Deivid Ribeiro

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Education

Columbia University, New York, NY 2016 - 2022
Ph.D. in Physics
Advisor: Brian Humensky
Dissertation: "Observations of Transient Events with Very-High-Energy Gamma-Ray Telescopes"

Columbia University, New York, NY 2016 - 2018
Master of Arts in Physics
Coursework: Advanced Electrodynamics, Graduate Quantum Mechanics, General Relativity, Classical Fields and Waves, Statistical Mechanics

Columbia University, New York, NY 2014 - 2016
Bridge-to-PhD Scholar
Coursework: Intro to Modern Astrophysics, Graduate Astrophysics, Quantum Mechanics

Brown University, Providence, RI 2011 - 2013
Sc.B. in Physics, completed December 2013
Coursework: Quantum Mechanics, Advanced Electromagnetic Theory, Nuclear and High Energy Physics, Cosmology, Modern Physics Laboratory, Ordinary Differential Equations

University of Massachusetts Dartmouth, North Dartmouth, MA 2009 - 2010
Coursework: Statistical Thermodynamics, Mechanics, Intermediate Mathematical Physics

Cape Cod Community College, Barnstable, MA 2007 - 2009
Associate of Arts, Mathematics and Science, May 2009

Publications

- *Variability and Spectral Characteristics of Three Flaring Gamma-Ray Quasars Observed by VERITAS and Fermi-LAT,* The Astrophysical Journal, 2022: 95.
- *Observation of the Gamma-Ray Binary HESS J0632+057 with the H.E.S.S., MAGIC, and VERITAS Telescopes,* The Astrophysical Journal, 2021: 241.
- *Multiwavelength Observation Campaign of the TeV Gamma-Ray Binary HESS J0632 + 057 with NuSTAR, VERITAS, MDM, and Swift,* The Astrophysical Journal, 2021: 17.
- *The throughput calibration of the VERITAS telescopes,* arXiv e-prints, 2021: arXiv:2111.04676.
- *Prototype Schwarzschild-Couder Telescope for the Cherenkov Telescope Array: Commissioning the Optical System,* arXiv e-prints, 2021: arXiv:2110.07463.
- *Detection of the Crab Nebula by the prototype Schwarzschild-Couder Telescope,* arXiv e-prints, 2021: arXiv:2109.06225.

- *Design and performance of the prototype Schwarzschild-Couder Telescope camera,* arXiv e-prints, 2021: arXiv:2109.05127.
- *VERITAS contributions to the 37th International Cosmic Ray Conference,* arXiv e-prints, 2021: arXiv:2109.05119.
- *An Archival Search for Neutron-star Mergers in Gravitational Waves and Very-high-energy Gamma Rays,* The Astrophysical Journal, 2021: 66.
- *VizieR Online Data Catalog: 10yr of radio-to-gamma-ray obs. of 1ES 1215+30.3 (Valverde+, 2020),* VizieR Online Data Catalog, 2021: J/ApJ/891/170.
- *Technical and scientific performance of the prototype Schwarzschild-Couder telescope for CTA,* Astronomical Optics: Design, Manufacture, and Test of Space and Ground Systems III, 2021: 118200E.
- *A Search for TeV Gamma-Ray Emission from Pulsar Tails by VERITAS,* The Astrophysical Journal, 2021: 117.
- *VERITAS Observations of the Galactic Center Region at Multi-TeV Gamma-Ray Energies,* The Astrophysical Journal, 2021: 115.
- *Broadband Multi-wavelength Properties of M87 during the 2017 Event Horizon Telescope Campaign,* The Astrophysical Journal, 2021: L11.
- *Detection of the Crab Nebula with the 9.7 m prototype Schwarzschild-Couder telescope,* Astroparticle Physics, 2021: 102562.
- *Sensitivity of the Cherenkov Telescope Array for probing cosmology and fundamental physics with gamma-ray propagation,* Journal of Cosmology and Astroparticle Physics, 2021: 048.
- *Sensitivity of the Cherenkov Telescope Array to a dark matter signal from the Galactic centre,* Journal of Cosmology and Astroparticle Physics, 2021: 057.
- *Search for Gamma-ray Emission from Superluminous Supernovae with Fermi-LAT,* American Astronomical Society Meeting Abstracts, 2021: 409.02.
- *Alignment of the optical system of the 9.7-m prototype Schwarzchild-Coulder Telescope,* Society of Photo-Optical Instrumentation Engineers (SPIE) Conference Series, 2020: 114456A.
- *Verification of the optical system of the 9.7-m prototype Schwarzschild-Couder Telescope,* Optical System Alignment, Tolerancing, and Verification XIII, 2020: 1148805.
- *VERITAS Discovery of VHE Emission from the Radio Galaxy 3C 264: A Multiwavelength Study,* The Astrophysical Journal, 2020: 41.
- *Upper Limits on TeV Emission from Superluminous Supernovae,* American Astronomical Society Meeting Abstracts #236, 2020: 121.02.
- *A Decade of Multiwavelength Observations of the TeV Blazar 1ES 1215+303: Extreme Shift of the Synchrotron Peak Frequency and Long-term Optical-Gamma-Ray Flux Increase,* The Astrophysical Journal, 2020: 170.
- *Demonstration of stellar intensity interferometry with the four VERITAS telescopes,* Nature Astronomy, 2020: 1164-1169.

