Euclid Activities Status Report

Sezione Roma 1

Meeting Referee INFN

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Milano, 11/09/2026

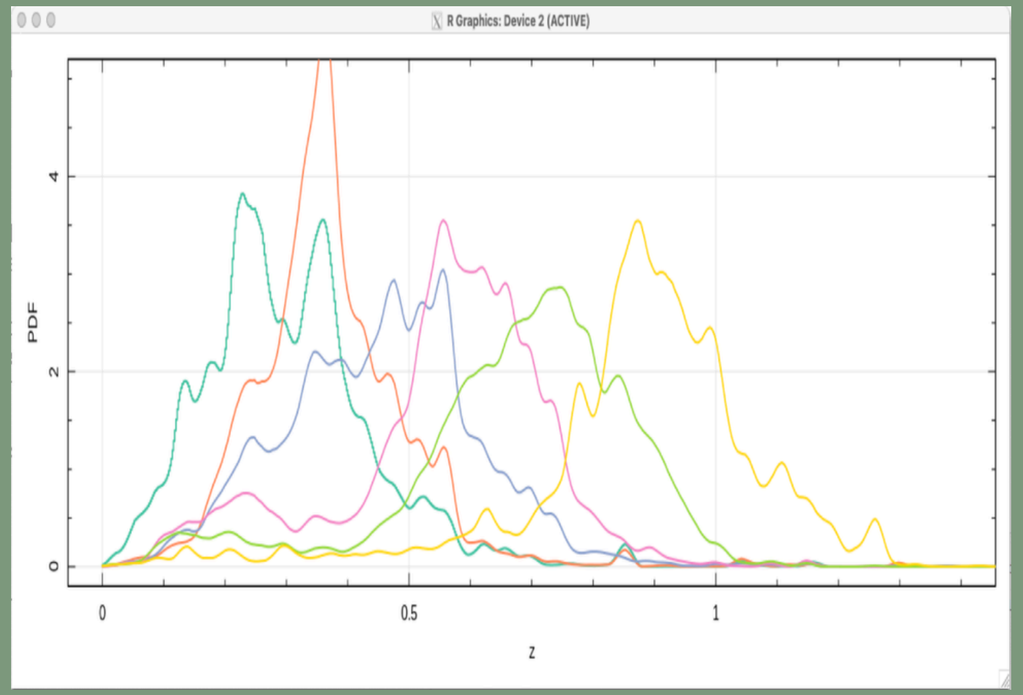
Summary of Activities in Rome 1

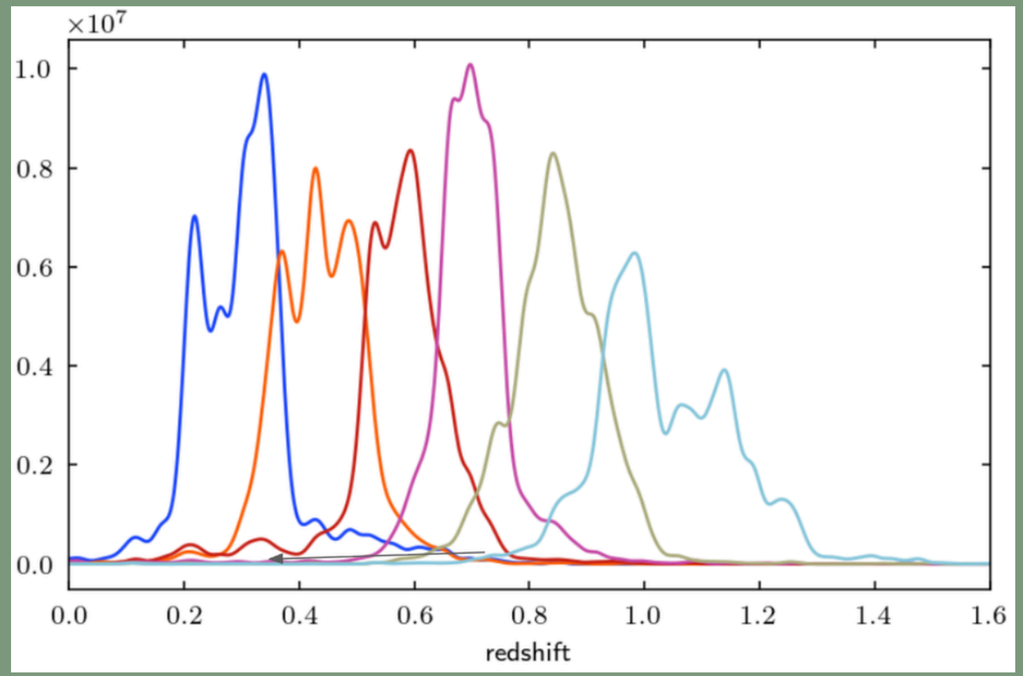
3x2pt Modelling	Higher Order Statistics	GW x LSS (Euclid WP)	Coordination (SWG and KPs)
Photometric Galaxy Clustering sample definition	Investigating optimal setup and impact of systematics	Modelling of GW x LSS observables for bright and dark sirens	Co - leadership of the WL SWG (also in charge of tracking portal for WL)
Scale cuts for controlling bias from baryons	Discriminating among GR and MG using high order statistics	Forecasts from joint use of Euclid and future GW experiments	Coordination of two DR1 Key projects (both WL and theory)
Analytic covariance matrix computation	Analytic covariance matrix for 3pCF	Release of codes for GW x LSS investigation	First authors of different DR1 KP papers

