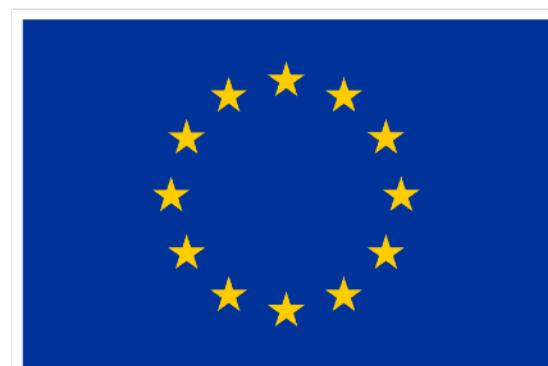


Euclid-INFN@TO Activity Report 2025

Stefano Camera

Department of Physics, Alma Felix University of Turin, Italy



Funded by
the European Union
NextGenerationEU

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Euclid-INFN@TO Group



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Stefano Camera
[Associate Professor]



Francesco Pace
[Researcher]



Nicolao Fornengo
[Full Professor]



Lorenzo Fatibene
[Full Professor]



Matteo Luca Ruggiero
[Associate Professor]



Benedict Bahr Kalus
[Postdoctoral Researcher]



Giulia Piccirilli
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Sam(anth) Rossiter
[4th-yr PhD Student]



Federico Montano
[2nd-yr PhD Student]



Jiakang (Jack) Han
[2nd-yr PhD Student]

+ $O(5)$ *MPhys Students*
and *Collaborators*

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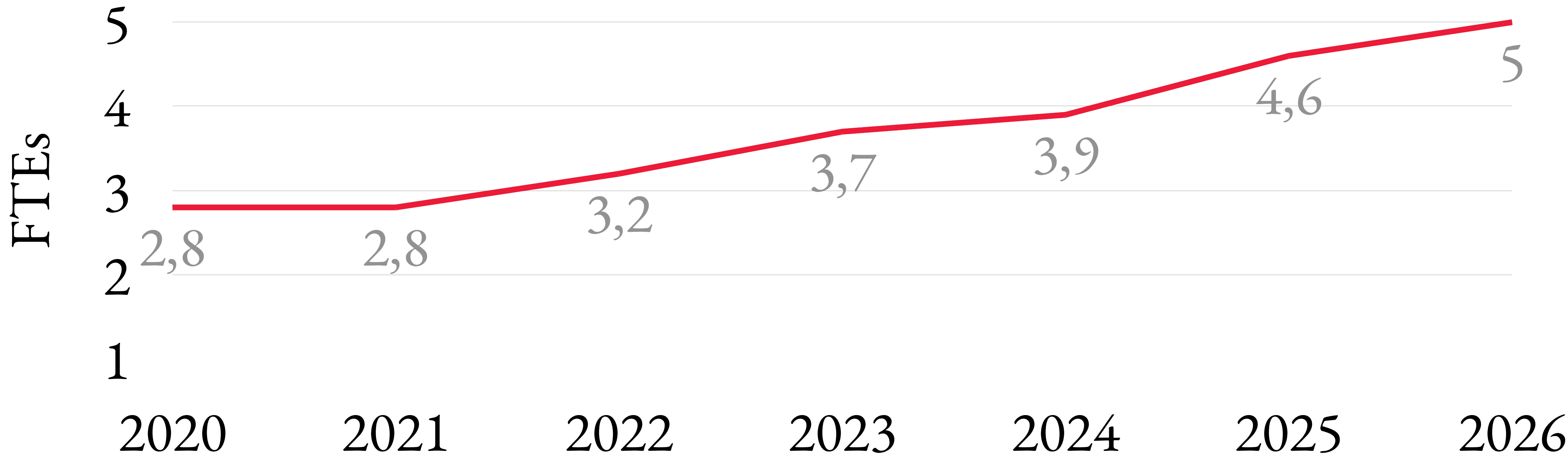


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- Who are we?
 - Active and proactive group; built up momentum over the years; diverse set of skills, building bridges between theory and observations; good balance between senior and junior members (~30% w/ management roles and ~70% working on projects)

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- Proficiencies and know-how
 - Large-scale structure of the Universe; cosmological perturbations (linear and non-linear regimes); extended models of gravity for dark matter and dark energy; modelling of power spectra in Fourier and harmonic space; novel observables and multi-wavelength synergies; development of techniques to detect of new effects

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- Involvement in the Euclid Consortium
 - Galaxy Clustering, Weak Lensing, Theory, and CMBX Science Working Groups (SWGs)
 - Inter SWG Taskforces (ISTs) for Forecasts, Likelihood, and Non-linearities
 - Diversity Committee, Publication Group for Science, pre-launch and DR1 Key Project (KP) coordination
 - Q1 and DR1 data analysis

Research activities in 2025



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- Milestone
 - Submission of PL-KP-GC-7 Paper (Euclid Collaboration: Duret et al., arXiv:2503.11621) [^{*}]

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- Work on data/pipeline
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 - Work on the spectroscopic galaxy clustering pipeline to implement relativistic and wide-angle effects [*]
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- Other deliverables
 - Active involvement (=1st-tier authorship) in 6 KP Papers [A&A 693, A58 [*]; A&A 693, A249; A&A 694, A321; A&A 697, A85; A&A 697, A1; A&A 698, A233]
 - Submission of Euclid Collaboration: Albuquerque et al., arXiv:2506.03008
 - Submission to EC Editorial Board of PL-KP-JC-3 (CLOE) Papers 1–6
 - Submission to EC Editorial Board of PL-KP-GC-7 Paper: Matthewson et al.
 - Submission to EC Editorial Board of Q1 SP Paper: Piccirilli, Bahr-Kalus, Camera et al. [*]

[*] Milestone



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Euclid preparation.

