

CURRICULUM VITAE:

CRISTIAN JOANA

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PROFILE:

I am third year PhD student in theoretical physics and cosmology at the University of Louvain, under the supervision of Prof. C. Ringeval (UCLouvain) and Prof. S. Clesse (ULB).

I am involved in the use and development of numerical relativity tools to study the non-linear dynamics and backreactions of the Early Universe. My research focus are in inflation, reheating and formation of primordial black holes.

I am part of the developing team of GRChombo (www.grchombo.com), an open source numerical relativity code that I use for my simulations. I am also a member of the LISA-PBH working group.

In the past, I also worked as an intern researcher in quantum information systems (in 2013), and as an assistant researcher in computational neuroscience (from 2016-2018).

ACADEMIC RECORDS:

- **2019/22** **(Candidate for) PhD in Physics (FRNS - FRIA)**
at IRMP, CURL, University of Louvain, Louvain-la-Neuve, Belgium
- **2014/16** **Master's degree in Physics, major in QFT and Gauge theories**
at RWTH Aachen University, Aachen, Germany.
- **2009/13** **Degree (EEES) in Physics, mention in Fundamental Physics**
at Autonomous University of Barcelona, Catalonia/Spain.

SCIENTIFIC GRANTS AND AWARDS:

- **2020** **ICERM visiting grant** (3 months),
National Science Foundation and ICERM's Federal funds, NSF, USA
- **2019/22** **FNRS - FRIA grant** (bourse de doctorat, 4 years),
Fonds de la Recherche Scientifique, FRS-FNRS, Belgium
- **2013** **NII International Internship Program** (6 month)
National Institute of Informatics, Sokendai, Japan

RESEARCH EXPERIENCE:

- **2019/22** **(Candidate) PhD in Physics at CURL, University of Louvain (Belgium)**
Supervisors: **Christophe Ringeval** (UCLouvain), **Sebastien Clesse** (ULB)
Topic: *Inhomogeneous Early Universe cosmology*
Keywords: Inflation, Reheating, Primordial black holes, Numerical-GR

- **2016/19** **Research assistant at the Institute of Neuroscience and Medicine (INM-6), Juelich Research Centre (Germany)**
 Lab PI: **Sonja Gruen** (FZ-Juelich)
 Topic: *Neuronal activity during active visual sensing*
 Keywords: Neural data analysis, visual cortex, electrophysiology, spike-sorting

- **2013/14** **Internship researcher at the National Institute Informatics, Tokyo, (Japan)**
 Lab PI: **Tim Byrnes** (currently at NYU Shanghai)
 Topic: *Negative Wigner function light from exciton-polariton systems.*
 Keywords: Continuous-Variables Quantum Computing, Quantum optics

TEACHING EXPERIENCE:

- **2019/20/21** **Tutor in Quantum Mechanics II (UCLouvain)**
- **2017/18** **Tutor in Computational Neuroscience (RWTH Aachen)**
- **2017** **Tutor in the Advanced Neural Data Analysis '17 school (FZ-Juelich)**

OTHER EDUCATION AND TRAINING:

- **2020** **Tonale winter school of cosmology 2021**
 at Paso del Tonale, (Italy), organized by Heidelberg University (Germany)

- **2020** **Advances in Computational Relativity workshop**
 at ICERM, Brown University, Providence (USA)

- **2019** **Gravitational wave astronomy summer school**
 at ICTS, Bangalore (India)

- **2017** **(Tutor) Advanced Neural Data Analysis 2017 summer school**
 at Juelich Research Center, Juelich (Germany)

- **2016** **Workshop ‘Cosmology after Planck: what is next?’**
 at Ecole de Physique des Houches (*France*)

- **2014** **ESI-EMS-IAMP Summer school on Mathematical Relativity**
 Erwin Schrödinger Institute, Vienna (*Austria*)

PERSONAL DETAILS AND SKILLS:

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| Nationality: | Catalan, Spanish |
| Date of birth: | 01-05-1990 |
| Status: | Single |
| Languages: | Native in Catalan and Spanish, Proficiency in English Intermediate level in French and German. |
| ICT Skills: | Debian GNU/Linux based Operative Systems, Programming in C/C++ and Python, <i>Mathematica</i> TM , <i>LaTeX</i> |
| Hobbies: | Reading, playing chess, traveling and hiking. |

RESEARCH ACHIEVEMENTS:

LIST OF PUBLICATIONS: (PUBLISHED)

