DEMNUni-Covariances project

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	Number of sims	Cosmology (background)	BoxSize / NumPart	Number of snapshot (+FoF, SubGroups, M200, …)
LCDM (Euclid official)	50 sims **+ 50 in early 2019**	OmeBr = 0.05 OmNeu = 0.0 OmCDM = 0.27 OmLam = 0.6800	Box Size = 1 Gpc/h Num Part = 1024^3	63 z in [0,99]
LCDM + Mnu= 0.16	50 sims **+ 50 in early 2019**	OmeBr = 0.05 OmNeu = 0.0 OmCDM = 0.27 OmLam = 0.6800	Box Size = 1 Gpc/h Num Part = 1024^3	63 z in [0,99]

Available (Healpix) Maps:

Particle Maps	• 50 x 63 Surface Mass Density Maps (for each snapshot/redshift, for each nbody simulation) • 50 x 63 CMB-Convergence Maps (for each snapshot/redshift, for each nbody simulation) → 50 <u>CMB-Convergence Integrated Map</u> (in Born approx. for each nbody simulation)
Grid maps	• 50 CMB-lensing potential & ISW/RS • 50 WL maps with sources placed at z=8,5,2,1

DEMNUni-Covariances project: CMB-Convergence

Corr.Matrix R_{ij} DEMNUni N_{sims} :50
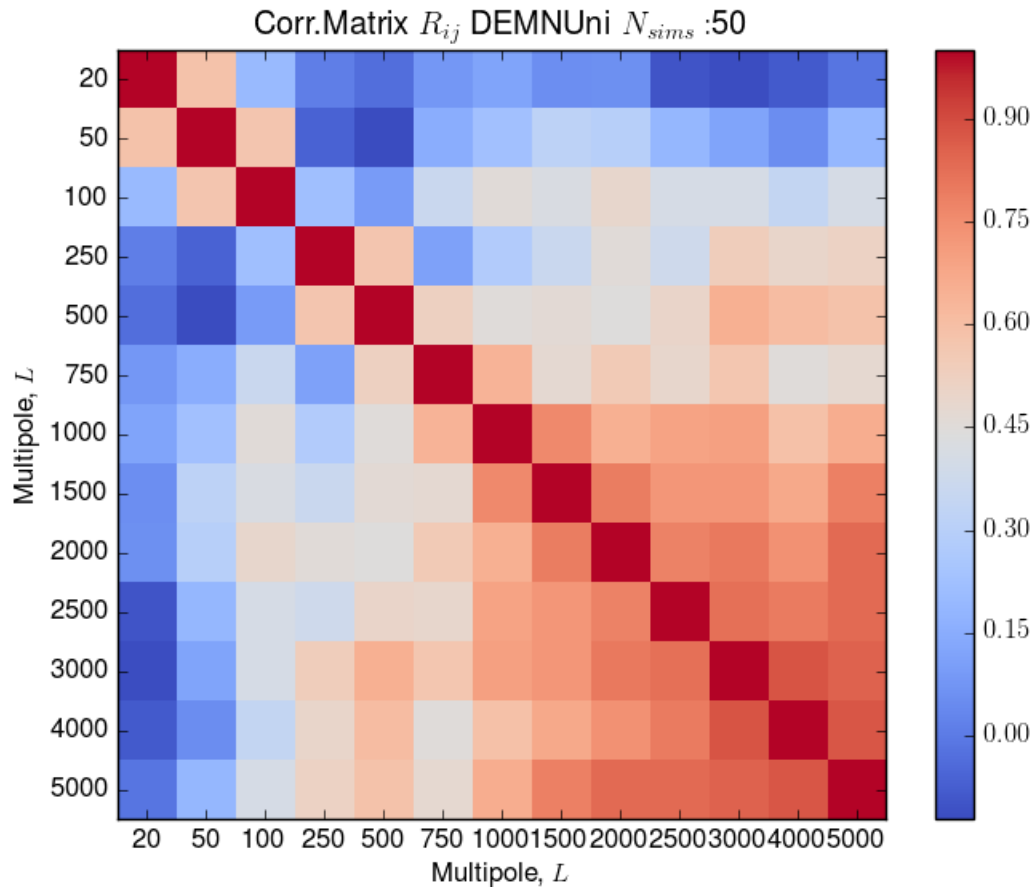
C_L CMB-Convergence DEMNUni →
Covariance Matrix