BAO analysis of photometric galaxy clustering in configuration space

Euclid Collaboration: V. Duret^{★1}, S. Escoffier¹, W. Gillard¹, I. Tutusaus², *S. Camera*^{3,4,5}

[*] Milestone

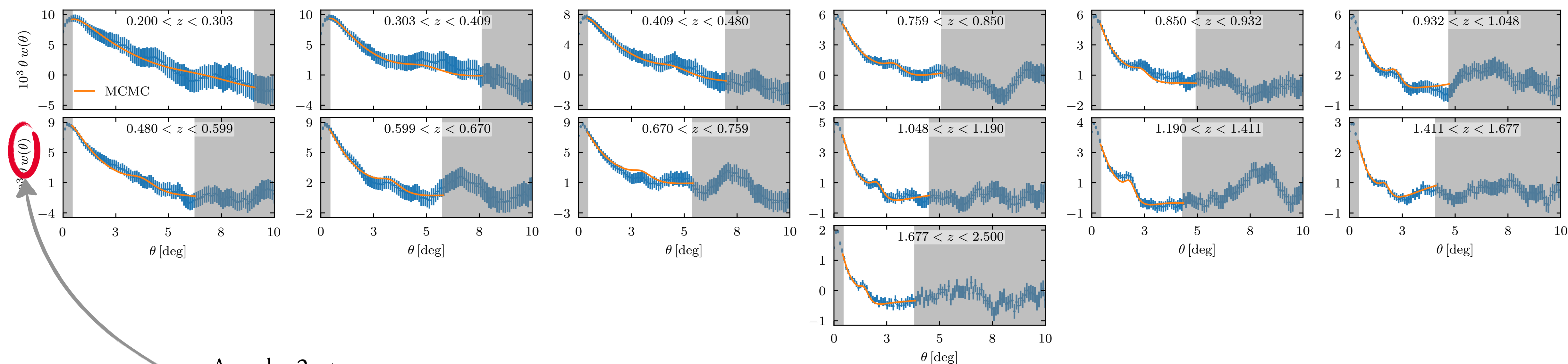


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Angular 2-pt
correlation function

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- Per-bin detection of the (transverse) Alcock-Paczyński parameter, α

Bin	z_{\min}	z_{eff}	z_{\max}	α	$\Delta_{\text{det}} (\sigma)$
1	0.200	0.307	0.396	$1.055^{+0.102}_{-0.148}$	no detection
2	0.396	0.432	0.507	$1.021^{+0.118}_{-0.131}$	no detection
3	0.507	0.578	0.657	$1.086^{+0.068}_{-0.106}$	1.2
4	0.657	0.727	0.840	$0.909^{+0.113}_{-0.070}$	1.2
5	0.840	0.893	1.040	$1.016^{+0.120}_{-0.155}$	no detection
6	1.040	1.325	2.500	$1.045^{+0.079}_{-0.089}$	1.1

Bin	z_{eff}	α	$\Delta_{\text{det}} (\sigma)$
1	0.290	$1.026^{+0.122}_{-0.140}$	no detection
2	0.374	$1.044^{+0.097}_{-0.107}$	1.2
3	0.436	$0.957^{+0.112}_{-0.093}$	1.1
4	0.527	$1.003^{+0.146}_{-0.123}$	no detection
5	0.613	$1.002^{+0.079}_{-0.095}$	1.1
6	0.705	$0.985^{+0.087}_{-0.096}$	no detection
7	0.802	$0.932^{+0.072}_{-0.054}$	1.5
8	0.858	$1.052^{+0.067}_{-0.067}$	1.7
9	0.972	$1.037^{+0.057}_{-0.048}$	1.5
10	1.090	$1.015^{+0.029}_{-0.028}$	2.7
11	1.245	$1.031^{+0.024}_{-0.024}$	4.0
12	1.488	$0.996^{+0.040}_{-0.038}$	2.4
13	1.922	$0.991^{+0.036}_{-0.037}$	2.9

