Institut de Ciències del Cosmos
UNIVERSITAT DE BARCELONA

EXCELENCIA MARÍA DE MAEZTU 04/2025-03/2031

ET Activities at ICCUB

and Future Plans

Hristijan Kochankovski

on behalf of the ICCUB ET Research Unit

ET-Spain Meeting, Barcelona, 4 November 2026

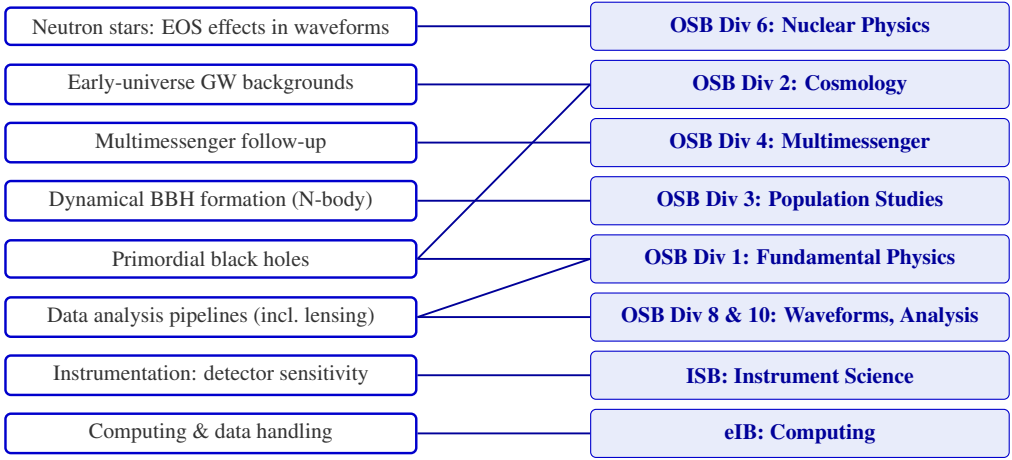
ICCUB in the Einstein Telescope Collaboration

- Institute of Cosmos Sciences, University of Barcelona: ∼170 people (scientists, engineers, postdocs, PhD students)
- **María de Maeztu** unit of excellence: **GW physics is one of its three Grand Challenges**
- **Joined ET shortly after the collaboration was founded**
- **19 ET members** in **OSB** (Div 1, 2, 3, 4, 6, 7, 8, 10), **ISB**, **eIB** (computing) and **Infra-Dev** (outreach)
- ICCUB authors on the **ET Blue Book** (JCAP 03 (2026)): J. Fumagalli, P. Ruiz-Lapuente, T. Andrade (former ICCUB)
- 9 April 2026: first **ICCUB GW meeting**, around 30 participants, towards a common GW strategy
- **This month:** general **ET–ICCUB meeting** at the institute

ET Board / Division	FTE
OSB Div 2: Cosmology	0.20
OSB Div 4: Multimessenger	0.20
OSB Div 6: Nuclear Physics	0.60
OSB Div 1, 3, 7, 8, 10	0.10
ISB, eIB, Infra-Dev	0.15
Total (4 Core members)	**1.25**

Pledged FTE, ET membership database, November 2026

GW Science at ICCUB ↔ ET

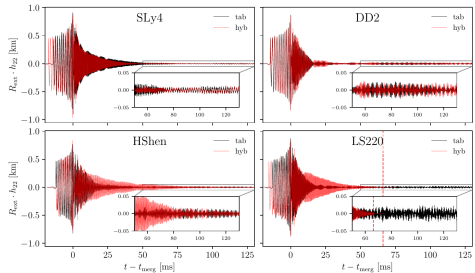


Dense Matter & Neutron Stars

OSB Div 6

Nuclear & hadron physics (A. Rios, M. Centelles, À. Ramos, X. Roca-Maza, H. Kochankovski, C. Mondal)

- **Task force on Bayesian parameter estimation** with realistic equations of state (C. Mondal)
- **Thermal effects** in mergers: $\Gamma_{\rm th}$ of neutron-star matter, without and with exotic components
- **Ongoing with Univ. of Valencia**: joint PhD, numerical-relativity (NR) simulations (G. Rivieccio)



Guerra et al. arXiv:2512.05118

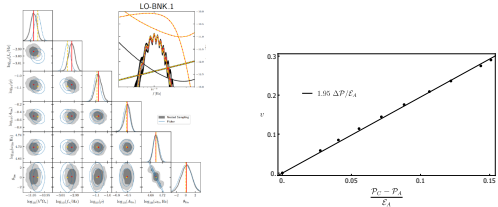
Refs: Rivieccio et al. ApJ 987 (2025); Kochankovski et al. MNRAS 517 (2022)

ET angle: kHz sensitivity resolves the post-merger signal: thermal effects, hyperons, phase transitions

Early Universe & Stochastic Background

OSB Div 2

- **LISA–ET synergy project on the SGWB** (J. Fumagalli)
- **Inflation, scalar-induced GWs, PBHs** (J. Fumagalli, J. Garriga, C. Germani)
- **First-order phase transitions from holography**: bubble wall velocity from first principles (D. Mateos, J. Casalderrey-Solana)



Left: LISA CosWG JCAP 11 (2024). Right: Bea et al. PRD 104 (2021)

Refs: Fumagalli et al. PRD 111 (2025); LISA CosWG JCAP 05 (2025)

