

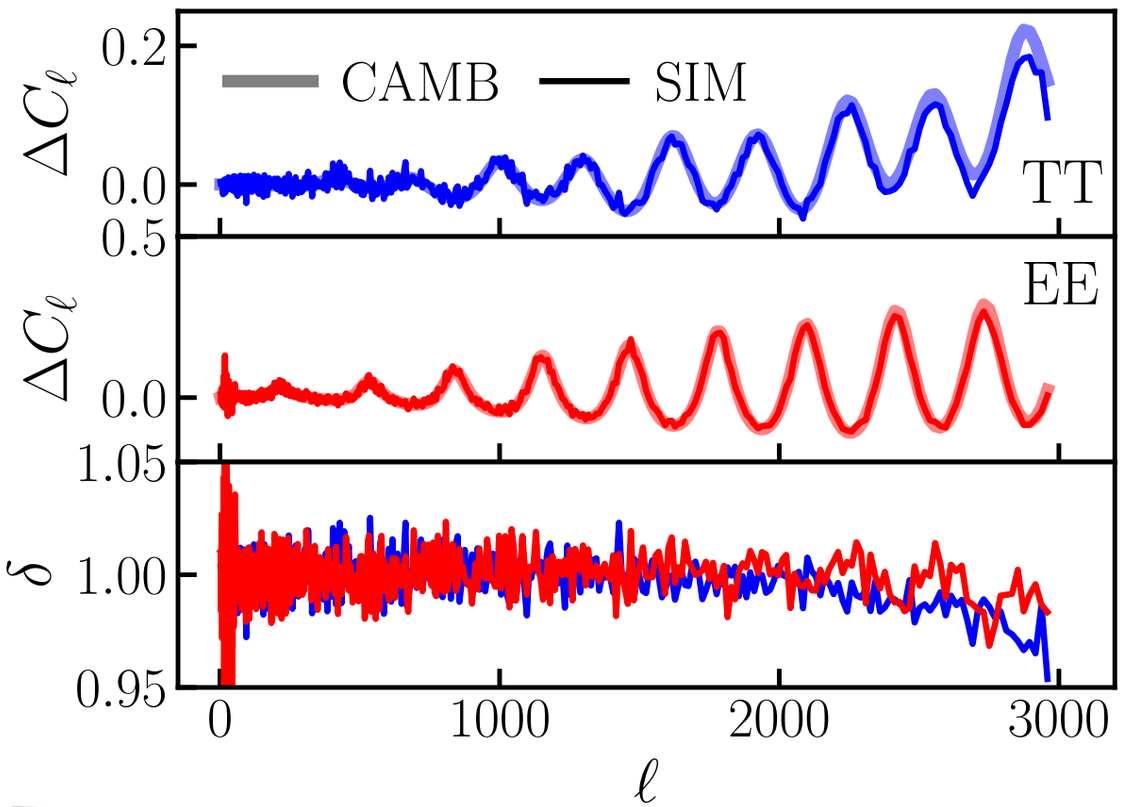
convergence map > lensing potential > modified lenspix

