

Rafael Díaz Hernández Rojas

Curriculum Vitae

Education

- March 2021 **PostDoc**, *Sapienza Università di Roma*, Rome, Italy.
–present 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**, *Univeristy 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 the 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 C. Artiaco, R. Díaz Hernández Rojas, G. Parisi, and F. Ricci-Tersenghi, “Hard-sphere jamming through the lens of linear optimization”, [Physical Review E **106**, 055310 \(2022\)](#).
- ² 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 \(2021\)](#).
- ³ 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 \(2021\)](#).
- ⁴ J. Song, S. Still, R. Díaz Hernández Rojas, I. Pérez Castillo, and M. Marsili, “Optimal work extraction and mutual information in a generalized Szilàrd Engine”, [Physical Review E **103**, 052121 \(2021\)](#).
- ⁵ 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 \(2019\)](#).
- ⁶ 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 \(2018\)](#).
- ⁷ 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 \(2018\)](#).
- ⁸ 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 \(2017\)](#).
- ⁹ R. Díaz Hernández Rojas, 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

- November 15–18, 2022 **Meeting**, *Annual meeting of the Simons Collaboration on Cracking the Glass Problem*, Venice, Italy.
- May 16–20, 2022 **School**, *Random Matrices, Random Graphs and Statistical Physics for Machine Learning and Inference*, ICTP, Trieste, Italy.
- November 16–19, 2021 **Meeting**, *Annual meeting of the Simons Collaboration on Cracking the Glass Problem*, Venice, Italy.
- 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, **Sumer School**, *International Summer Science Institute at the Weizmann Institute of Science*, 2009 Rehovot, Israel.

Seminars and Posters Presentations

1. June 12-16, 2022 **Poster**, *Conference of the Middle European Cooperation in Statistical Physics*, Erice, Italy.
Title: [Jamming of Hard-Spheres through the Lens of Constrained Optimization](#)
2. June 6-8, 2022 **Poster**, *From water to colloidal water*, Sapienza University of Rome, Rome, Italy.
Title: [Jamming of Hard-Spheres through the Lens of Constrained Linear Optimization](#)
3. May 12-14, 2022 **Talk**, *FisEs '22: XXIII Congreso de Física Estadística (From the Royal Spanish Physics Society)*, University of Zaragoza, Zaragoza, Spain.
Title: [Jamming of Hard-Spheres through the Lens of Constrained Optimization](#)
4. March 16, 2022 **Talk**, *APS March Meeting*, Virtual contributed talk.
Title: [Jamming Hard-Spheres configurations through Iterative Linear Optimization](#)
5. November 29, 2021 **Talk**, *Complex Systems Seminar*, UNAM, Mexico City, Mexico.
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)
6. 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](#)
7. 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](#)
8. 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](#)
9. 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](#)
10. 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](#)
11. 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](#)
12. 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](#).
13. 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](#)
14. March 27, 2017 **Seminar**, *Students Seminar of the Physics Institute*, Mexico City, Mexico.
Title: [Randomness Characterization using Bayesian Model Selection](#)
15. December 9, 2016 **Talk**, *XIV Congress of the Physics Graduate Students*, Mexico City, Mexico.
Title: [Image Reconstruction using the Expectation Propagation Algorithm](#)

16. September 26-30, 2016 **Poster Presentation**, *XI Mexican School on Statistical Physics*, Guanajuato, Guanajuato, Mexico.
Work: [Generalized Szilard's Engine. An information theoretic approach](#)
17. 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.](#)
18. 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.](#)
19. 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.](#)
20. 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.](#)
21. 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](#)
22. 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](#)
23. 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.)
24. 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](#)
25. June, 2014 **Talk**, *Modern Physics Laboratories microCongress*, UNAM, Mexico City, organized by the Physics Department of UNAM's Faculty of Sciences.
Title: [Random Lasers](#)
26. 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

- May 2022 **Article (in Spanish)**, [Science blog of the Nexos Magazine](#), Mexico.
I wrote a [popular science article](#) about the controversy aroused by the alleged solution to the problem of random close packing in $3d$.
- 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.

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