

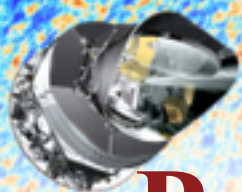
PLANCK

New CIB measurements of Planck 2015 Data

Daisy Mak, KICC/IoA, University of Cambridge

Collaborators:

Anthony Challinor, George Efstathiou, Guilaine Lagache



Power Spectrum Analysis of CIB from Planck

D.,M, Anthony Challinor, George Esftathiou, Guilaine Lagache 2015 (in prep)

The idea: *High frequency version of CMB likelihood analysis, but with main focus on CIB.*

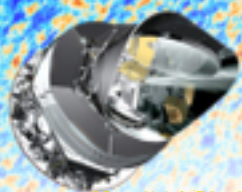
Models of the high frequency sky:

$$*D_\ell \equiv \ell(\ell + 1)C_\ell/(2\pi)$$

$$D_\ell^{\text{th}, \nu \times \nu'} = D_\ell^{\text{clu, CIB}, \nu \times \nu'} + D_\ell^{\text{Dust}, \nu \times \nu'} + D_\ell^{\text{CMB}, \nu \times \nu'} + D_\ell^{\text{PS}, \nu \times \nu'}$$

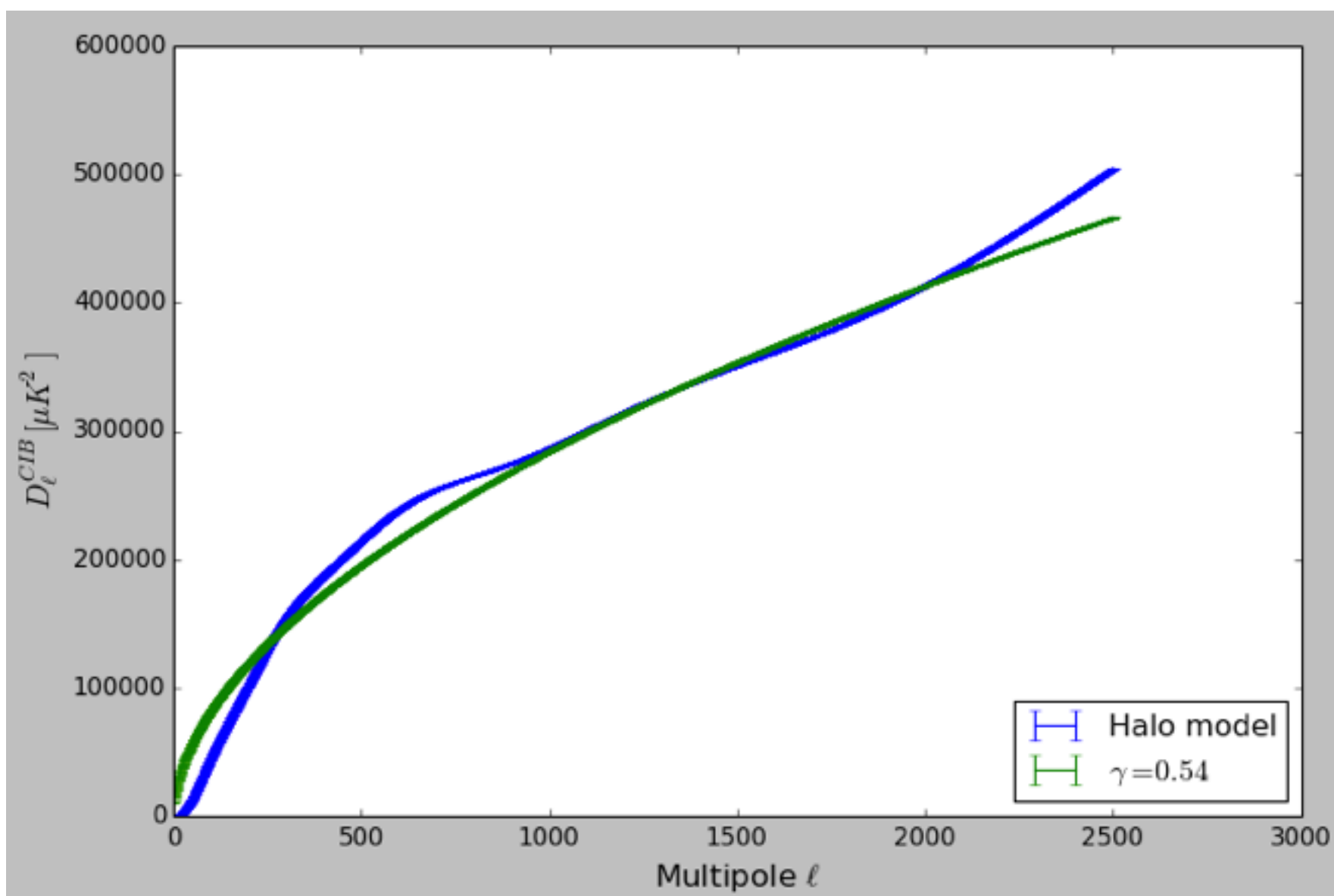
Objectives:

- * Updated measurements of CIB power spectrum over 1/2 sky using Planck data only at 353-857 GHz
- * Full likelihood analysis (CAMSPEC + CosmoMC)
- * Probe CIB, Galactic Dust, Point sources properties



CIB models

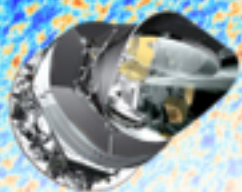
$$D_{\ell}^{\text{th}, \nu \times \nu'} = D_{\ell}^{\text{clu, CIB}, \nu \times \nu'} + D_{\ell}^{\text{Dust}, \nu \times \nu'} + D_{\ell}^{\text{CMB}, \nu \times \nu'} + D_{\ell}^{\text{PS}, \nu \times \nu'}$$



