Spotlight talks

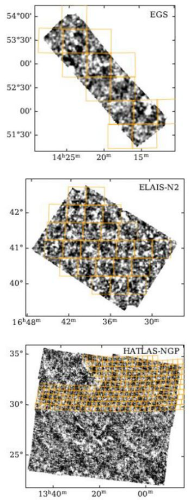
4:30-5 pm Monday 3 June

Images (even with all sources removed) contain LSS information!

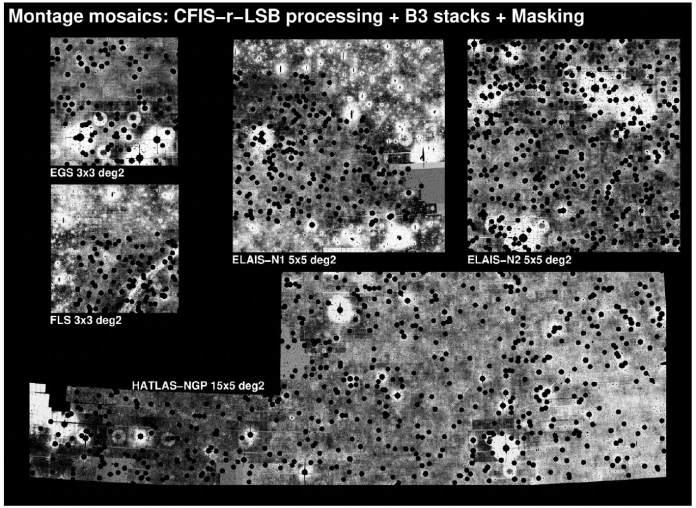
Douglas Scott (UBC) – see Lim et al. 2022, arXiv:2203.16545

Pilot study: Herschel-SPIRE X CFHT

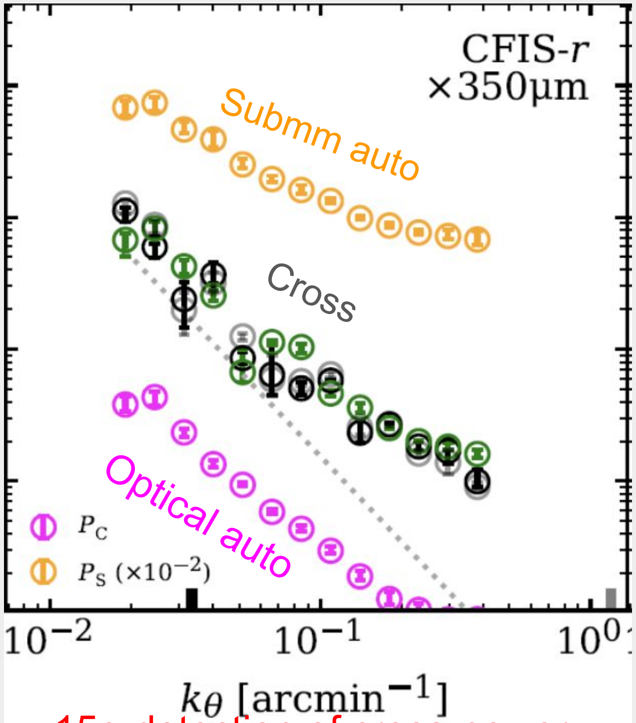
Overlap of 5 fields, ~90sq.deg., are used for CIB-optical cross-correlation



FIR/submm



Optical (*r* band)



15σ detection of cross-power

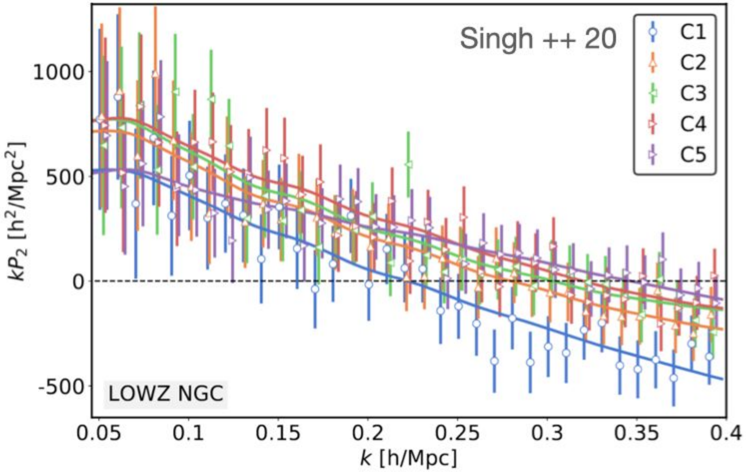
Will be dramatically better using Euclid images correlated with CCAT etc.

