

## Cristian Joana

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<b>PRINCIPAL INTERESTS</b>	early Universe cosmology, cosmic inflation, (p)reheating, primordial black holes, exotic compact objects, gravitational waves sources, numerical relativity.
<b>RESEARCH AND ACADEMIC BACKGROUND</b>	<div><div><b><i>Postdoctoral researcher</i></b></div><div>09/2025 –</div><div>International Center for Theoretical Physics Asia-Pacific (ICTP-AP), China. Advisor: Prof. Jun Zhang</div></div> <div><div><b><i>Visitor researcher</i></b></div><div>2025</div><div>Institute of Science Tokyo, Japan. PI: Prof. Teuraki Suayama</div></div> <div><div><b><i>Postdoctoral researcher</i></b></div><div>2022 - 2025</div><div>Institute of Theoretical Physics (ITP-CAS), China. Advisor: Prof. Shi Pi</div></div> <div><div><b><i>Visitor researcher</i></b></div><div>2021-2022</div><div>Free University of Brussels (ULB), Belgium. Advisor: Prof. Sebastien Clesse</div></div> <div><div><b><i>Ph.D. in Physics</i></b></div><div>2019 - 2022</div><div>University of Louvain, (UCLouvain-CURL), Belgium. Thesis supervisors: Prof. Christophe Ringeval and Prof. Sebastien Clesse.</div></div> <div><div><b><i>M.Sc. in Physics</i></b>, major in QFT and Gauge Theories</div><div>2014 - 2016</div><div>RWTH Aachen University, Germany. Thesis supervisor: Prof. Julien Lesgourgues.</div></div> <div><div><b><i>B.Sc. in Physics</i></b>, mention in theoretical physics</div><div>2009 - 2013</div><div>Autonomous University of Barcelona (UAB), Catalonia/Spain. Thesis supervisor: Prof. Rafel Escribano</div></div>

	<b><i>NII International Internship Program (6 months)</i></b>	2013
	National Institute of Informatics, Sokendai, Japan.	
<b>TEACHING EXPERIENCE</b>	<b><i>Tutor in Quantum Mechanics II</i></b> (UCLouvain)	2021
	<b><i>Tutor in Quantum Mechanics II</i></b> (UCLouvain)	2020
	<b><i>Tutor in Quantum Mechanics II</i></b> (UCLouvain)	2019
	<b><i>Tutor in Computational Neuroscience</i></b> (RWTH Aachen)	2017
<b>SUPERVISION</b>	<ul style="list-style-type: none"> <li>Student: ChengYou Sun. Co-supervision with J. Zhan (ICTP-AP/Tongji U.) MSc project: <i>Phase Transitions from Scalar Field Collapse.</i> 2025 – ongoing</li> <li>Student: Yoshihiro Kishimoto. Co-supervision with T. Suyama (Science Tokyo) PhD project: <i>Formation of Cosmic Strings</i> 2025 – ongoing</li> <li>Student: ZiYan Yuwen. Co-supervision with RG Cai and SH Wang (ITP-CAS). PhD project: <i>Phase Transitions and Primordial Black holes</i> 2022-2024</li> </ul>	
<b>RESEARCH ACTIVITIES</b>	<ul style="list-style-type: none"> <li>Member of the LISA Cosmology Gravitational Wave working group.</li> <li>Member of the LISA Primordial Black Hole working group.</li> <li>Member of the GRTL Collaboration (previously known as the GRChombo Collaboration), and developer/user of the GRChombo numerical relativity code.</li> <li>Member and contributor of the yt-project code (astrophysical python toolkit).</li> <li>Associate member for the TAIJI gravitational wave experiment.</li> <li>Journal referee for PRL, PRD, JCAP, JOSS, elsevier</li> </ul>	
<b>PERSONAL DETAILS</b>	Nationality: Spanish	
	Date of birth: 01-05-1990	
	Languages: Native in Catalan and Spanish, Proficiency in English, Intermediate level in French, Basics in Mandarin Chinese, Japanese and German.	
	ICT Skills: Debian GNU/Linux based Operative Systems, Programming in C/C++ and Python, Mathematica™, LaTeX	
	Hobbies: Reading, playing chess, astronomy, traveling and hiking.	