1. Parametric

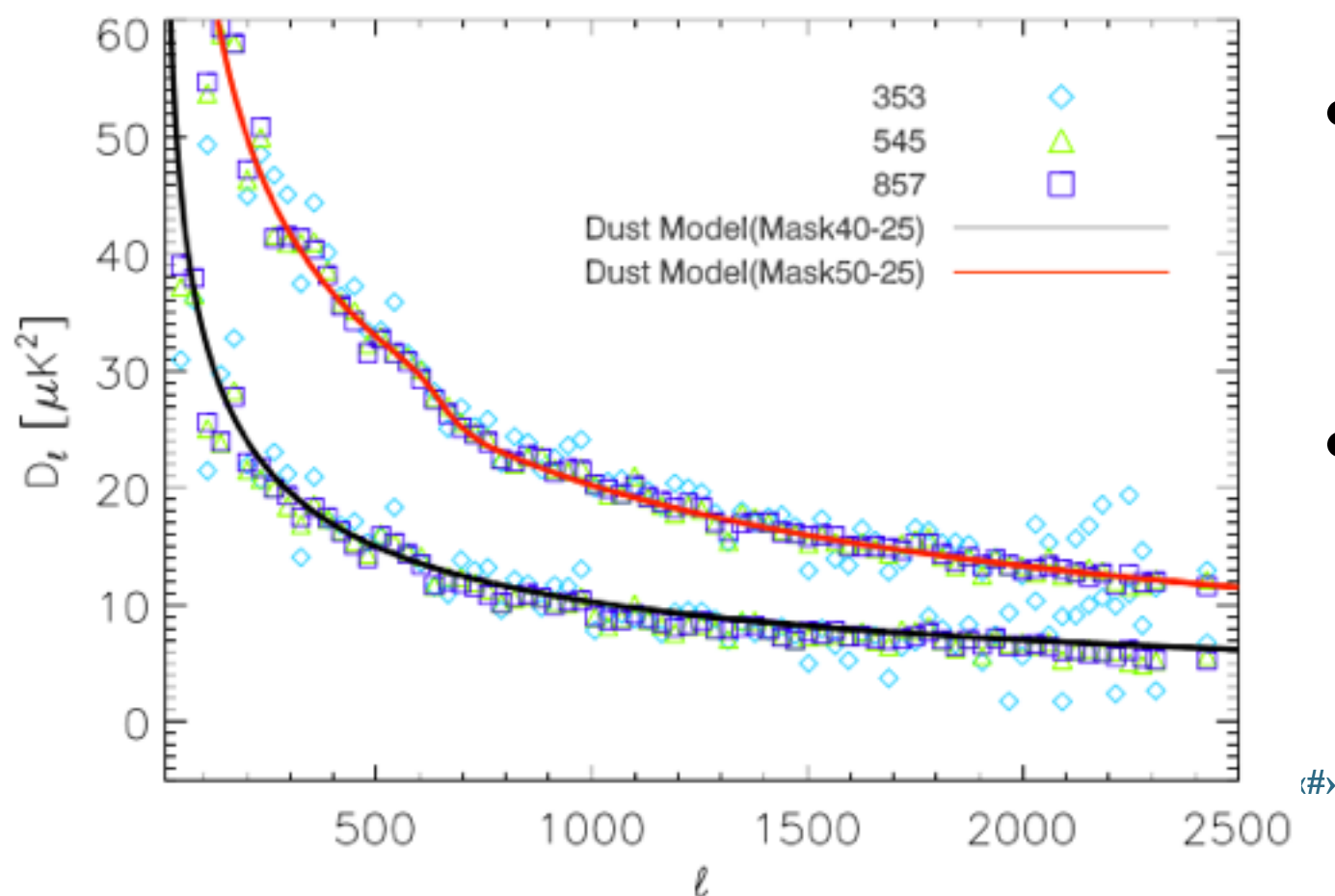
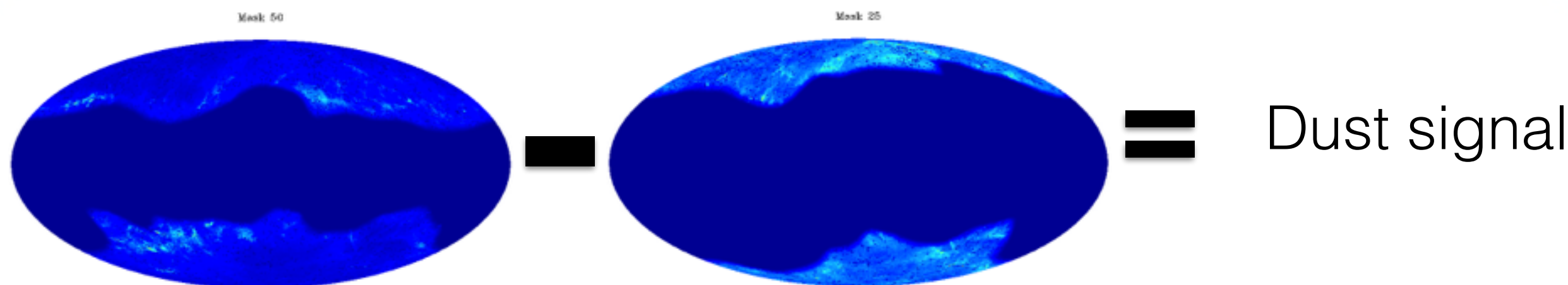
$$D_{\ell}^{\text{clu, CIB}, \nu \times \nu'} = A_{\ell}^{\text{CIB}, \nu \times \nu'} \left(\frac{\ell}{2000} \right)^{\gamma_{\text{CIB}}}$$

2. Template shape from Planck 2013 CIB



Foreground 1: Galactic Dust PLANCK

$$D_{\ell}^{\text{th}, \nu \times \nu'} = D_{\ell}^{\text{clu, CIB}, \nu \times \nu'} + D_{\ell}^{\text{Dust}, \nu \times \nu'} + D_{\ell}^{\text{CMB}, \nu \times \nu'} + D_{\ell}^{\text{PS}, \nu \times \nu'}$$



- Mask difference gives anisotropic signal: Galactic
- Dust template is universal among frequency and sky area, up to 50% of sky

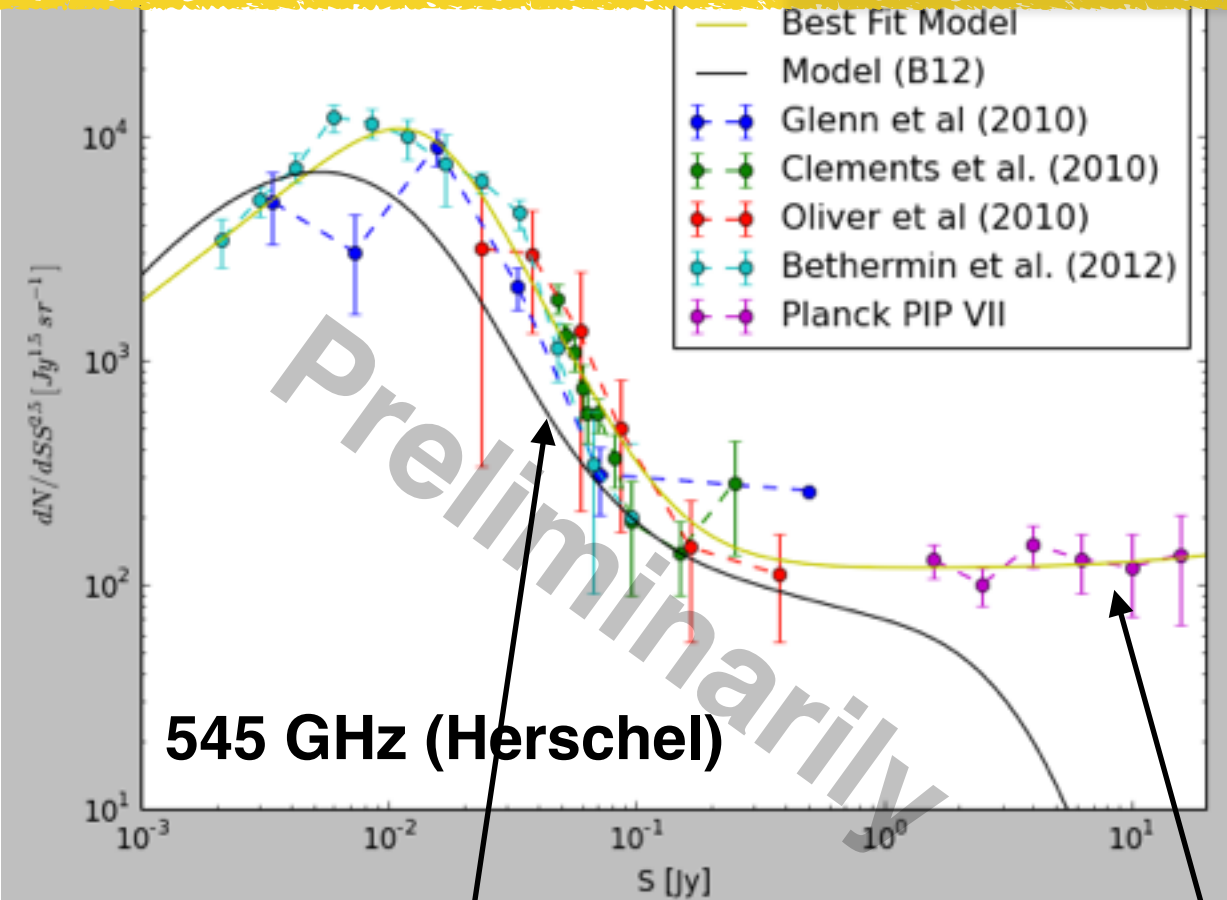


Foreground 2: Infrared Point sources

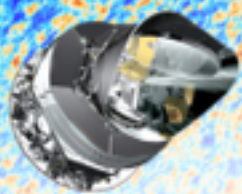
PLANCK

$$D_{\ell}^{\text{th},\nu\times\nu'} = D_{\ell}^{\text{clu,CIB},\nu\times\nu'} + D_{\ell}^{\text{Dust},\nu\times\nu'} + D_{\ell}^{\text{CMB},\nu\times\nu'} + D_{\ell}^{\text{PS},\nu\times\nu'}$$