3x2pt Modelling: GCph Sample Definition and Decontamination

(D. Sciotti in coll. with S. Camera and M. Vai)

- Define the lenses sample by
  - optimising the photo-z accuracy
  - reducing the overlap among bins
  - increasing the galaxy bias
- Final sample selection
  - VIS < 23.5
  - 0.2 < z < 1.2
  - H < 22
- Cleaner sample but
  - lower galaxies number density
  - (yet larger than DES)
  - check decontamination with NISP data



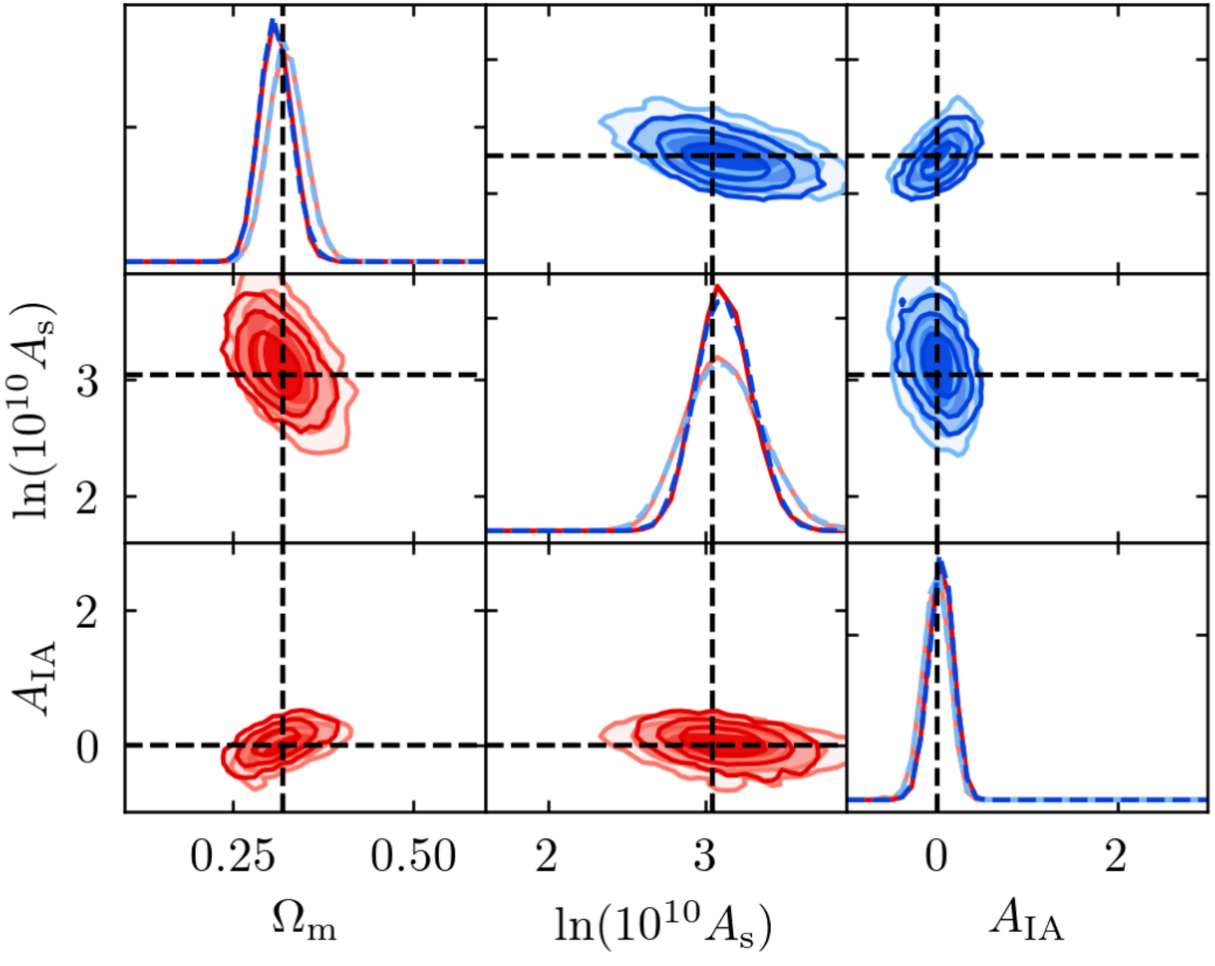


