

# Jose Perdiguero

## Curriculum Vitae

Universitat de València  
Physics department  
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### Research interests

Currently, I am working in the field of modified or alternative gravitational theories like metric-affine theories using Palatini's formalism or purely affine models of gravity, like Polynomial Affine Gravity. Exploring classical aspects in the field of cosmology, black-holes and bosons stars.

Additionally, I am interested in the use of deep learning techniques, specifically the use of neural networks or PINNs (Physics Informed Neural Network) to solve numerically partial differential equations within the context of metric-affine or purely affine models of gravity.

### Appointments

- 2019 – 2023 *Scientific Research*, Federico Santa Maria Technical University, Chile.
- 2015 – 2019 *Teaching Assistant*, Federico Santa Maria Technical University, Chile.

### Education

- 2023–2026 **PhD Physics student**, *Universitat de València*, Spain.
- 2021–2022 **PhD Physics student**, *Federico Santa Maria Technical University*, Chile.  
I completed five semesters before leaving the program.
- 2017–2019 : **Master of Science, Physics**, *Federico Santa Maria Technical University*, Chile.
- 2014–2016 : **Bachelor of Science, Physics**, *Federico Santa Maria Technical University*, Chile.

### Scholarships & Awards

- 2018 – 2019 **PIIC** (Programa de incentivos a la investigacion Cientifica) scholarship, Federico Santa Maria Technical University.
- 2017 – 2019 **Full M.Sc. tuition fees scholarship**, Federico Santa María Technical University
- 2017 – 2019 **Full M.Sc. stipend scholarship**, Federico Santa María Technical University

### Publications

#### Preprints

- 2023 Oscar Castillo-Felisola, Bastian Grez, Jose Perdiguero, and Aureliano Skrzewski. Inflationary scenarios in an effective polynomial affine model of gravity. dec 2023.
- 2022 José Perdiguero and Oscar Castillo-Felisola. Polynomial affine gravity in 3+1 dimensions, 2022.

#### Journa Articles

- 2023 Oscar Castillo-Felisola and Jose Perdiguero Garate. Does the metric play a fundamental role in the building of gravitational models? *International Journal of Geometric Methods in Modern Physics*, page 13, 2023.
- 2023 Oscar Castillo-Felisola, Bastian Grez, Oscar Orellana, José Perdiguero, Aureliano Skrzewski, and Alfonso R Zerwekh. Corrigendum: Emergent metric and geodesic analysis in cosmological solutions of (torsion-free) polynomial affine gravity (2020 class. quantum grav.37 075013). *Classical and Quantum Gravity*, volume 40, page 249501. IOP Publishing, nov 2023.

- 2022 Castillo-Felisola, Oscar, Orellana, Oscar, Perdiguero, José, Ramírez, Francisca, Skrzewski, Aureliano, and Zerwekh, Alfonso R. Polynomial affine model of gravity in three-dimensions. *Universe*, volume 8, 2022.
- 2022 Castillo-Felisola, Oscar, Orellana, Oscar, Perdiguero, José, Ramírez, Francisca, Skrzewski, Aureliano, and Zerwekh, Alfonso R. Aspects of the polynomial affine model of gravity in three dimensions - with focus in the cosmological solutions. *Eur. Phys. J. C*, volume 82, page 8, 2022.
- 2020 Oscar Castillo-Felisola, José Perdiguero, Oscar Orellana, and Alfonso R Zerwekh. Emergent metric and geodesic analysis in cosmological solutions of (torsion-free) polynomial affine gravity. *Classical and Quantum Gravity*, volume 37, page 075013. IOP Publishing, mar 2020.

### Books

- 2018 Oscar Castillo-Felisola, José Perdiguero, and Oscar Orellana. Cosmological solutions to polynomial affine gravity in the torsion-free sector. In Brian Albert Robson, editor, *Redefining Standard Model Cosmology*, chapter 5. IntechOpen, Rijeka, 2018.

### Current research projects

- 10-2023 - **Space-time classification of exact cosmological solutions to three-dimensional polynomial affine model of gravity.**, The project study all analytic solutions to the field equations in the context of cosmology, and defined the type of space according to the structure of emergent metric tensor and non-metricity..
- 04-2024
- 10-2023 - **Review of cosmological solutions in the four-dimensional polynomial affine model of gravity.**, By using the results obtained from the model in  $2 + 1$  dimensions, we are able to reduce the complexity of the field equations and introduce the effects of the torsion. We study analytic solutions with all fundamental fields turned on.
- 2-2024
- 01-2024 - **Spherical and static solutions to polynomial affine model of gravity in the torsion free sector**, In this project we explore the space of static spherical solutions to the polynomial affine model of gravity in the torsion-free limit. Because of the structure of the field equations we explore numerical methods to find solution using neural networks, specifically PINNs (Physics Informed Neural Network).
- 04-2024

### Monograph

- 09-2019 **Cosmología en gravedad afin polinomial (in Spanish)**, M.Sc. in Physics Thesis, UTFSM , Chile, <https://repositorio.usm.cl/handle/11673/48007/>.

### Conferences

- 12-2023 **Cosmological solutions with torsion effects in Polynomial Affine Gravity**, 7th Workshop Universidad de Valencia, Spain.
- 05-2023 **An inflationary scenario in an effective polynomial affine model of gravity**, Panoramas UTFSM-PUCV, Chile.
- 11-2022 **Polynomial Affine Gravity in 3+1 dimensions**, Sochifi (Chilean Physics' Society), Chile.
- 10-2022 **Cosmology in Polynomial Affine Gravity in 3 + 1 dimensions with torsion**, Panoramas UTFSM-PUCV, Chile.
- 11-2021 **Cosmology in Polynomial Affine Gravity in 2 + 1 dimensions with torsion**, Panoramas UTFSM-PUCV, Chile-via zoom.
- 09-2021 **Polynomial Affine Gravity**, Alternative Gravities and Fundamental Cosmology, Poland-via zoom.

### Schools

- 09-2023 **3rd Winter School: Topics on Graviticulas**, Pontificie Universidad Católica de Chile, Chile.

03-2020 **School of Classical and Quantum Black Holes**, University of Concepcion, Chile.

03-2020 **School of Gravity and General Relativity**, CECs (Centro de Estudios Científicos), Chile.

## Teaching Assistant

2017 – 2019: **Physics IV**, Department of Physics, Federico Santa Maria Technical University.

2015 – 2016: **Intermediate Mechanics I**, Department of Physics, Federico Santa Maria Technical University.

2016 **Optics**, Department of Physics, Federico Santa Maria Technical University.

## Computer skills

Languages SageMath, Cadabra, Mathematica, LaTeX and Overleaf, Currently learning Python and its libraries numpy, matplotlib applied to solve numerically systems of differential equations and dynamical systems

CodeCademy Learn Python 3 (25 hours), Learn Statistics with Python (4 hours), Learn Statistics with Numpy (4 hours), Machine Learning: Introduction with Regression (3 hours), Machine Learning: K-Nearest Neighbors (2 hours)

Udemy Python for Data Science and Machine Learning Bootcamp (25 hours), Physics Informed Neural Networks (PINNs) (6.5 hours)

## Languages

Spanish **Native.**

English **C1**, *IELTS-Academic Test*, 7.5.