RAS-2020

Cross-correlation of thermal Sunyaev Zeldovich effect(Planck) and projected density field (WISE)

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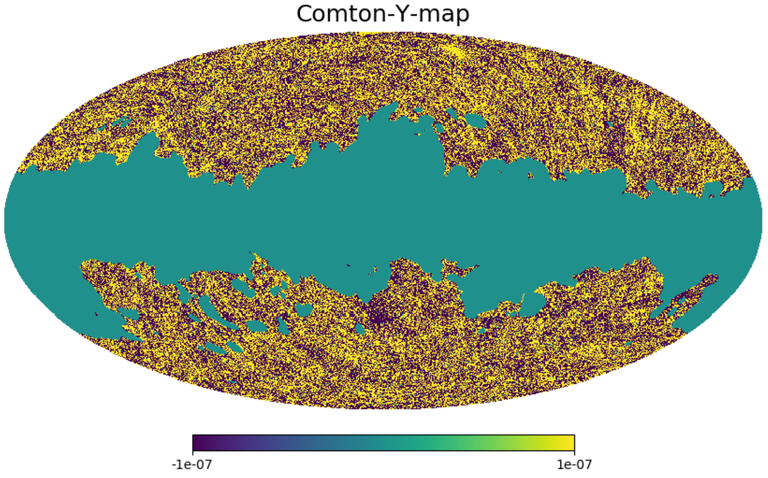
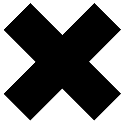
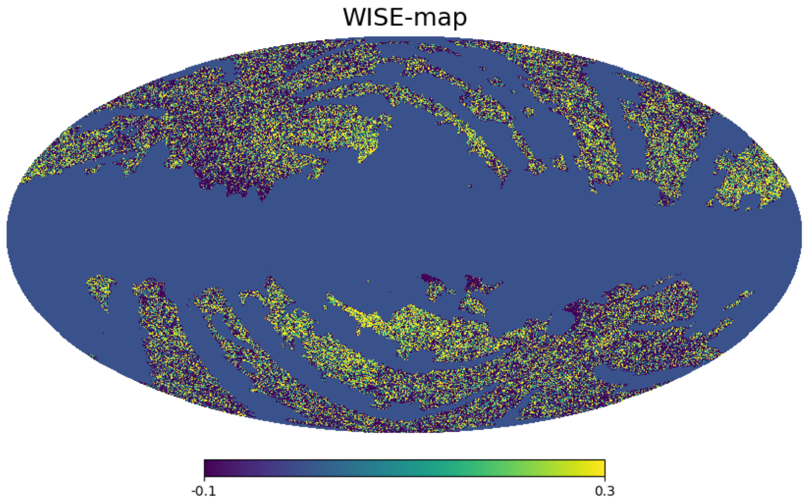
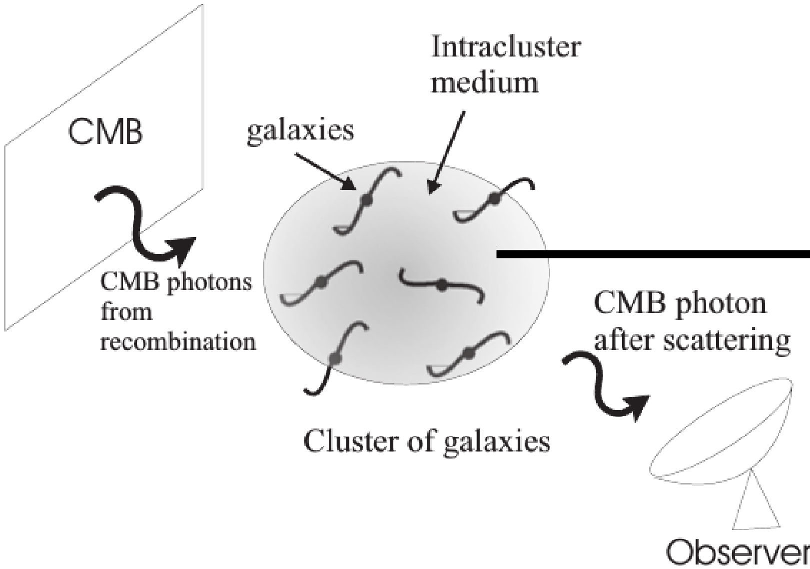
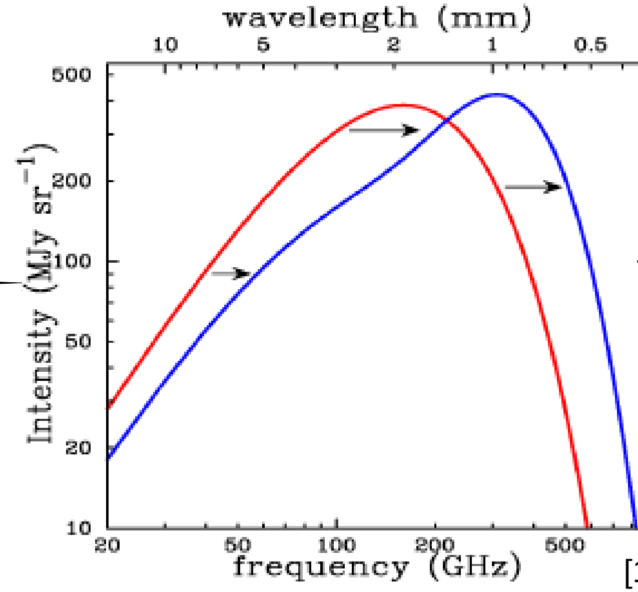










