Dust in tSZ cross-correlations

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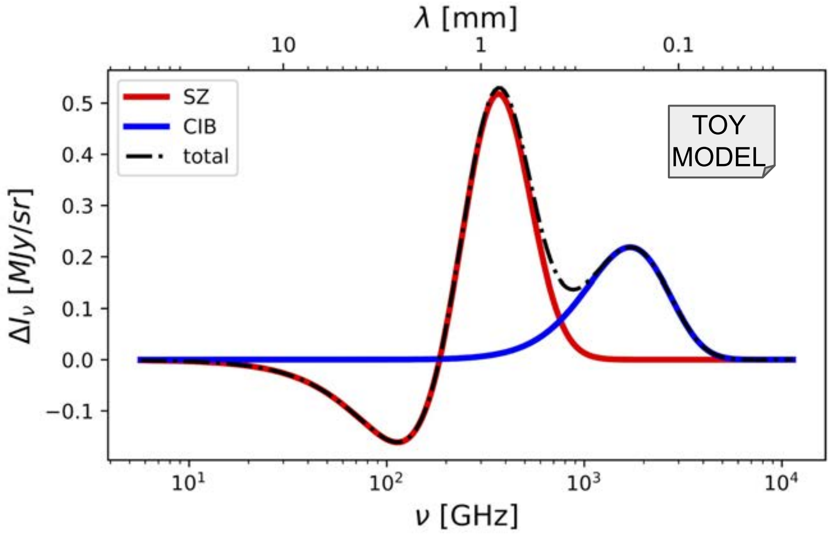
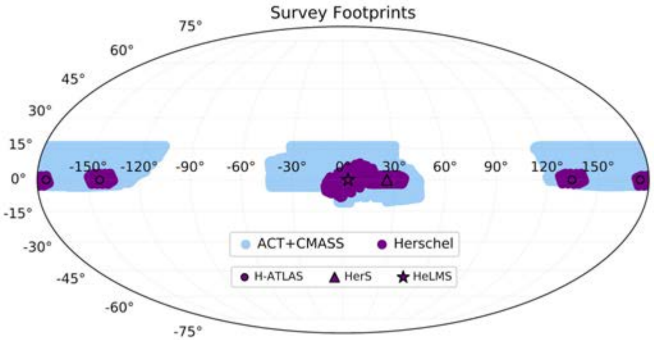
- CMB x LSS observations probe baryonic effects in galaxy formation through SZ measurements

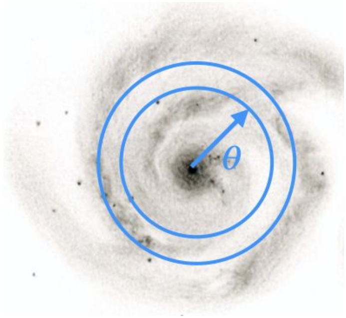
- Need to quantify contamination of the Cosmic Infrared Background (CIB, or “dust”) to the thermal SZ

