

Alejandro CÁRDENAS-AVENDAÑO

Montana State University

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Fundación Universitaria Konrad Lorenz

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25 years old
Born in Bogotá D.C
Colombia

Education

- 2016-- MONTANA STATE UNIVERSITY
eXtreme Gravity Institute
Ph.D. in Physics.
Advisor: Prof. Nicolás Yúnes.
August 2016 - -
- 2016 UNIVERSIDAD NACIONAL DE COLOMBIA
Observatorio Astronómico Nacional
M.Sc. (magna cum laude) in Astronomy.
Thesis: "Probing the regular nature of the spacetime by direct measurement of black hole properties"
August 2014 - September 2015
- 2014 UNIVERSIDAD NACIONAL DE COLOMBIA
Departamento de Física
B.Sc. in Physics.
January 2009 - June 2014
- 2013 FUNDACIÓN UNIVERSITARIA KONRAD LORENZ
Facultad de Matemáticas e Ingenierías
B.Sc. (summa cum laude) in Mathematics
January 2009 - June 2013

Research Interests

Gravitation, Astrophysics, Testing GR and Alternative Theories of Gravity.

Honors and Awards

- 2017 *Above and Beyond Award*, Physics Department, Montana State University, Nov 2017.
- 2017 *Graduate Representative on the Computer committee*, Physics Department, Montana State University, Aug 2017.
- 2017 *Scientific Publication Incentive*, Fundación Universitaria Konrad Lorenz May 2017.
- 2017 *Distinguished Young Investigator Science Award*, Fundación Universitaria Konrad Lorenz, May 2017.
- 2016 *College of Letters and Science Student Research Travel Grant*, College of Letters and Science, Montana State University, September 2016.

- 2016 *Scientific Publication Incentive*, Fundación Universitaria Konrad Lorenz May 2016.
- 2016 *Graduate Meritorious Fellowship*. Montana State University, Feb 2016.
- 2015 Honors (*magna cum laude*) M.Sc. in Astronomy. Universidad Nacional de Colombia, September 2015.
- 2015 *Distinguished Young Investigator Science Award*, Fundación Universitaria Konrad Lorenz, May 2015.
- 2014 *Graduate Teaching Assistant Scholarship*, National Astronomical Observatory of Colombia, National University of Colombia.
- 2014 *Distinguished Young Investigator Science Award*, Fundación Universitaria Konrad Lorenz, May 2014.
- 2013 Honors (*summa cum laude*) B.Sc. in Mathematics. Fundación Universitaria Konrad Lorenz, September 2013.
- 2012 First-prize in essay competition on the fight against drugs: "*Con la Droga no solo mueres tú*", Embassy of the United States of America, United Nations Office on Drugs and Crime and the Ministry of Justice and Law of Colombia. Essay title: "El potencial de la burbuja".

Teaching Experience

- 2016-2017 Graduate Teaching Assistant, Department of Physics, Montana State University, United States of America. 205 (Physics I) and 220 (Physics I with calculus) Labs.
- 2013- Lecturer, Department of Mathematics, Fundación Universitaria Konrad Lorenz, Bogotá, Colombia. Undergraduate Courses Taught: *Ordinary differential equations*, *Partial differential equations*, *Introduction to Scientific Computing*.
- 2016 Instructor, Summer Program for High School Students, Clubes de Ciencia Colombia 2016. Universidad Nacional de Colombia.

Research Experience

- 2018- Research Assistant, Department of Physics, **Montana State University**, United States of America. Supervisor: *Nicolás Yunes* (nicolas.yunes@montana.edu).
- 2015-2016 Visitor at **Fudan University**, Shanghai, China. (19/05/2014 - 25/06/2014) and (17/11/2015 - 30/01/2016). *Project*: Black Hole Astrophysics. Supervisor: *Cosimo Bambi* (bambi@fudan.edu.cn).
- 2015 Researcher under the Visiting Graduate Fellows program at **Perimeter Institute for Theoretical Physics**, Waterloo, Canada. (24/02 - 14/04). *Project*: Numerical Relativity. Supervisor: *Luis Lehner* (llehner@perimeterinstitute.ca).
- 2012 Summer internship at EU Universe Awareness educational program at department of Astronomy of **Leiden University**, the Netherlands. *Projects*: Research on Open Educational Repositories, Evaluation of Astronomy for Development and Public Outreach initiatives. Supervisor: *Pedro Russo* (russo@strw.leidenuniv.nl).