$$C_{\ell} = \text{constant} = \int_0^{S_{\text{cut}}} \frac{dN}{dS} S^2 dS$$

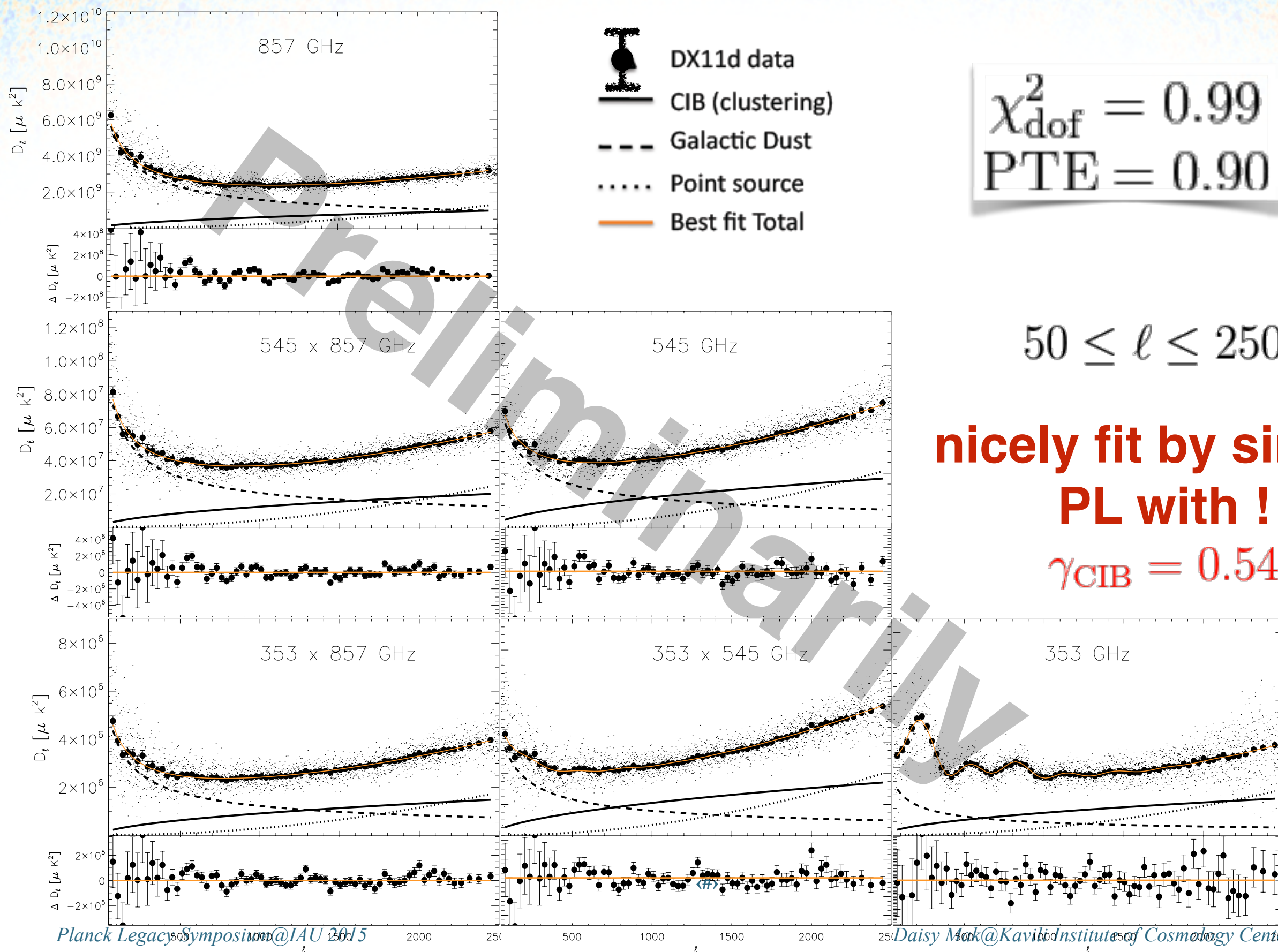


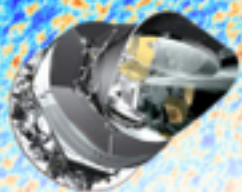
freq [GHz]	Planck 2013	B12 model	source count
353 [Jy/sr]	262	225	247 ₋₁₈₃ ⁺³¹¹
545 [Jy/sr]	1690	1454	1860 ₋₁₆₁₈ ⁺²¹⁰⁴
857 [Jy/sr]	5364	5628	6713 ₋₆₂₅₀ ⁺⁷¹⁷⁷