13 Bins in multipole, L =
{20,50,100,250,500,750,1000,1500,2000,
2500,3000,4000,5000}
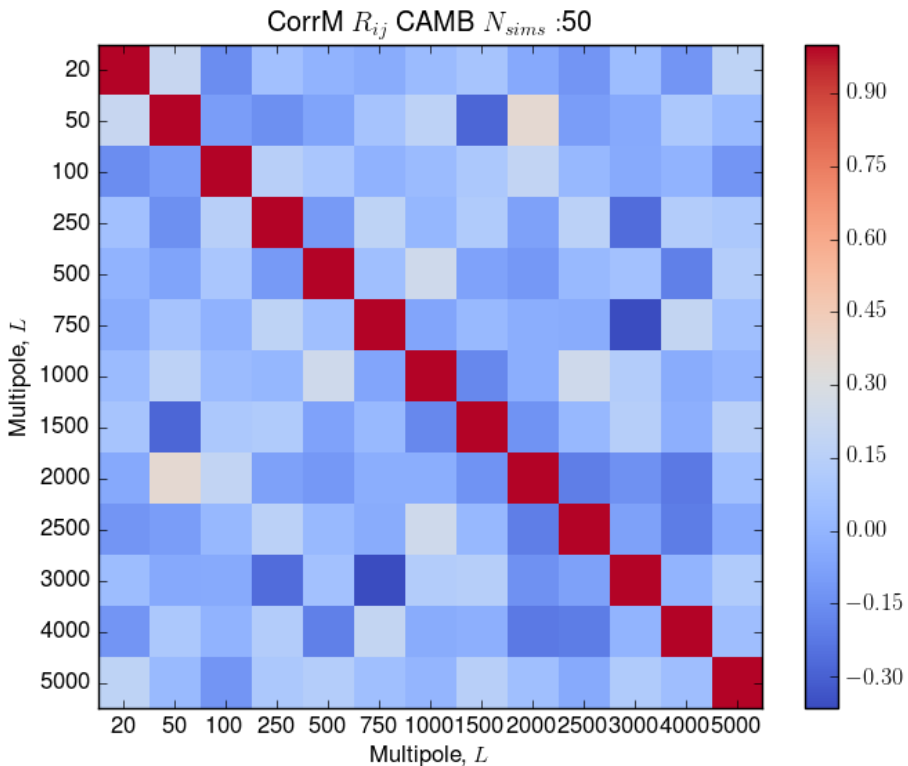
Nside Convergence maps = 4096
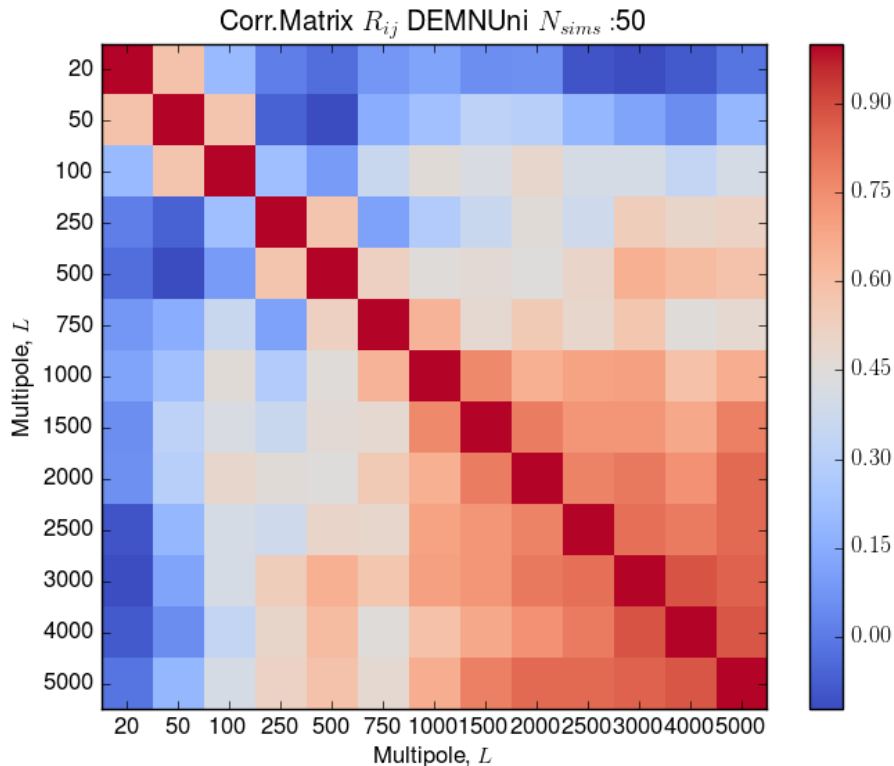Number of Simulations = 50