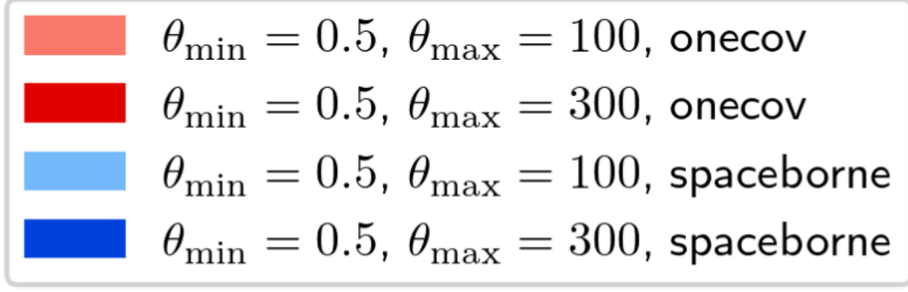
3x2pt Modelling: Analytical Covariance

(D. Sciotti, V.F. Cardone)

Spaceborne

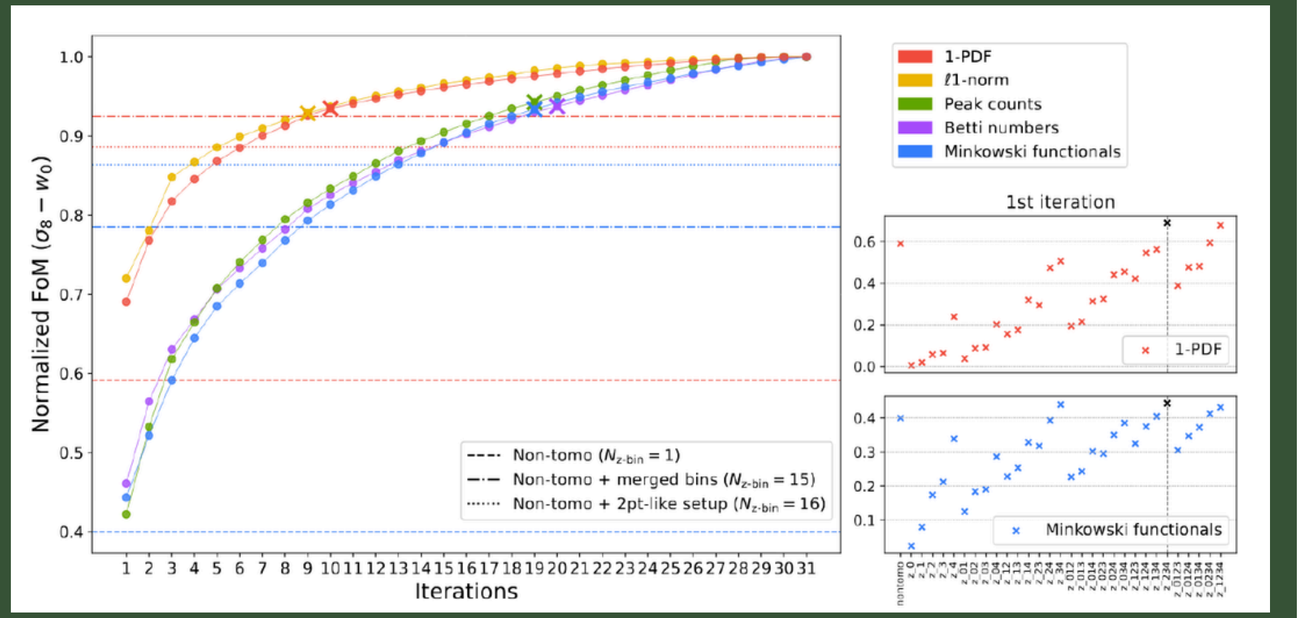
- to be used for all Euclid cosmology papers
- added COSEBIs covariance matrix computation
- validated against benchmark external codes
- implemented and tested mask convolution
- successful comparison with numerical estimates
- included the effects of observational weights