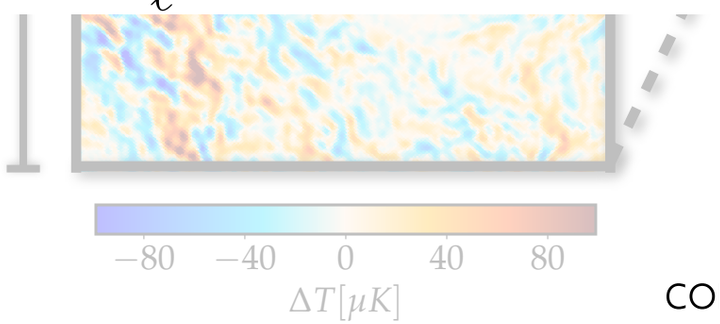
Lensing Difference











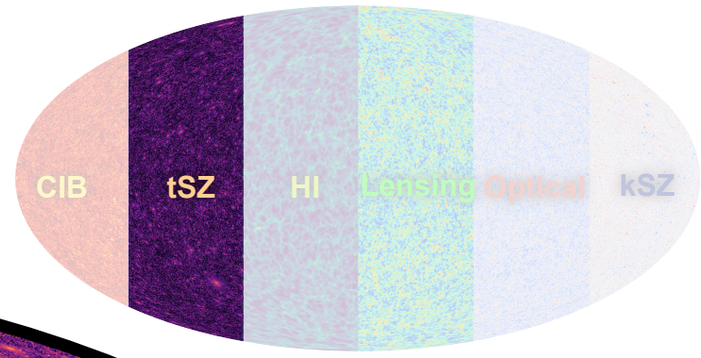
Fullsky, z < 4.5 LSS lensing

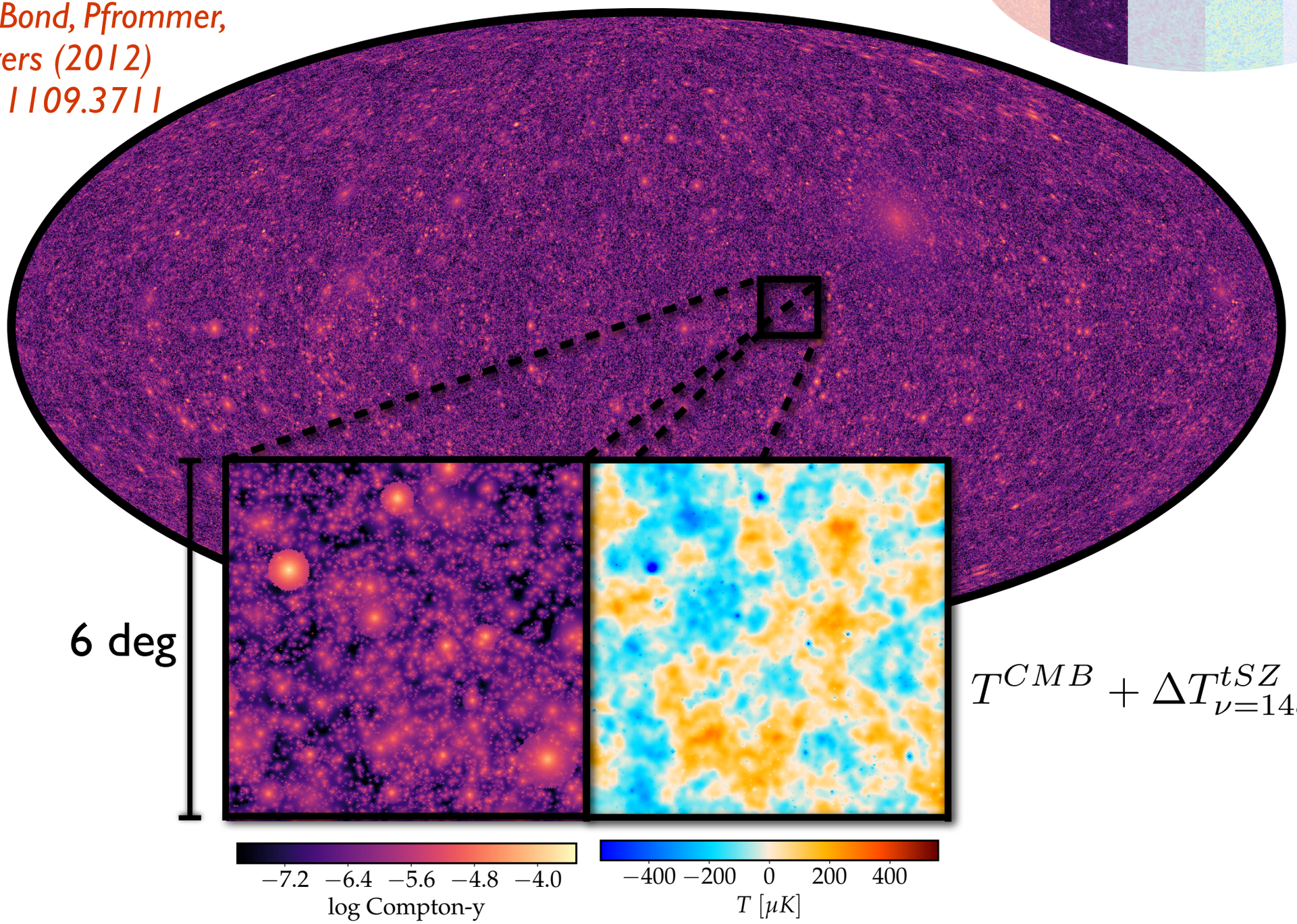
convergence map > lensing potential > modified lenspix