LCDM only
(LCDM+Mnu=0.16 *in production*)

<u>Figures are Correlation Matrix</u>
(Covariances normalized to diagonal variances)
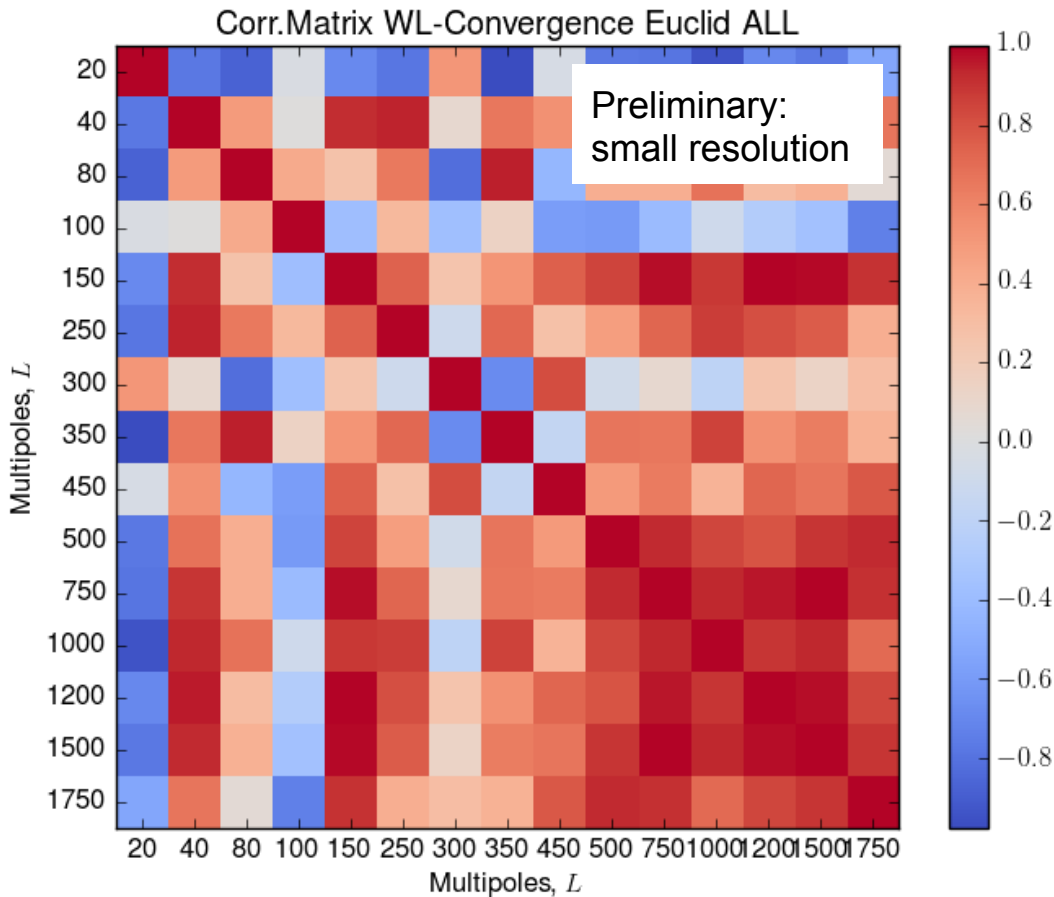
DEMNUni-Covariances project: CMB-Convergence

C_L CAMB → Covariance Matrix

C_L DEMNUni → Covariance Matrix

DEMNUni-Covariances project: WL-Convergence

Corr.Matrix WL-Convergence Euclid ALL

Preliminary:
small resolution

C_L WL-Convergence DEMNUni →
Covariance Matrix

16 Bins in multipole, L =
{20,40,80,100,150,250,300,350,450,500,750,1000,1200,1500,1750,2000}

Nside Convergence maps = 1024
elle-max = 2048
(Preliminary, small resolution)