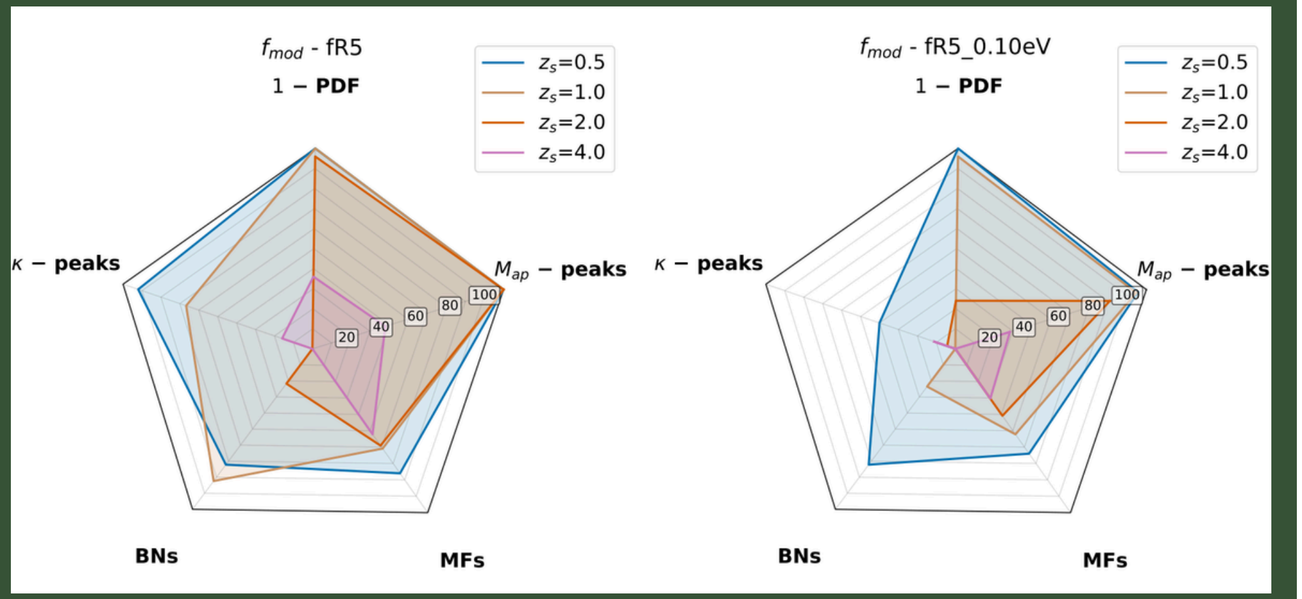
Higher Order Weak Lensing Statistics

(V.F. Cardone, R. Maoli, A. Vadalà with F. Bouchè and S. Vinciguerra)



Optmising analysis setup for DR1 data

- Repeat Fisher matrix analysis of HOWLS Paper 1 but
  - adding tomography with realistic photo-z accuracy
  - account for the effect of survey (and GAIA) mask
  - include systematics from mass mapping reconstruction
- Look for the optimal number of redshift bins
  - accounting for noise in the numerical covariance
  - selecting observables with Gaussian distribution
  - considering the correlation among different HOS probes



Discriminating among GR and MG with HOS

- Investigate which HOS can discriminate among GR and MG
  - f(R) vs GR account for the effect of realistic survey (and GAIA) mask
  - include systematics from mass mapping reconstruction
- Look for the optimal number of redshift bins
  - accounting for noise in the numerical covariance
  - selecting observables with Gaussian distribution
  - considering the correlation among different HOS probes

3pt Shear Correlation Function

(A. Vadalà in coll. with M. Bonici, S. Chiarenza, S. Camera)