Antón Baleato Lizancos, postdoc at BERKELEY CENTER *for* COSMOLOGICAL PHYSICS

Can we select galaxy samples with fewer Fingers of God?

with U. Seljak

- FoG are sourced by a small fraction of galaxies with large virialized velocities
- They are **non-perturbative** on rather large scales
- The **zero-crossing of the quadrupole** is a marker of the prevalence of FoG — fewer FoG bring it to higher k
- We can define **density-independent selections** that push the zero-crossing to higher k!

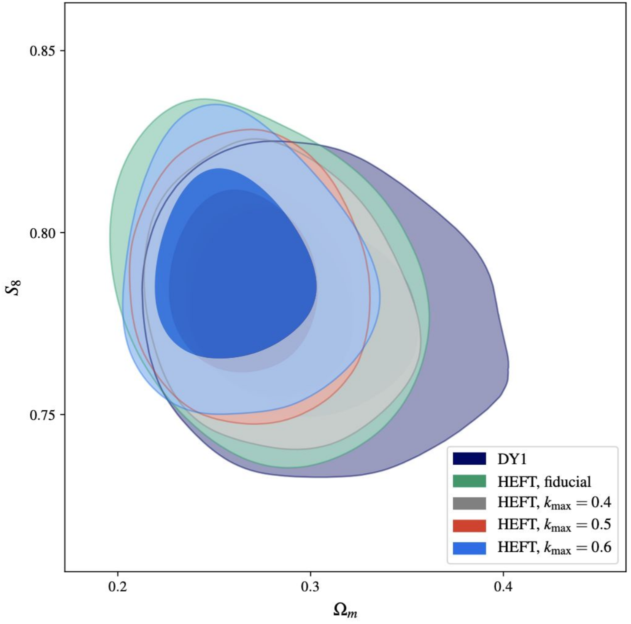


For example, one could discard the 25% reddest galaxies of BOSS LOWZ

Jahmour Givans (Flatiron Institute and Princeton)

How should we model HSC clustering on small scales?

- HSC is a testbed for future analyses with Rubin
- Access to increased information by moving beyond linear regime
- Exploring methods for combining EFT frameworks with insights from simulations
    - See Tuesday talks for more discussion
- Previously applied to data from DES Y1 by Hadzhiyska+ 2021
    - Improved constraints on (S_8,Ω_m) by (10%,35%), see figure



Finn Roper (PhD student at the IfA)

Supervised by Yan-Chuan Cai and John Peacock

Directly detecting the kinematic Sunyaev–Zel'dovich effect in the CMB.

