

PABLO VILLANUEVA DOMINGO

PHD IN PHYSICS & DATA SCIENTIST

I recently obtained my **PhD in theoretical physics** at the University of València, Spain. During my research, I have led international collaborations, publishing scientific articles and presenting the results in multiple seminars. I have focused on employing **data analysis** and **deep learning** techniques in cosmology and astrophysics, such as Convolutional Neural Networks and Graph Neural Networks, which now I aim to apply in industry.

CONTACT

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SKILLS

💻 Computation

Programming languages

Python, C, C++, C#, Fortran, SQL,
HTML/CSS, Javascript

General software

Mathematica, LaTeX, MATLAB, Git, Unity

Data analysis

Numpy, SciPy, Pandas, Networkx

Visualization

Matplotlib, Plotly, Gnuplot

Data scraping

Beautiful Soup, Tweepy

🤖 Machine learning

ML libraries

PyTorch, TensorFlow/Keras,
PyTorch Geometric, Scikit-learn

Neural Nets experience

Convolutional Neural Nets (CNNs), U-Nets,
Generative Adversarial Nets (GANs), Graph
Neural Nets (GNNs), Long short-term
memory (LSTM)

Fields

Computer vision, Natural Language
Processing, Reinforcement Learning

See my work in ML and programming at

<https://pablovd.github.io/codes>

💬 Soft skills

Communication

Public speaking, writing skills

Project management

Collaboration, teamwork, initiative,
organization

Problem solving

Logical reasoning, lateral thinking,
creativity, data modeling

🌐 Languages

Spanish	Mother tongue
Catalan	Mother tongue
English	Fluent
Portuguese	Basics

👛 WORK HISTORY

• Research assistant

📅 Jun. 2021- Dec. 2021 | 📍 Instituto de Física Corpuscular - Universitat de València
Técnico superior de apoyo a la investigación, CIDEAGENT/2018/019, CPI-21-108

• PhD fellowship

📅 May 2017 - Mar. 2021 | 📍 Instituto de Física Corpuscular - Universitat de València
FPI Severo Ochoa, Ref. SEV-2014-0398-16-3

• PhD contract

📅 Oct 2016 - May 2017 | 📍 Instituto de Física Corpuscular
Sabor y origen de la materia (SOM), PROMETEU CPI-16-242

• Research introduction fellowship

📅 May-Oct. 2016 | 📍 Instituto de Física Corpuscular
Iniciación a la investigación Severo Ochoa

🎓 EDUCATION

• PhD in Physics, *cum laude*

📅 2016-2021 | 📍 Instituto de Física Corpuscular - Universitat de València

• Master in Advanced Physics

📅 2015-2016 | 📍 Universitat de València

• Bachelor of Physics

📅 2011-2015 | 📍 Universitat de València

As well as multiple schools and courses in data science, machine learning, computational tools and physics, which can be found at <https://pablovd.github.io/talks.pdf>

✈️ RESEARCH STAYS

I have led several international research collaborations, visiting universities from different countries:

📅 Nov.- Dec. 2019 | 📍 3 weeks at Service de Physique Théorique, Université Libre de Bruxelles, Brussels, Belgium.

📅 Sep.- Oct. 2019 | 📍 1 month at Department of Astrophysical Sciences, Princeton University, New Jersey, USA.

📅 Sep.- Nov. 2018 | 📍 2 months at Kavli IPMU, University of Tokyo, Japan.

📅 Jun.- Aug. 2017 | 📍 2 months at Fermi National Accelerator Laboratory (Fermilab), Illinois, USA.

🏆 AWARDS

📅 Dec. 2016 | 1st prize in the *XXVII edición del Premio Rotary al Fomento del Trabajo Experimental en Física* for the physics experiment design *Medida del brillo superficial límite de imágenes con corrientes de marea*.

TALKS

I have given **7 seminars** at the universities of Princeton (USA), Tokyo, Nagoya (Japan), Brussels and València; as well as **7 talks** in conferences, meetings and schools.

A complete list can be found at <https://pablovd.github.io/talks.pdf> These are some of my last talks:

- *Machine Learning at galactic and cosmological scales*

 Nov. 17 2021 |  Instituto de Física Corpuscular | [Video](#) and [slides](#)

- *Weighing the Milky Way and Andromeda with Graph Neural Networks*

 Nov. 4 2021 |  CAMELS meeting, online, organized by the Center for Computational Astrophysics, Flatiron Institute, New York

- *Constraining Primordial Black Hole scenarios with 21 cm cosmology*

 Oct. 14 2019 |  Department of Astrophysical Sciences, Princeton University, USA

SELECTED PUBLICATIONS

I have published **14 scientific articles** in high impact journals based on my research on cosmology and astrophysics. The full list of publications can be found in my INSPIRE profile [P.Villanueva.Domingo.1](#). Among them, I have applied **deep learning** methods in the following works:

- *Weighing the Milky Way and Andromeda with Artificial Intelligence*

Pablo Villanueva-Domingo, Francisco Villaescusa-Navarro, Shy Genel, Daniel Anglés-Alcázar, Lars Hernquist, Federico Marinacci, Mark Vogelsberger and Desika Narayanan

 Nov. 2021 |  [2111.14874](#)

The total masses of the Milky Way and Andromeda galaxies are predicted using AI for the first time, via Graph Neural Networks.

- *Inferring halo masses with Graph Neural Networks*

Pablo Villanueva-Domingo, Francisco Villaescusa-Navarro, Daniel Anglés-Alcázar, Shy Genel, Federico Marinacci, David N. Spergel, Lars Hernquist, Mark Vogelsberger, Romeel Dave and Desika Narayanan

 Nov. 2021 |  [2111.08683](#)

Graph Neural Networks in PyTorch Geometric are trained in simulations to infer the mass of dark matter halos.

- *Removing Astrophysics in 21 cm maps with Neural Networks*


Pablo Villanueva-Domingo and Francisco Villaescusa-Navarro


 Jan. 2021 |  [The Astrophysical Journal, 907\(1\):44, 2021; 2006.14305](#)


The cosmic density field is predicted from maps of distribution of hydrogen training a U-Net in PyTorch.

OUTREACH & ADDITIONAL WORK EXPERIENCE

 Feb. 2021 | [Outreach video](#) about the astronomer Sandra M. Faber within the project *Pioneras - Recordando a Lise Meitner*.



 2020 - Now | Journal referee for Monthly Notices of the Royal Astronomical Society (MNRAS).

 Jun. 2019 | Member of the local organizing committee of the Invisibles19 Workshop at València and Invisibles19 School at Laboratorio subterráneo de Canfranc (LSC)

 2016-2017 | Collaboration in the organization of the outreach event *Feria-Concurso Experimental*, València.

REFERENCES

- Dr. Olga Mena Requejo

 Instituto de Física corpuscular, CSIC |  omena@ific.uv.es

- Dr. Francisco Villaescusa Navarro

 Center for Computational Astrophysics, Flatiron Institute, New York |  villaescusa.francisco@gmail.com

- Dr. Sergio Palomares Ruiz

 Instituto de Física corpuscular, CSIC |  Sergio.Palomares.Ruiz@ific.uv.es

- Dr. Laura Lopez Honorez

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