Convergence bispectrum from matter bispectrum

Need to compute the analytical covariance too

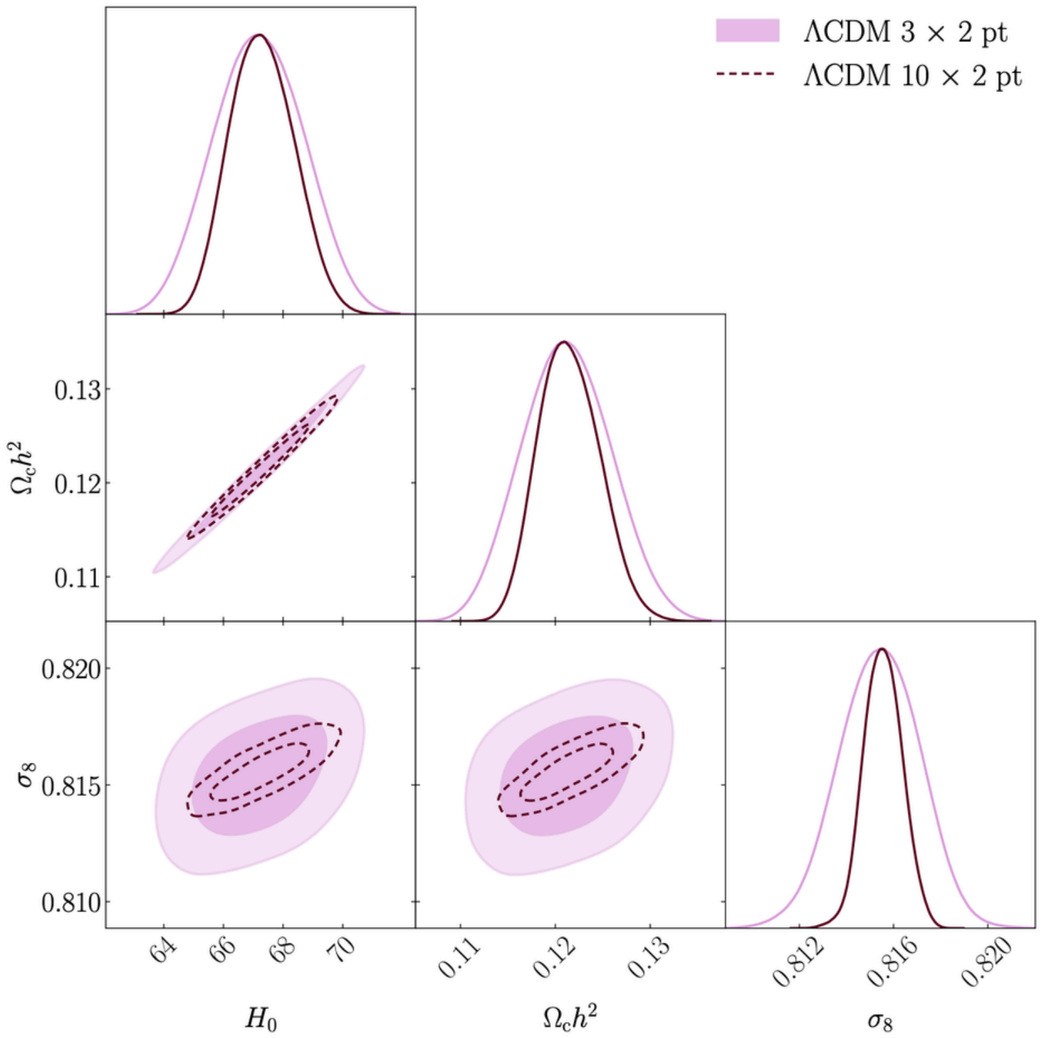
$$\Gamma_0^{\mathcal{P}}(\vartheta_1,\vartheta_2,\phi) = \langle\, \gamma\,(\mathbf{X_1};\zeta_1)\ \gamma\,(\mathbf{X_2};\zeta_2)\ \gamma\,(\mathbf{X_3};\zeta_3)\,\rangle$$
$$\Gamma_1^{\mathcal{P}}(\vartheta_1,\vartheta_2,\phi) = \langle\, \gamma^*(\mathbf{X_1};\zeta_1)\ \gamma\,(\mathbf{X_2};\zeta_2)\ \gamma\,(\mathbf{X_3};\zeta_3)\,\rangle$$
$$\Gamma_2^{\mathcal{P}}(\vartheta_1,\vartheta_2,\phi) = \langle\, \gamma\,(\mathbf{X_1};\zeta_1)\ \gamma^*(\mathbf{X_2};\zeta_2)\ \gamma\,(\mathbf{X_3};\zeta_3)\,\rangle$$
$$\Gamma_3^{\mathcal{P}}(\vartheta_1,\vartheta_2,\phi) = \langle\, \gamma\,(\mathbf{X_1};\zeta_1)\ \gamma\,(\mathbf{X_2};\zeta_2)\ \gamma^*(\mathbf{X_3};\zeta_3)\,\rangle$$