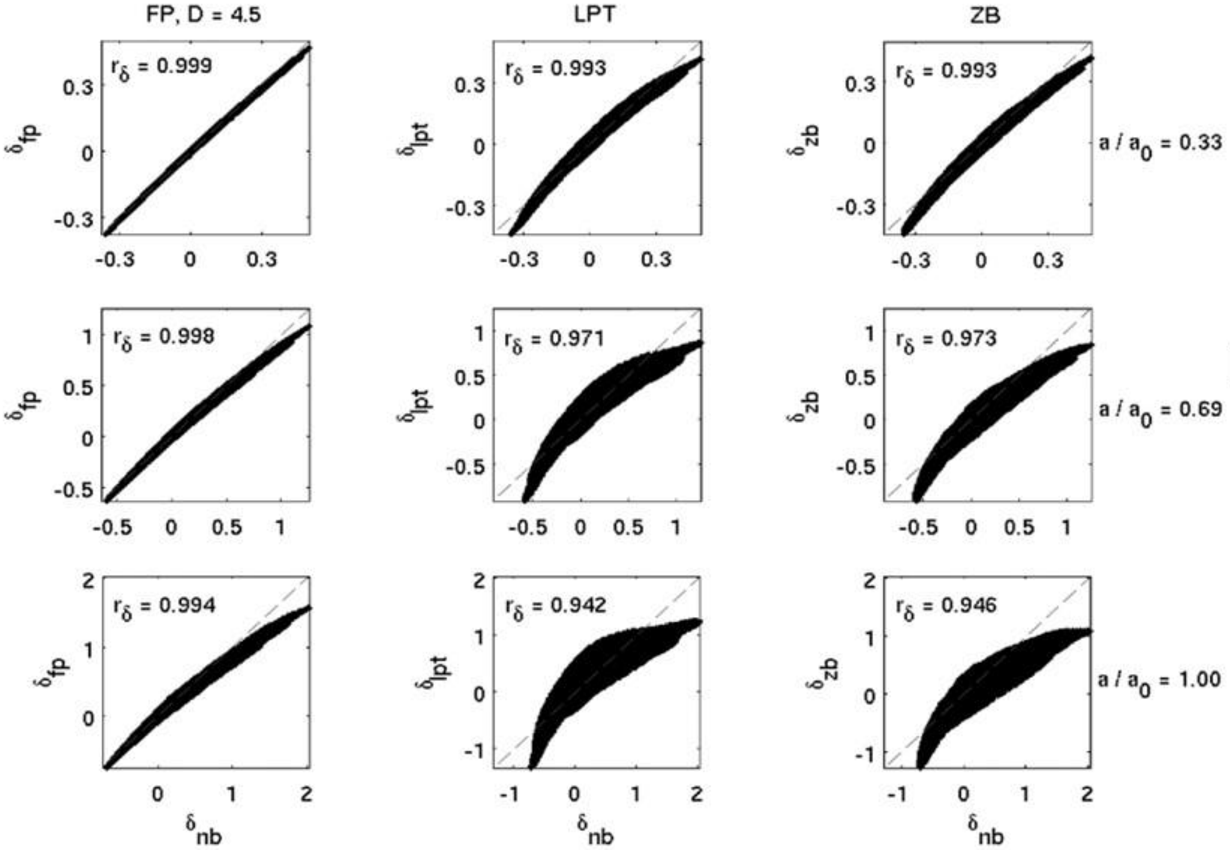
$$\frac{\delta T_{\rm kSZ}(\hat{\mathbf{r}})}{T_0} = -\int n_{\rm e}\, \sigma_{\rm T} \left(\frac{\mathbf{v}}{c} \cdot \hat{\mathbf{r}}\right) \mathrm{d}l$$

- **kSZ is a tiny effect.** Each galaxy group contributes $|\delta T| \lessapprox 1$ μK. Overall, this accounts for $\sim 10^{-5}$ of the observed CMB power.
- Given group masses and positions, we can **reconstruct the density field and then the peculiar velocity field** in the linear regime.
- With this knowledge, we can **stack this signal** over millions of groups to obtain a significant direct detection.
- This allows us to, for example, obtain the average gas mass fraction in haloes.

Reconstructing with wave mechanics

Aoibhinn Gallagher supervised by Peter Coles

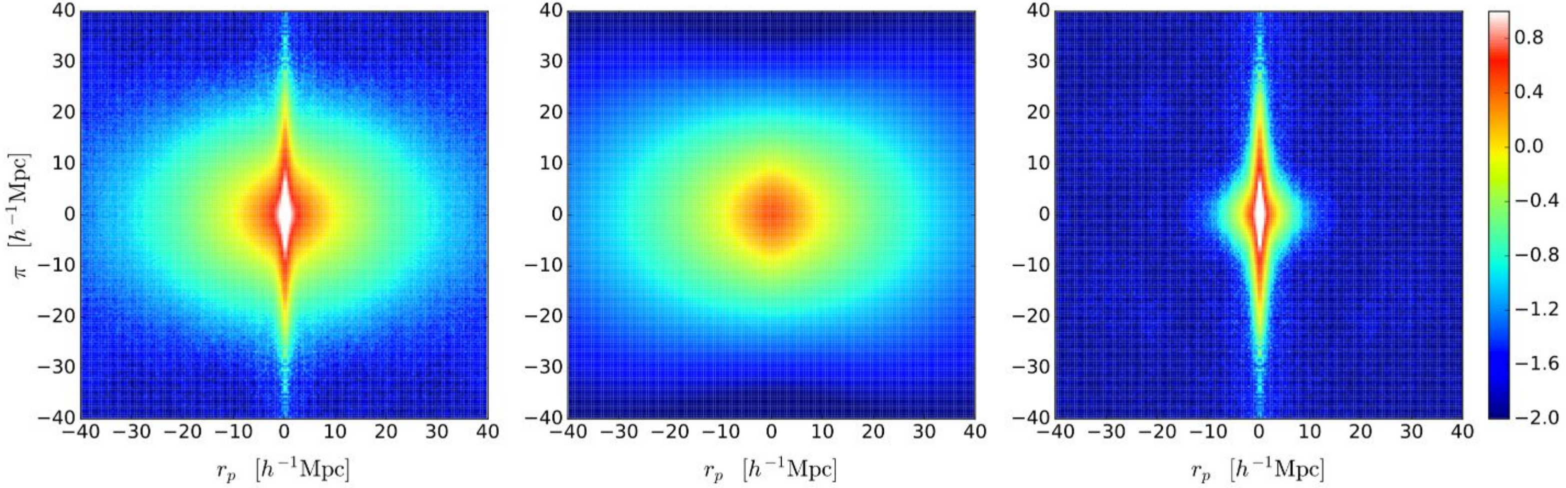
Maynooth University
National University of Ireland Maynooth