tSZ

Continuous gNFW pressure profile fit to gas dynamical sims

Battaglia, Bond, Pfrommer, Sievers (2012)
arxiv: 1109.3711



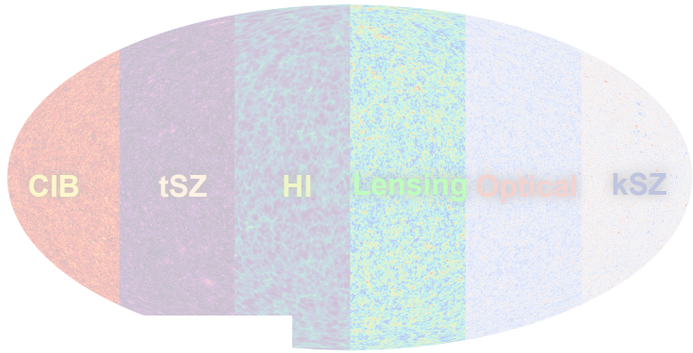


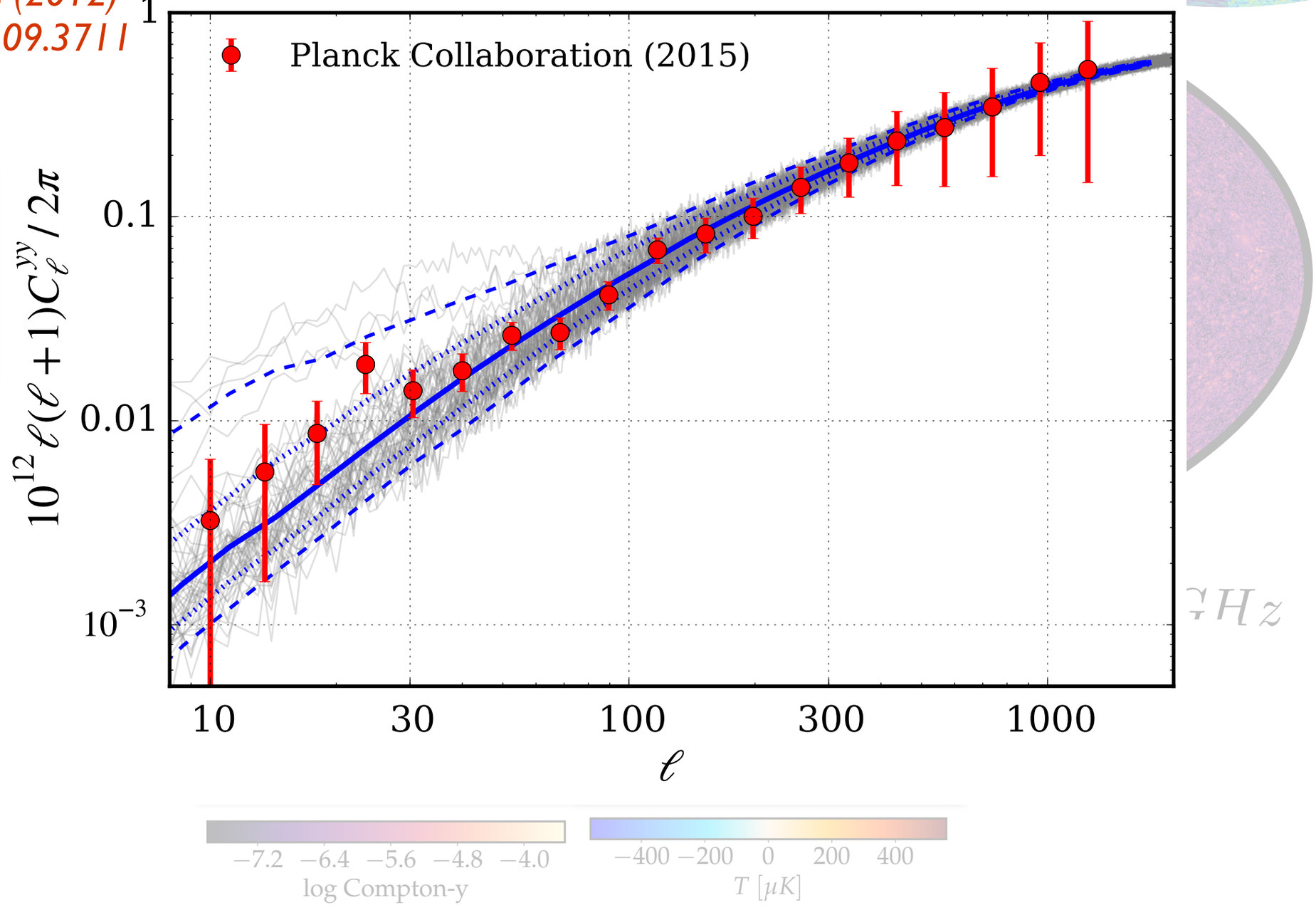
$$T^{CMB} + \Delta T^{tSZ}_{\nu=148GHz}$$