PLANCK

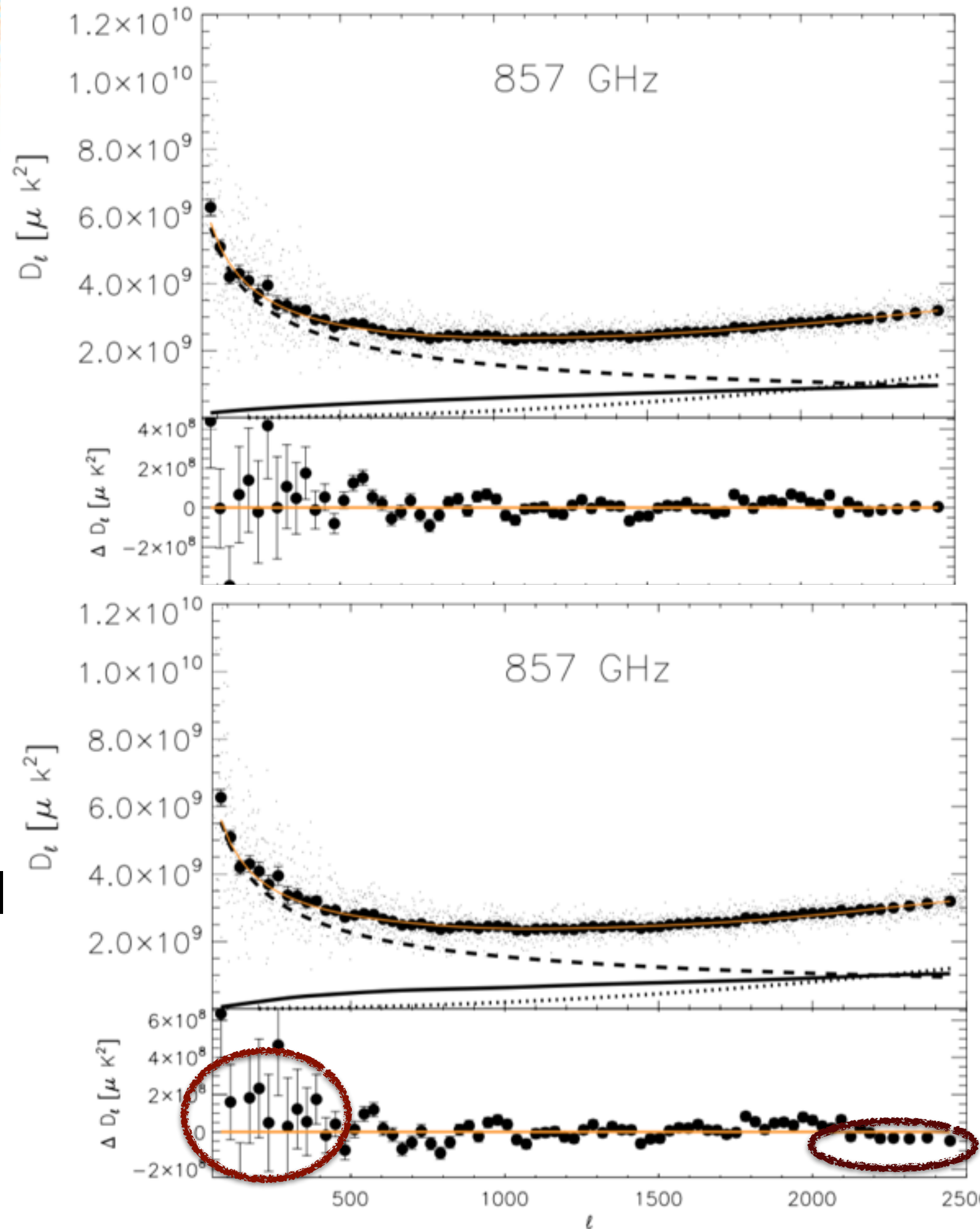
New CIB spectra. Now...at 40% sky

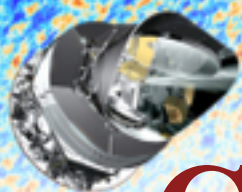




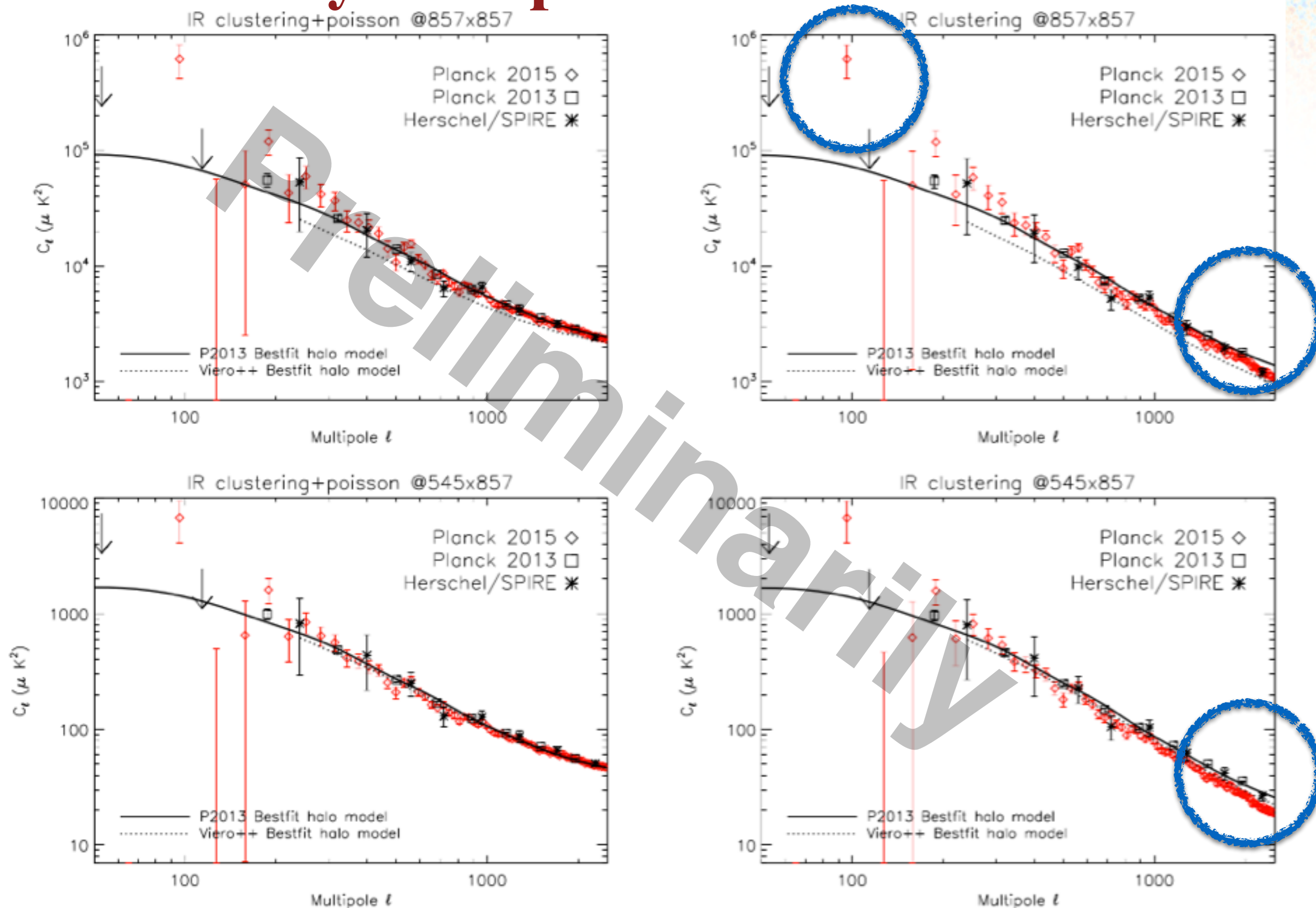
Parametric vs Halo model (template)

