

Rafael Díaz Hernández Rojas

Curriculum Vitae

Dipartimento de Fisica
Sapienza Università di Roma
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[Google Scholar profile](#)

Education

- March–December, 2021 **PostDoc**, *Sapienza Università di Roma*, Rome, Italy.
Working with Profs. Federico Ricci Tersenghi and Giorgio Parisi
- 2018–2021 **Ph.D.: Physics**, *Sapienza Università di Roma*, Rome, Italy, Thesis: *Numerical study of the microscopic structure of jammed systems: from inferring their dynamics to finite size scaling*; Advisors: *Prof. Federico Ricci Tersenghi and Prof. Giorgio Parisi*.
Thesis defended on July 5, 2021. (Available [here](#).)
- 2015–2017 **M. Sc.: Physics**, *Universidad Nacional Autónoma de México (UNAM)*, Mexico City, **Final grade: 9.33** (out of 10).
Thesis: *Mejora en la caracterización de la aleatoriedad usando selección Bayesiana de modelos* (Improving randomness characterization through Bayesian model selection)
- 2009–2014 **B. Sc.: Physics**, *Universidad Nacional Autónoma de México (UNAM)*, Mexico City, **Final grade: 9.97** (out of 10).
Thesis: *Respuesta Plasmónica de Partículas Anidadas usando Medio Efectivo* (Plasmonic Response of Nested Nanoparticles using Effective Medium Theory)
- January–June, 2013 **One semester academic exchange**, *University of California, Santa Cruz*.
Sponsored by Fundación UNAM and Fundación Televisa (\$10,000 USD grant).

Distinctions

- 2019 **“Alfonso Caso” Medal**, *bestowed by the Universidad Nacional Autónoma de México*, (Master in Science Level).
Award to best student in the Master in Physics Graduate Program, years 2015–2017.
- 2017 **“Juan Manuel Lozano Mejía” Medal**, *bestowed by UNAM’s Physics Institute*, (Master in Science Level).
Distinction for the best master thesis of the year. Title: *Mejora en la caracterización de la aleatoriedad usando selección Bayesiana de modelos* (Improving randomness characterization through Bayesian model selection)
- 2017 **M. Sc. degree attained with Honorable Mention**, *bestowed by the UNAM’s Physics Institute*.

- 2015 **“Juan Manuel Lozano Mejía” Diploma**, bestowed by UNAM's Physics Institute, (Bachelor Level).
Distinction for an outstanding bachelor thesis. Title: *Respuesta Plasmónica de Partículas Anidadas usando Medio Efectivo* (Plasmonic Response of Nested Nanoparticles using Effective Medium Theory)
- 2014 **B. Sc. degree attained with Honorable Mention**, bestowed by the UNAM's Faculty of Sciences.

Publications

- ¹ P. Charbonneau, E. I. Corwin, R. C. Dennis, R. Díaz Hernández Rojas, H. Ikeda, G. Parisi, and F. Ricci-Tersenghi, “Finite-size effects in the microscopic critical properties of jammed configurations: A comprehensive study of the effects of different types of disorder”, [Physical Review E **104**, 014102 \(2021\)](#).
- ² R. Díaz Hernández Rojas, G. Parisi, and F. Ricci-Tersenghi, “Inferring the particle-wise dynamics of amorphous solids from the local structure at the jamming point”, [Soft Matter **17**, 1056–1083 \(2021\)](#).
- ³ J. Song, S. Still, R. Díaz Hernández Rojas, I. Pérez Castillo, and M. Marsili, “Optimal work extraction and mutual information in a generalized Szilard Engine”, [Physical Review E **103**, 052121 \(2021\)](#).
- ⁴ A. P. Muntoni, R. Díaz Hernández Rojas, A. Braunstein, A. Pagnani, and I. Pérez Castillo, “Nonconvex image reconstruction via expectation propagation”, [Physical Review E **100**, 032134 \(2019\)](#).
- ⁵ R. Díaz Hernández Rojas, C. S. Hidalgo Calva, and I. Pérez Castillo, “Universal behavior of the full particle statistics of one-dimensional Coulomb gases with an arbitrary external potential”, [Physical Review E **98**, 020104 \(2018\)](#).
- ⁶ A. C. Martínez, A. Solís, R. Díaz Hernández Rojas, A. B. U'Ren, J. G. Hirsch, and I. Pérez Castillo, “Advanced Statistical Testing of Quantum Random Number Generators”, [Entropy **20**, 886 \(2018\)](#).
- ⁷ R. Díaz Hernández Rojas, A. Solís, A. M. Angulo Martínez, A. B. U'Ren, J. G. Hirsch, M. Marsili, and I. Pérez Castillo, “Improving randomness characterization through Bayesian model selection”, [Scientific Reports **7**, 3096 \(2017\)](#).
- ⁸ R. Diaz-H.R, R. Esquivel-Sirvent, and C. Noguez, “Plasmonic Response of Nested Nanoparticles with Arbitrary Geometry”, [The Journal of Physical Chemistry C **120**, 2349–2354 \(2016\)](#).