Point by point comparison

$$r_\delta = \frac{\langle \delta_{nb}\delta \rangle}{\langle \delta_{nb}^2 \rangle^{\frac{1}{2}} \langle \delta^2 \rangle^{\frac{1}{2}}}$$

John Peacock: other things

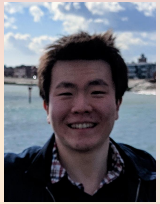


Halo streaming: use simulations to extract 1-halo template (2206.05065)

CMB lensing tomography: low Ω_m as a solution to S_8 tension (2010.00466)

Anthropic galaxy formation: simulate SFR(t) for large Λ (2209.08783)

Tidal anisotropy assembly bias: detected in GAMA survey (2305.01266)



Tripolar Spherical Harmonic Bispectrum

MikeSWang   mikeshengbo.wang@ed.ac.uk

TRIUMVIRATE

arXiv 2304.03643 JOSS 10.21105/joss.05571

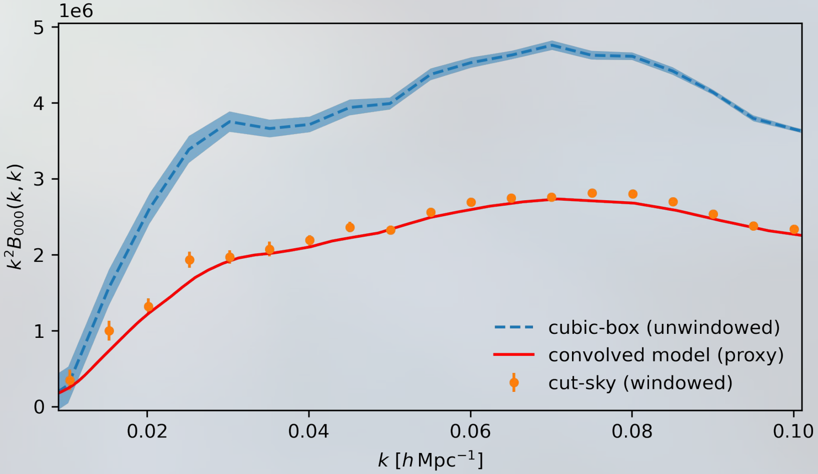
Tripolar spherical-harmonic decomposition (Sugiyama+ 2019)

$$B(k_1, k_2, \hat{n}) = \sum_{\ell_1 \ell_2 L} H^{-1}_{\ell_1 \ell_2 L} B_{\ell_1 \ell_2 L}(k_1, k_2) \sum_{m_1 m_2 M} \begin{pmatrix} \ell_1 & \ell_2 & L \\ m_1 & m_2 & M \end{pmatrix} y_{\ell_1}^{m_1}(\hat{k}_1)\, y_{\ell_2}^{m_2}(\hat{k}_2)\, y_L^M(\hat{n})$$

$$B_{\ell_1 \ell_2 L}(k_1, k_2) \propto \sum_M \int \mathrm{d}\cos\theta\, y_{\ell_2}^{M} \cdots B_{LM}(k_1, k_2, \theta)$$

Comparison with Scoccimarro multipoles:

- Lower data vector dimensions (2D vs 3D binning);
- No explicit triangles (handled through an inverse FFT);
- Window convolution analogous to power spectrum.