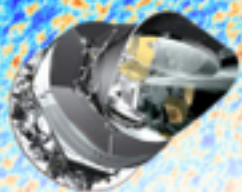
0.8 σ shift between model





Consistency with previous measurements

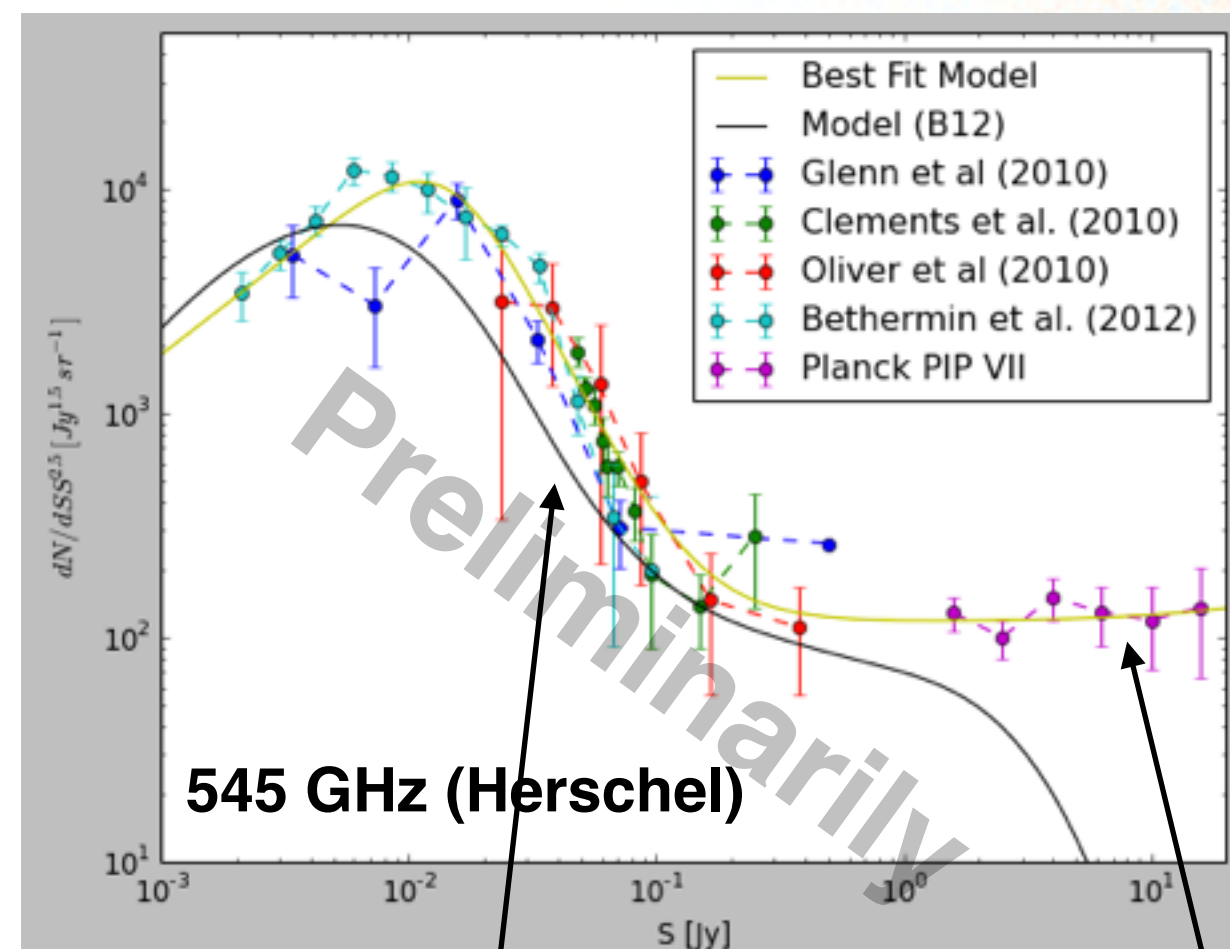




Updated Poisson levels

Our results are:

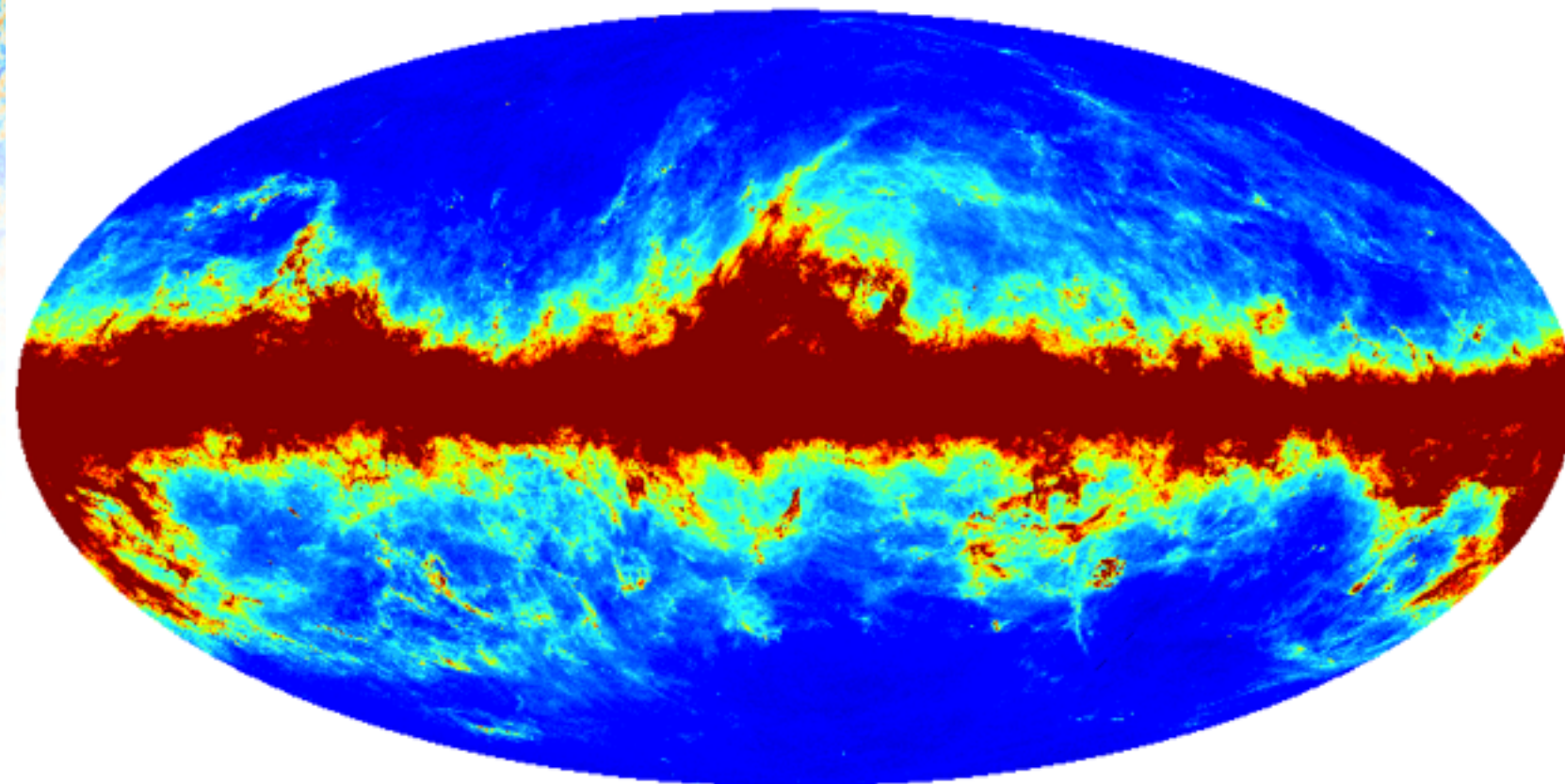
1. consistent with source count measurements!
2. always above Planck 2013& model prediction



freq [GHz]	This work	Planck 2013	B12 model	source count
353 [Jy/sr]	282	262	225	247 ₋₁₈₃ ⁺³¹¹
545 [Jy/sr]	1883	1690	1454	1860 ₋₁₆₁₈ ⁺²¹⁰⁴
857 [Jy/sr]	6841	5364	5628	6713 ₋₆₂₅₀ ⁺⁷¹⁷⁷

