322 Whitmore Lab
Pennsylvania State University
University Park, PA 16802 USA

Mauricio Gamonal

mgamonal@psu.edu
mauricio-gamonal.github.io
: 0000-0002-0677-4926

Education

Ph.D. (c), Physics Pennsylvania State University, University Park, PA, USA **Present**

Advisor: Prof. Eugenio Bianchi.

M.Sc., Physics, Pontificia Universidad Católica de Chile, Santiago, Chile **June 2021**

Thesis Title: Cosmic inflation in modified models of gravity and an analysis on GWs.

Advisor: Prof. Jorge Alfaro.

Degree conferred with maximum distinction.

B.Sc., Physics, Pontificia Universidad Católica de Chile, Santiago, Chile **July 2018**

Degree conferred with maximum distinction.

Research Interests

What is the fundamental structure of spacetime? I'm interested in addressing this question from both formal and observational perspectives. I've been involved in projects that ranges from non-perturbative and background independent approaches to quantum geometry, such as the spinfoam formulation of LQG, to extensions to General Relativity motivated by semi-classical gravity. I find particularly interesting the use of cosmological measurements of primordial observables as a probe of a near-Planck regime of nature that could be sensitive to quantum gravity effects.

Research Experience

Research Assistant, Pennsylvania State University

Prof. Eugenio Bianchi: Aspects of Quantum Gravity **Summer 2022 – Now**

- Developed mathematical techniques to compute primordial power spectra of quantum fields in cosmological spacetimes to a high precision, using analytical and numerical methods.
- Studied the representation theory of the group SL(2,$\mathbb{C}$), formal aspects of the spinfoam formulation of loop quantum gravity, and fundamental notions of causality.

Prof. Abhay Ashtekar: Asymptotic structure of spacetime **Summer 2023**

- Incorporated quantum electrodynamics into the mathematical framework of the Newman-Penrose formalism to study the quantum nature of the Coulombic interaction.

Research Assistant, Pontificia Universidad Católica de Chile

Prof. Jorge Alfaro: Gravitational phenomena **August 2018 – June 2021**

- Developed a theoretical framework in linearized gravity to study corrections to gravitational wave propagation in the ΛCDM model, with potential applications in PTA experiments.

Upcoming publications

7. A. Ashtekar, **M. Gamonal**, *Notes on the quantum nature of the Coulomb interaction* (In preparation, 2024).
6. E. Bianchi, C. Chen, **M. Gamonal**, M. Rincón-Ramirez, *A causal proposal for the EPRL model of spinfoams* (In preparation, 2024).
5. E. Bianchi, **M. Gamonal**, *Squeezed vacua and primordial features in effective theories of inflation at N2LO* (2024) [arXiv:2410.11812].

Refereed Publications

4. E. Bianchi, **M. Gamonal**, *Primordial power spectrum at N3LO in effective theories of inflation*, Phys. Rev. D **110**, 104032 (2024), [arXiv:2405.03157].
3. **M. Gamonal**, *Slow-roll inflation in $f(R,T)$ gravity and a modified Starobinsky-like inflationary model*, Phys. Dark Univ. **31**, 100768 (2021) [arXiv:2010.03861].
2. J. Alfaro and **M. Gamonal**, *A nontrivial footprint of standard cosmology in the future observations of low-frequency gravitational waves*, Gen. Rel. Grav. **52**, no.12, 118 (2020) [arXiv:1902.04550].

Unrefereed Publications

1. **M. Gamonal**, (2021) *Cosmic inflation in modified models of gravity and an analysis on gravitational waves*, Master's thesis at Pontificia Universidad Católica de Chile.