Outreach Experience

- 2017-- Latin American Webinars on Physics (Lawphysics, <https://lawphysics.wordpress.com>) coordinator.
- 2017-- Leader of Astronomy on Tap - BOG, Bogotá, Colombia. (<https://astronomyontap.org>)
- 2017-- Leader of Astronomy on Tap - BZN, Bozeman, Montana. (<https://astronomyontap.org>)
- 2017 Montana State University Campus Total Solar Eclipse 2017 Volunteer. Attended ~500 people.
- 2012-- Major participant and material generator in community outreach efforts in Colombia.
- 2009-- Public Speaker, ~30 talks given at Fundación Universitaria Konrad Lorenz, Observatorio Astronómico Nacional, Planetario de Bogotá, Museo del Oro, Maloka, Festival de Astronomía en Villa de Leyva, Red de Astronomía de Colombia, Universidad Central.

Conferences, Workshops and Schools

- 2017 *eXtreme Matter meets eXtreme Gravity*, **Monstana State University**, Bozeman, United States of America.
- 2016 Attended at *26th Midwest Relativity Meeting*, **Perimeter Institute for Theoretical Physics**, Waterloo, Canada. Talk presented: "A study for testing the Kerr metric with AGN iron line eclipses".
- 2016 Attended at *21st International Conference on General Relativity and Gravitation*, **Columbia University**, New York, United States of America. Talk presented: "A model for testing strong gravity via X-ray reflection spectroscopy". Poster presented: "Wormholes and nonsingular space-times in Palatini $f(R)$ gravity".
- 2015 Attended at *New Spaces in Mathematics and Physics*, **Institut Henry Poincaré**, Paris, France.
- 2015 Attended at *Recent Advances in Mathematical General Relativity*, **Institut Henry Poincaré**, Paris, France.
- 2015 *Introductory school: Introduction to mathematical general relativity*, **Institut Henry Poincaré**, Paris, France.
- 2015 *Extreme Gravity Workshop in Bozeman*, **Monstana State University**, Bozeman, United States of America.
- 2015 *Workshop on Astrophysics and Relativity: Astro-GR 2015*, **ICTP South American Institute for Fundamental Research**, Sao Paulo, Brazil.
- 2015 *School on Gravitational Waves: from data to theory and back*, **ICTP South American Institute for Fundamental Research**, Sao Paulo, Brazil. Talk presented: "Regular black holes based on smeared mass distributions".
- 2015 Attended at *Superluminality in Effective Field Theories for Cosmology*, **Perimeter Institute for Theoretical Physics**, Canada.

- 2014 Attended at *X Latin American Symposium of High Energy Physics (SILAFEA)*, **Universidad de Antioquia**, Colombia. Poster presented: “*Electrostatic Self-energy of a Charged Particle in the Surroundings of a Topologically Charged Black Hole in the Brane*”.
- 2014 Attended at *EHT 2014*, **Perimeter Institute for Theoretical Physics**, Canada. Poster presented: “*Probing the regular nature of the spacetime by measuring the shadow of a black hole*”.
- 2014 *XIX Ciclo de Cursos Especiais, Advanced School in Astrophysics*, **Observatório Nacional de Brasil no Rio de Janeiro**, Rio de Janeiro, Brazil. Poster presented: “*Gravitational Lensing in String and Einstein Frames*”.
- 2014 *Physics School on General Relativity @ 99*, **Deutsche Physikalische Gesellschaft**, Physikzentrum, Bad Honnef, Germany.
- 2014 Attended at *International Conference Boltzmann, Vlasov and related equations: Last results and open problems*, **Universidad de Cartagena**, Cartagena, Colombia.
- 2013 *SciCoder 2013*, **New York University**, United States of America.
- 2012 *XVII Ciclo de Cursos Especiais, Advanced School in Astrophysics*, **Observatório Nacional de Brasil no Rio de Janeiro**, Brazil.
- 2012 *International Summer School. Solar Astrophysics: Modern Trends and Techniques*. **Universidad Nacional de Colombia**, Colombia.
- 2011 *XVI Ciclo de Cursos Especiais, Advanced School in Astrophysics*, **Observatório Nacional de Brasil no Rio de Janeiro**, Brazil.
- 2011 *First School on Numerical Relativity*. **Universidad Nacional de Colombia**, Colombia.

Organizing events

- 2016 Member of the Local Organizing Committee of the *Communicating Astronomy with the Public 2016 (CAP 2016)* conference, Medellín, Colombia.
- 2013-- Member of the Academic Committee of the *Ciclo de Cursos Especiales en Sistemas Dinámicos (CCE)*, Fundación Universitaria Konrad Lorenz, Colombia.