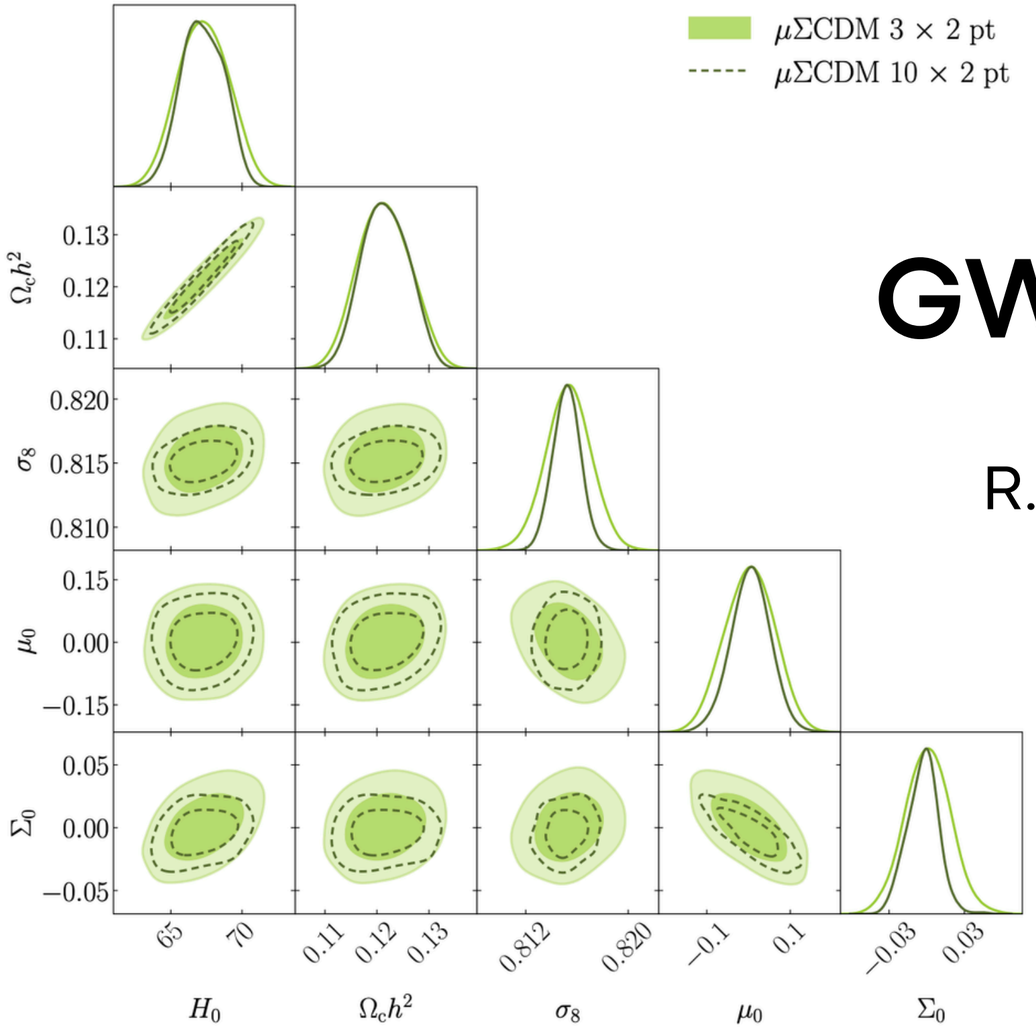
$$\Upsilon_0^{\times}(\Theta_1,\Theta_2,\Phi) \equiv -\sum_{i,j,k=1}^{N_{\rm gal}} w_i\gamma_{{\rm c},i}\ w_j\gamma_{{\rm c},j}\ w_k\gamma_{{\rm c},k}\ \mathrm{e}^{-3\mathrm{i}(\varphi_{ij}+\varphi_{ik})} \times \mathcal{B}\left(\theta_{ij}\in\Theta_1\right)\ \mathcal{B}\left(\theta_{ik}\in\Theta_2\right)\mathcal{B}\left(\phi_{ijk}\in\Phi\right)\,,$$