- *Probing the Properties of the Pulsar Wind in the Gamma-Ray Binary HESS J0632+057 with NuSTAR and VERITAS Observations,* The Astrophysical Journal, 2020: 115.
- *Measurement of the Extragalactic Background Light Spectral Energy Distribution with VERITAS,* The Astrophysical Journal, 2019: 150.
- *Characterization and assembly of near-ultraviolet SiPMs for the Schwarzschild-Couder medium-size telescope proposed for the CTA Observatory,* Hard X-Ray, Gamma-Ray, and Neutron Detector Physics XXI, 2019: 111140D.
- *Prototype Schwarzschild-Couder Telescope for the Cherenkov Telescope Array: Commissioning Status of the Optical System,* arXiv e-prints, 2019: arXiv:1909.11403.
- *Development and operations of INFN optical modules for the SCT Telescope camera proposed for the Cherenkov Telescope Array Observatory,* arXiv e-prints, 2019: arXiv:1909.08361.
- *VERITAS contributions to the 36th International Cosmic Ray Conference,* arXiv e-prints, 2019: arXiv:1909.08114.
- *Monte Carlo studies for the optimisation of the Cherenkov Telescope Array layout,* Astroparticle Physics, 2019: 35-53.
- *The gravitational wave follow-up program of the Cherenkov Telescope Array,* 36th International Cosmic Ray Conference (ICRC2019), 2019: 790.
- *The Cherenkov Telescope Array sensitivity to the transient sky,* 36th International Cosmic Ray Conference (ICRC2019), 2019: 673.
- *Prototype Schwarzschild-Couder Telescope for the Cherenkov Telescope Array: Commissioning Status of the Optical System,* 36th International Cosmic Ray Conference (ICRC2019), 2019: 672.
- *Science with the Cherenkov Telescope Array,* Science with the Cherenkov Telescope Array, 2019.
- *Prototype 9.7 m Schwarzschild-Couder telescope for the Cherenkov Telescope Array: status of the optical system,* arXiv e-prints, 2017: arXiv:1709.06324.
- *Cherenkov Telescope Array Contributions to the 35th International Cosmic Ray Conference (ICRC2017),* arXiv e-prints, 2017: arXiv:1709.03483.
- *Prototype 9.7m Schwarzschild-Couder telescope for the Cherenkov Telescope Array: status of the optical system.,* 35th International Cosmic Ray Conference (ICRC2017), 2017: 815.
- *Contributions of the Cherenkov Telescope Array (CTA) to the 6th International Symposium on High-Energy Gamma-Ray Astronomy (Gamma 2016),* arXiv e-prints, 2016: arXiv:1610.05151.
- *Construction of a medium-sized Schwarzschild-Couder telescope as a candidate for the Cherenkov Telescope Array: development of the optical alignment system,* arXiv e-prints, 2015 arXiv:1509.02463.
- *Toward the construction of a medium size prototype Schwarzschild-Couder telescope for CTA,* Society of Photo-Optical Instrumentation Engineers (SPIE) Conference Series, 2015: 960305.
- *CTA Contributions to the 34th International Cosmic Ray Conference (ICRC2015),* arXiv e-prints, 2015: arXiv:1508.05894.