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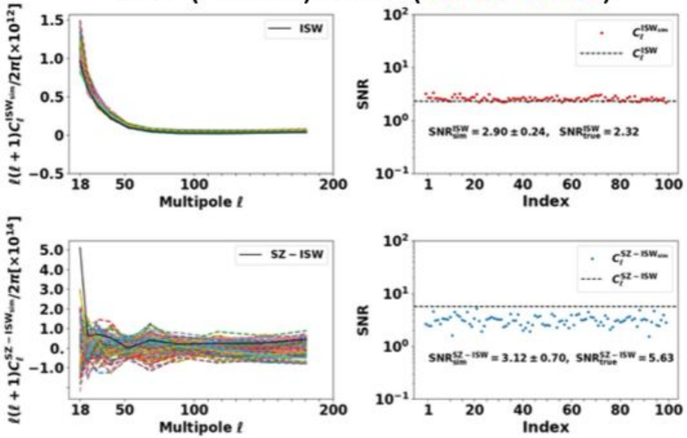
Yin-Zhe Ma: Other observations

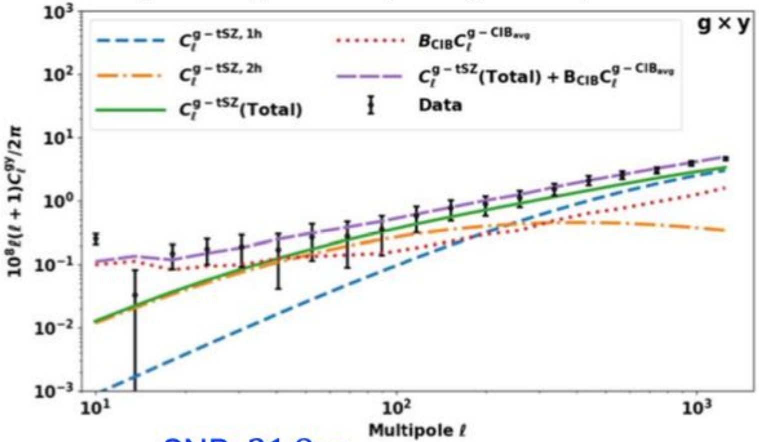
Head of Astrophysics Group, Stellenbosch University (South Africa)

ISW (Planck) × tSZ (2310.18478)



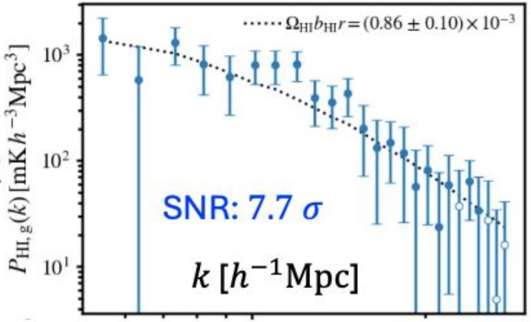
SNR: $(5.63 - 3.12)/0.7 \simeq 3.6$

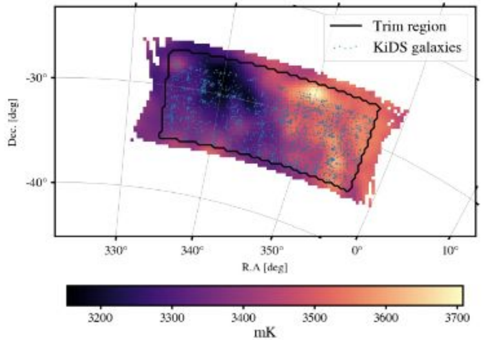
Projected galaxies (WISE) × tSZ (2310.18478)



SNR: $21.8\,\sigma$

MeerKAT X WiggleZ





Yan-Chuan Cai

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Large-scale structure with density-split clustering

