RODOLFO CAPDEVILLA, Ph.D.

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PROFILE

Physicist with 11+ years of research experience specializing in physics-based numerical simulation, deep learning, 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, C++, Fortran, SQL, Wolfram Mathematica, Monte Carlo (MC) simulation, numerical modeling, statistical inference, high-performance/scientific computing, Linux.

EDUCATION

University of Notre Dame, *Doctor of Philosophy*, Physics. **South Bend, IN (Aug 2019)**
Sao Paulo State University, *Master of Science*, Theoretical 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 **Computer Vision** and **Deep Learning** for the MS in AI program.
- 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 a CNN-based system.

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

- Proposed a new experiment to detect gravitational waves with great potential for new discoveries.
- Mentored 3 graduate students on quantum sensing and cosmic ray-weather correlation data analysis.
- Delivered 20+ seminars to international technical and non-technical audiences, consistently translating cutting-edge physics into accessible insights.
- 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 on MicroBooNE (Fermilab neutrino experiment) cosmic muon flux data to identify and predict severe-weather systems.
- **AI-Driven Concealed Firearm Detection (AIMS)**: Built and trained a CNN 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

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

TEACHING

- *May-Jun (2026), Deep Learning, Atlantis U.*, Students worked on personal projects with CNN and autoencoders.
- *May-Jun (2026), Solid State Physics, Atlantis U.*, Thermal, electromagnetic, and quantum properties of matter.
- *Apr-May (2026), Computer Vision, Atlantis U.*, From classic CV techniques to modern architectures (YOLO/RCNN).
- *2013-2019, Teaching Assistant, U. Notre Dame*, Lab session and tutorials; Mechanics, Electro- and Thermo-dynamics.

SELECTED PUBLICATIONS (full list of 23+ papers in inspire-hep)

- *A. Berlin, **RC**, T. Cheng, M. Hostert, P. Machado, Neutrino-Antineutrino Conversion…* *e-Print: 2605.06777*
- ***RC**, Gravitational Photon Polarization Twist to Probe the Early Universe & the Galactic Center,* *e-Print: 2507.05347*
- ***RC**, R. Harnik, T. Kim, T. Krokotsch, High-frequency gravitational wave detection...* *Phys. Rev. D112 (2025) 3, 035031*
- ***RC**, G. Gelmini, J. Hyman, A. Millar, E. Vitagliano, Gravitational Wave Detection…* *Phys. Rev. D112 (2025) 5, 055011*
- ***RC** and T. Han, Electroweak Symmetry Restoration…* *Phys. Rev. Lett. 135 (2025) 10, 101801*
- ***RC**, F. Garosi, D. Marzocca, B. Stechauner, Testing the Neutrino Content of the Muon…* *JHEP 04 (2025) 168*
- ***RC**, F. Meloni, J. Zurita, Discovering Electroweak Interacting Dark Matter...* *Phys. Rev. Lett. 134 (2025) 18, 181802*
- *M. Barela and **RC**, Di-Higgs Signatures in Neutral Naturalness* *JHEP 02 (2024) 050*

SELECTED SEMINARS/INTERVIEWS

- *La materia oscura, dónde está? Muones, Higgsino, Chargino…*, Interview by *Luciérnagas* Radio Show Jan/21/2026
- *Guaranteed Deliverables for the Muon Collider*, USMCC 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
- *High-Frequency Gravitational Waves and Axion Dark Matter 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, SERVICE, MENTORSHIP

- American Physical Society (APS); U.S. & International Muon Collider Collaborations (USMCC & IMCC) **Present**
- Theorist of the Month, DESY (Deutsches Elektronen-Synchrotron), Hamburg, Germany. **Jun 2023**
- Ganey Community-Based Research Graduate Stipend, University of Notre Dame. **2016**
- Member speaker committee, Topic of the week seminar, LHC Physics Center, Fermilab. **Nov/2024 - Oct/2025**
- Conducted LHC Master Classes on data interpretation with QuarkNet (50+ attendees/event). **2023–2026**
- 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**
- Mentored student Mario Barela (Sao Paulo State U.), publication on the Higgs boson for PhD completion. **2023**
- Co-organizer, NDCO program, Colombian students visiting Notre Dame for a summer research program. **2016-2019**
- Masterclass Institutes Collaborating Americas (MICA-IV), Cosmic rays & particle physics for high schoolers. **2018**