857 GHz

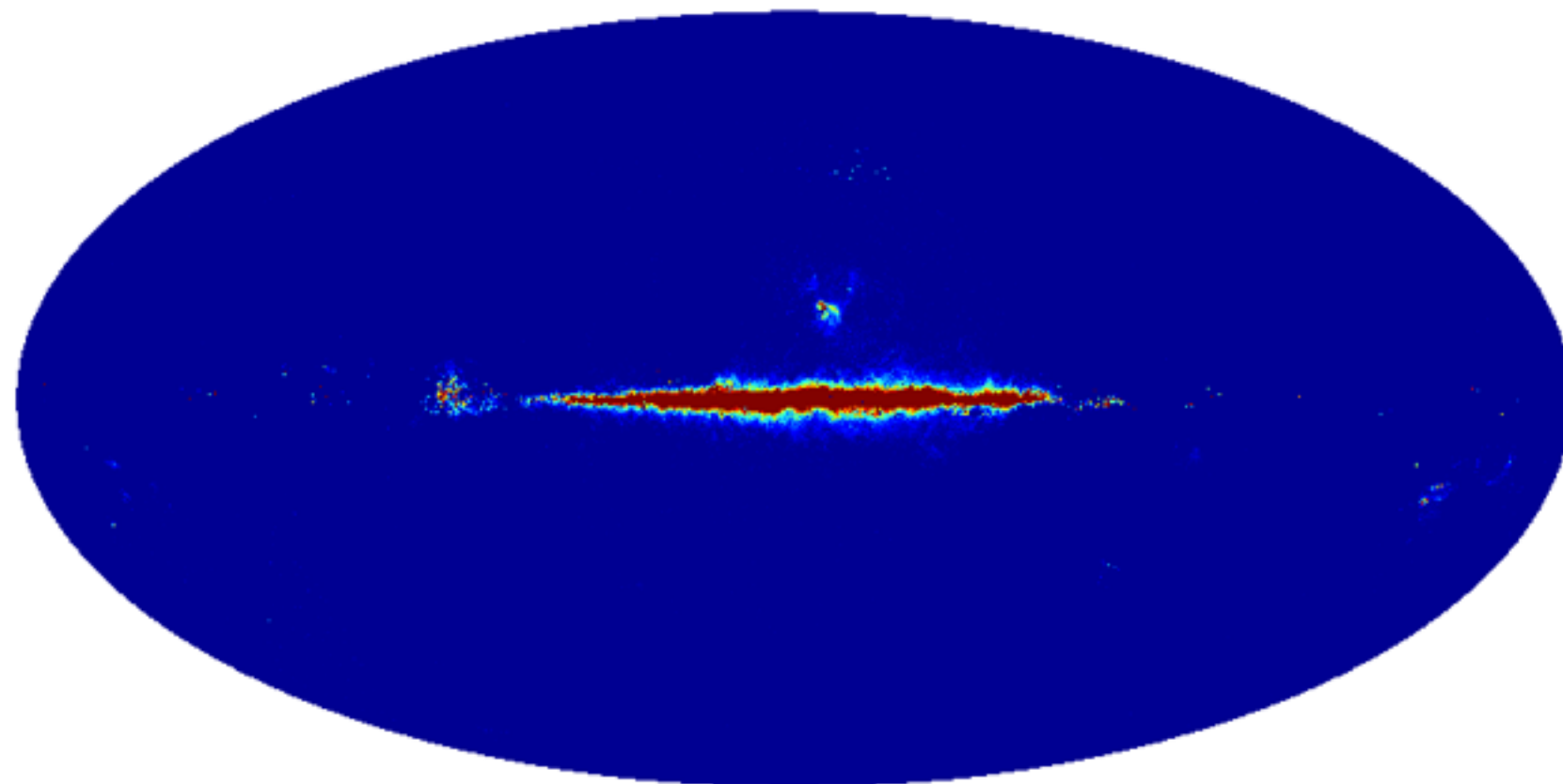
PLANCK



0.0 5.0

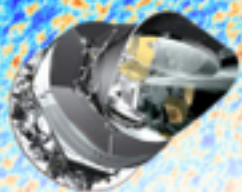
Dust cleaning using 545 GHz

857 - α 545



0.0 5.0

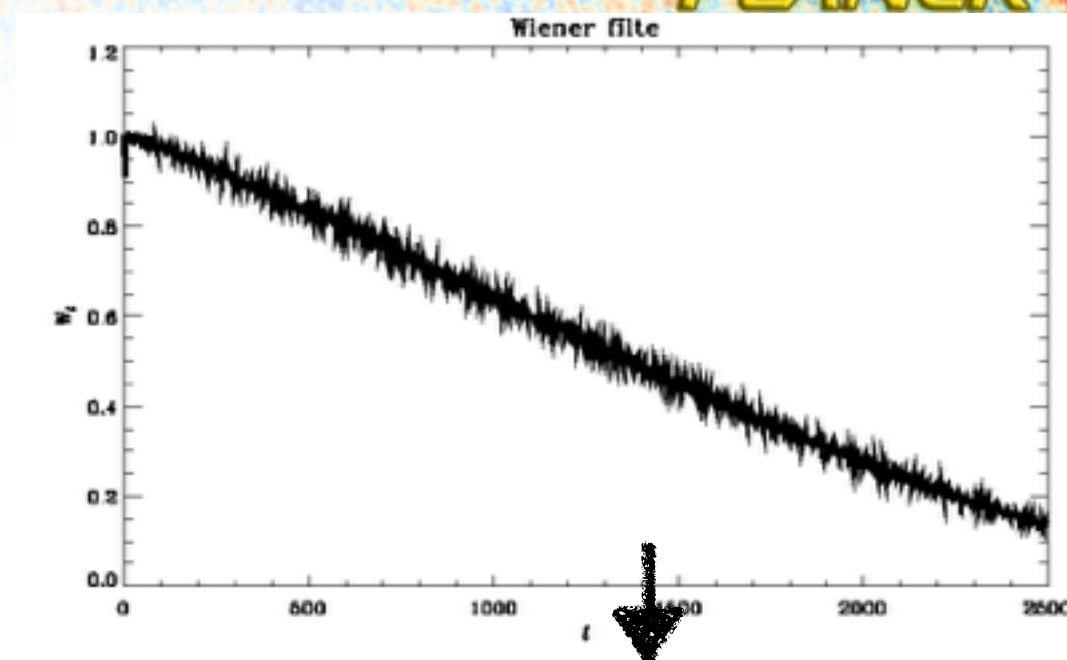
$$\alpha = \sqrt{\frac{A_{\text{dust}}^{857}}{A_{\text{dust}}^{545}}}$$



PLANCK

Wiener filter to reveal CIB signal!

