

PABLO VILLANUEVA DOMINGO

PHD IN PHYSICS & DEEP LEARNING SCIENTIST

I obtained my **PhD in theoretical physics** at the University of València, Spain, researching **deep learning** techniques in cosmology and astrophysics. During my PhD, I led international collaborations, published scientific articles and presented the results in multiple seminars. Currently, I am working as **deep learning scientist** in the autonomous driving simulator project CARLA.



CONTACT

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SKILLS

💻 Computation

Programming languages

Python, C, C++, C#, Fortran, SQL

General software

Git, Docker, LaTeX, MATLAB, Mathematica

Data analysis

Numpy, SciPy, Pandas, OpenCV, Networkx

Visualization

Matplotlib, Seaborn, Plotly, Folium

3D engines

Basics of Unreal, Godot, Unity

Autonomous driving software

CARLA, ROS2

Physical simulation software

Chrono, Flex

Web development

HTML, CSS, Javascript, Jekyll, Flask

🤖 Machine learning

ML libraries

PyTorch, TensorFlow, PyTorch Lightning,

PyTorch Geometric, Scikit-learn

Neural Nets Architectures

Graph (GNNs), Convolutional (CNNs), U-Nets,

Diffusion models, GANs, LSTMs

Natural Language Processing

LLMs, RAG, Chatbots

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

• Deep Learning Scientist

📅 Jan. 2022- Now | 📍 Computer Vision Center - Universitat Autònoma de Barcelona
Data-driven traffic models, AI behavior agents, neural terramechanics and computer vision at the autonomous driving simulator [CARLA](#)

• 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

📅 Oct 2016 - Mar. 2021 | 📍 Instituto de Física Corpuscular - Universitat de València
FPI Severo Ochoa, Ref. SEV-2014-0398-16-3

• 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 PhD schools and courses which can be found [here](#).

✈️ 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

📅 Feb. 2023 | CSIC 2021 relevant PhD Thesis Award, by Consejo Superior de Investigaciones Científicas (CSIC).

📅 Dec. 2016 | 1st prize in the XXVII edición del Premio Rotary al Fomento del Trabajo Experimental en Física.

TALKS

I have given **9 seminars** at the universities of Princeton (USA), Tokyo, Nagoya (Japan), Brussels and València; as well as **8 talks** in conferences, meetings and schools.

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

- *Neural Terramechanics and the RACER-SIM project*

 Jul. 28 2022 |  EAI Tech Forum, Intel Labs, online

- *Weighing the Milky Way with AI*

 Jan. 17 2022 |  *Cosmology Talks*, online (Youtube channel) | [Video](#)

- *Machine Learning at galactic and cosmological scales*

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

SELECTED PUBLICATIONS

I have published **21 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](#). I have applied **deep learning** methods in part of my research, such as 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 |  [Physical Review D 107, 103003, 2023](#), [arXiv: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 |  [The Astrophysical Journal, Volume 935\(1\):30, 2022](#), [arXiv: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](#); [arXiv: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 journals such as MNRAS and ApJ. See reviews in my [Publons](#) profile

 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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