tSZ

Continuous gNFW pressure profile fit to gas dynamical sims

Battaglia, Bond, Pfrommer, Sievers (2012) arxiv: 1109.3711

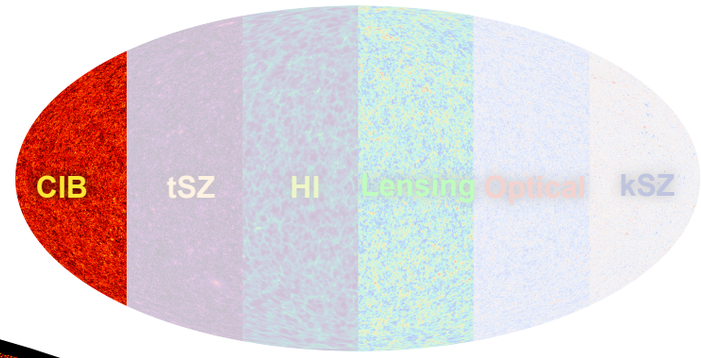


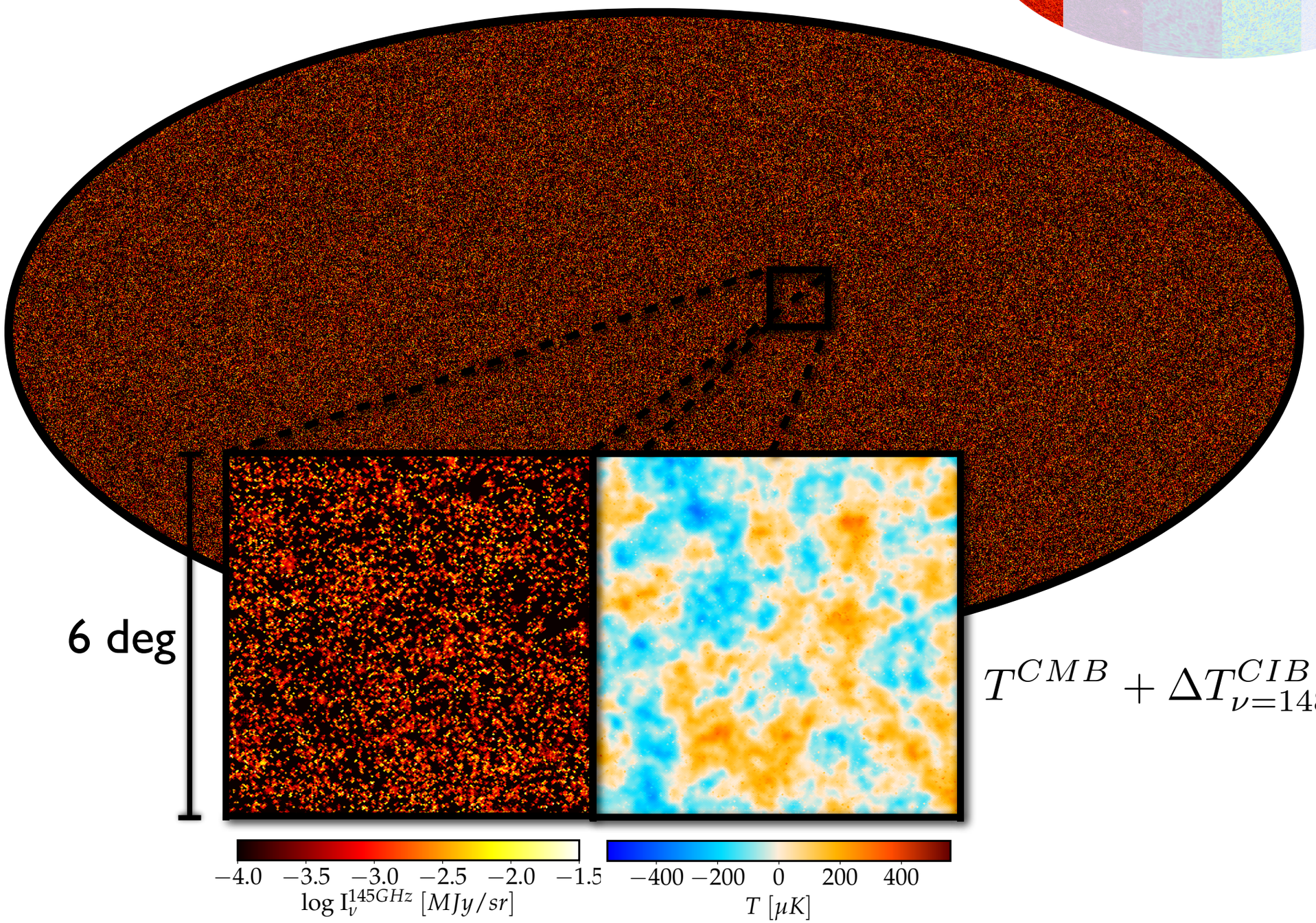


CIB

Stochastic Halo Occupation Distribution (HOD)