- Use FIR/submm observations where CIB spectrum peaks and extrapolate profile

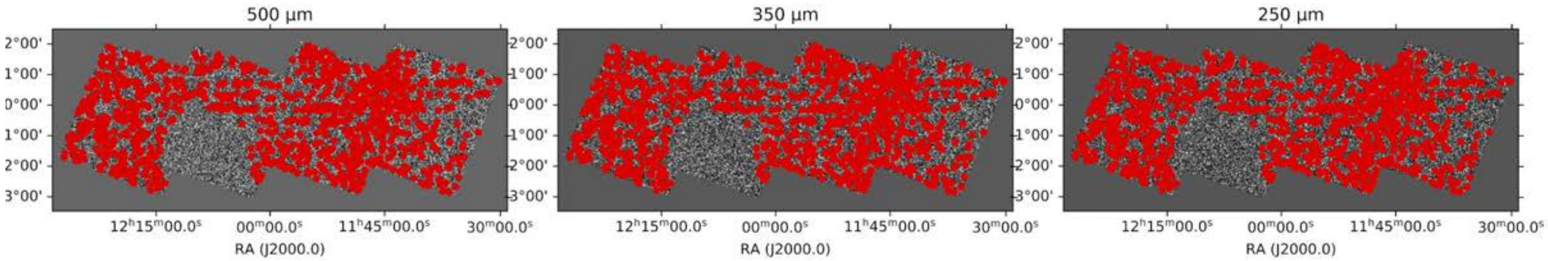


- CIB observations from *Herschel* extragalactic surveys

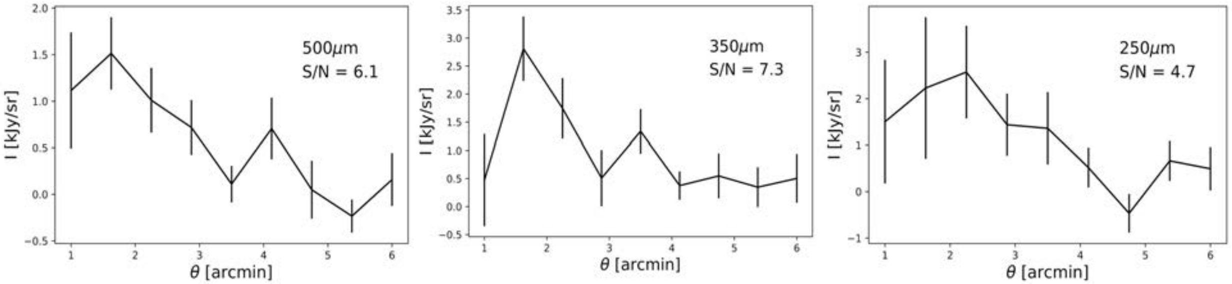




- Aperture photometry in circular apertures



- multi-frequency stacked profiles



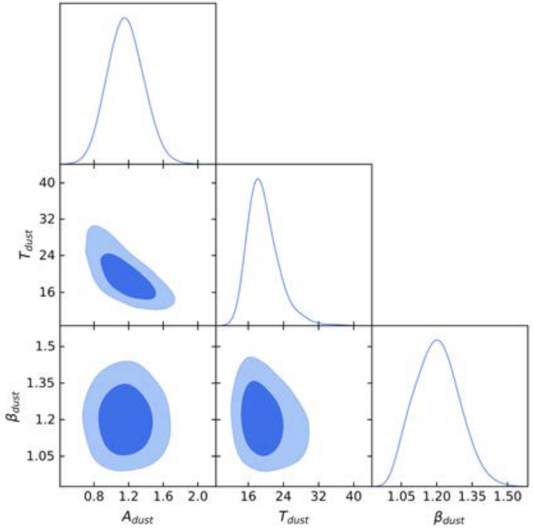
- fit to dust model (modified BB, e.g. Erler+18)

$$I(\nu) = A_{dust} \left(\frac{\nu(1+z)}{\nu_0} \right)^{\beta_{dust}+3} \frac{e^{x_0} - 1}{e^{x} - 1}$$