Teaching Experience

- Spring 2014 **Electromagnetism I**, *Teacher Assistant*, Faculty of Sciences, UNAM, Mexico City.
Course of Prof. Cecilia Noguez
- Fall 2014 **Computational Physics**, *Teacher Assistant*, Faculty of Sciences, UNAM, Mexico City.
Course of Prof. David Sanders

- Spring 2015 **Vectorial Mechanics**, *Teacher Assistant*, Faculty of Sciences, UNAM, Mexico City.
Course of Prof. Rodolfo Patricio Martínez
- Fall 2015 **Quantum Mechanics**, *Teacher Assistant*, Faculty of Sciences, UNAM, Mexico City.
Course of Prof. Rodolfo Patricio Martínez
- Spring 2016 **Electromagnetism I**, *Teacher Assistant*, Faculty of Sciences, UNAM, Mexico City.
Course of Prof. Alejandro Crespo
- Fall 2016 **Thermodynamics**, *Teacher Assistant*, Faculty of Sciences, UNAM, Mexico City.
Course of Prof. Alejandro Crespo
- Spring–
Summer
2020 **Physics (laurea in Scienze Naturali)**, *Teacher Assistant*, Sapienza Università di Roma, Rome.
Course of Prof. Paolo Bagnaia

Attendance to Conferences, Workshops and Schools

- July 11 – 24,
2021 **Summer School**, *Fundamental Problems in Statistical Physics XV*, Brunico, Italy.
- February
16–21, 2020 **Congress**, *Recent progress in glassy systems*, Les Houches, France, organized by the Les Houches School of Physics.
- June 24 –
July 6, 2019 **Summer School**, *The Beh Rohu Summer School “Wind and Physics”*, Saint Pierre-Quiberon, France, Topic: Glasses, Jamming, and Slow Dynamics.
- July 2–13,
2018 **Summer School**, *VIII GEFENOL Summer School on Statistical Physics of Complex Systems*, Palma de Mallorca, Spain, organized by Topical Group on Statistical and Non Linear Physics (GEFENOL) of the Royal Spanish Physical Society.
- April 10–May
5, 2017 **Spring School**, *6th Spring College on the Physics of Complex Systems*, Trieste, Italy, organized by The “Abdus Salam” International Centre for Theoretical Physics.
- September
26–30, 2016 **School**, *XI Mexican School on Statistical Physics*, Guanajuato, Guanajuato, Mexico, organized by the Mexican Physics Society.
- April 25–May
20, 2016 **Spring School**, *5th Spring College on the Physics of Complex Systems*, Trieste, Italy, organized by The “Abdus Salam” International Centre for Theoretical Physics.
- October 6–17,
2012 **Workshop**, *Pan-American Advanced Institute “Frontiers of Casimir Physics”*, Ushuaia, Argentina, organized by Indiana University – Purdue University Indianapolis.
- June 18–29,
2012 **Summer School**, *20th Summer School on Physics*, Mexico City and Cuernavaca, Morelos, organized by the UNAM’s Physics Institute, Institute of Physical Sciences, and the Physics Graduate Program.
- July 3–28,
2009 **Sumer School**, *International Summer Science Institute at the Weizmann Institute of Science*, Rehovot, Israel.