1. Andrade, T., Joana C. et, al. (2021) "GRChombo: An adaptable numerical relativity code for fundamental physics", Journal of Open Source Software, 6(68), 3703, <https://doi.org/10.21105/joss.03703>
2. Joana, C., Clesse, S. (2021) "Inhomogeneous pre-inflation accross Hubble scales in full general relativity", Phys. Rev. D 103, 083501 (2021). arXiv:2011.12190
3. Joana, C., van Loock, P., Deng, H., & Byrnes, T. (2016). "Steady-state generation of negative-Wigner-function light using feedback". Phy. Rev. A, 94, 063802 (2016). arXiv:1612.00629

MANUSCRIPTS IN PROGRESS: (NOT YET PUBLISHED)

4. Joana, C. (2022) "Higgs inflation in full general relativity: Preinflation and preheating with auxiliary field coupling", (*Submitted for Publication at Phys. Rev. D*)
5. LISA Collaboration (2022), (WHITE PAPER) "Recent Primordial Black Hole scenarios and their gravitational-wave signatures", (*in progress*)
6. Ito, J., Joana, C., Yamane, Y. Fujita, I., Tamura, H, Maldonado, P., Gruen, S. (2022), "Neuronal activity during active visual sensing: latency shortening with enhanced sparseness and responsiveness", (*Submitted for Publication at Nature Neuroscience*)

SCIENTIFIC GRANDS AND AWARDS:

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| - 2020 | ICERM visiting grant (3 months), <i>National Science Foundation and ICERM's Federal funds, NSF, USA</i> |
| - 2020/21 | Co-I, PRACE Tier-0 No. 2018194669 (6 months), <i>30M CPU/hrs, Computational Grant</i> |
| - 2019/22 | FNRS - FRIA grant (bourse de doctorat, 4 years), <i>Fonds de la Reserche Scientifique, FRS-FNRS, Belgium</i> |
| - 2013 | NII International Internship Program (6 month) <i>National Institute of Informatics, Sokendai, Japan</i> |

GIVEN AND CONTRIBUTED TALKS:

* (Underline names refers to the author who gave the talk)

- Exploring the early Universe with numerical General Relativity
Cristian Joana
Tonale winter school of cosmology, Tonale, Italy, 8th December 2021
- Exploring the early Universe with numerical General Relativity
Cristian Joana
Belgian Gravitational-Wave Meeting, ULB, Brussels, 3rd November 2021
- The inhomogeneous pre-inflationary era: A numerical relativity approach
Cristian Joana
GRChombo workshop '20, Oxford University, Oxford, UK, 2nd December 2020
- Gravitational waves from the inhomogeneous pre-inflationary era
Cristian Joana
Belgian Gravitational Wave Seminars, KU-Leuven, Leuven, Belgium 25th November 2020
- The inhomogeneous pre-inflationary era
Cristian Joana
Advances in Computational Relativity, ICERM, Brown University, US, 12th November 2020
- Layer specific modulation of response latency in V1 under active and passive viewing conditions
Junji Ito, Cristian Joana, Yukako Yamane, Pedro Maldonado, Sonja Grün
EITN workshop, Paris, France, 26th November 2019
- Activity of visual cortex neurons differs between passive stimulation and active free viewing
Junji Ito, Cristian Joana, Yukako Yamane, Pedro Maldonado, Sonja Grün
ECVP, Leuven, Belgium, 28th August 2019
- GR-Hydrodynamics (perfect fluid) simulations with GRChombo
Cristian Joana
GRChombo workshop '19, KCL, London, UK, 11th June 2019
- Inhomogeneous scalar field dynamics and backreactions in non-conformally flat spacetimes
Cristian Joana
GRChombo workshop '19, QMUL, London, UK, 19th February 2019
- Neural correlates in macaque V1 and IT during active and passive vision
Cristian Joana, Junji Ito, Yukako Yamane, Pedro Maldonado, Sonja Grün
Universidad de Chile, BNI - Neurosistemas, Santiago de Chile, Chile
- Steady-state generation of negative Wigner function light with exciton-polaritons
Cristian Joana, Peter van Loock, Hui Deng, Tim Byrnes
Quantum Manipulations of Atoms and Photons 2015, Shanghai, China, 27th Oct 2015
- Negative Wigner function distribution light generated by coherent excitation of polaritons
Cristian Joana, Peter van Loock, Tim Byrnes
WE-Heraeus-Seminar: Continuous Variable Entanglement in Atomic Systems: Fundamentals and Applications, Bad Honnef, Germany, 11th May 2015