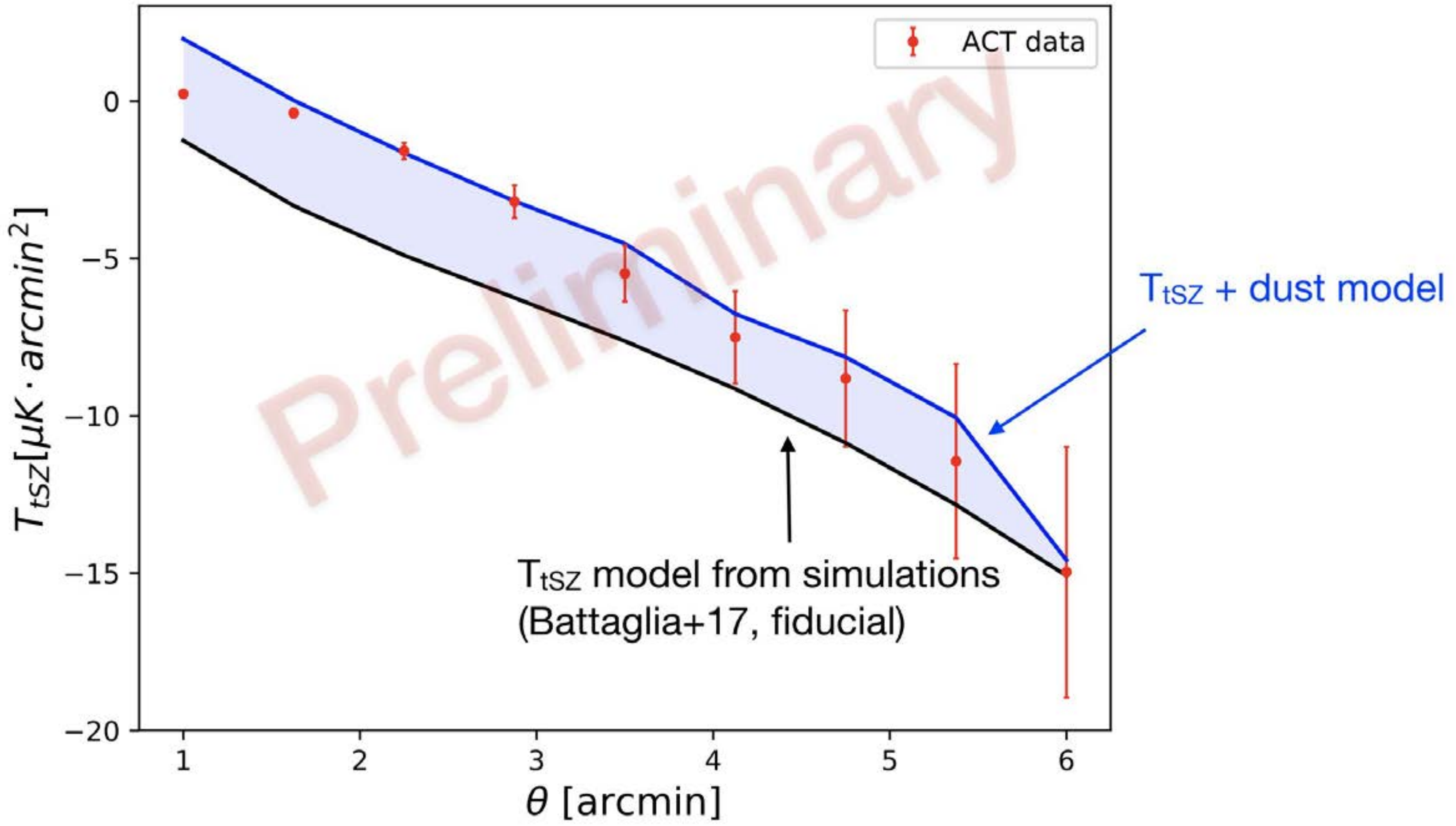
$$x \equiv h\nu(1+z)/(k_B T_{dust})$$

<u>Best fit (1σ)</u>

$$A_{\rm dust} = 1.2 \pm 0.2 \ {\rm kJy/sr}$$
$$T_{\rm dust} = 19 \pm 4 \ {\rm K}$$
$$\beta_{\rm dust} = 1.2 \pm 0.1$$



Modeling the tSZ: include dust!