Planck 2013 (XXX) & 2015 (XXIII) models





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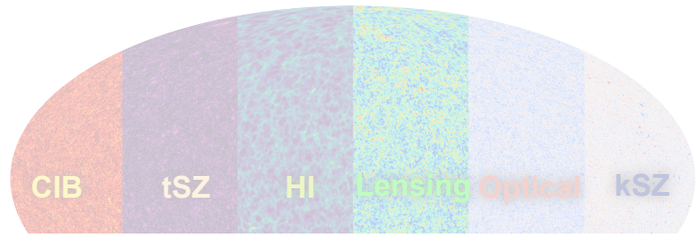
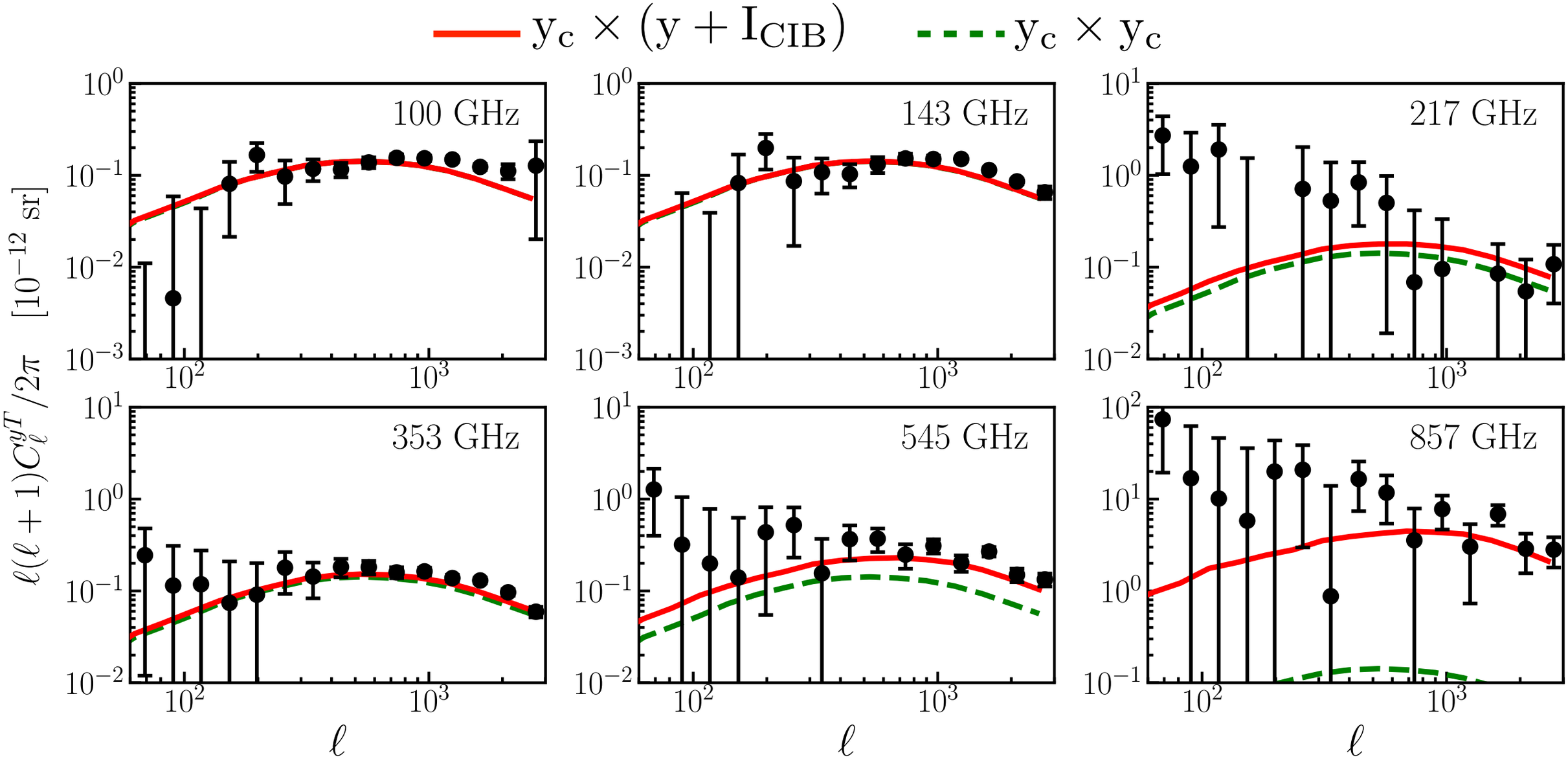




CIB x y (PSZ2 clusters)