- *Construction of a medium-sized Schwarzschild-Couder telescope as a candidate for the Cherenkov Telescope Array: development of the optical alignment system,* 34th International Cosmic Ray Conference (ICRC2015), 2015: 990.

Research Experience

Post-Doctoral Researcher, University of Minnesota September 2022 - Present

- Developed advanced machine learning algorithms for gamma-ray data analysis from the VERITAS observatory
- Implemented novel feature extraction techniques, significantly improving classification accuracy for astrophysical sources
- Conducted rigorous statistical analysis and validation of model performance metrics
- Delivered critical insights into gamma-ray source behavior, contributing to multiple collaboration publications
- Expanded analysis capabilities for high-energy sources including NGC1275, RBS 1366, and HBLs
- Advanced core analysis software including VEGAS and V2DL3 through targeted improvements

Graduate Research Assistant, Columbia University September 2016 - September 2022

- Successfully commissioned and aligned the prototype Schwarzschild-Couder Telescope to meet on-axis optical design specifications
- Managed both hardware and software components of the complex optical system
- Established follow-up observation program for gamma-ray emissions from superluminous supernovae with VERITAS
- Served as primary analyst for gamma-ray observations of classical novae
- Analyzed gamma-ray burst (GRB) observations using time-dependent statistical methods for VERITAS 2017-2021 dataset
- Engineered gamma-ray follow-up algorithm for large-area tiled observation of gravitational wave triggers from LIGO/VIRGO
- Created software enabling instantaneous observation planning for rapidly evolving astronomical sources
- Calculated time-dependent sensitivity metrics for Cherenkov Telescope Array using CTOOLS and for Fermi-LAT using FermiPY

Bridge-to-PhD Scholar, Columbia University July 2014 - August 2016

- Validated effectiveness and sensitivity of the Disp method for shower reconstruction in VERITAS analysis software
- Utilized observations of the Crab pulsar at large zenith angles to benchmark reconstruction algorithms
- Developed and tested calibration design for mirror panel edge sensors for the Cherenkov Telescope Array prototype

- Led team of undergraduate students in quality assessment and scanning of 360 high-precision optical sensors

Research Assistant, Brown University January 2012 - July 2014

- Implemented statistical methodology to characterize millisecond pulsar population distribution across the Fermi-LAT sky
- Organized and analyzed 192 equal-area pixels of gamma-ray data to identify population trends
- Investigated correlations between unassociated gamma-ray sources in the 2nd Fermi catalog and Herbig Haro objects
- Determined flux upper limits and spectral properties for candidate sources
- Utilized specialized timing software (PRESTO and TEMPO2) to search for pulsations in hidden pulsars
- Conducted comprehensive search for gamma-ray emission from all Milky Way globular clusters using Fermi-LAT data
- Modeled gamma-ray sources with four-year dataset using FermiTools for unassociated source characterization

Karen T. Romer Undergraduate Teaching and Research Award, Brown University Summer 2013

- Calculated flux upper limit of globular cluster Koposov 1 using Fermi-LAT photon data
- Developed innovative histogram binning method to determine overdensity at candidate locations
- Created Python implementation of Maximum Likelihood Estimation integrated with FermiTools

Research Assistant, University of Massachusetts Dartmouth Spring 2011

- Developed Fortran program to calculate periodicity of Brown Desert Dwarf Binary Pairs
- Contributed to research on Type IIa Supernovae originating from turbulent systems
- Created virtual campus mapping using AutoCAD software for emergency evacuation simulation modeling