Seminars and Posters Presentations

- November 29, **Talk**, *Complex Systems Seminar*, UNAM, Mexico City, Mexico.
1. 2021 Title: [*Propiedades críticas de sistemas de esferas duras en la transición de jamming: un estudio numérico*](#) (Critical properties of Hard-Spheres systems at the jamming transition: a numerical study)

2. October 20, 2021 **Talk**, *Special Event on the Nobel Prize in Physics 2021*, Complex Systems Seminar, Universidad Autónoma Metropolitana-Iztapalapa, Mexico City, Mexico.
Title: [Mean Field Theory of \(simple\) glasses and jamming](#)
3. October 21–25, 2019 **Talk**, *Symposium on Artificial Intelligence for Science, Industry and Society*, UNAM, Mexico City, Mexico.
Work: [Randomness Characterization using Bayesian Model Selection](#)
4. September 10–13, 2019 **Poster Presentation**, *40 Years of Replica Symmetry Breaking*, La Sapienza University of Rome, Italy.
Work: [Inferring the particle-wise dynamics of nearly jammed configurations of hard spheres](#)
5. May 7–11, 2019 **Poster Presentation**, *Statistical Physics of Complex Systems*, NORDITA, Stockholm, Sweden.
Work: [Inferring the particle-wise dynamics of nearly jammed configurations of hard spheres](#)
6. September 19–22, 2018 **Poster Presentation**, *Disordered serendipity. A workshop in honour of Giorgio Parisi's 70th birthday*, Sapienza Università di Roma. Rome, Italy.
Work: [Single particle diffusivity in nearly jammed configurations of hard spheres](#)
7. July 2–14, 2018 **Poster Presentation**, *VIII GEFENOL Summer School on Statistical Physics of Complex Systems*, Palma de Mallorca, Spain.
Work: [Randomness Characterization using Bayesian Model Selection](#)
8. December 7, 2017 **Talk**, *XV Congress of the Physics Graduate Students*, Mexico City, Mexico.
Title: [Complete statistics of a 1d Coulomb gas with an arbitrary potential](#)
9. April 10–May 5, 2017 **Poster Presentation**, *6th Spring College on the Physics of Complex Systems*, ICTP, Trieste, Italy.
Work: [Expectation Propagation for Image Reconstruction](#)
10. March 27, 2017 **Seminar**, *Students Seminar of the Physics Institute*, Mexico City, Mexico.
Title: [Randomness Characterization using Bayesian Model Selection](#)
11. December 9, 2016 **Talk**, *XIV Congress of the Physics Graduate Students*, Mexico City, Mexico.
Title: [Image Reconstruction using the Expectation Propagation Algorithm](#)
12. September 26–30, 2016 **Poster Presentation**, *XI Mexican School on Statistical Physics*, Guanajuato, Guanajuato, Mexico.
Work: [Generalized Szilard's Engine. An information theoretic approach](#)
13. September 26–30, 2016 **Poster Presentation**, *XI Mexican School on Statistical Physics*, Guanajuato, Guanajuato, Mexico.
Work: [Randomness Characterization through Bayesian Inference. An application to bits sequences.](#)
14. April 25–May 20, 2016 **Poster Presentation**, *5th Spring College on the Physics of Complex Systems*, ICTP, Trieste, Italy.
Work: [Randomness Characterization through Bayesian Inference. An application to bits sequences.](#)
15. February 18, 2016 **Talk**, *Seminar of the High Energy Physics and Gravitation Department*, Nuclear Sciences Institute, UNAM, Mexico City, Mexico.
Title: [Model Selection using Bayesian Inference and an Application to Random Bits Sequences.](#)
16. December 8, 2015 **Talk**, *XIII Congress of the Physics Graduate Students*, Mexico City, Mexico.
Title: [Model Selection using Bayesian Inference and an Application to Random Bits Sequences.](#)
17. November 2015 **Poster Presentation**, *"Open Doors Day" at the Physics Institute*, UNAM, Mexico City.
Work: [Mathematical Aspects of Recursive Effective Medium Theories in Layered Nanoparticles](#)
18. August 16–20, 2015 **Poster Presentation**, *XXIV International Materials Research Congress*, Cancun, Mexico, organized by The Materials Research Society and the Mexican Materials Society.
Work: [Numerical Calculation of Plasmonic Response of Nested Nanoparticles of Complex Geometry](#)