[*] Milestone

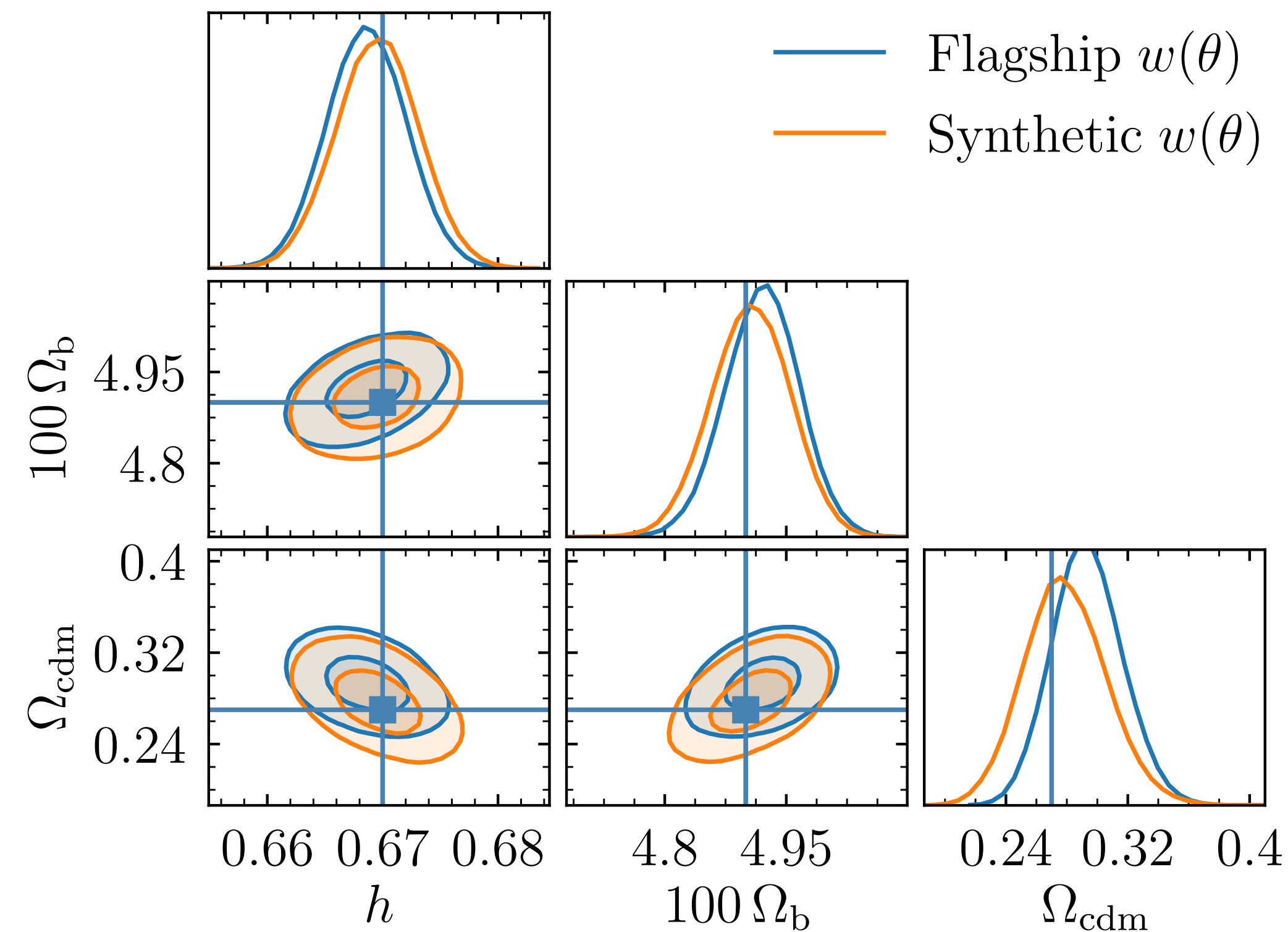


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[*] Relativistic & wide-angle effects

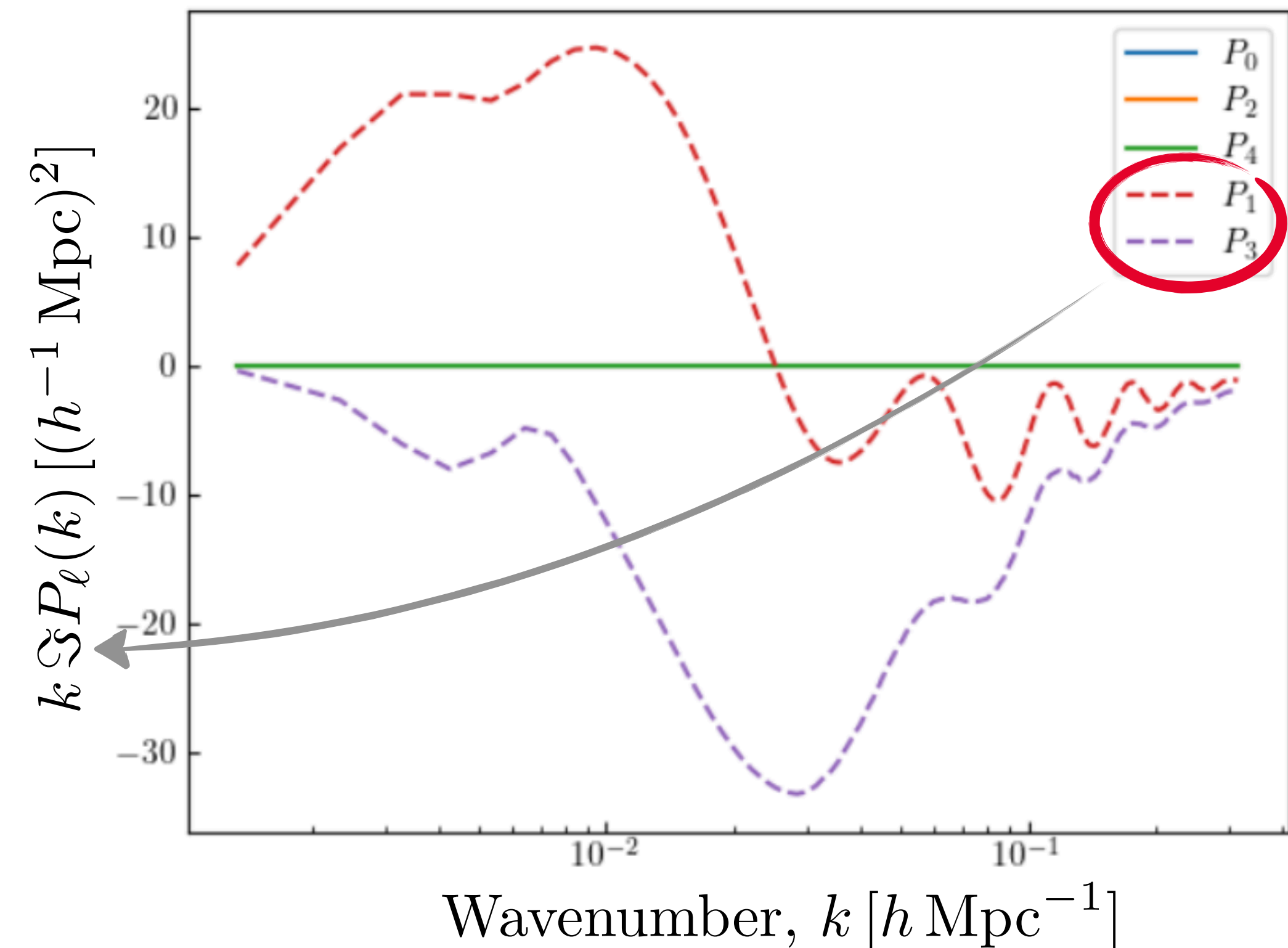
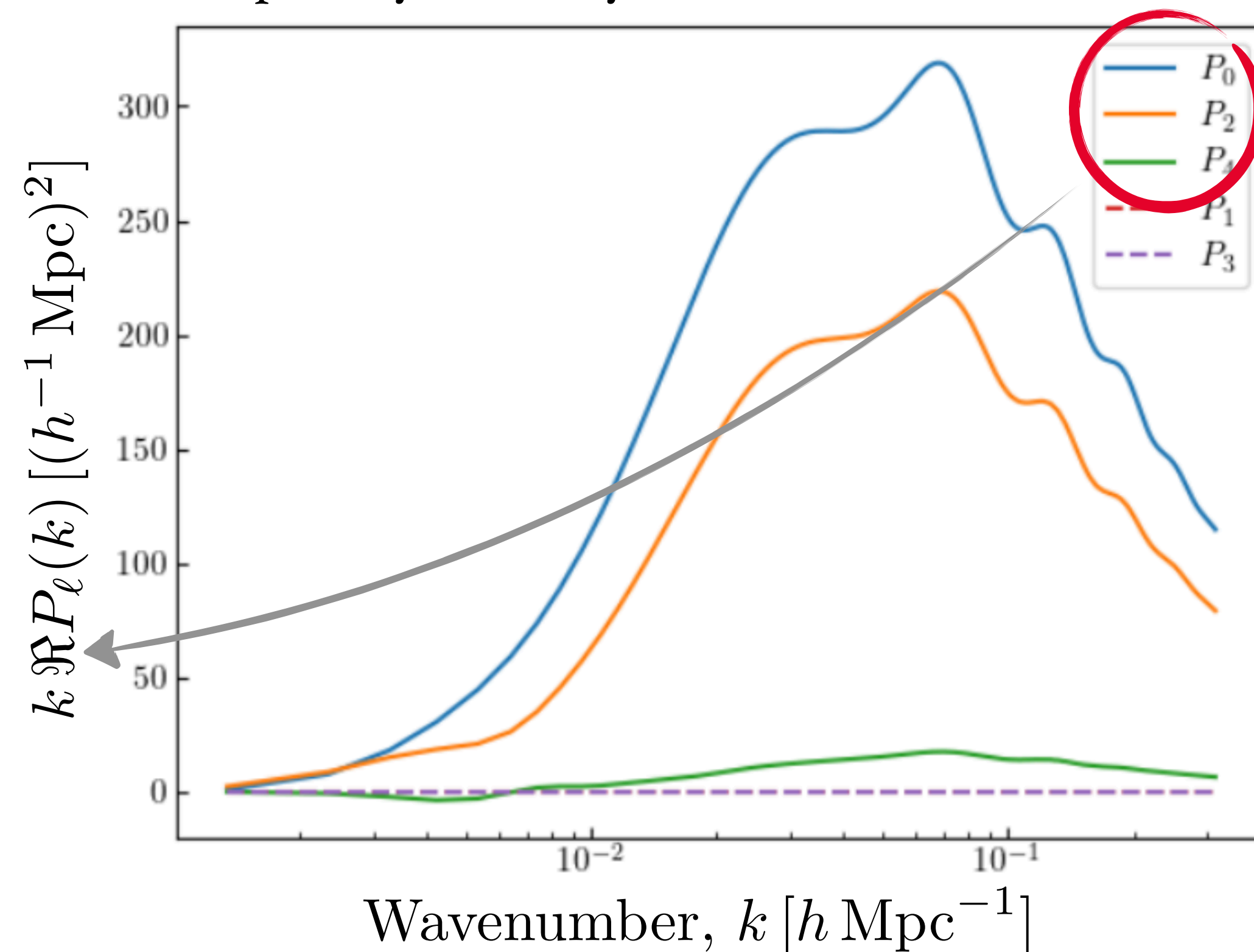