**LIST  
OF  
PUBLICATIONS**

***GR-QC, ASTRO-CO, HEP-Th, COND-MAT:***

1. Joana, C., van Loock, P., Deng, H., Byrnes, T. (2016). “Steady-state generation of negative-Wigner-function light using feedback”. *Phys. Rev. A*, 94, 063802 (2016). arXiv:1612.00629
2. Joana, C., Clesse, S. “Inhomogeneous pre-inflation across Hubble scales in full general relativity”, *Phys. Rev. D* 103, 083501 (2021). arXiv:2011.12190
3. Joana, C. “Gravitational dynamics of Higgs inflation: Preinflation and pre-heating with an auxiliary field”, *Phys. Rev. D*, vol. 106, pp. 023504 (2022). arXiv:2202.07604
4. Andrade, T., Joana C. et. al. “GRChombo: An adaptable numerical relativity code for fundamental physics”, *Journal of Open Source Software (JOSS)*, 6(68), 3703, arXiv:2201.03458
5. Auclair, P., Bacon, D., Joana, C, et. al. [LISA Collaboration], “Cosmology with the Laser Interferometer Space Antenna”, *Living Rev Relativ* 26, 5 (2023). arXiv:2204.05434
6. Bagui, E., Clesse, S., Joana, C., et. al. [LISA Collaboration], “Primordial black holes and their gravitational wave signatures”, *Living Rev.Rel.* 28 (2025) 1, 1, arXiv:2310.19857
7. Dumpui, E., Joana, C., Clesse, S., Escrivá A., ”Baryogenesis from sub-threshold curvature perturbations”, arXiv:2401.09408 (Submitted to PRL)
8. Joana, C. “Beginning inflation in non-conformally flat spacetimes”, *Phys.Rev.D* 110 (2024) 6, 063534, arXiv:2406.00811
9. Yuwen, Z-Y., Joana, C, Wang S-H, Cai R-G., ”Bubbles kick off primordial black holes to form more binaries”, *Phys. Rev. Res.* **7**, no.2, 023180 (2025), arXiv: 2406.05838
10. Inui, R., Joana, C. Motohashi, H., Pi, S., Tada, Y., Yokoyama, S., “Primordial black holes and induced gravitational waves from logarithmic non-Gaussianity”, *J. Cosmol. Astropart. Phys.* 2025 021, arXiv:2411.07647
11. Joana, C., Yuwen, Z-Y., “Primordial black holes from primordial voids”, *Phys.Rev.D* 113 (2026) 2, 023518, arXiv: 1025.11611

***INTERDISCIPLINARY:***

12. Yamane, Y., Ito, J., Joana, C., Fujita, I., Tamura, H, Maldonado, P., Gruen, S., “Neuronal population activity in macaque visual cortices dynamically changes through repeated fixations in active free viewing”, *eNeuro* 5 October 2023, ENEURO.0086-23.2023; doi:10.1523/ENEURO.0086-23.2023.
13. Ito, J., Joana, C., Yamane, Y., Fujita, I., Tamura, H, Maldonado, P., Gruen, S. (2022), “Latency shortening with enhanced sparseness and responsiveness in V1 during active visual sensing”, *Sci Rep* 12, 6021 (2022)

***ARTICLES IN PREPARATION:***

14. Bagui, E., Clesse, S., Joana, C., et. al. [LISA Collaboration], “PrimBHoles: A code for the computation of the gravitational wave signatures of primordial black holes ”, (in progress)
15. Turk, M., Joana, C., et. al [yt-project Collaboration] “Introducing yt 4.0: Analysis and Visualization of Volumetric Data”, (in progress)

## GIVEN TALKS

- Primordial Black Holes and early Universe gravitational wave signatures  
KBFI Seminars, Tallinn, Estonia, 28 October 2025
- Primordial Black Holes and Gravitational Wave signatures including non-Gaussianities  
3rd Early Universe Gravitational Waves workshop, Ningbo, China, 3rd Sep 2025
- Primordial Black Holes and Scalar Induced Gravitational Waves with local non-Gaussianities (Poster)  
CosmoFondue 2025, Geneva U., Switzerland, 10th June 2025
- Primordial Black Holes with local non-Gaussianities (Poster)  
Rencontre de Moriond 2025, La Thuile, Italy, 3rd April 2025
- Numerical Relativity and Primordial Black Holes with local non-Gaussianities  
Cosmology seminars, Science Tokyo, Japan, January 2025
- Primordial black holes and scalar induced gravitational waves from logarithmic non-Gaussianity  
2nd Bangkok workshop on Gravity & Cosmology, Thailand, January 2025
- Numerical Relativity simulations for the early Universe (Poster)  
COSMO'24, Kyoto U., Japan, October 2024
- Beginning inflation from inhomogeneous initial conditions  
Majorana-Raychaudhuri Seminars, INFN, Italy & PAMU, India, Aug 2024
- Starting inflation from conformally curved initial conditions  
GRTL meetings, Cambridge U., UK, June 2024
- Generating Chombo checkpoint files using python.  
GRTL meetings, Cambridge U., UK, June 2024
- PrimBHoles: a pythonic toolkit to compute PBH signatures  
11th LISA CosGW workshop, Porto U., Portugal, June 2024
- On Primordial Black Hole Formation  
PCFT/ICTS seminars, USTC, Hefei, P.R. China, October 2023
- Introduction to Numerical Relativity in Cosmology  
College of Physics seminars, Chongqing U., P.R. China, April 2023
- GR-Simulations of the Early Universe  
Chinese GW annual meeting, Chongqing, P.R. China, April 2023
- Numerical relativity in Cosmology  
Gravity-matters seminars, University of Oslo, Norway, Nov. 2022
- Visualization tools for GRChombo: Yt and Visit  
GRChombo meetings '22 (I), Cambridge U., UK, March 2022
- Dynamics of pre- and post- Higgs inflation  
GRChombo meetings '22 (I), Cambridge U., UK, March 2022
- Gravitational dynamics of Higgs pre-inflation and preheating  
Oxford gr-qc JC, Oxford U., UK, March 2022
- Simulations of the early Universe with numerical General Relativity  
Tonale winter school of cosmology, Tonale, Italy, December 2021
- Exploring the early Universe with numerical General Relativity  
Belgian Gravitational Wave Seminars, ULB, Brussels, Belgium, Nov. 2021
- The inhomogeneous pre-inflationary era: A numerical relativity approach  
GRChombo meetings '20 II, Oxford U., Oxford, UK, December 2020
- Gravitational waves from the inhomogeneous pre-inflationary era  
Belgian Gravitational Wave Seminars, KU-Leuven, Belgium, Nov. 2020