

# 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

#### Web development

HTML, CSS, Javascript, React, Jekyll, Flask

#### General software

Git, Docker, LaTeX, MATLAB, Mathematica

#### Data analysis

Numpy, SciPy, Pandas, OpenCV, Networkx

#### Visualization

Matplotlib, Seaborn, Plotly, Folium

#### Simulation & game engines

Chrono, Flex, basics of Unreal, Godot, Unity

#### Autonomous driving & robotics software

CARLA, ROS, Scenic, Xviz

### 🤖 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, Agents with Langchain

#### 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

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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

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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

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 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 Experimenta*, València.

## REFERENCES

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- Dr. Olga Mena Requejo

 Instituto de Física corpuscular, CSIC |  [omena@ific.uv.es](mailto:omena@ific.uv.es)

- Dr. Francisco Villaescusa Navarro

 Center for Computational Astrophysics, Flatiron Institute, New York |  [villaescusa.francisco@gmail.com](mailto:villaescusa.francisco@gmail.com)

- Dr. Sergio Palomares Ruiz

 Instituto de Física corpuscular, CSIC |  [Sergio.Palomares.Ruiz@ific.uv.es](mailto:Sergio.Palomares.Ruiz@ific.uv.es)

- Dr. Laura Lopez Honorez

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