[1]

MOTIVATION

With such a cross-correlation between tSZ and WISE at z~0.8, do we expect to see a major improvement in the constrain of the mass bias parameter taking the foreground component known as the cosmic infrared background into consideration on small-scales (high redshift)?

THEORY: Halo Model

We used a model that assume that all galaxies live inside halo (a basic unit of cosmology structure). This model is called the HALO MODEL [2]

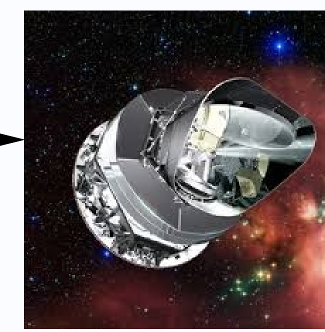
We modelled our calculation (theoretical prediction) using by categorising the contribution from single halo (1-halo term) and two or more halo (called 2-halo term)

$$C_\ell^{XY,1\mathrm{h}} = \int_0^{z_{\max}} \mathrm{d}z \frac{c\chi^2}{H(z)} \int_{M_{\min}}^{M_{\max}} \mathrm{d}M \frac{\mathrm{d}n}{\mathrm{d}M} X_\ell(M,z) Y_\ell(M,z)$$

$$C_\ell^{XY,2h} = \int_0^{z_{max}} dz \frac{c\chi^2}{H(z)} P_m^{lin}\left(k = \frac{\ell+1/2}{\chi(z)}, z\right) \times \left[\int_{M_{min}}^{M_{max}} dM \frac{\mathrm{d}n}{\mathrm{d}M} b(M,z) X_\ell(M,z)\right] \times \left[\int_{M_{min}}^{M_{max}} dM \frac{\mathrm{d}n}{dM} b(M,z) Y_\ell(M,z)\right]$$