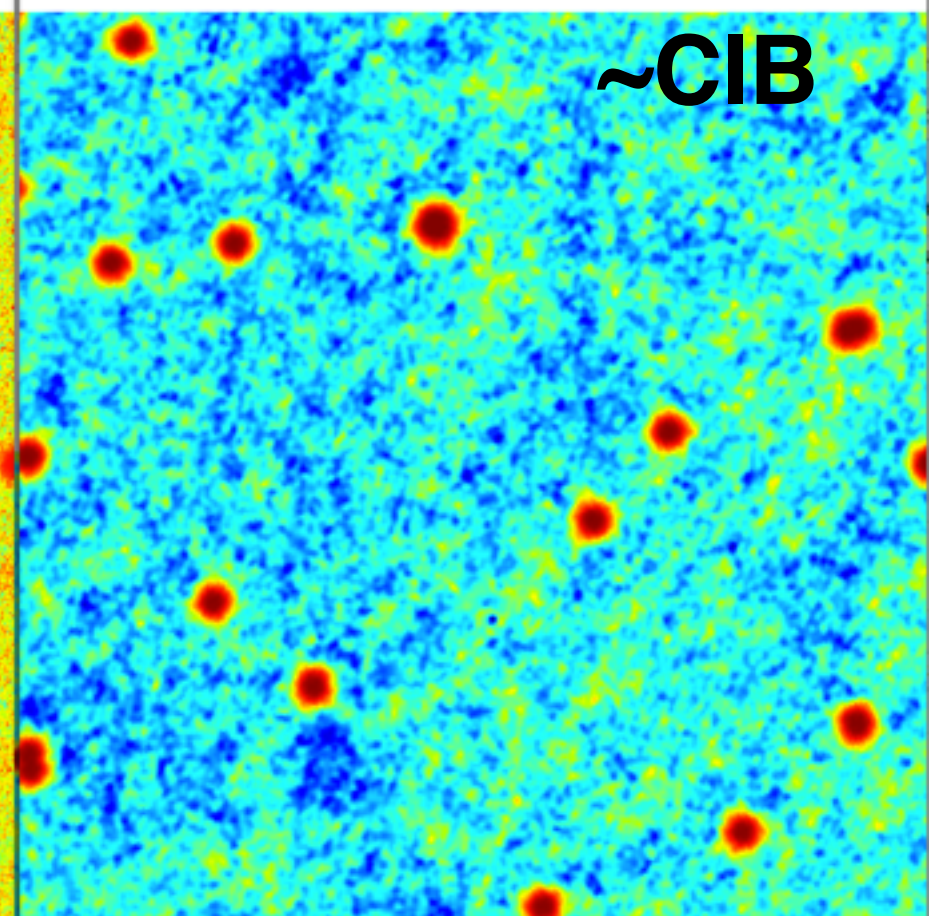
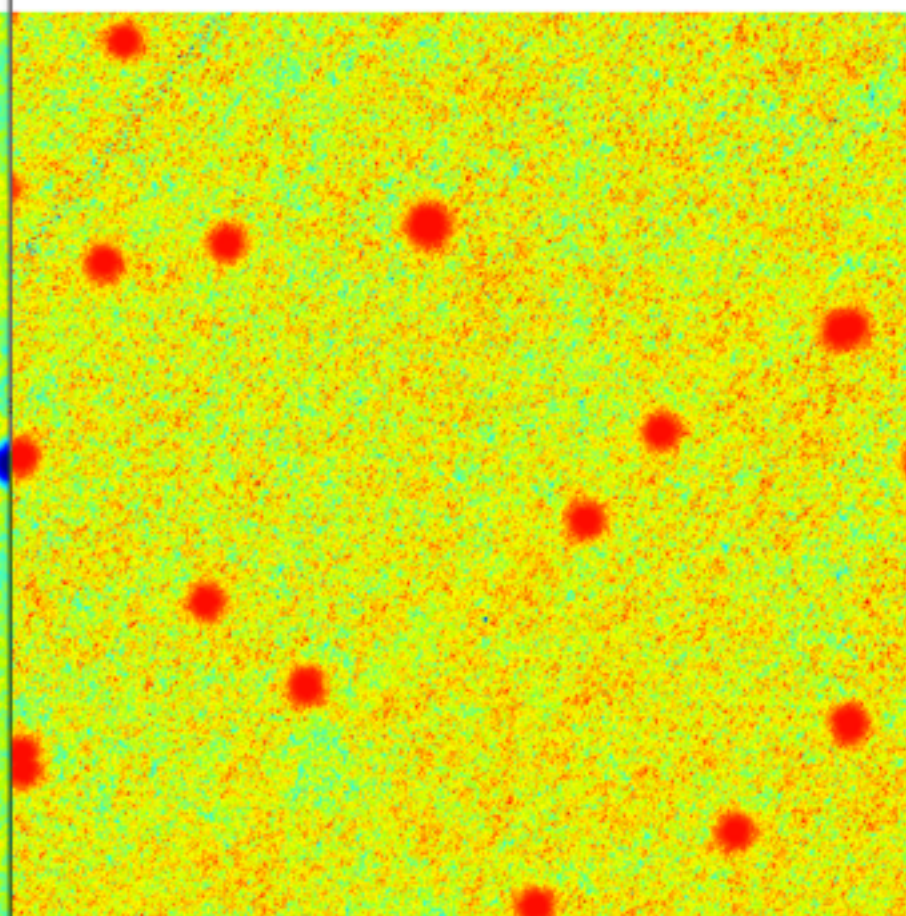
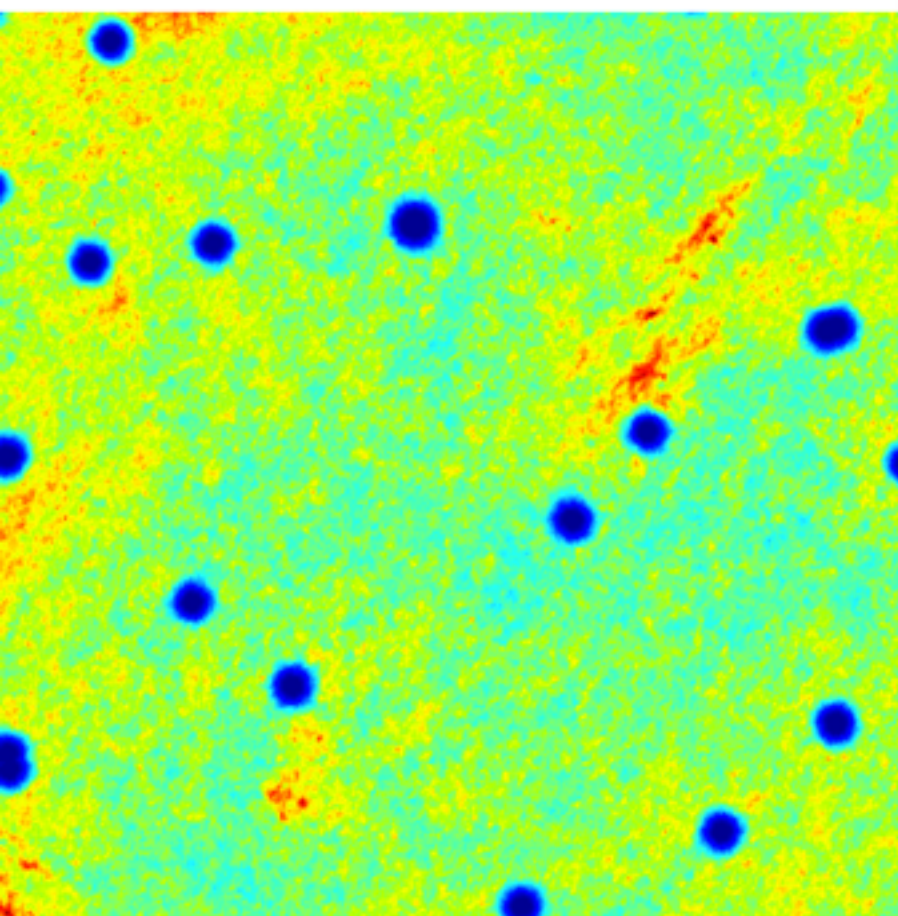
$$W_\ell = \frac{C_\ell^{\text{CIB}}}{C_\ell^{\text{total}}}$$