LCDM only
(LCDM+Mnu=0.16 *in production*)

n(z) is Euclid red book

Figures are Correlation Matrix
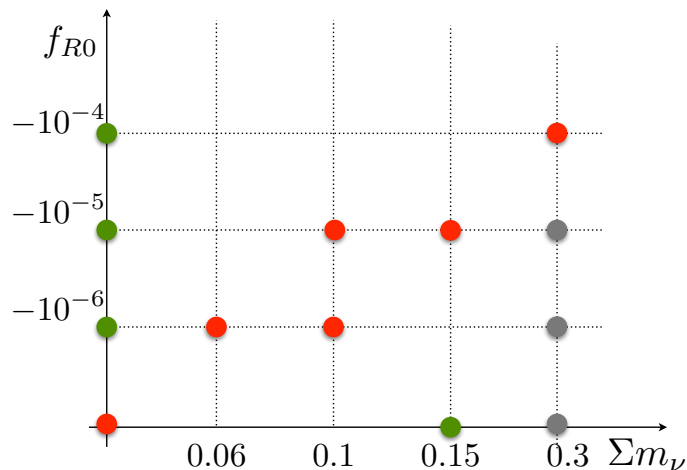*(Covariances normalized to diagonal variances)*

D U S T G R A I N

Dark Universe Simulations to Test GRAvity In the presence of Neutrinos

Combining **a full solver for f(R) gravity** (ᴍɢ-ɢᴀᴅɢᴇᴛ, Puchwein, MB & Springel 2013) with the **particle-based implementation of massive neutrinos** (ɴᴜ-ɢᴀᴅɢᴇᴛ, Viel, Haehnelt & Springel 2010)
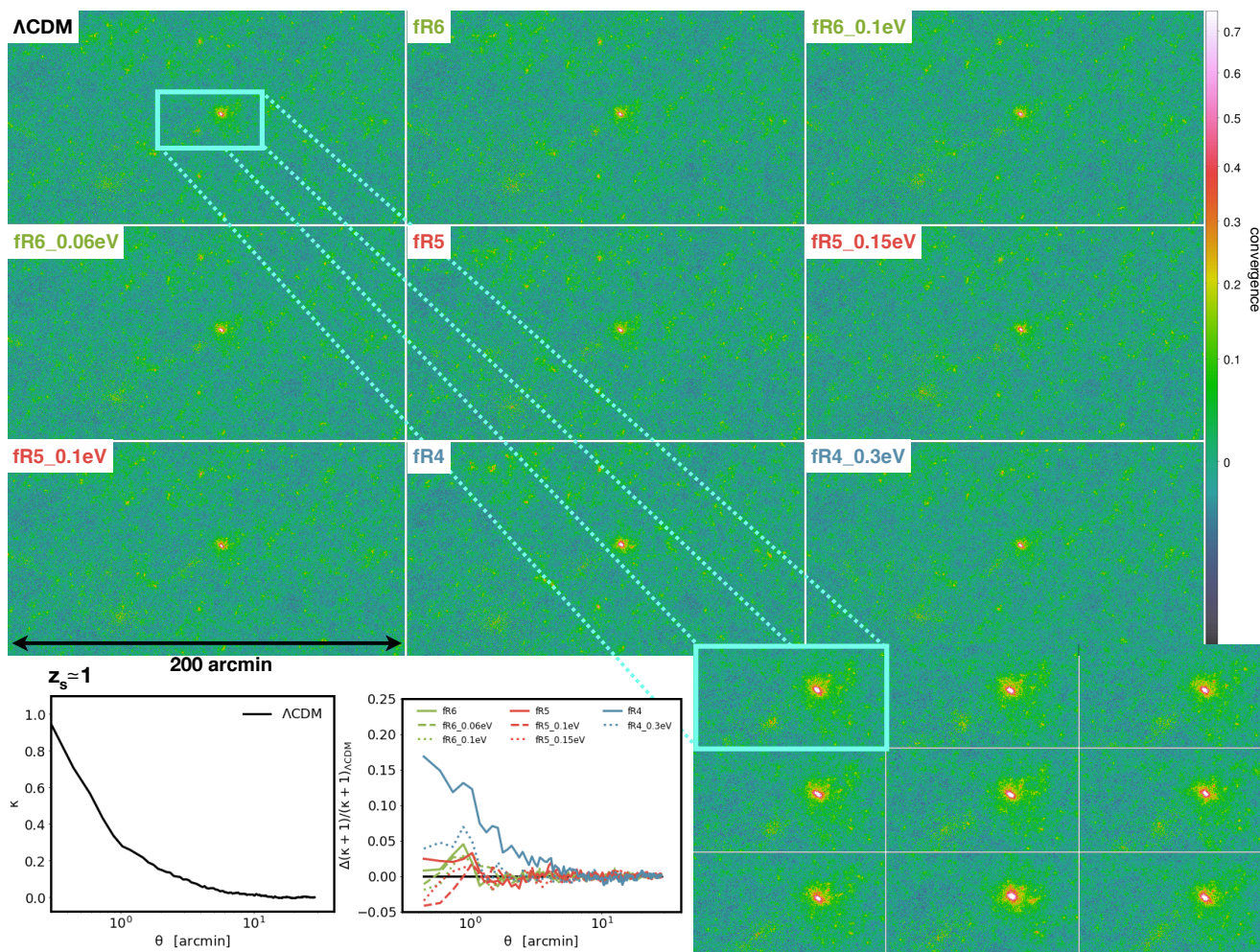
Full simulations (2 Gpc, 2x2048³ particles) **currently running…**
Calibration sample (DUSTGRAIN-*pathfinder*) **available!**