ET angle: multi-band SGWB reconstruction (ET + LISA); PeV-scale phase transitions peak in the ET band

Multimessenger Follow-up

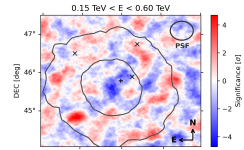
OSB Div 4

Very-high-energy gamma rays (M. Ribó, P. Bordas, A. Aguasca-Cabot, J. M. Paredes)

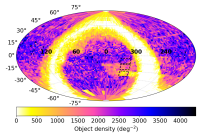
- **MAGIC, LST, CTAO**: significant contributions (LST physics, transients, GW follow-up)

Optical & infrared

- **BlackGEM follow-up**; REGALADE catalogue (∼80 million galaxies); GW progenitors (luminous red novae) (N. Blagorodnova)
- **Roman and ELT follow-up** of optical-IR counterparts; core-collapse supernova spectra with Gemini (P. Ruiz-Lapuente)



GW240615 follow-up: MAGIC & LST PASP 138 (2026)



REGALADE galaxy density: Tranin et al. A&A 706 (2026)

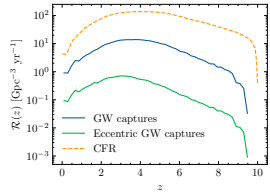
Refs: Blagorodnova et al. ApJ 834 (2017)

ET angle: early warning and $O(10\text{–}100)$ BNS/yr with counterparts

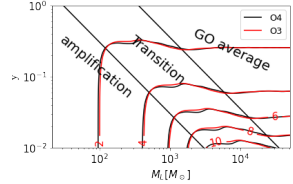
Sources, Propagation & GW Modelling

OSB Div 1, 3, 8, 10

- **BBHs in star clusters**: hierarchical mergers, eccentric captures, rate vs z (M. Gieles)
- **Microlensing of GWs**, LVK lensing searches (R. Bondarescu, H. Ubach, O. Bulashenko)
- **GW modelling**: NS modes and resonant tides in BNS inspirals (R. Bondarescu, A. Revilla-Peña, J. Miralda-Escudé, R. Márquez); first ICCUB NR catalogue of eccentric BBH waveforms



Marín Pina et al. A&A 698 (2025)



Bondarescu et al. PRD 108 (2023)

Refs: Antonini et al. MNRAS 486 (2019); LVK ApJ 970 (2024); Revilla-Peña et al. PRD 114 (2026); Trenado et al. arXiv:2509.05269

ET angle: BBHs to $z \gtrsim 10$, low-frequency reach: cluster history, eccentricity, many more lensed events, resolvable tidal resonances in BNS

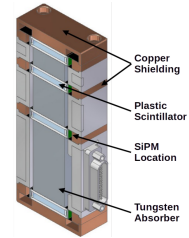
Data, Computing & Instrumentation

Data & computing (G. Skorobogatov)

- **eIB computing**: ICCUB members; LVK data-analysis experience

Technological Unit (D. Guberman, D. Gascón, J. Portell, . . .)

- **Particle detector for LISA** (with IEEC/ICE): monitors the cosmic rays that charge the test masses; prototype beam-tested, small-satellite version planned
- **Detector electronics** for other experiments (axions, particle physics, gamma rays): BabyIAXO, LHCb, CTAO



LISA Radiation Monitor: Guberman et al.
Mazzanti et al. PoS ICRC2023 (2023)

Refs: Sanmukh et al. Nucl. Sci. Tech. 35 (2024)

Capabilities available to ET: environmental and radiation monitoring, low-noise electronics and data acquisition

Future Plans 2026–2028

1. **Consolidate the Research Unit**: 4 Core members, 1.25 FTE
2. **People**: see the announcement of the ICCUB director, Domènec Espriu
3. **Service**: contributions to OSB documents, ET computing, outreach (Infra-Dev WP10)
4. **Instrumentation**: explore an ISB contribution from the Technological Unit

Summary

- ICCUB members in OSB, ISB, eIB and Infra-Dev, with **ET Blue Book authors** and **ET task-force participation**
- Broad GW programme that maps directly onto ET science: **dense matter, early universe, multimessenger, populations, lensing**, plus instrumentation and computing know-how
- Next steps: consolidate the Research Unit, dedicated people and **joint work with the ET-Spain groups**

Turning broad GW expertise at ICCUB into ET contributions, together with ET-Spain

We acknowledge the Einstein Telescope Collaboration.

Backup: Full Member Table

Name	Position	Core	FTE
Anna Argudo	Engineer		–
Ruxandra Bondarescu	Postdoc		0.10
Javier Castañeda	Engineer		–
Mario Centelles	Professor		–
Ana Climent Catalá	PhD student		–
Nooshineh Fallahzabihi	PhD student		–
Fotis Fronimos	PhD student		–
Jacopo Fumagalli	Postdoc	✓	0.20
Jaume Garriga	Professor		–
Mohammad Ali Gorji	Postdoc		–
Hristijan Kochankovski	Postdoc	✓	0.20
David Mateos	Professor		–
Chiranjib Mondal	Postdoc	✓	0.30
Alessio Notari	Professor		–
Marc Ribó	Professor		–
Arnau Rios	Professor		0.10
Pilar Ruiz-Lapuente	Professor	✓	0.20
Georgy Skorobogatov	Engineer		0.15
Licia Verde	Professor		–

19 members; 4 Core members; pledged FTE total 1.25 (ET membership database, November 2026)