

Cristian Joana

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PRINCIPAL INTERESTS	early Universe cosmology, cosmic inflation, (p)reheating, primordial black holes, exotic compact objects, gravitational waves sources, numerical relativity.	
RESEARCH AND ACADEMIC BACKGROUND	Postdoctoral researcher International Center for Theoretical Physics Asia-Pacific (ICTP-AP), China. Advisor: Prof. Jun Zhang	09/2025 –
	Visitor researcher Institute of Science Tokyo, Japan. PI: Prof. Teuraki Suayama	2025
	Postdoctoral researcher Institute of Theoretical Physics (ITP-CAS), China. Advisor: Prof. Shi Pi	2022 - 2025
	Visitor researcher Free University of Brussels (ULB), Belgium. Advisor: Prof. Sebastien Clesse	2021-2022
	Ph.D. in Physics University of Louvain, (UCLouvain-CURL), Belgium. Thesis supervisors: Prof. Christophe Ringeval and Prof. Sebastien Clesse.	2019 - 2022
	M.Sc. in Physics , major in QFT and Gauge Theories RWTH Aachen University, Germany. Thesis supervisor: Prof. Julien Lesgourgues.	2014 - 2016
	B.Sc. in Physics , mention in theoretical physics Autonomous University of Barcelona (UAB), Catalonia/Spain. Thesis supervisor: Prof. Rafel Escribano	2009 - 2013
OTHER RESEARCH EXPERIENCE	Research Assistant Institute of Neuroscience and Medicine (INM-6), Juelich Research Centre, Germany. Group Leader: Prof. Sonja Gruen	2016 - 2018
	Research Internship National Institute of Informatics (NII), Japan. Group Leader: Prof. Tim Byrnes	2013 - 2014
SCIENTIFIC GRANTS AND AWARDS	NSFC Research Fund for International Scientist (No. W2433007) National Natural Science Foundation of China, NSFC, RFIS I, China.	2025
	NSFC Special Fund for Theoretical Physics. (No. 12347132) National Natural Science Foundation of China, NSFC, China.	2024
	ICERM visiting grant (3 months) CANCELLED due to COVID-19 National Science Foundation and ICERM's Federal funds, NSF, USA.	2020
	Co-I, PRACE Tier-0. (No. 2018194669) 30M CPU/hrs, Computational Grant.	2020
	FNRS-FRIA grant (bourse de doctorat, 4 years) Fonds de la Recherche Scientifique, FRS-FNRS, Belgium.	2019

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

**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
- Visualitzation 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
- Gravitional waves from the inhomogeneous pre-inflationary era
Belgian Gravitational Wave Seminars, KU-Leuven, Belgium, Nov. 2020