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- Team: *F. Montano*, *S. Camera*, M.Y. Elkhatab (INAF-OATs), J. Salvalaggio (UniTS)

[*] Relativistic & wide-angle effects

- Team: *F. Montano*, *S. Camera*, M.Y. Elkhshab (INAF-OATs), J. Salvalaggio (UniTS)
- Results:
 - Derived and implemented the cross-correlation power spectrum model in the PBJ code—and it can consequently be easily absorbed into the official EC likelihood code, CLOE



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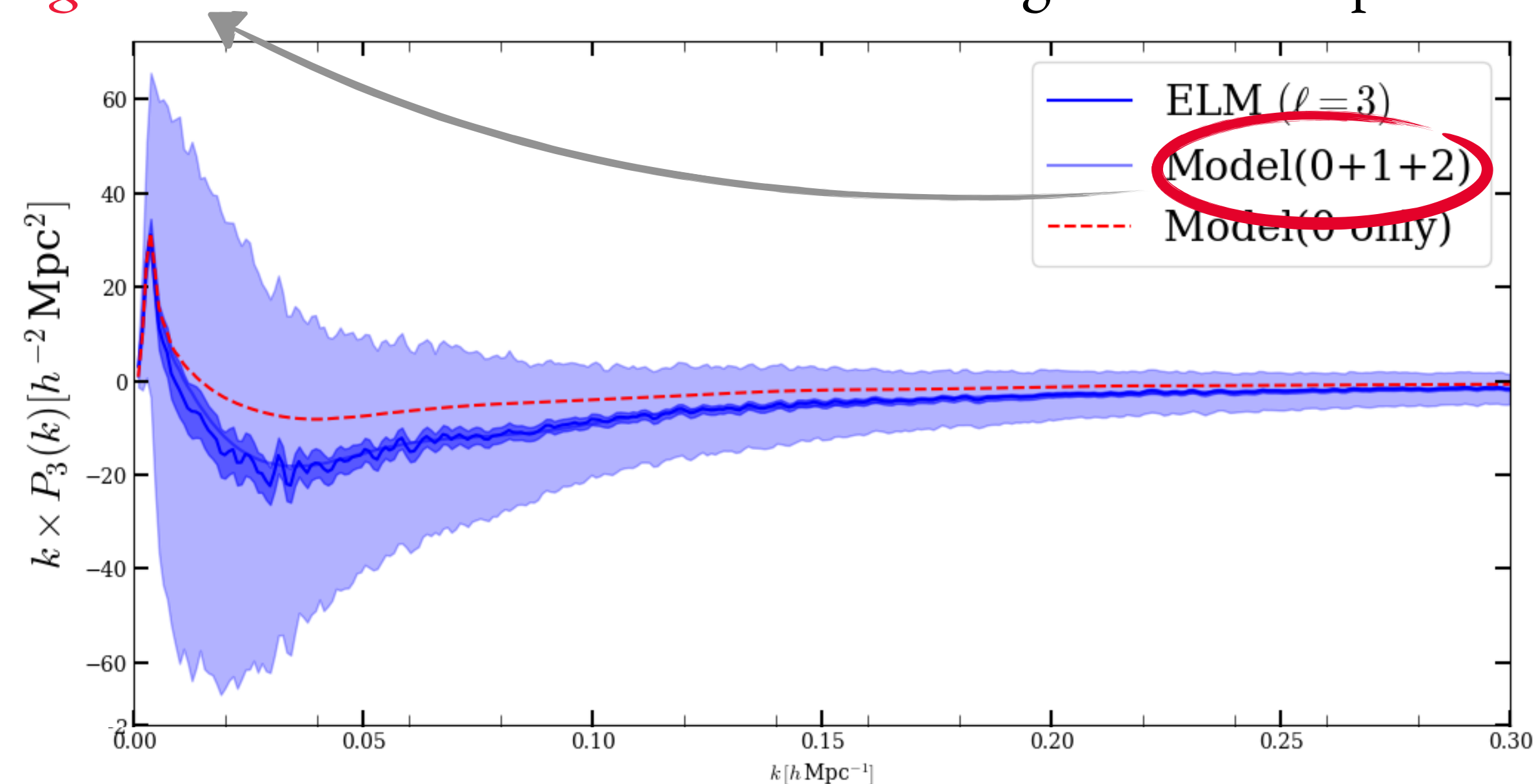
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 - Created low-resolution mocks to estimate the cross-spectrum signal

