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, CIDEGENT/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 **15 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, David N. Spergel, 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 Experimenta*, 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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