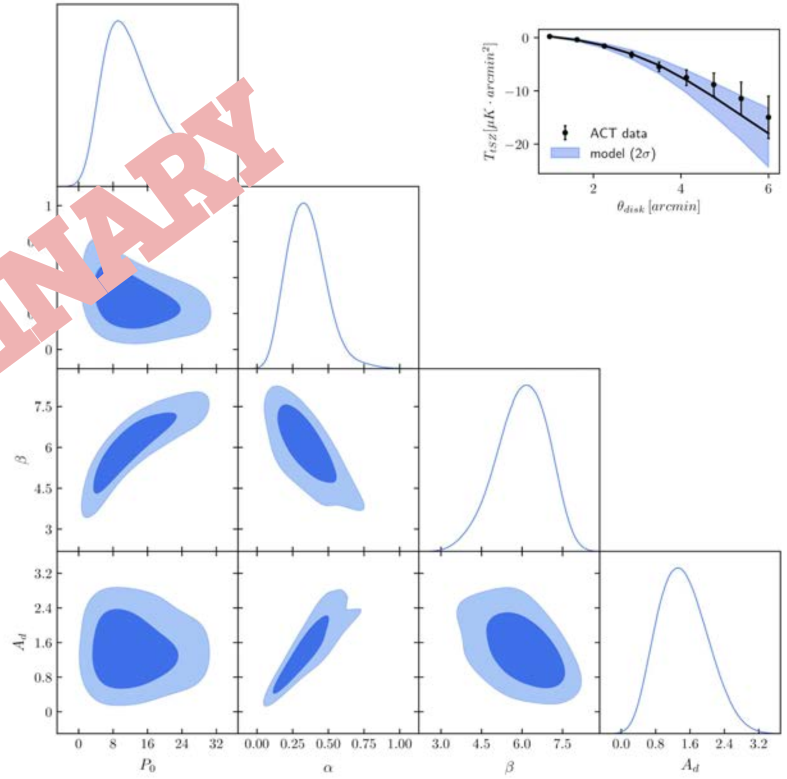


Constraints on thermal pressure profile from tSZ + dust

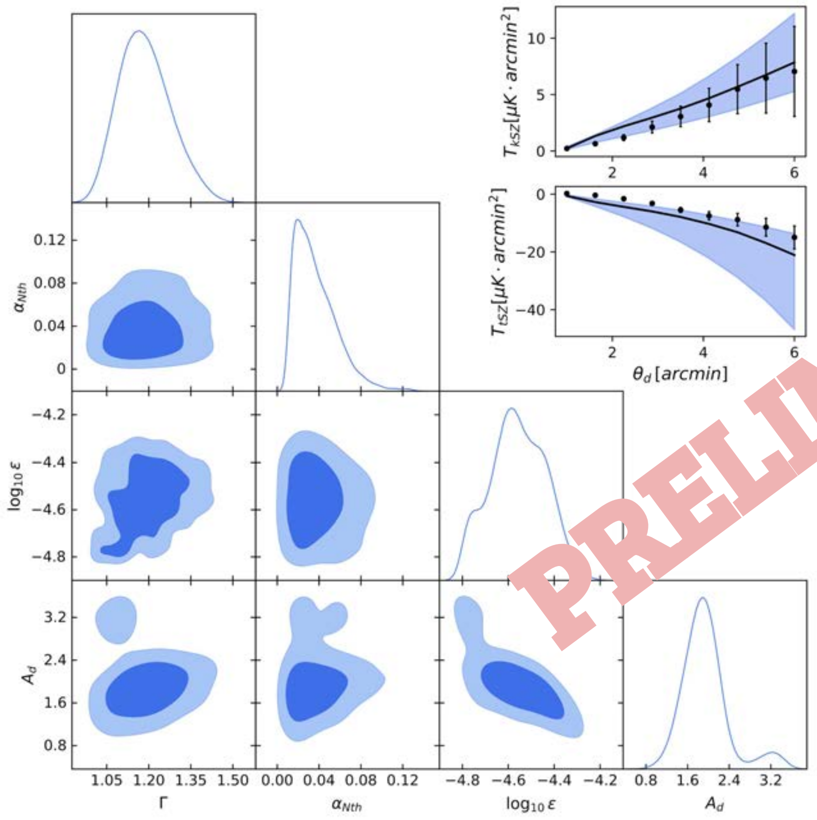
$$P_{\rm th} = P_{200} P_0 (x/x_c)^{\gamma} [1 + (x/x_c)^{\alpha}]^{-\beta}$$

parameter	description	constraints (68% uncert.)	rel. uncert.(%)
P_0	amplitude	$11.6^{+8.2}_{-5.5}$	60
α	intermediate slope	0.3 ± 0.1	4[illegible]
β	outer slope	6.1 ± 0.1	16
A_d	dust amplitude	1.4 ± 0.6	43

Amodeo+ and Schaan+ in prep.



Constraints on feedback processes from kSZ + tSZ + dust



parameter	description	constraints (68% uncert.)	rel. uncert.(%)
[illegible]	polytropic index	1.2 ± 0.1	8
α_{Nth}	non-thermal pressure norm.	0.03 ± 0.02	61
ϵ	feedback efficiency	$(2.7 \pm 0.8) \times 10^{-5}$	30
$A_{\rm d}$	dust amplitude	1.9 ± -0.4	19

Amodeo+ and Schaan+ in prep.

- We can “measure” thermodynamic profiles including dust contamination

- Huge gain from next generation of CMB and LSS experiments
    - CCAT-p will replace Herschel over a larger area
    - Synergies with Simons Observatory and AdvACT

- Tight constraints on baryonic physics (cfr simulations, reduce systematic uncertainties from baryonic effects on the matter power spectrum)