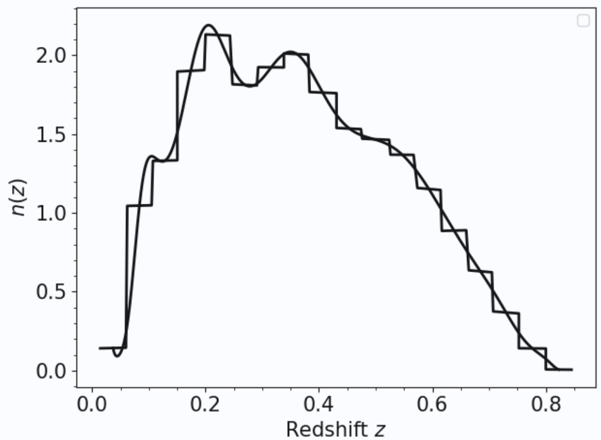
DATA-SETS

1. The *Planck* Satellite



2. The Wide-field Infrared Survey Explorer

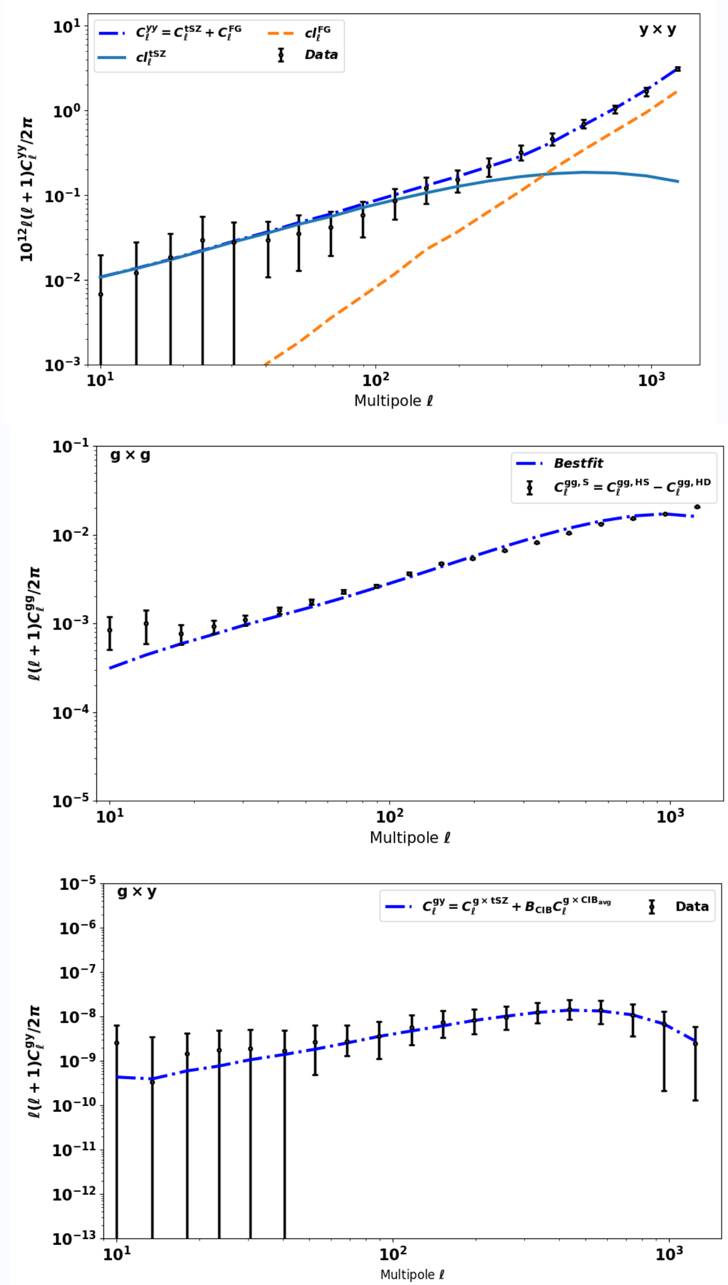
- **How sure are we that WISE data is good for this work?**