19. August 16–20, 2015 **Poster Presentation**, *XXIV International Materials Research Congress*, Cancun, Mexico, organized by The Materials Research Society and the Mexican Materials Society.
Work: [Mathematical Aspects of Recursive Effective Medium Theories in Layered Nanoparticles](#) (This work obtained the **second place** during the posters contest session.)
20. January, 2015 **Poster Presentation**, *8th Workshop of Molecular and Condensed Matter Physics*, Cuernavaca, Morelos, Mexico, organized by the Universidad Autónoma del Estado de Morelos.
Work: [Optical Properties of Nested Nanoparticles using Effective Medium Theory](#)
21. June, 2014 **Talk**, *Modern Physics Laboratories microCongress*, UNAM, Mexico City, organized by the Physics Department of UNAM's Faculty of Sciences.
Title: [Random Lasers](#)
22. November, 2007 **Poster Presentation**, *50th National Physics Congress*, Boca del Río, Veracruz, México, organized by the Mexican Physics Society.
Work: [Variables that Influence the Functioning of a Thermoacoustic Resonator](#)

Popularization of science

- October 2021 **Podcast (in Spanish)**, *Historias Cientificas*.
In [this episode](#) I talked about the work of Giorgio Parisi and the motivation for the Nobel Prize in Physics 2021 being awarded to him.
- September 5, 2021 **Article (in Spanish)**, [Science blog](#) of the *Nexos Magazine*, Mexico.
I wrote a [popular science article](#) about the Maxwell's Demon
- April 2021 **Podcast (in Spanish)**, *Historias Cientificas*.
In [this episode](#) I talked about statistical mechanics of glassy and disordered systems.

Physics Contests (Undergraduate Level)

State Physics Olympiads

- 2006 **Metropolitan Contest of Talented Students on Physics**, *Mexico City, Mexico*, organized by the Mexican Physics Society, **First Place**.
- 2006 **17th Metropolitan Physics Olympiad**, *Mexico City, Mexico*, organized by the Mexican Physics Society, **First Place**.
- 2007 **18th Metropolitan Physics Olympiad**, *Mexico City, Mexico*, organized by the Mexican Physics Society, **First Place**.
- 2008 **19th Metropolitan Physics Olympiad**, *Mexico City, Mexico*, organized by the Mexican Physics Society, **First Place**.

National Physics Olympiads

- July, 2006 **2nd Second National Contest of Talented Students on Physics**, *Mexico City, Mexico*, organized by the Mexican Physics Society, **First Place**.
- November, 2006 **17th National Physics Olympiad**, *Durango, Durango, Mexico*, organized by the Mexican Physics Society, **Honorable Mention**.
- November, 2007 **18th National Physics Olympiad**, *Tuxtla Gutiérrez, Chiapas, Mexico*, organized by the Mexican Physics Society, **Bronze Medal**.

November, **19th National Physics Olympiad**, Tampico, Tamaulipas, Mexico, organized by the Mexican Physics Society, **Gold Medal**.

International Physics Olympiads

September, **12th Ibero-American Physics Olympiad**, Morelia, Michoacán, Mexico, **Silver Medal**.
2008

Experimental Contests

2007 **17th National Contest of Devices and Experiments in Physics**, Culiacán, Sinaloa, Mexico, organized by the Mexican Physics Society, **First Place**.

Work: [Variables that Influence the Functioning of a Thermoacoustic Resonator](#)

2007 **National ExpoScience, Natural and Exact Sciences Category**, Puebla, Puebla, Mexico, **First Place**.

Work: [Variables that Influence the Functioning of a Thermoacoustic Resonator](#)

2008 **16th University Contest "Science Fair"**, Experimental Research Category, Mexico City, Mexico, organized by UNAM, **First Place**.

Work: [Variables that Influence the Functioning of a Thermoacoustic Resonator](#)

2008 **4th Latin American ExpoScience**, Lima, Peru, **Invited exhibitor**.

Work: [Variables that Influence the Functioning of a Thermoacoustic Resonator](#)

2009 **Centro Universitario Anglo Mexicano's Research Congress**, Cuernavaca, Morelos, Mexico, **First Place**.

Work: [Medium with Variable Refractive Index](#)

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