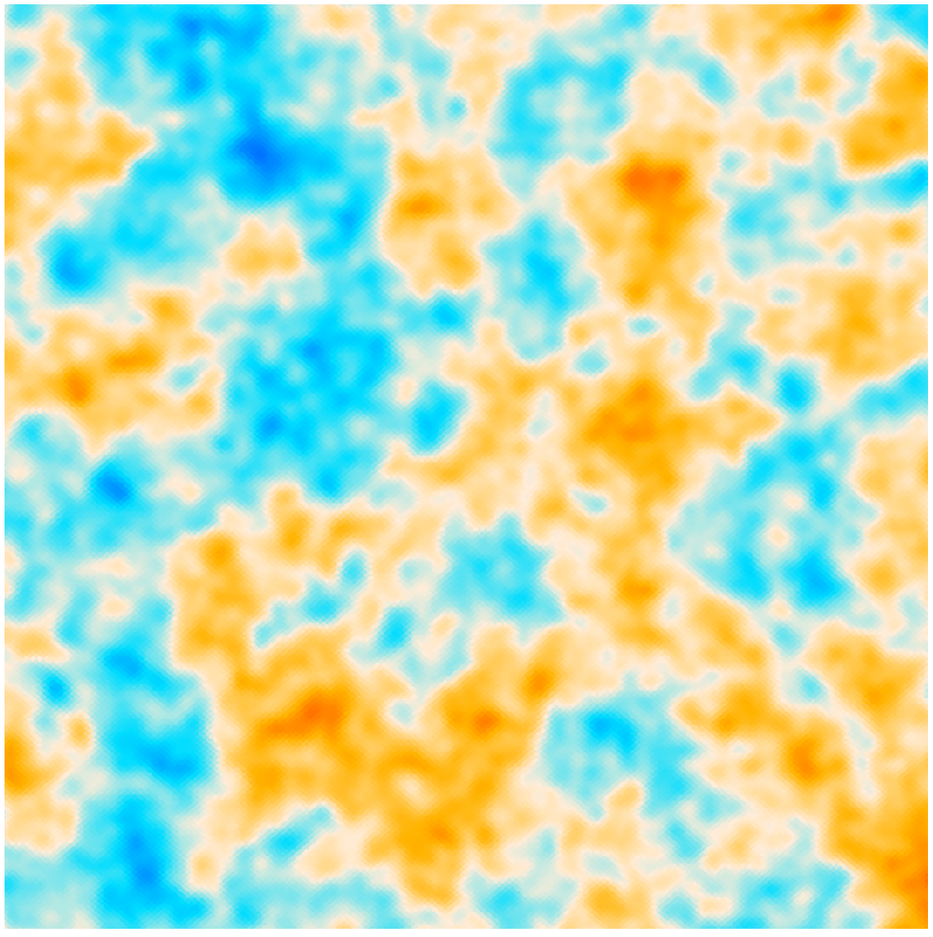
Matches Planck XXIII figure 12

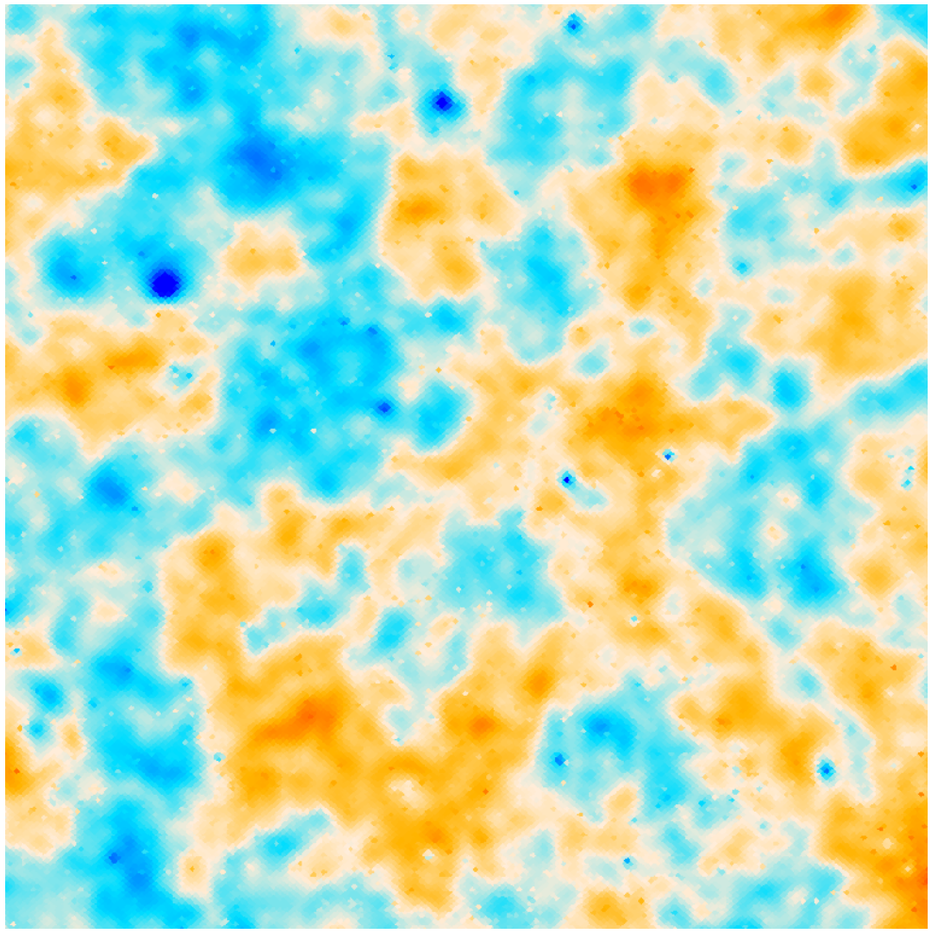
CMB without Extragalactic Foregrounds

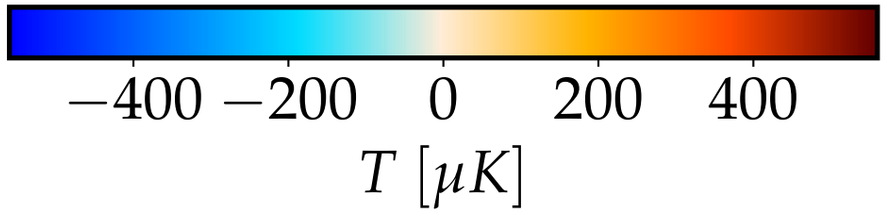
CMB with Extragalactic Foregrounds

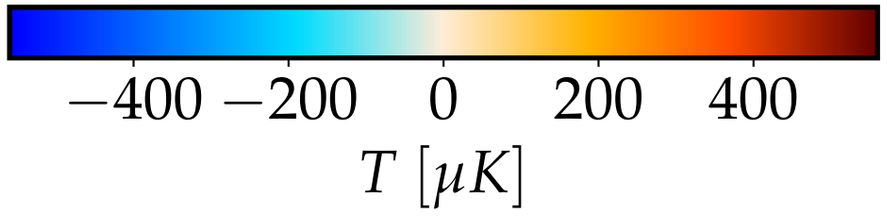