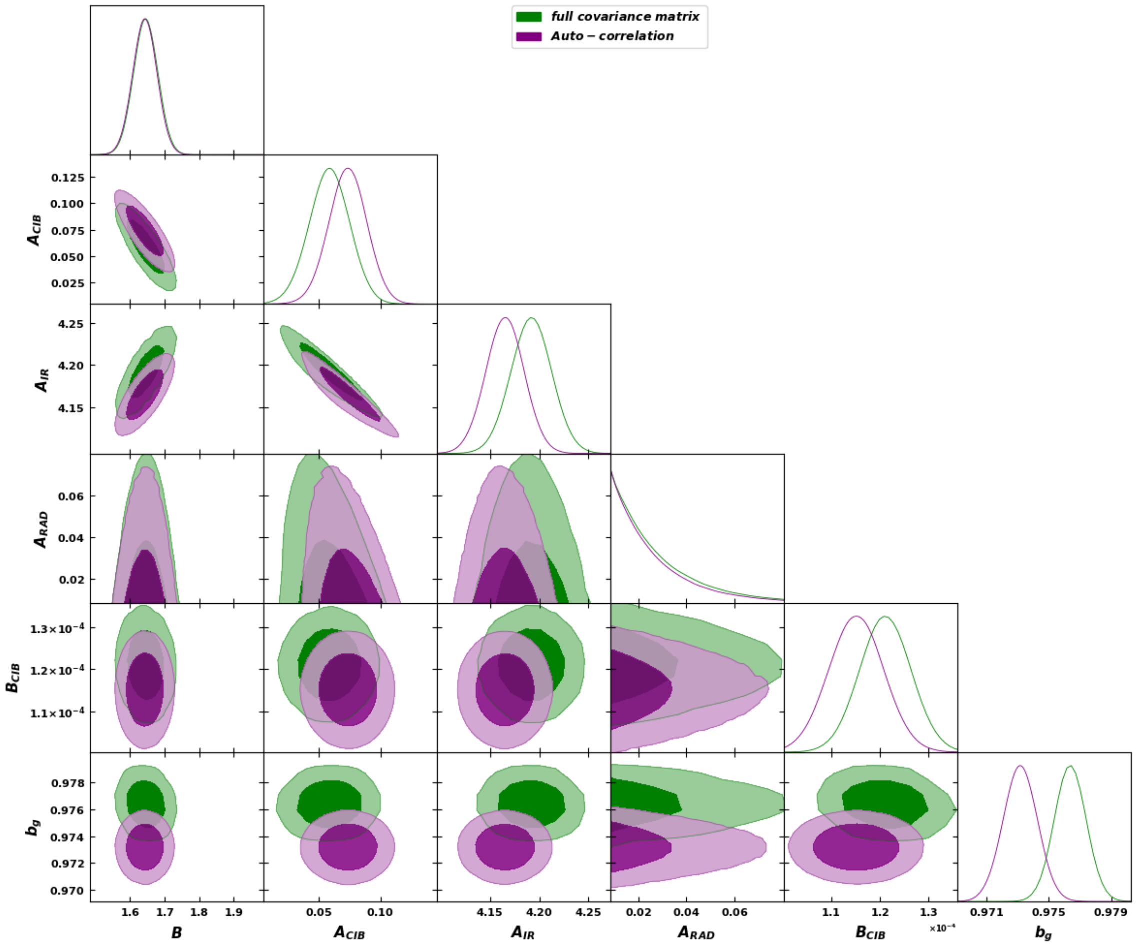
- **Lets compare our result with previous work**

Observation	Quantity	Estimated Value	Reference
This Work	B	1.64 ± 0.04	Ibitoye et al. (in prep.)
tSZ+ CMB lensing	$1-b$	0.71 ± 0.10	Zubeldia & Challinor (2019)
tSZ+ WG lensing	$1-b$	$\simeq 26.9^{+8.9}_{-4.4}$ %	Osato et al. (2019)
CMB + tSZ	$1-b$	0.62 ± 0.05	Salvati et al. (2019)
tSZ+ Cosmic shear	$1-b$	0.73 ± 0.11	Makiya et al. (2019)
tSZ + 2MASS	B	1.54 ± 0.098	Makiya et al. (2018)
tSZ DES	B	1.71 ± 0.17	Bolliet et al. (2018)
Planck 2015 SZ + *Planck* 2018 CMB	$1-b$	0.62 ± 0.04	Planck Collaboration et al. (2018)
WL	$1-b$	0.76 ± 0.07	Miyatake et al. (2019)
CMB WL +X-ray	$1-b$	0.70 ± 0.05	Hurier et al. (2019)
tSZ-CMB lensing	b	0.26 ± 0.07	Hurier & Angulo (2018)
CCCP	$1-b$	0.76 ± 0.11	Hoekstra et al. (2015)
CMB lensing	$1/(1-b)$	0.99 ± 0.19	Planck Collaboration et al. (2016b)
WtG	$1-b$	0.688 ± 0.072	von der Linden et al. (2014)