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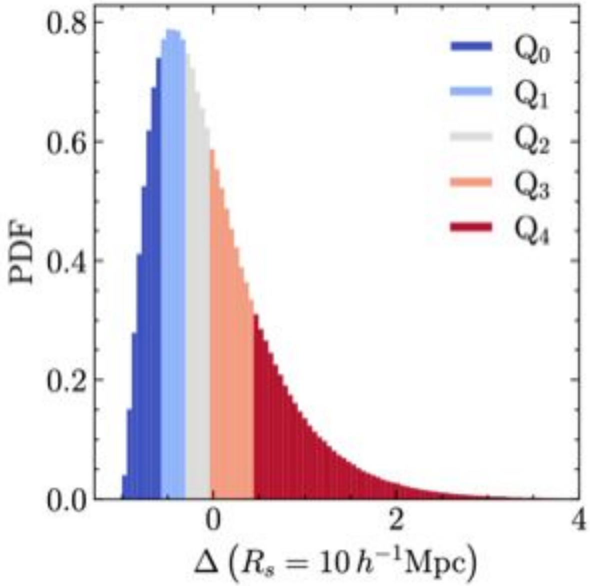
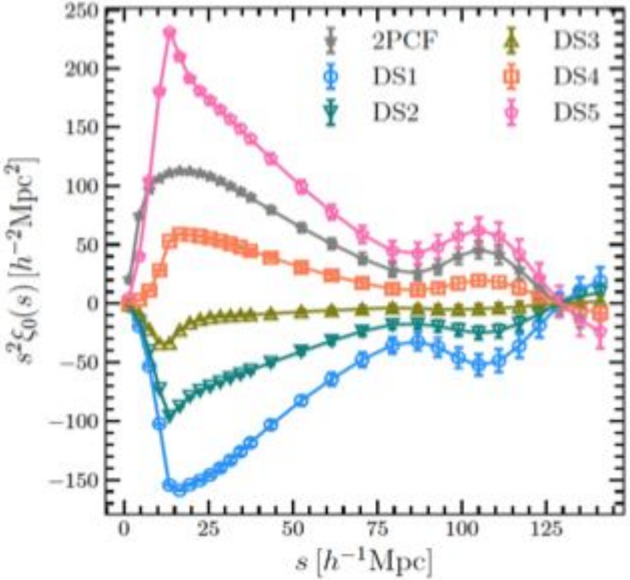
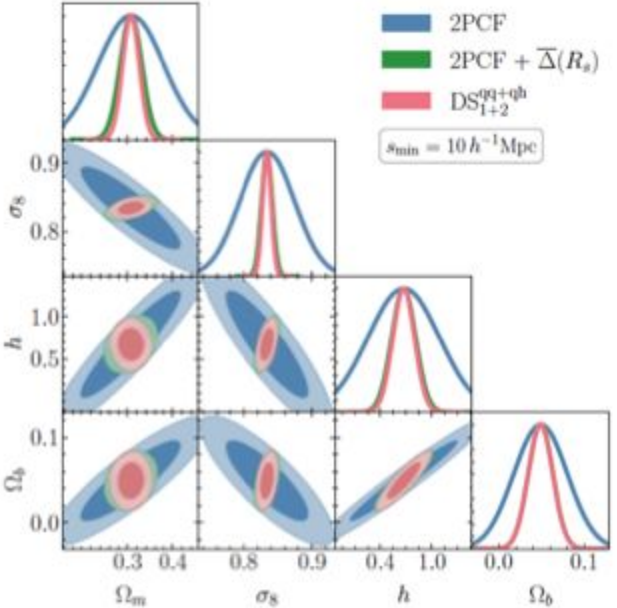






E. Paillas, YC, N. Padilla, A. Sánchez, 2021, MNRAS.505.5731P

E. Paillas, C. Cuesta-Lazaro, P. Zarrouk, YC... 2023, MNRAS.522.606P

Giblin B., YC & Hornois-Deraps 2023, MNRAS.520.1721G

E. Paillas...YC et al. 2024, MNRAS.531.898P

C. Cuesta-Lazaro...YC et al. arXiv:2309.16539

See also:

D. Gruen et al. 2018PhRvD..98b3507G

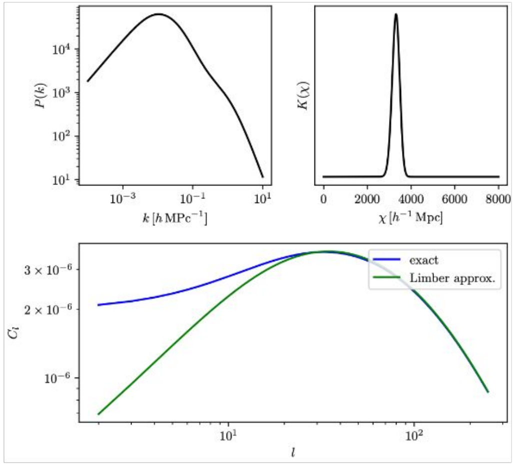
Neyrinck, M. et al, 2018, MNRAS.478.2495N