Invited Talks

6.	International Loop Quantum Gravity Seminar, Online.	September 10, 2024
5.	GravUC Seminar, Pontificia Universidad Católica de Chile	December 2023
4.	Primordial Universe and Gravitation Seminar, IGC, Penn State	October 2023
3.	Primordial Universe and Gravitation Seminar, IGC, Penn State	November 2022
2.	La Parte y el Todo VIII, Afunalhue, Chile (online talk)	January 2021
1.	PizzaSeminar 2020 (online talk, in Spanish)	June 2020

Contributed Talks (selected)

8.	Loops' 24, Florida Atlantic University, Fort Lauderdale, FL, USA.	May 2024
7.	6th Neighborhood Workshop, Penn State, State College, PA, USA.	April 2024
6.	Cosmology from Home 2023 (online, pre-recorded talk).	July 2023
5.	American Physical Society, April Meeting, Minneapolis, MN, USA.	April 2023
4.	American Physical Society, Mid-Atlantic Section, University Park, PA, USA.	December 2022
3.	XXII Chilean Symposium of Physics, UTEM, Santiago, Chile.	November 2020
2.	Cosmosur V, UV & PUCV, Valparaíso, Chile.	October 2019
1.	XII Latin American Symposium on High Energy Physics, Lima, Perú.	November 2018

Attendance at summer schools & workshops

6.	Loops' 24 Summer School, Fort Lauderdale, FL, USA.	May 2024
5.	Basics of Quantum Gravity, ISQG (online).	May–November 2022
4.	Loops' 22 Summer School, Aix-Marseille & ENS Lyon, France.	July 2022
3.	Loop Quantum Gravity Summer School (online).	June 2021
2.	Vienna summer school on gravitational quantum physics (online).	September 2020
1.	CosmoAndes 2018, Pontificia Universidad Católica de Chile.	January 2018

Honors and Awards

LQG Summer School 2024 Grant, Loops'24 LOC/Blaumann Foundation. **2024**
Homer F. Braddock Fellowship, Pennsylvania State University. **2022**
David H. Rank Physics Award, Pennsylvania State University. **2022**
Blaumann Research Grant (Call #1), Blaumann Foundation. **2022**
Fulbright Fellowship, Fulbright Commission - ANID, Chile (# 56190016). **2021–2025**

Teaching Experience (selected)

Teaching Assistant, Pennsylvania State University

PHYS 250, Introductory Physics I (Lab).	**Fall/Spring 2022, Spring 2023**
PHYS 213, Fluids and Thermal Physics.	**Summer 2022**
PHYS 214, Wave Motion and Quantum Physics.	**Summer 2022**

Teaching Assistant, Pontificia Universidad Católica de Chile

FIZ0211, Thermodynamics.	**Spring 2020**
FIZ0311, Modern Physics.	**Falls 2018-2019**
FIZ3150, General Relativity (Graduate level).	**Fall 2018**
FIZ0312, Thermodynamics (Lab).	**Spring 2017, Spring 2019 & Fall 2017**
FIZ0312, Waves and Optics (Lab).	**Spring 2017**

Professional Activities, Outreach, and Service

Membership in American Physical Society

Member of the Division of Gravitational Physics (DGRAV).

Honor societies

Inductee at the Tri-Alpha, Eta Psi Chapter honor society.

Journal referee

Annals of Physics.

Conference organizer

1st PizzaSeminar poster session, PUC, Chile **March 2020**
Two-day online poster session, 20 participants.

School of Gravity and General Relativity, CECs, Valdivia, Chile **March 2020**
Week-long national summer school, 50 participants.

Seminar organizer

Primordial Universe and Gravitation (PUG) seminar, Penn State. **Fall 2024 – Present**

PizzaSeminar, PUC, Chile. **Spring 2020 – Spring 2021**

Conference chair

APS Mid-Atlantic Section, University Park, PA, USA. **December 2022**

La parte y el todo VIII, Afunalhue, Chile. **January 2021**

Outreach

Gravi-tea podcast **Starting on November 2024**
Podcasting with a group of graduate students.

TA in Physics LATAM. **June–September 2023**
Online lectures on General Relativity for Latin students.

Physics and Astronomy for Women+ **May 2022**
Outreach activities performed in an elementary school.

Desde la Ciencia Marathon **June 2020**
Outreach online talk on gravitational waves (in Spanish).

Science communication student organization: Fisica Itinerante **2015–2018**
Positions: Coordinator, Community Manager and Executive Director (2016).

Computational skills

Languages—Experience with Mathematica, Python, Markdown, Fortran, and LaTeX.

Other software—Python libraries: Numpy, Scipy, Matplotlib, etc. Cosmology libraries: CAMB, CLASS. Symbolic software: Cadabra, xAct, Maple, wxMaxima.

Operating systems—Mac OS, Linux, Windows.