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- Results:
 - Derived and implemented the cross-correlation power spectrum model in the PBJ code—and it can consequently be easily absorbed into the official EC likelihood code, CLOE
 - Created low-resolution mocks to estimate the cross-spectrum signal
 - Confirmed that *wide-angle corrections* recover observed odd Legendre multipoles of the *Euclid* Large Mocks



[*] *Euclid* and neutrinos



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Euclid preparation

LIV. Sensitivity to neutrino parameters

Euclid Collaboration: M. Archidiacono^{1,2,*} , J. Lesgourgues³ , S. Casas³ , S. Pamuk³ , N. Schöneberg⁴ ,
Z. Sakr^{5,6,7} , G. Parimbelli^{8,9,10} , A. Schneider¹¹ , F. Hervas Peters^{12,11}, *F. Pace*^{13,14,15} , V. M. Sabarish^{3,16} 

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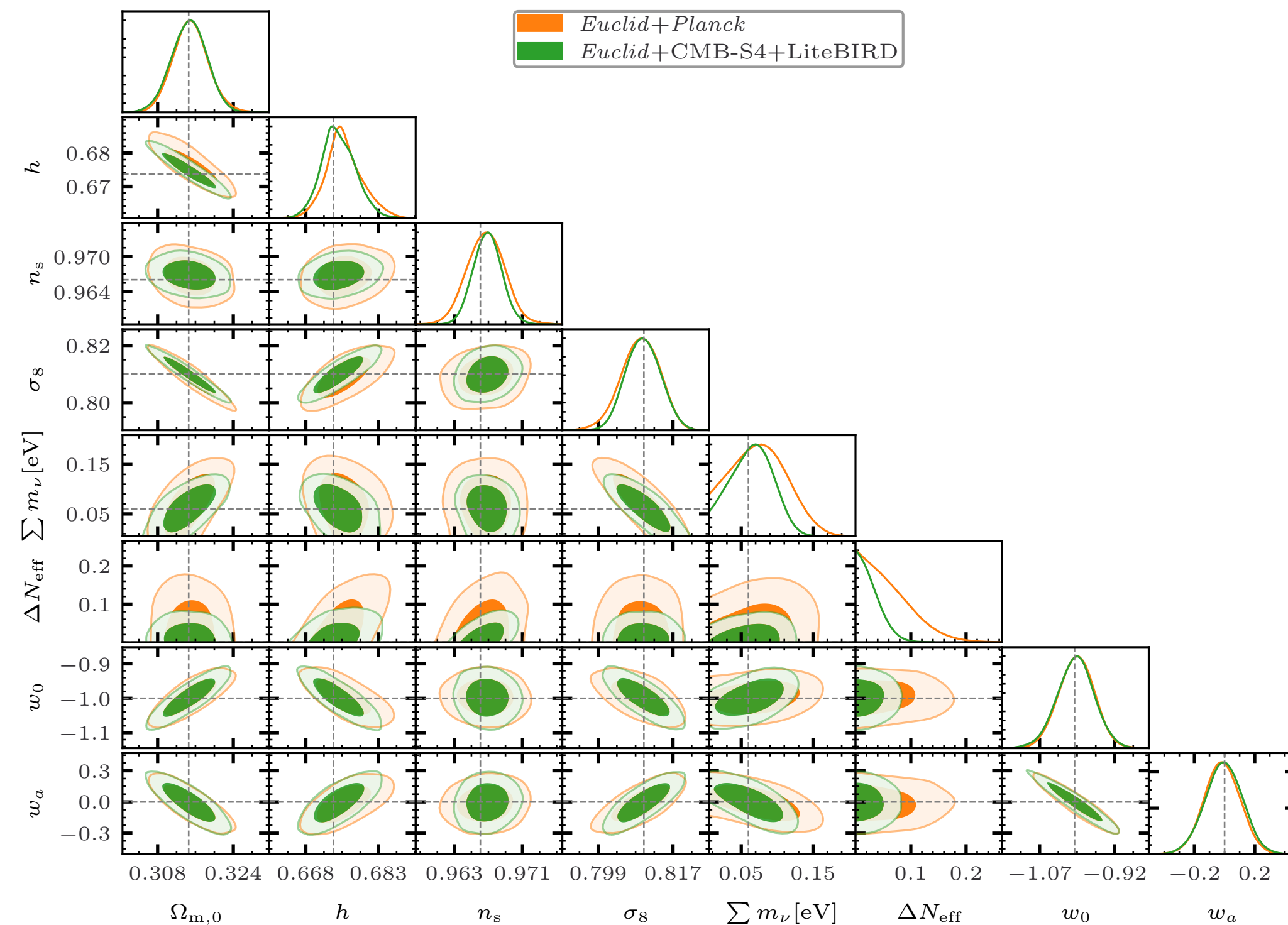