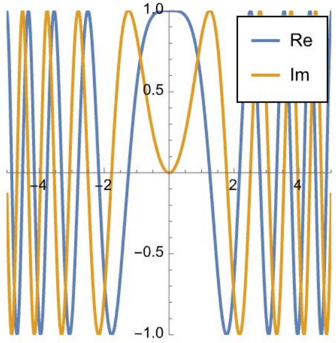
Abbas & Sheth 2007, MNRAS.378..641A

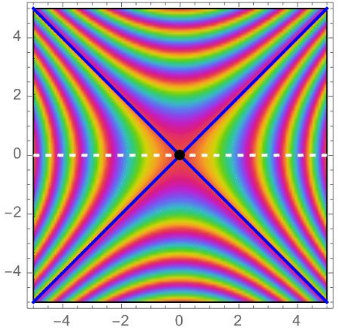
Repp & Szapudi, 2022, MNRAS.509..586R

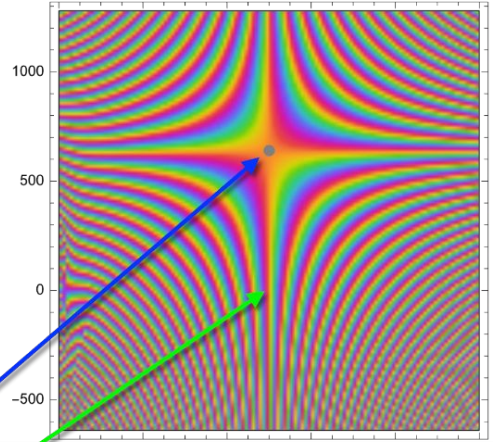
Complex Evaluation of Angular Power Spectra

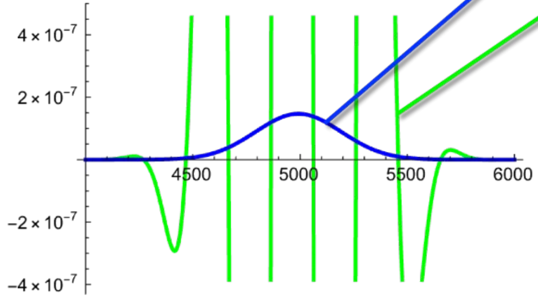
Benjamin Hertzsch, Job Feldbrugge

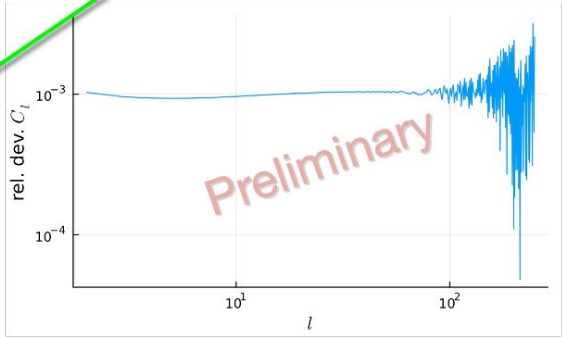












Angular power spectrum: three-dimensional integral

$$C_l = \frac{2}{\pi} \int\!\!\int\!\!\int \mathrm{d}k \mathrm{d}\chi_1 \mathrm{d}\chi_2 k^2 P(k, \chi_1, \chi_2) K_A(\chi) j_l(k\chi) K_B(\chi) j_l(k\chi)$$

Problem: Oscillatory integral (cf. Fresnel integral)

$$F_l(k) = \int_0^\infty \mathrm{d}\chi K(\chi) j_l(k\chi)$$ ➡ **complex SPA** [Feldbrugge (2023)]

- spherical Hankel integrand
- SPA for all relevant parameter space

➡ C_l **one-dimensional integral**, just like in Limber approximation

➡ **accurately evaluate** $F_l(k)$ without integral

Quenstion: Can we do integral in complex k …?