

Cosmo BCN-MAD

Meeting 27-01-2025

IFT UAM/CSIC, Madrid



Instituto de
Física
Teórica
UAM-CSIC



Staff:



Yashar Akrami



Juan García-Bellido



Violeta González-Pérez



Sachiko Kuroyanagi



Savvas Nesseris



Ester Ruiz Morales



Matteo Fasiello

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Postdocs:



George Alestas



Javier Carrón Duque



Andrius Tamosiunas



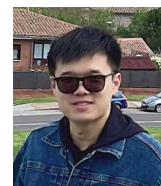
Alexandros
Papageorgiou



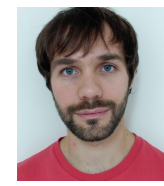
Ogan Ozsoy



Sukannya Bhattacharya



Xiaolin Liu



Martín Rodríguez Monroy



Miguel Icaza

PhD students:

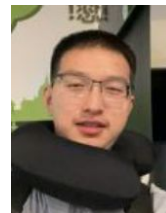
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Marienza Caldarola



Adrián Gutiérrez



Changcheng Jing



Gonzalo Morrás



Indira Ocampo



Mikel Martín



Mattia Cielo



Cristóbal Zenteno Gatica

MAIN GROUP INTERESTS (SURVEY ORIENTED)

DES: Lead (SA) the LSS cosmology analysis (BAO, PNG, etc.), produce mock catalogues, contribute to DES-GW (JGB) multimessenger, co-lead (MRM) the LSS-systematics analysis team, DES Builders (JGB, SA, MRM).

PAU: We are Builders (JGB) of PAU Cam and Founders of PAUS.

EUCLID: Lead CosWG/WP5 on “homogeneity and isotropy” (SN). We also use mocks to constrain systematic errors and inform emulators (KP-CS3; VGP, GRP, BVG), we do forecasts/ML analyses with external probes (WP5/10: SN). Co-lead of WP4 on “initial conditions and models of early Universe” (YA). Coordinator of KP-TH-1 on “forecasts for beyond-standard models in cosmology and fundamental physics” (YA). Observational systematics for clustering (VMPZ-ID: MRM).

MAIN GROUP INTERESTS (SURVEY ORIENTED)

DESI: We are constraining systematic errors producing mock catalogues with different techniques and also using simulations with different initial conditions (KP3, KP4-5; VGP, BVG, AGA). Have Lead DESI-EPO (JGB) and DESI Publication Board Chair (VGP).

Rubin/LSST: We study the nature of DM (JGB) via microlensing & ultra-faint dwarf galaxies (WG-MW). Methods for observational systematics mitigation (DESC-WLSS; MRM) and photometric corrections with LSST's AuxTel (DESC-PLC, DESC-PO, DESC-Commissioning; MRM).

LIGO/Virgo/KAGRA/LISA/ET: We perform analyses related to CBC/CHE searches and SGWB (JGB, ERM, SK, SN et al.).

MAIN GROUP INTERESTS (THEORY ORIENTED)

INFLATION: exploring the inflationary particle content via EFT methods and top-down approaches; primordial gravitational waves; non-gaussianity; GW anisotropies; axion inflation; (p)re-heating and connection with Standard Model particles.

PRIMORDIAL BLACK HOLES: study of their inflationary origin; PBH as a dark matter candidate; PBHs probes and tests.

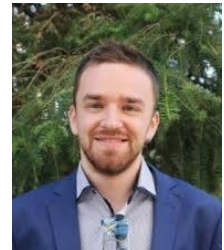
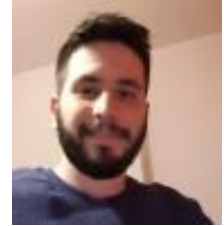
LSS: perturbative approaches to large scale structure dynamics.

DARK ENERGY: alternatives to the cosmological constant, from dark energy to quintessence to infrared modifications of gravity.

STUDENT AND POSTDOCS RESEARCH TOPICS

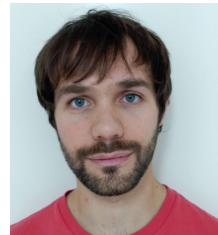
Postdocs:

- **George Alestas:** working on gravitational wave data analysis and cosmological anomalies/tensions
- **Javier Carrón Duque:** possible observable effects that the topology of the Universe would produce. Statistical tools to extract more information from cosmological observations.
- **Alexandros Papageorgiou:** ALPs in the early Universe. Phenomenology of axion-gauge interactions during inflation and analytic and numerical computation of associated signals



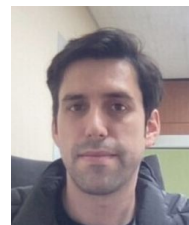
STUDENT AND POSTDOCS RESEARCH TOPICS

- **Ogan Ozsoy:** dynamics of quantum fields in early the Universe and their cosmological and astrophysical signatures. Primordial GWs from inflation, PBHs as DM, dynamics of (p)reheating and non-thermal DM candidates
- **Xiaolin Liu:** modeling of gravitational waves from compact binary systems and detection method on GWs and stochastic GWs background
- **Martín Rodríguez Monroy:** methods for mitigation of observational systematics on galaxy clustering. Methods for photometric corrections due to atmospheric transparency



STUDENT AND POSTDOCS RESEARCH TOPICS

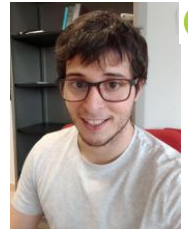
- **Andrius Tamosiunas:** topology, Machine Learning and CMB constraints.
- **Sukannya Bhattacharya:** Quantum gravity, Inflation, CMB constraints, spectral distortions, PBHs.
- **Miguel Icaza:** Gaussian Process emulators to calibrate galaxy models on simulations with PNG.



STUDENT AND POSTDOCS RESEARCH TOPICS

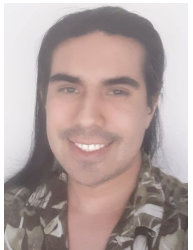
PhD students:

- **Marienza Caldarola** (advisor Savvas & Sachiko) is working on GW +SWGB data analysis with ML.
- **Adrián Gutiérrez** (advisors Santi & Violeta) is working on simulations with primordial non-Gaussianities and DESI.
- **Gonzalo Morrás** (advisor Juan) is working on Close Hyperbolic Encounters and LVK.



STUDENT AND POSTDOCS RESEARCH TOPICS

- **Mikel Martín** (advisor Yashar) is working on cosmic topology and anomalies, physics beyond Λ CDM with next generation surveys.
- **Mattia Cielo** (advisor Matteo) is working on primordial gravitational waves, (pre-)inflationary physics, neutrinos.
- **Cristóbal Zenteno Gatica** (advisor Matteo) is working on inflation, primordial gravitational waves, primordial black holes, gravitational wave anisotropies.



STUDENT AND POSTDOCS RESEARCH TOPICS

- **Indira Ocampo** (advisor Savvas) is working on Machine Learning analyses for LSS (DE, DM), Euclid DR1-KP-TH2, led recent PRL on ML Interpretability (Ocampo, Alestas, Nesseris et al., 2025).
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- **Changcheng Jing** (advisor Sachiko) is working on GWs, PBHs, α -attractors, cosmological constraints.