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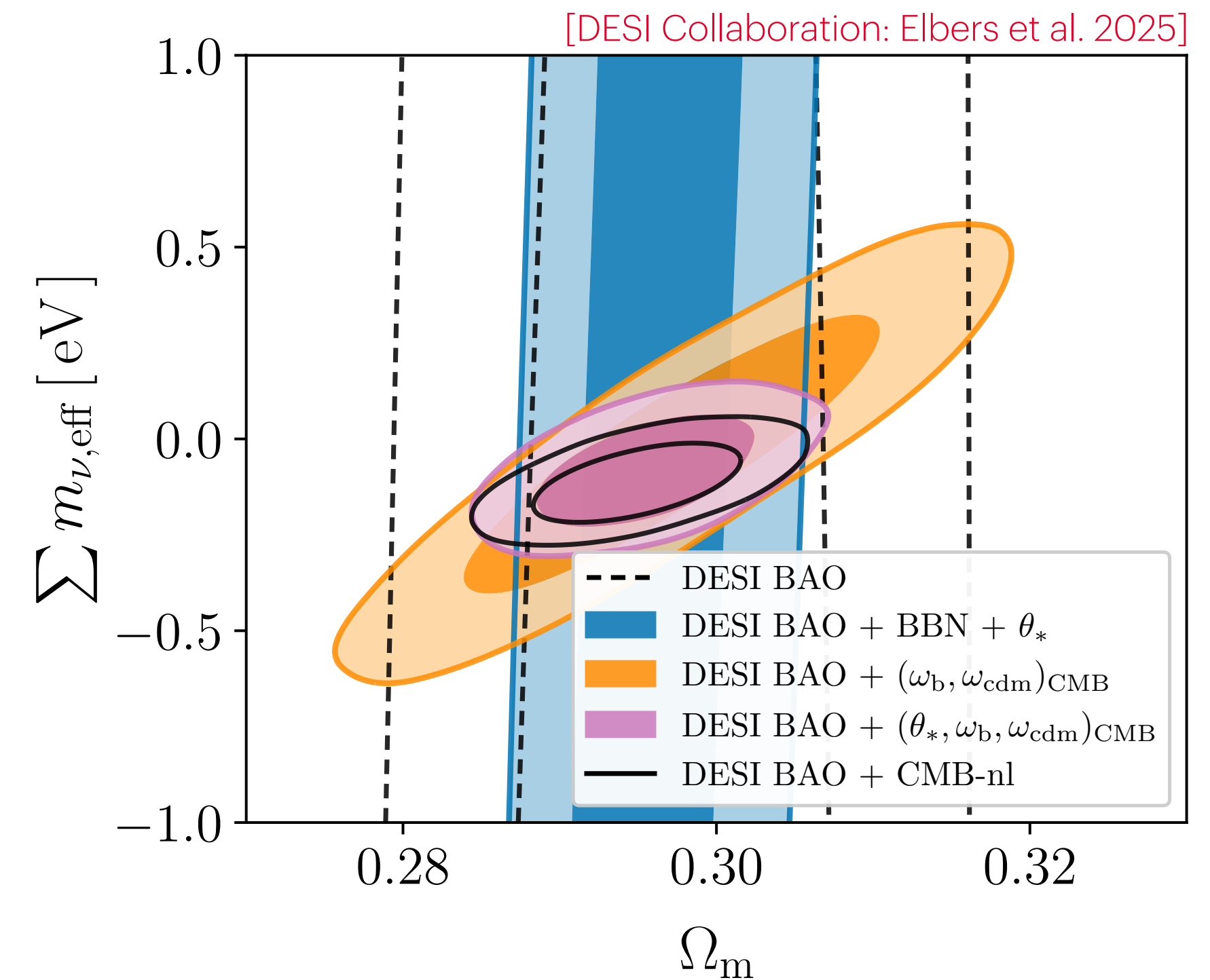
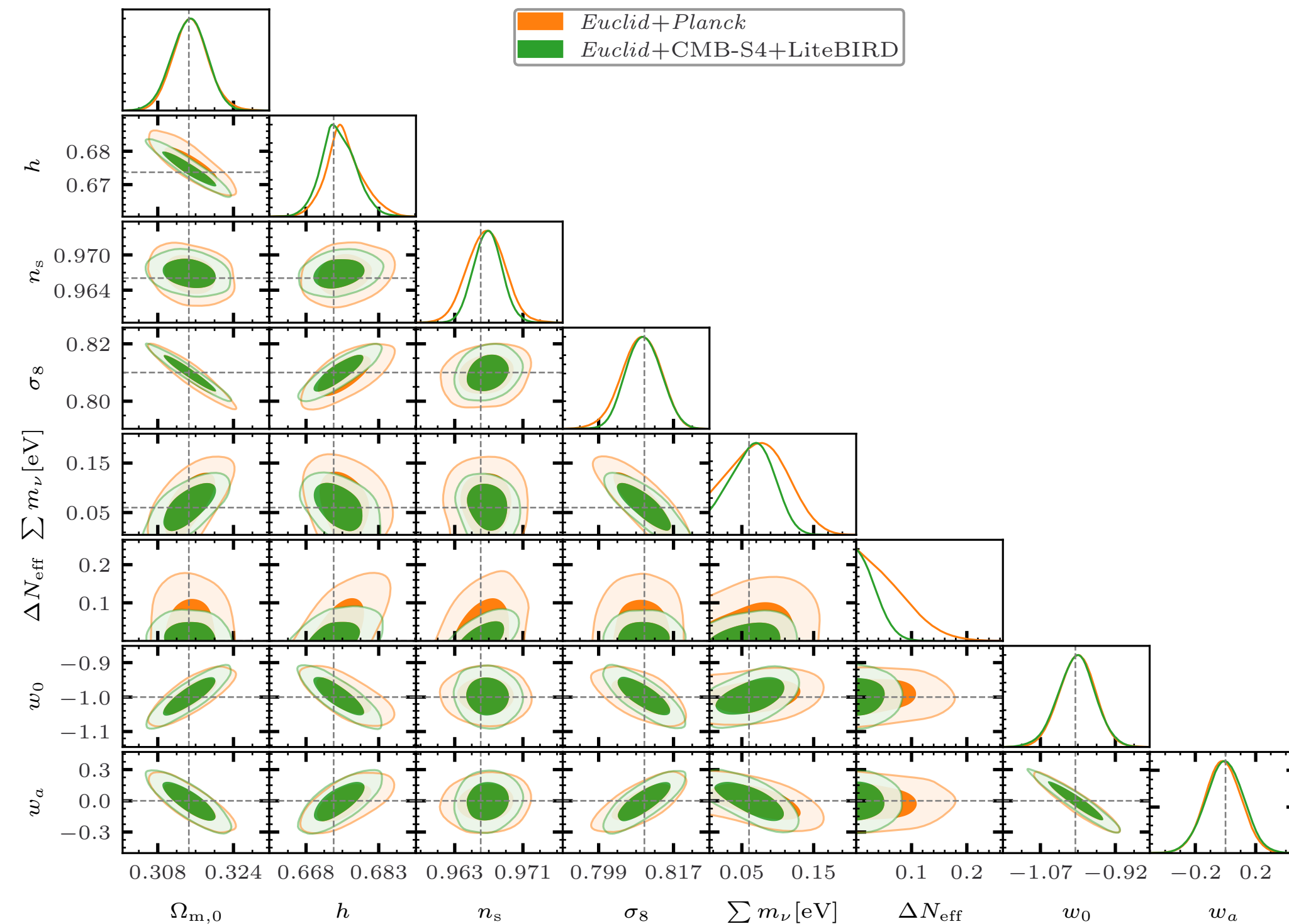


