CIB as a window into primordial NG

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work in progress with

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Primordial NG

- Measure Primordial NG to distinguish between models of inflation (and other paradigms for the early Universe)

- CMB: close to linear 😊 but 2D 😞

- LSS: highly non-linear 😞 but 3D 😊
Primordial NG

• Measure Primordial NG to distinguish between models of inflation (and other paradigms for the early Universe)

• CMB: close to linear 😊 but 2D 😕

• LSS: highly non-linear 😞 but 3D 😊

Many probes: cluster counts, galaxy bispectrum, non-Gaussian bias etc.
Non-Gaussian bias

- **Scale-dependent bias induced by** $f_{\text{NL}} \phi^2$: $\Delta b_1(k) \propto \frac{f_{\text{NL}}}{k^2}$

![Graph showing the effect of $f_{\text{NL}}$ on $P_{gg}(k, f_{\text{NL}})$](image)

[Dalal et al. 2008]
PNG in the CIB

- Very large comoving volume + low minimum halo mass “resolved”

\[ \text{mitigate shot-noise + cosmic variance} \]
PNG in the CIB

• Very large comoving volume + low minimum halo mass “resolved”

\[ I(\nu, \hat{n}) = \int_0^{\chi^*} dz \left( \frac{d\chi}{dz} \right) a(z) j_\nu(z) \left( 1 + \delta^2 + \delta_\parallel + 2s \delta_\perp \right) \]
PNG in the CIB

• Very large comoving volume + low minimum halo mass "resolved"

mitigate shot-noise + cosmic variance

• At first order in perturbations:

\[ I(\nu, \hat{n}) = \int_0^{\chi^*} dz \left( \frac{d\chi}{dz} \right) a(z) \bar{j}_\nu(z) \left( 1 + \delta_{j}^z + \delta_{||} + 2 s \delta_{\perp} \right) \]

• GR projection effects: \( O(f_{NL}^{\text{eff}}) \sim 0.3 \)
Non-Gaussian bias in CIB

353 GHz

C\text{I} [\text{Jy}^2 \text{sr}^{-1}]

ell

f_{NL}=5
f_{NL}=1
f_{NL}=-1

Dust (x10^{-2})

10^4

10^6

1000

10000

100

10

10% 40%
Adding frequencies $\sim$ multi-tracers

\[ f_{NL} = 0 \quad f_{NL} = 5 \]

$\ell = 2$

353 GHz
857 GHz

$\frac{dC_1(CIB)}{dz}$

$z$

0 1 2 3 4 5 6 7
Dust foreground removal
Summary & Outlook

• A combination of Planck + COre+ could achieve

\[ \sigma(f_{NL}) \sim 0.5 - 0.6 \]

with 40% of the sky provided dust emission is cleaned at 1% level

• Possible to reach “natural” target \( f_{NL} = 1 \)

• Having multiple frequency channels is crucial

• Theoretical uncertainties: \( \text{Meff etc.} \)