lensing + tSZ + kSZ + CIB

6 deg





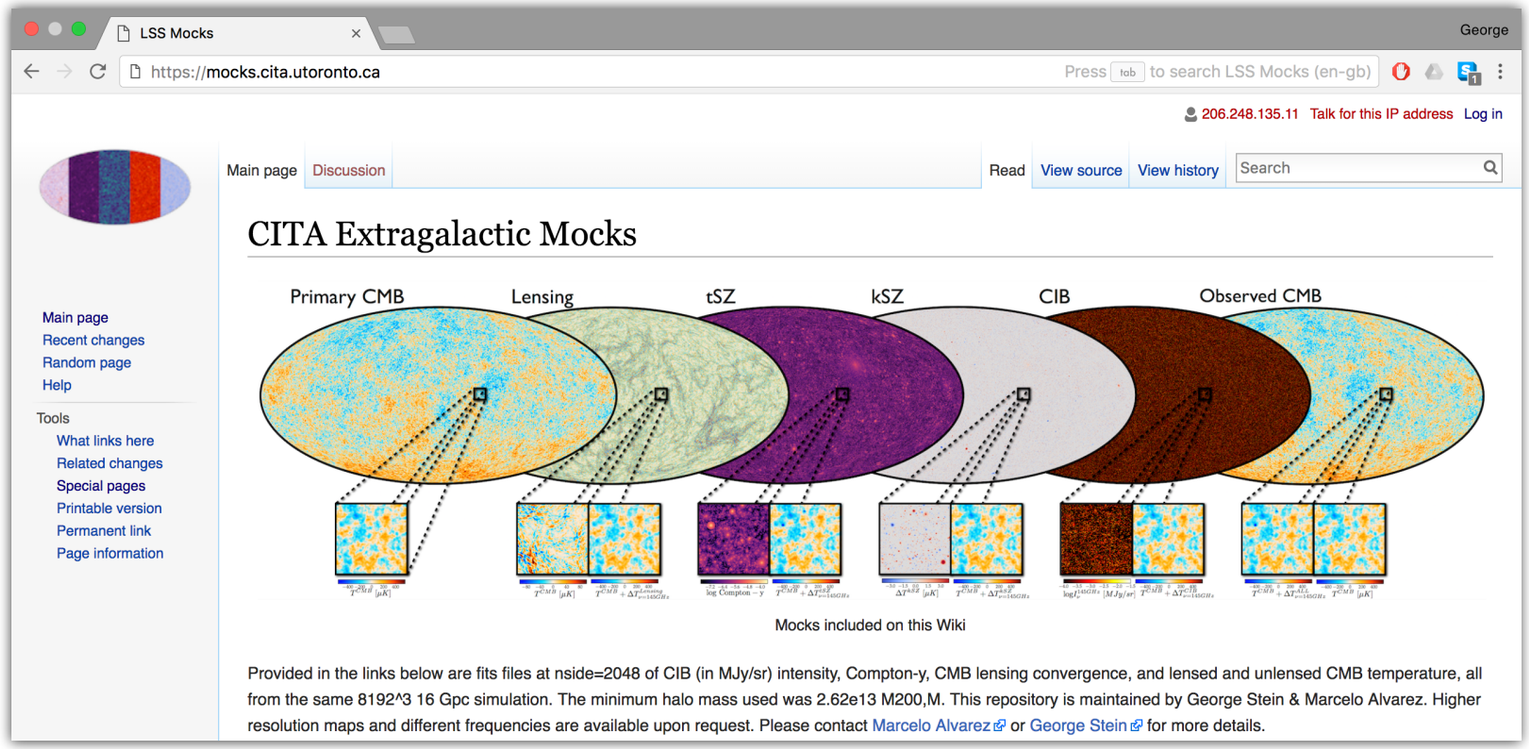




$\nu = 148GHz$

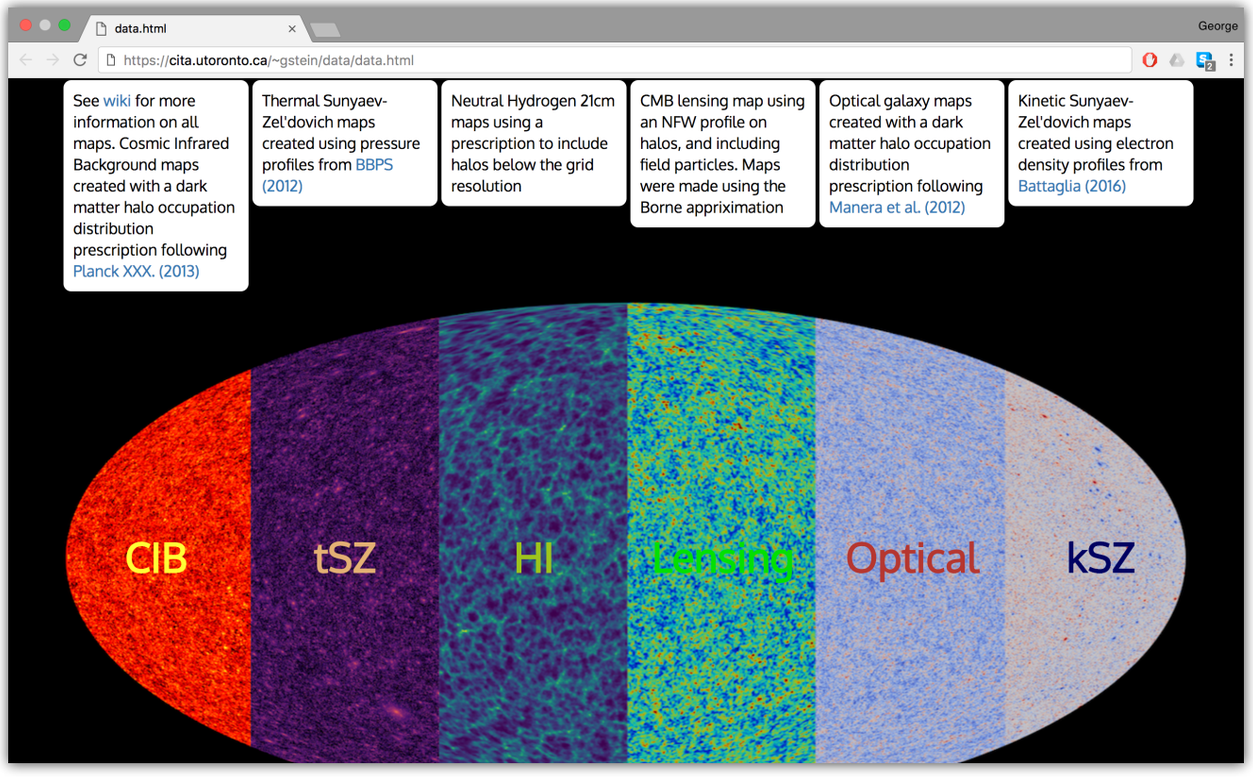
WebSky CMB Mocks

Available at
mocks.cita.utoronto.ca



Sims being used for EUCLID, ACT, SO, CMB-S4, COMAP, CHIME, CCAT-p, …

Or through my website at
cita.utoronto.ca/~gstein



Other useful links:
"Simulations of the Microwave Sky" - Sehgal et al 2009, https://lambda.gsfc.nasa.gov/toolbox/tb_sim_ov.cfm
Euclid halo + galaxy mocks - cosmohub, https://cosmohub.pic.es/, MICE-GC - http://maia.ice.cat/mice/grand_challenge.html