Online Courses

- 2017 *Statistical Mechanics: Algorithms and Computations*, Online Offering by Coursera. **École normale supérieure**.
- 2015 *Philosophy and the Sciences*, Online Offering by Coursera. **The University of Edinburgh**.
- 2014 *AstroTech: The Science and Technology behind Astronomical Discovery*, Online Offering by Coursera. **The University of Edinburgh**.
- 2013 *Galaxies and Cosmology*, Online Offering by Coursera (Distinction). **California Institute of Technology**.

2013 *From the Big Bang to Dark Energy, Online Offering by Coursera. The University of Tokyo.*

Affiliations

2017-- Member of the American Physical Society (APS).

2016-- Member of the International Society on General Relativity and Gravitation (ISGRG).

2012-2016 Universe Awareness (UNAWA) Student Ambassador. Leiden Observatory, Leiden University.

Computer Skills

Experience in *High Performance Computing* (HPC) on large scale computing systems in Extreme Science and Engineering Discovery Environment (XSEDE), the most advanced, powerful, and robust collection of integrated advanced digital resources and services in the world, and in Hyalite High-Performance Computing System, operated and supported by Montana State University's Information Technology Center.

Programming: Python, C/C++.

Scientific: Mathematica, Maple, Matlab.

Language Skills

Fluent: English, Portuguese.

Basic: German

Mother Tongue: Spanish

Thesis

2015 **A. Cárdenas-Avendaño**, "*Probing the regular nature of the spacetime by direct measurement of black hole properties*". Master's Thesis. Universidad Nacional de Colombia. SINAB Code: **51140**. Online version: <http://www.bdigital.unal.edu.co/51140/>

Publications

- 2017 C. Bambi, **A. Cardenas-Avendano**, T. Dauser, J. A. Garcia, S. Nampalliwar, “Testing the Kerr black hole hypothesis using X-ray reflection spectroscopy”. The Astrophysical Journal, Volume **842**:76, Number 2, 2017.
- 2016 Z. Cao, **A. Cardenas-Avendano**, M. Zhou, C. Bambi, C. A. R. Herdeiro, E. Radu, “Iron $K\alpha$ line of boson stars”. Journal Of Cosmology And Astroparticle Physics, **10** (2016) 003.
- 2016 Y. Ni, M. Zhou, **A. Cardenas-Avendano**, C. Bambi, C. A. R. Herdeiro, E. Radu, “Iron $K\alpha$ line of Kerr black holes with scalar hair”. Journal Of Cosmology And Astroparticle Physics, **07** (2016) 049.
- 2016 M. Zhou, **A. Cárdenas-Avendaño**, C. Bambi, B. Kleihaus, J. Kunz, “Search for astrophysical rotating Ellis wormholes with X-ray reflection spectroscopy”. Physical Review D **94**, 024036.
- 2016 **A. Cárdenas-Avendaño**, J. Jiang, C. Bambi, “Testing the Kerr black hole hypothesis: comparison between the gravitational wave and the iron line approaches”. Physics Letters B **760** 254–258.
- 2016 **A. Cárdenas-Avendaño**, J. Jiang, C. Bambi, “A study for testing the Kerr metric with AGN iron line eclipses”. Journal Of Cosmology And Astroparticle Physics, **04** (2016) 054.
- 2016 C. Bambi, **A. Cárdenas-Avendaño**, G. Olmo, D. Rubiera-Garcia, “Wormholes and nonsingular spacetimes in Palatini $f(R)$ gravity”. Physical Review D **93**, 064016.
- 2015 C. Benavides, **A. Cárdenas-Avendaño**, A. Larranaga, “Gravitational lensing in the strong field limit for Kar’s metric”. International Journal of Theoretical Physics, **55**, 4.
- 2015 A. Larranaga, **A. Cárdenas-Avendaño**, D. Torres, “Electrostatic Self-energy of a Charged Particle in the Surroundings of a Topologically Charged Black Hole in the Brane”. Romanian Journal of Physics **60**, 27.
- 2014 **A. Cárdenas-Avendaño**, “Hilbert-Pólya Conjecture”. (In spanish) Lecturas Matemáticas, **35** (2).
- 2013 V. Ribeiro, P. Russo, **A. Cárdenas-Avendaño**, “A Survey of Astronomical Research: A Baseline for Astronomical Development”. The Astronomical Journal **146**, 138.
- 2012 A. Larranaga, **A. Cárdenas-Avendaño**, “Geometric Thermodynamics of Schwarzschild-AdS black hole with a Cosmological Constant as State Variable”, Journal of the Korean Physical Society, **60**, No 7.

References (reference letters may be submitted upon request)

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Associate Professor
Waterloo University and University of Guelph
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