$$\mathcal{N}(\Theta_1,\Theta_2,\Phi) \equiv \sum_{i,j,k=1}^{N_{\rm gal}} w_i\ w_j\ w_k \times \mathcal{B}\left(\theta_{ij}\in\Theta_1\right)\ \mathcal{B}\left(\theta_{ik}\in\Theta_2\right)\mathcal{B}\left(\phi_{ijk}\in\Phi\right)\,.$$

$$\begin{aligned}
\Upsilon_{0,n}^{\times}(\Theta_1,\Theta_2) &\equiv \int_0^{2\pi} \mathrm{d}\phi\ \Upsilon_0^{\times}(\Theta_1,\Theta_2,\phi)\mathrm{e}^{-\mathrm{i}n\phi} \\
&= -\int_0^{2\pi}\mathrm{d}\phi \sum_{i,j,k=1}^{N_{\rm gal}} w_i\gamma_{{\rm c},i}\ w_j\gamma_{{\rm c},j}\ w_k\gamma_{{\rm c},k}\ \mathrm{e}^{-3\mathrm{i}(\varphi_{ij}+\varphi_{ik})} \\
&\qquad \times \mathcal{B}\left(\theta_{ij}\in\Theta_1\right)\ \mathcal{B}\left(\theta_{ik}\in\Theta_2\right)\ \mathcal{B}\left(\phi_{ijk}\in\{\phi\}\right)\ \mathrm{e}^{-\mathrm{i}n\phi} \\
&= -\sum_{i,j,k=1}^{N_{\rm gal}} w_i\gamma_{{\rm c},i}\ w_j\gamma_{{\rm c},j}\ w_k\gamma_{{\rm c},k}\ \mathrm{e}^{-3\mathrm{i}(\varphi_{ij}+\varphi_{ik})}\mathrm{e}^{-\mathrm{i}n(\varphi_{ik}-\varphi_{ij})} \\
&\qquad \times \mathcal{B}\left(\theta_{ij}\in\Theta_1\right)\ \mathcal{B}\left(\theta_{ik}\in\Theta_2\right) \\
&= -\sum_{i=1}^{N_{\rm gal}} w_i\gamma_{{\rm c},i} \sum_{j=1}^{N_{\rm gal}} w_j\gamma_{{\rm c},j}\ \mathrm{e}^{\mathrm{i}(n-3)\varphi_{ij}}\ \mathcal{B}\left(\theta_{ij}\in\Theta_1\right) \\
&\qquad \times \sum_{k=1}^{N_{\rm gal}} w_k\gamma_{{\rm c},k}\ \mathrm{e}^{-\mathrm{i}(n+3)\varphi_{ik}}\ \mathcal{B}\left(\theta_{ik}\in\Theta_2\right) \\
&\equiv -\sum^{N_{\rm gal}} w_i\gamma_{{\rm c},i}\ G_{n-3}^{\rm disc}(\boldsymbol{\theta}_i;\Theta_1)\ G_{-n-3}^{\rm disc}(\boldsymbol{\theta}_i;\Theta_2)\,, \qquad (21)
\end{aligned}$$

- Split the different terms into the product of a model dependent part and a model independent one
- Project the model independent part on Chebychev basis and compute those integrals once for all
- Compute the coefficents of the series expansion for the model dependent part only





GW x LSS

C. De Leo
R. D'Agostino
M. Martinelli

- from 3x2pt to 10x2pt
- forecasts for both GR and MG
- developed GW-MGCAMB
- bright vs dark sirens (CANDI)

CANDI Public

A cosmology code to place constraints using distance-related observables, allowing you to easily test and include your own non-standard expansion history models

Jupyter Notebook ☆ 3

GW-MGCAMB Public

Extension of MGCAMB that includes GWs source terms

Fortran

Euclid istitutional roles

WLSG lead

Vincenzo F. Cardone

KP/WP coordinators

Chiara De Leo
(WP7 in Theory SWG)

Matteo Martinelli
(DR1-KP-TH-2)

Davide Sciotti
(DR1-KP-GC-8)

Paper leads

Chiara De Leo
(DR1-KP-TH-2 paper on distance duality)