Prizes and Grants

The Simon Swordy Outstanding VERITAS Contribution Award January 2022

- Recognized for exceptional contributions to the VERITAS (Very Energetic Radiation Imaging Telescope Array System) collaboration

Lead Teaching Fellow, Columbia University Center for Teaching & Learning 2018 - 2019

- Selected for competitive fellowship program to develop innovative teaching practices within the Physics Department

The Allan M. Sachs Award for Outstanding Contributions to Teaching August 2018

- Honored for excellence in physics education and pedagogical innovation at Columbia University

Columbia University Provost Diversity Fellow August 2016

- Awarded prestigious university-wide fellowship supporting diverse doctoral candidates

Bridge-to-PhD Scholar, Columbia University 2014 - 2016

- Selected for intensive post-baccalaureate research program preparing underrepresented students for doctoral studies

Brown University Science Center Fellow Summer 2013

- Received competitive fellowship to conduct science communication and outreach projects

Karen T. Romer Undergraduate Teaching and Research Award (UTRA) Summer 2012

- Granted $3,000 to support independent astrophysics research at Brown University

Phyllis J. Fleming Scholarship, Cape Cod Community College 2009

- Awarded merit-based scholarship recognizing academic excellence in sciences

Presentations

HEPRO VIII October 2023.

ICRC July 2023.

D. Ribeiro, et al., "The Optical System for the Prototype Schwarzschild-Couder Telescope for the Cherenkov Telescope Array", APS April Meeting, April 2022.

D. Ribeiro, et al., "The VERITAS Time-Domain Astrophysics Program", HEAD 19, March 2022.

D. Ribeiro, et al., "Prototype Schwarzschild-Couder Telescope for the Cherenkov Telescope Array: Commissioning the Optical System", Virtual ICRC 2021, July 2021.

D. Ribeiro, "A Graduate Student's Life Building a Novel Dual-Mirror Telescope", Barnard Summer Seminar Series, July 2021.

D. Ribeiro, et al., "The VERITAS Gamma-Ray Burst Follow-up Program", Marcel Grossmann Meeting 16, June 2021.

D. Ribeiro, et al., "Upper Limits on TeV Emission from Superluminous Supernovae", COSPAR 2021, February 2021.

D. Ribeiro, et al., "Upper Limits on TeV Emission from Superluminous Supernovae", AAS 2020, June 2020.

D. Ribeiro, "pSCT Optics Overview", CTA Symposium 2020, May 2020.

D. Ribeiro, "Superluminous Supernovae SLSNe in High-Energy Gamma Rays", Astrofest 2019, September 2019.

V. Fiorretti, **D. Ribeiro**, T.B. Humensky, "The Cherenkov Telescope Array sensitivity to the transient sky", Madison, WI, ICRC 2017, August 2019.

D. Ribeiro, T.B. Humensky, V. Fiorretti , "A Clearer Gamma-Ray Bursting Sky", Bridge to the PhD Symposium, May 2018.

D. Ribeiro, T.B. Humensky."The Alignment System for a Medium-Sized Schwarzschild-Couder Telescope Prototype for the Cherenkov Telescope Array", Poster for AAS Meeting 227, January 2016.

D. Ribeiro Senior Thesis: "Likelihood Analysis of gamma-ray Emission in the Milky Way Galaxy " Brown Astrophysics Seminar Series, 2013.

D. Ribeiro, U. Chadayammuri. "Huge Databases and Minuscule Particles". Poster for Brown University Summer Research Symposium, 2012.