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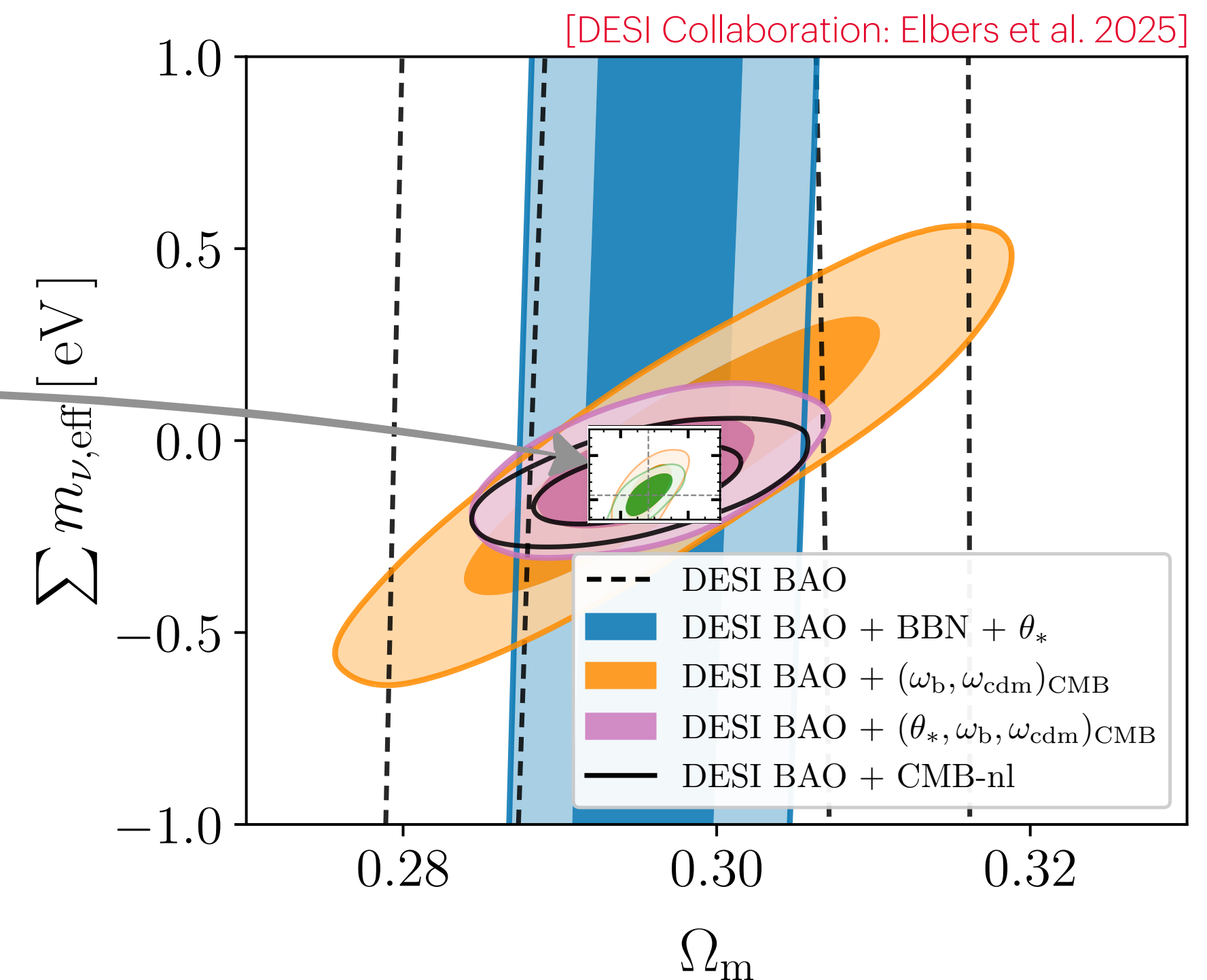
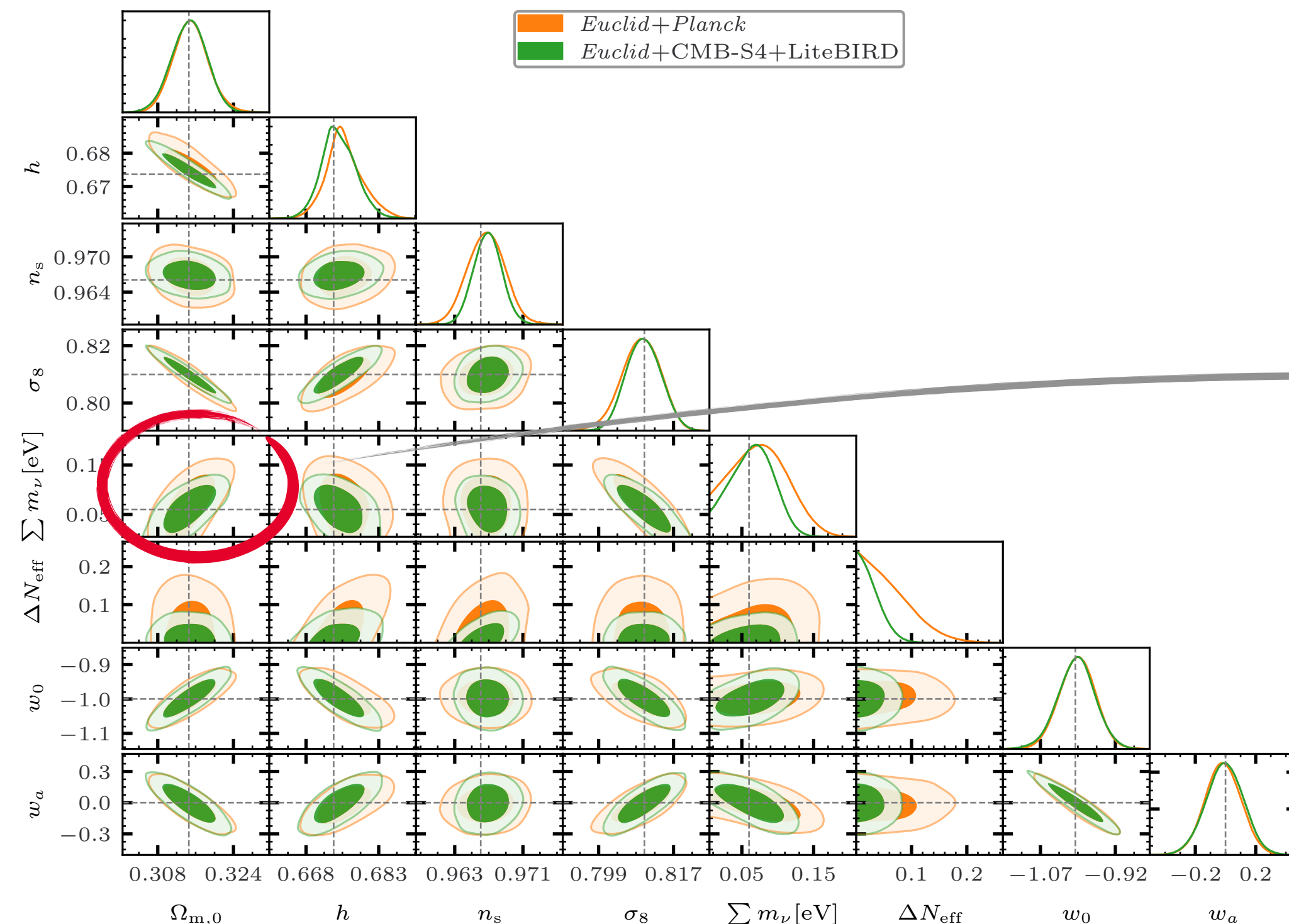