Davide Sciotti
(DR1-KP-JC-2 on 3x2pt analytic covariance)

Alessandro Vadalà
(DR1-KP-WL-7 on HOS in beyond LCDM

DR1-KP-WL-8 on 3ptCF analytic covariance)

Members and Funding (from INFN and ASI)

Cardone	Vincenzo Fabrizio		ROMA1	G1	Associato	Scientifica Dipendenti altri enti	Attivo	CSN2	50%
D'Agostino	Rocco		ROMA1	G1	Associato	Scientifica Assegni non INFN	Attivo	CSN4	50%
De Leo	Chiara		ROMA1	G1	Associato	Scientifica Dottorandi	Attivo	CSN2	70%
Ferraiuolo	Sarah		ROMA1	G1	Associato	Scientifica Dottorandi	Attivo	CSN2	20%
Maoli	Roberto		ROMA1	G1	Contratto non Trovato			CSN2	70%
Martinelli	Matteo		ROMA1	G1	Associato	Scientifica Dipendenti altri enti	Attivo	CSN2	40%
Melchiorri	Alessandro		ROMA1	G1	Associato	Incarico di Ricerca scientifica	Attivo	CSN4	*
Scaramella	Roberto		ROMA1	G1	Contratto non Trovato			CSN2	50%
Sciotti	Davide		ROMA1	G1	Associato	Scientifica Assegni non INFN	Attivo	CSN2	50%
Vadala'	Alessandro		ROMA1	G1	Associato	Scientifica Dottorandi	Attivo	CSN2	70%

Contract on ASI funds

Additional ASI Funds

- 6kEuro/year for missions
- not a 1 - to - 1 matching between INFN and INAF users
- other funding to be shared with other teams

- **Errors to be corrected:** R. Maoli finalising association, R. Scaramella to be understood, A. Melchiorri to be removed
- **Variations in the coming year:** R. D'Agostino and A. Vadalà leaving, G.Sarracino (TD) and F. La Valle (PhD) joining
- **Current situation of INFN funds:** spent less than expected because of (unexpected) una tantum funds for postdocs

Requests for 2027 (from INFN and ASI)

Capitolo	Descrizione	Parziali (k€)		Totale (k€)	
		Richieste	SJ	Richieste	SJ
missioni	[EU] [MEETING]--Euclid Consortium Meeting 2027 (conferenza annuale del consorzio)-1 Mis x 4 pp x 5 gg-[Viaggio 500â ¬-Soggiorno 200â ¬/gg-Extra 600â ¬ Quota d'iscrizione per ogni partecipante]	8.50	0.00	16	4.5
	[EU] [OPERATIVO]--Coordinamento 3x2pt (attivitÃ legata all'analisi dati di uno dei due "Key Project" principali per cosmologia per il primo rilascio di dati; personale coinvolto: V.F. Cardone in quanto WLSWG lead e Davide Sciotti come DR1-KP-GC-8 coordinator)-1 Mis x 2 pp x 4 gg-[Viaggio 500â ¬-Soggiorno 200â ¬/gg]	3.00	0.00		
	[EU] [OPERATIVO]--Coordinamento HOWLS (attivitÃ legata all'analisi dati di uno dei "Key Project" per il primo rilascio di dati; personale coinvolto: V.F. Cardone in quanto WLSWG lead)-1 Mis x 1 pp x 3 gg-[Viaggio 500â ¬-Soggiorno 200â ¬/gg]	1.50	0.00		
	[EU] [OPERATIVO]--WLSWG Meeting (conferenza annuale per del SWG di Weak Lensing di cui V.F. Cardone Ã¨ lead)-1 Mis x 2 pp x 4 gg-[Viaggio 500â ¬-Soggiorno 200â ¬/gg-Extra 150â ¬ Quota d'iscrizione per ogni partecipante]	3.00	0.00		
	[ITA] [MEETING]--Euclid Italia 2027 (conferenza annuale della comunitÃ Â Euclid italiana)-1 Mis x 4 pp x 3 gg-[Viaggio 300Ã¢Â Â¬-Soggiorno 200Ã¢Â Â¬/gg-Extra 200Ã¢Â Â¬ Quota d'iscrizione per ogni partecipante]	0.00	4.50		
Totale				16	4.5

- **Comments:** no more extra funding for INAF young postdocs
- **ASI funding**
  - renewal of the contracts of M. Martinelli and D. Sciotti
  - separate funding for missions (to be understood how it will work)