Teaching Experience

Research Mentor, Columbia University Spring 2023

- Mentored graduate student Maria Balvanera Montano, providing guidance on research methodology and analysis techniques

Research Mentor, Columbia University Fall 2021 - Present

- Supervised graduate student Anjana Talluri in developing and validating gamma/hadron selection algorithms
- Provided expertise on boosted decision tree implementation and image template methods within VERITAS offline analysis software
- Conducted regular progress reviews to ensure research objectives were met

Research Mentor, Nevis Labs REU Program Summer 2021

- Guided undergraduate student Miles Garcia through selection and analysis of gamma-ray bursts observed by VERITAS
- Facilitated hands-on learning of advanced data analysis techniques in astrophysics
- Collaborated on development of analysis protocols for time-sensitive astronomical phenomena

Research Mentor, Columbia University Summer 2019 - Spring 2020

- Directed Pazit Rabinowitz's senior thesis research on *Fermi*-LAT analysis of superluminous supernovae SN2015bn and SN2017egm
- Provided instruction in specialized data analysis techniques for high-energy astrophysics
- Supported manuscript preparation and scientific writing development

Research Mentor, Columbia University Fall 2018 - Spring 2019

- Conducted weekly mentoring sessions with undergraduate Sierra Watkins throughout her senior thesis research
- Provided guidance on research design, data analysis, and scientific communication

Research Mentor, Nevis Labs REU Program Summer 2017

- Mentored undergraduate Colin Adams on classic novae simulations and analysis techniques
- Supervised Sierra Watkins in developing simulations and analytical methods for short time gamma-ray bursts
- Facilitated regular progress meetings and provided technical support for computational astrophysics applications

Graduate Teaching Assistant, Columbia University Physics Department 2016 - 2018

- Led three laboratory sections of introductory physics courses (PHYS1291, PHYS1292), supervising approximately 20-25 students per section
- Designed and delivered supplementary instructional materials to enhance student comprehension
- Taught weekly recitation section of 15 students for PHYS1202, focusing on problem-solving techniques
- Evaluated student performance through grading assignments, midterm, and final examinations

Mathematics and Science Tutor, Cape Cod Community College 2007 - 2009

- Provided one-on-one and small group tutoring across multiple disciplines including Algebra, Calculus, Linear Algebra, Statistics, Physics, and Chemistry
- Developed customized learning plans to address individual student needs and learning styles
- Collaborated with faculty to align tutoring approaches with classroom instruction

Other Employment Experience

Physics Department Preceptor, Columbia University Physics Department 2017 - 2018

- Managed and mentored 50 Graduate Teaching Assistants, providing guidance throughout their teaching assignments
- Established and led bimonthly TA meetings to review curriculum and address pedagogical challenges
- Created and implemented comprehensive TA development program, including innovative peer observation workshop
- Conducted research on student learning outcomes through design and analysis of attitudinal surveys in introductory physics labs
- Led complete overhaul of PHYS1291 and PHYS1292 laboratory manuals, modernizing content and experimental procedures
- Maintained laboratory equipment ensuring optimal functionality for student experiments

Student Laboratory Assistant, Brown University Physics Department Fall 2013

- Prepared and maintained experimental equipment for multiple introductory physics laboratory courses
- Contributed to laboratory manual development, focusing on clarity of procedures and learning objectives
- Performed technical maintenance and repairs on precision physics equipment

Colloquium Assistant, Brown University Physics Department Fall 2013

- Facilitated weekly departmental colloquia, managing logistics, technology setup, and hospitality services
- Served as primary technical point of contact for visiting presenters

Science Center Fellow, Brown University Summer 2013

- Produced documentary film showcasing Brown University's historic Ladd Observatory
- Conducted research interviews with astronomers, staff, and volunteers to capture institutional knowledge
- Collaborated with cross-functional partners to create educational content for university outreach

Communications Director, Student Immigrant Movement May 2010 - August 2011

- Designed and implemented comprehensive digital presence, including new website and internal management systems
- Led multiple student teams in community organizing initiatives and leadership development programs
- Established strategic media relations plan, cultivating new partnerships with regional news organizations
- Successfully organized legislative hearing at the Massachusetts State House for in-state tuition legislation, garnering significant public and political attention

Languages

Spoken English (fluent), Portuguese (fluent).

Computer C++ (proficient), Python (proficient), LaTeX (proficient), shell scripting (intermediate), SQL(intermediate), HTML and CSS (basic), Linux-Ubuntu, Docker (intermediate).

Certification

Construction Fall Protection Certification OSHA 29 CFR 1926 Subpart M Training