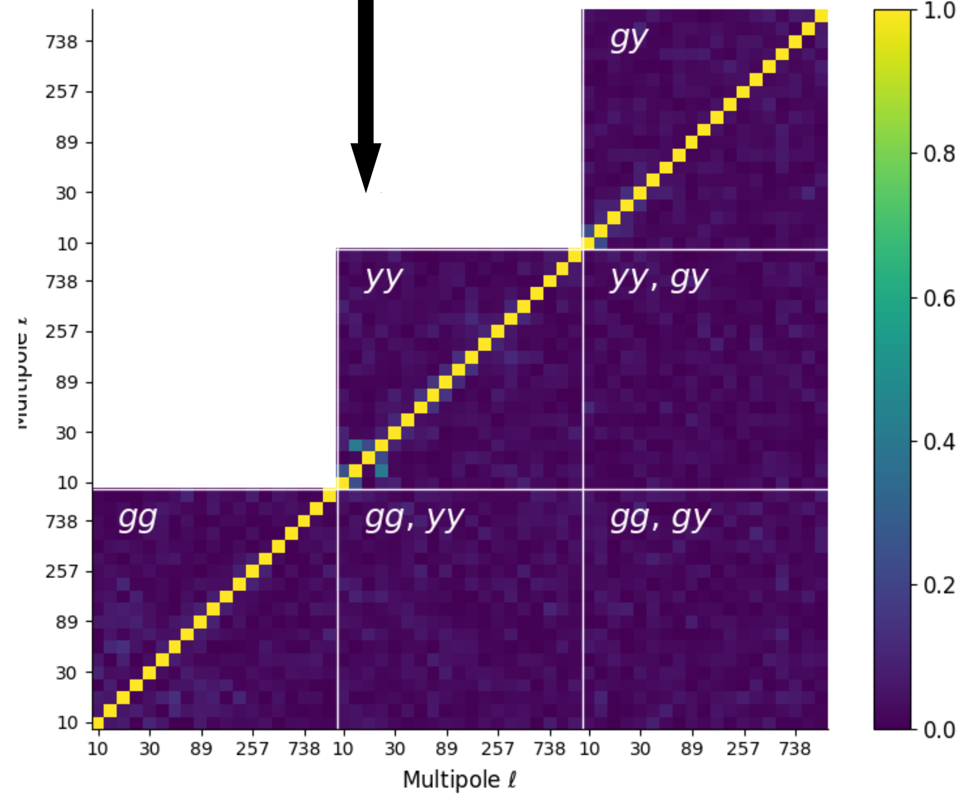
- **Can we model the contribution of galaxies in the halo to match what telescope sees?**



Parameter estimation



Correlation coefficient matrix for auto- and cross- spectra. Along the diagobal: (Bottom) WISE auto-, (Middle) tSZ auto-,and (Top) tSZ-WISE cross



Reference

1. John E. Carlstrom, Gilbert P. Holder, and Erik D. Reese. Cosmology with the Sunyaev-Zel'dovich Effect.Annual Review of Astronomy and Astrophysics, 40:643–680, Jan 2002

2. Eiichiro Komatsu and Tetsu Kitayama. Sunyaev-Zeldovich Fluctuations from SpatialCorrelations between Clusters of Galaxies.Astrophysical Journal Letters, 526(1):L1–L4,November 1999

Conclusion

1. We measured a signal-to-noise ratio (how significant the results is) to 15.6 sigma confidence level detection and reached a constrain on the mass-bias parameter: B = 1.634±0.04

2. Our results shows that the Planck cluster mass should be 37% lower than the true mass of cluster.

3. Our results also suggest that CIB input to tSZ-galaxy cross correlation will be an exciting work to do with upcoming survey/telescope observation.