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[*] First *Euclid*-radio survey synergy



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EMU and *Euclid*: Detection of a radio-optical galaxy clustering cross-correlation signal between EMU and *Euclid* ★

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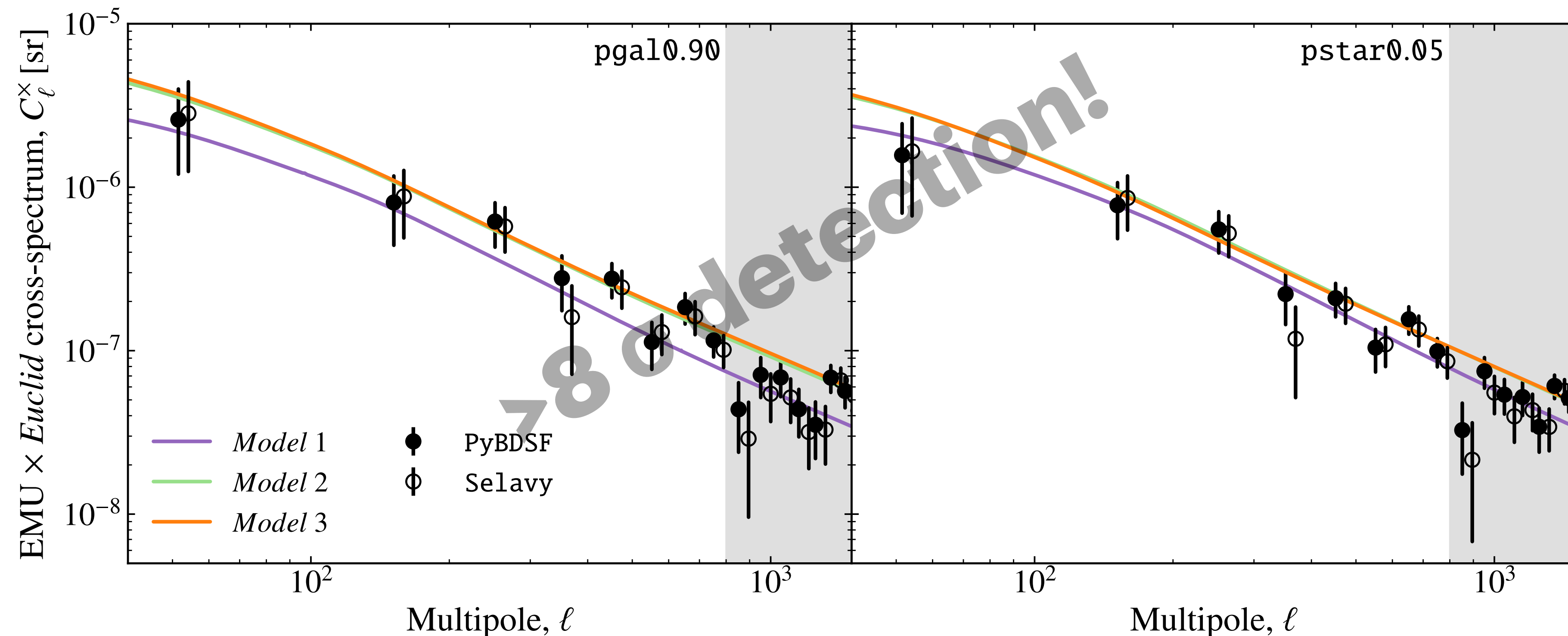
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Plan for 2026



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- Keep on working on Q1 data, especially in synergy with surveys at other wavelengths (radio, microwave, ...)
- Stress-testing and first analysis of RR2 data set
- Work on DR1 KPs
 - Coordination of DR1-KP-JC-2 '*Euclid* cosmological constraints from combined photometric probes'
 - Merging of relativistic and wide-angle power spectrum estimator in CLOE
 - Exhaustive assessment of the 'scattering matrix' approach to DR1 photo- z clustering power spectra