RODOLFO CAPDEVILLA, Ph.D.

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PROFILE

Physicist with 10+ years of research experience specializing in physics-based numerical simulation, deep learning (autoencoders, CNNs), and large-scale scientific computing. Author of 20+ peer-reviewed publications and inventor of a patented energy-conversion technology; currently Faculty Lead of a Masters-in-AI program. Passionate about applying AI and accelerated computing to hard scientific problems, from weather and climate anomaly detection to high-fidelity physics modeling.

Technical Skills: Python (PyTorch, NumPy, pandas, scikit-learn, Streamlit), C++, Fortran, SQL, Wolfram Mathematica; deep learning (autoencoders, CNNs, object detection), Monte Carlo simulation, numerical modeling, statistical inference, high-performance/scientific computing, Git/Linux.

EDUCATION

University of Notre Dame, *Doctor of Philosophy*, Physics. **South Bend, IN (Aug 2019)**
Sao Paulo State University, *Master of Science*, Physics. **Sao Paulo, Brazil (Feb 2013)**
University of Atlantico, *Bachelor of Science*, Physics. **Barranquilla, Colombia (Jun 2010)**

PROFESSIONAL EXPERIENCE

Atlantis University (AU) **Miami, FL**
Faculty Lead, Masters Program in AI (Part time) **Dec 2025 – present**

- Designed and delivered instructor-led courses in **Human-AI Interaction, Computer Vision,** and **Deep Learning** for the MS in AI program; built curriculum from the ground up aligning learning outcomes with industry needs.
- Built Claude Code workflow automations that streamline internal course-administration processes at the university.
- Delivered webinars and worked closely with marketing and admission teams to recruit new students.

Chromatic Lighting, LLC **Dallas, TX (Remote)**
Project Manager (Part time) **Oct 2025 – Dec 2026**

- Led a NASA NIAC grant application for the Muon Weather Observatory Network (MWON): anomaly detection via *autoencoders* on cosmic muon flux data to identify and predict severe weather systems in real time.
- Led a U.S. Air Force SBIR application on autonomous target identification using *Machine Learning* (CNN-based concealed firearm detection in IR images).

Fermi National Accelerator Laboratory (Fermilab) **Chicago, IL**
Research Associate, Theoretical Particle Physics (Full time) **Oct 2022 – Oct 2025**

- Designed and executed a Python-based Machine Learning classification pipeline for a Higgs Boson search strategy, demonstrating end-to-end ML modeling in a high-stakes research environment.
- Mentored 3 graduate students on quantum sensing and cosmic ray–weather correlations using ML; guided projects from hypothesis to publication-ready results.
- Delivered 20+ seminars to international technical and non-technical audiences, consistently translating cutting-edge physics into accessible insights—core competency for organization-wide AI training.
- Built numerical models and large-scale simulations of particle-collider and gravitational-wave processes; authored 10 peer-reviewed publications and served as referee for leading scientific journals.

Perimeter Institute for Theoretical Physics **Waterloo, Canada**
Postdoctoral Fellow, Theoretical Particle Physics (Full time) **Sep 2019 – Sep 2022**

- Developed numerical models and simulations in theoretical physics, producing 7 peer-reviewed publications; presented research at international conferences, building cross-institutional collaborations.

APPLIED AI & MACHINE LEARNING PROJECTS

- **Muon Weather Observatory Network (MWON)**: Physics-informed autoencoder anomaly detection (PyTorch) on MicroBooNE cosmic muon flux data (10,000× QuarkNet sensitivity) to identify and predict severe-weather systems. Led student collaboration; secured grant funding pipeline (NASA NIAC + Air Force SBIR).
- **AI-Driven Concealed Firearm Detection (AIMS)**: Built and trained a CNN (PyTorch) on a 1,300+ IR image dataset (varied angles, distances, focal resolutions), achieving AUC = 0.98 for firearm present/absent classification. Roadmap includes MMW/THz sensor fusion and drone-based portable deployment.
- **Claude Code Workflow Automations**: Implemented GenAI-powered automations at Atlantis University to streamline course administration and content workflows, deployed as internal models for AI adoption.

DESIGN PATENT

- Invented a *Radiovoltaic Generator*: compact nuclear-to-electricity power converter (target: 1 kW output). Developed a high-fidelity Monte Carlo radiation-transport simulation to model the device physics. Provisional Patent Application No. 63/874,784.

SELECTED PUBLICATIONS/SEMINARS/INTERVIEWS

- *La materia oscura, dónde está? Muones, Higgsino, Chargino…*, Interview by *Luciérnagas* Radio Show (Jan/21/2026).
- *Guaranteed Deliverables for the Muon Collider*, U.S. Muon Collaboration Annual Meeting, U. Chicago (Aug/07/2025).
- *High-Frequency Gravitational Waves on BREAD*, Online seminar *El Journal Club más Sabroso* (Jun/24/2025).
- *Towards a Muon Collider*, High-Energy Physics Seminar at U. Northwestern (Apr/21/2025).
- *Detecting High-Frequency Gravitational Waves with Axion DM Experiments*, EPT Seminar, U. Maryland (Nov/11/2024).
- *Road to Minimal WIMPs*. LEPP Theory Seminar, Cornell (Nov/08/2024).
- *Road to Minimal WIMPs*. High Energy Seminars, UC Davis (Oct/14/2024).
- *Road to Minimal WIMPs*. Theoretical Physics Seminar, SLAC National Lab (Oct/02/2024).
- *Road to Minimal WIMPs*. High Energy Physics Seminar, Argonne National Lab (Sep/24/2024).
- *Interplay between Theory and Experiment at the Muon Collider*. US Muon Collaboration, Fermilab (Aug/08/2024).
- *Electroweak Interacting Dark Matter at Muon Colliders*. Online Latin American Webinars on Physics (Jun/02/2024).
- *Discovering Minimal Dark Matter at Muon Colliders.* DPF-PHENO, U. Pittsburgh & Carnegie Mellon (May/13/2024).
- *Soft Tracks for Higgsino discovery*, talk at the International MCC Annual Meeting, CERN, Switzerland (Mar/14/2024).

AFFILIATIONS, AWARDS & MENTORSHIP

- Member, American Physical Society; U.S. & International Muon Collider Collaborations. **Present**
- Theorist of the Month, DESY (Deutsches Elektronen-Synchrotron), Hamburg, Germany. **Jun 2023**
- Ganey Community-Based Research Graduate Stipend, University of Notre Dame. **2016**
- Conducted LHC Master Classes on data interpretation with QuarkNet (50+ attendees/event). **2023–2025**
- Mentored student Yusuf Aamir (U. Maryland): Muon Flux Variance from Severe Atmospheric Conditions. **2024**
- Mentored student Angel Perez (U. Atlantico): Characterization of an Optical Quantum Resonator. **2024**