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How does the Galaxy impact N_{eff} inference and does this drive frequency coverage?

- Constraints are driven by TE (+ EE)
- Relevant Galactic foregrounds:
  - Thermal dust
  - Synchrotron
- For TT, we'd also have to consider CO, free-free, AME, …

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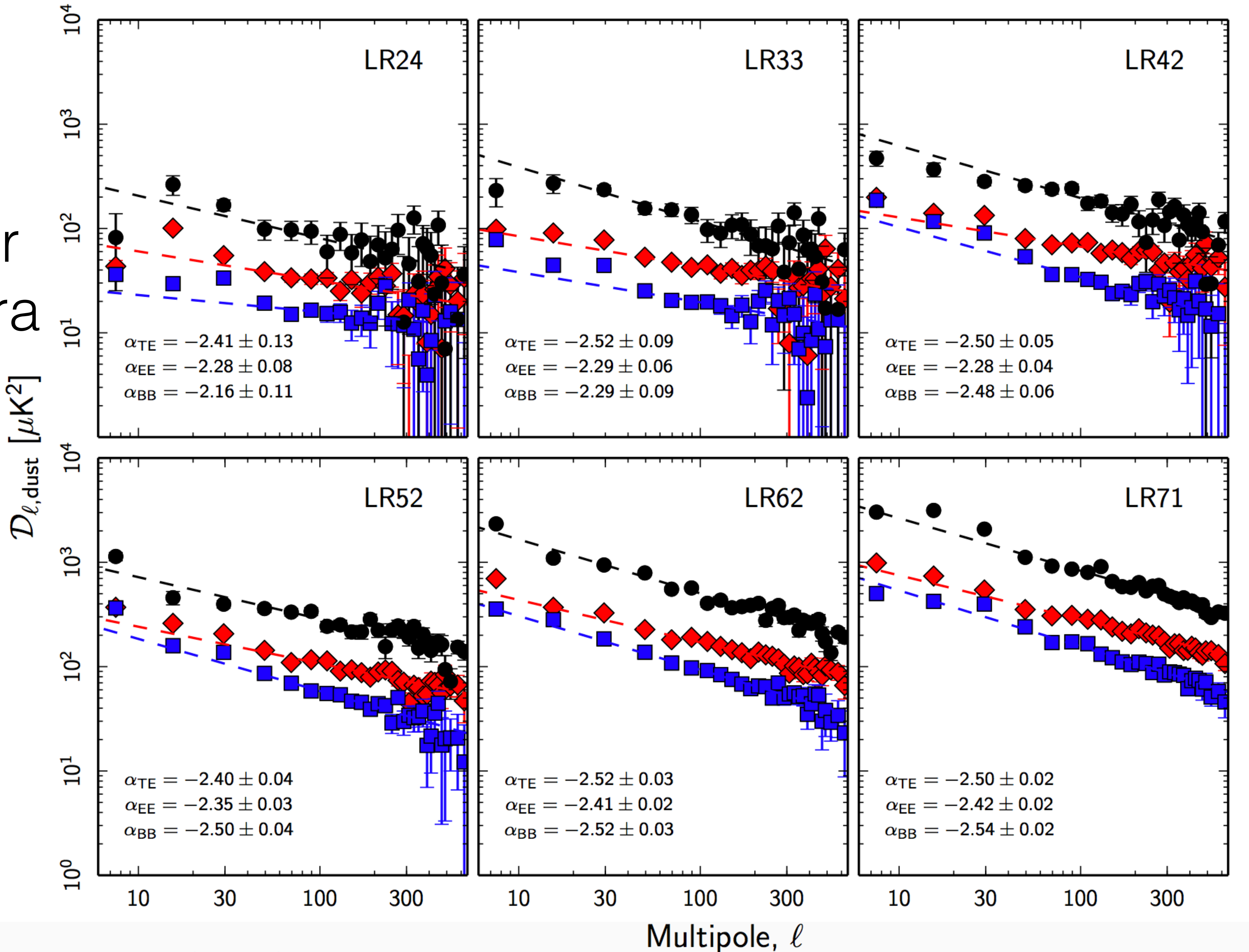
353 GHz Dust Power Spectra



TE
EE
BB

Planck Collaboration (2018)

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- What was done in DSR N_{eff} forecasts:
    - Galactic cirrus (thermal dust), using model of Dunkley+2013
    - Only TT dust included (not TE or EE, as far as I can tell)
    - Amplitude of this model is probably very wrong for f_{sky}=70%

- Two things to consider:
    - Possible bias on N_{eff}, e.g., if dust is present in data but not included in the model fit
    - Inflation of error bars due to presence of dust

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Back of the envelope estimate

- Consider LR62 (62% of sky)
- Scale from 353 to 150 GHz: factor of ~625 in μK^2
- Assume Planck power-law fit holds out to ell~2500
- This yields D_{ell}^{TE} ~ 0.2 μK^2 at ell~2500 and 150 GHz
- Planck 2018 LCDM: D_{ell}^{TE} ~ -3 μK^2 at ell~2500
- Suggests CMB-S4 N_{eff} forecast is safe from large dust biases, but dust is not completely negligible
- Synchrotron is likely less of an issue than dust

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- Use Planck 353 GHz results to include dust in TT, TE, EE power spectra model at all S4 frequencies (w/ MBB SED)

- Exercise 1: propagate through harmonic ILC for various detector frequency allocations and obtain effective noise curves, forecast N_{eff}

- Exercise 2: run MCMC chains for parametric fit to power spectra (as done in Planck/ACT/SPT likelihoods) — still treating dust as Gaussian field

- Exercise 3: do exercise 2 using actual simulated non-gaussian sky maps (thereby including dust 4-pt in power spectra covariance matrix)