857 GHz

857-a545

Wiener filtered 857-a545

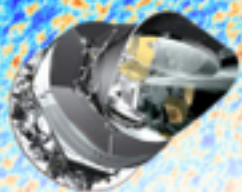


0.0 0.92

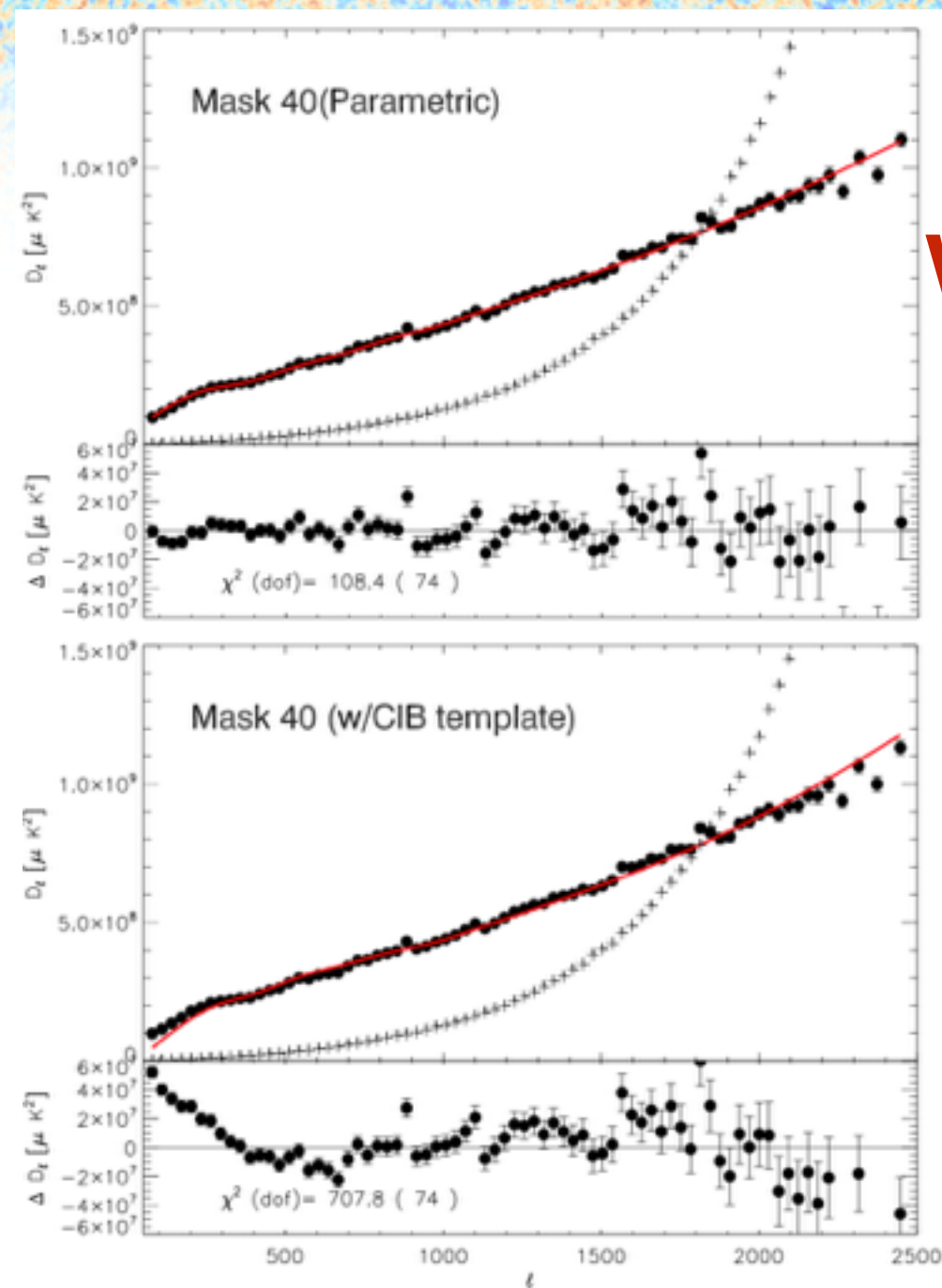
-0.64 0.086

-0.29 0.0086

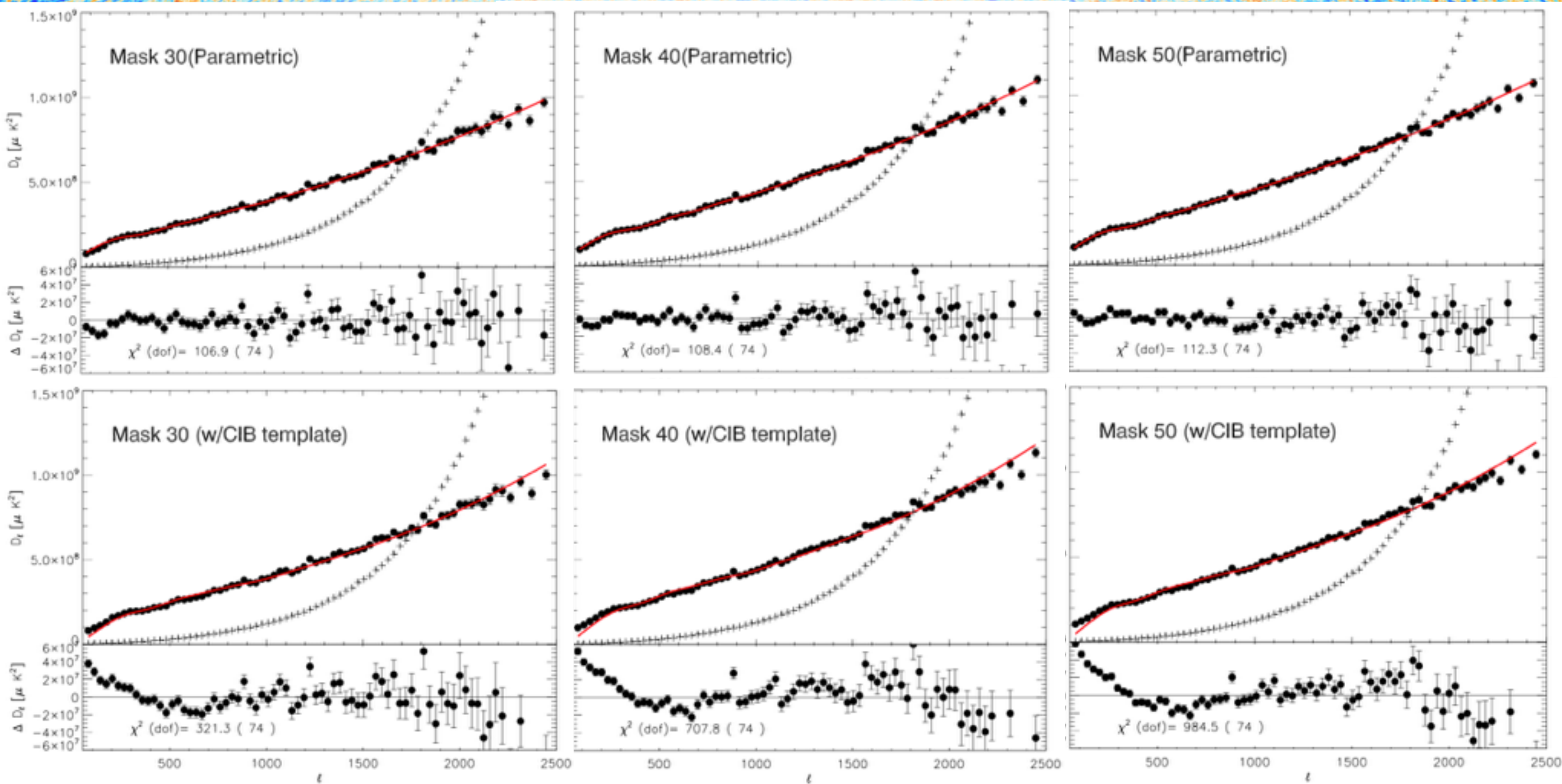
⟨#⟩



Work in Progress



$$C_{\ell}^{\text{cleaned}} = C_{\ell}^{857Y1 \times 857Y2} - \alpha C_{\ell}^{857Y1 \times 545Y2} - \alpha C_{\ell}^{545Y1 \times 857Y2} + \alpha^2 C_{\ell}^{545Y1 \times 545Y2}$$



Dust clean spectrum: 857 - a545

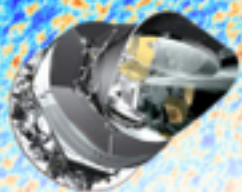
CIB template has obvious deficient at multipoles < 300
compare to the parametric model

⟨#⟩

The scientific results that we present today are a product of the Planck Collaboration, which includes individuals from more than 100 scientific institutes in Europe, the USA and Canada



Planck is a project of the European Space Agency, with instruments provided by two scientific Consortia funded by ESA member states (in particular the lead countries: France and Italy) with contributions from NASA (USA), and telescope reflectors provided in a collaboration between ESA and a scientific Consortium led and funded by Denmark.



Summary

- New CIB measurement based on likelihood analysis and new foreground treatment
 - the measured power spectrum nicely fit by simple parametric models $\gamma_{\text{CIB}} = 0.54$
 - the best fit CIB power spectrum consistent with previous measurements
- Improvement/updates over previous method:
 - increase of sky use, >20K sq. deg
 - new Poisson power constraints, and more consistent with source count measurement
 - foreground solutions allow for dust cleaning using 545
 - further investigation of the parametric vs halo model differences at large scale