C. Giocoli

Giocoli & MB in prep.

Peel, MB et al. arXiv:1805:05146

source redshift $z_s = 1.0$

Legend:
- ΛCDM
- $f_4(R)$ $[m_\nu = 0\,\text{eV}]$
- $f_5(R)$ $[m_\nu = 0\,\text{eV}]$
- $f_6(R)$ $[m_\nu = 0\,\text{eV}]$

Axes: $\ell^2 P_\kappa(\ell)$ versus multipole ℓ; lower panel relative $\Delta_{\Lambda\text{CDM}}$

Peel, MB et al. arXiv:1805:05146

source redshift $z_s = 1.0$

Plot legend:
- ΛCDM
- $f_5(R)$ $[m_\nu = 0\,\mathrm{eV}]$
- $f_5(R)$ $[m_\nu = 0.1\,\mathrm{eV}]$
- $f_5(R)$ $[m_\nu = 0.15\,\mathrm{eV}]$

Vertical axis (top): $\ell^2 P_\kappa(\ell)$
Vertical axis (bottom): relative $\Delta_{\Lambda\mathrm{CDM}}$
Horizontal axis: multipole ℓ
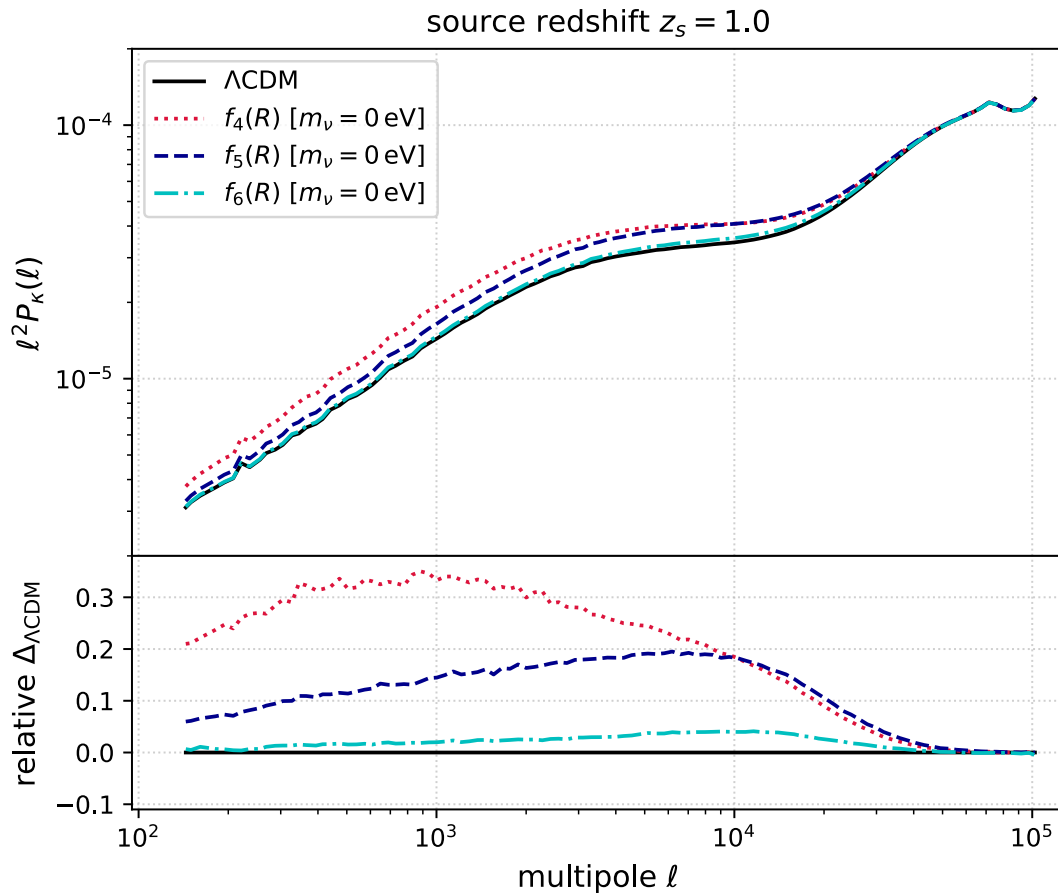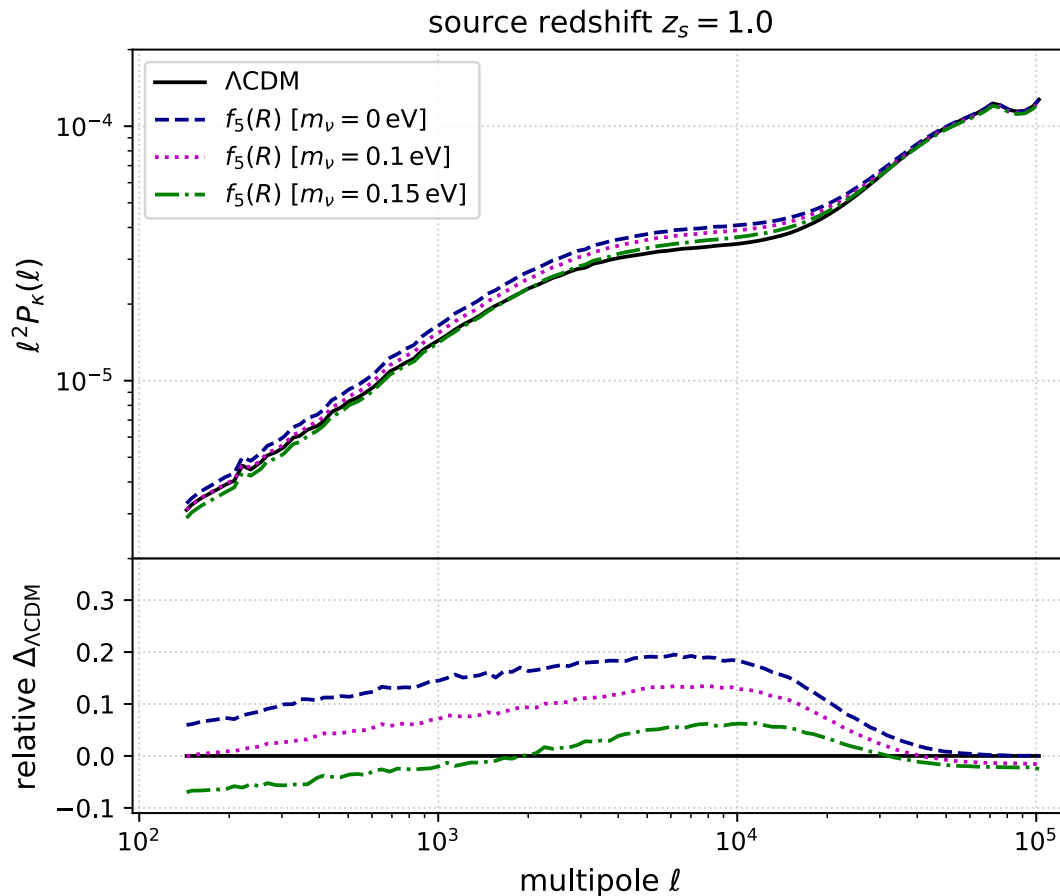
Status and plan

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Done	- Galaxy weak-lensing capabilities tested with code comparison project - Estimation of CMB lensing potential with 2nd-order effects
Doable	- Improve ISW-galaxy cross-correlation simulations - Start investigating covariance of estimators with (some) non-linear effects
Todo	- Raytracing to have post-Born effects / observables - Interface with SZ cluster simulations @ IAS
Problems	- HOD and SHAM galaxy mocks for cross-correlation - Expertise lost, considering publicly available tool **Need Manpower**