Mohamed El Hedi Bahri

Department of Mathematics, Rutgers University
Hill Center, 110 Frelinghuysen Road, Piscataway, NJ 08854, USA
mbahri@math.rutgers.edu ORCID 0000-0003-4987-4406

Research Interests

Rigorous statistical mechanics. The Bose gas, Lieb's Simplified Approach and the Lee–Huang–Yang formula. Lee–Yang zeros, phase transitions and particle-number fluctuations.

Appointments

2024–present	Hill Assistant Professor (postdoctoral position), Department of Mathematics, Rutgers University. Working with Ian Jauslin and Joel L. Lebowitz.
2023–2024	Post-Graduate Researcher, Department of Mechanical and Aerospace Engineering, Princeton University.

Education

2023	**Ph.D.**, Mechanical and Aerospace Engineering, Princeton University. Specialization in statistical mechanics, field theory and elasticity. Thesis *Thermal fluctuations of active and anisotropic elastic membranes*, adviser Andrej Košmrlj, defended February 27, 2023. Research project with Michael Aizenman on partial differential inequalities for the random-cluster model, toward the sharpness of its phase transition. Proved the analogue of the "ϕ^3" inequality of Aizenman and Barsky.
2014	**B.S.**, Mathematics and Physics, Rutgers University, New Brunswick. Double major, summa cum laude, with highest honors in mathematics and in physics. Joint senior thesis in mathematics and physics, *Einstein's relativity theory*, advisers Michael Kiessling and Nataša Šešum. A study of the foundations and assumptions of general relativity, with an exploration of renormalization.

Honors and Awards

2017	NSF Graduate Research Fellowship Program, Honorable Mention.
2014	Joseph P. Bradley Memorial Prize in Mathematics, Rutgers University.
2014	Rutgers Academic Excellence Award.
2013	Phi Beta Kappa.
2013	Weill Scholarship (Mathematics), Rutgers University.
2012	Richard J. Plano Summer Research Internship (Physics), Rutgers University.
2011	Rutgers Excellence Award.

Papers

[1] M. E. H. Bahri and I. Jauslin, *The Lee–Huang–Yang formula for the hard-core Simple Equation*. Manuscript (2026). To be submitted to Commun. Math. Phys.

[2] M. E. H. Bahri, I. Jauslin and J. L. Lebowitz, *Lee–Yang zeros and particle fluctuations*, arXiv:2607.26975 (2026). Under review at J. Stat. Phys.

[3] M. E. H. Bahri, S. Sarkar, D. A. Matoz-Fernandez and A. Košmrlj, *A new perspective on thermally fluctuating 2D elastic membranes: introducing odd elastic moduli and non-equilibrium effects*, arXiv:2307.05749 (2023). Under review at Phys. Rev. Lett.

[4] S. Sarkar, M. E. H. Bahri and A. Košmrlj, *Statistical mechanics of nanotubes*, arXiv:2305.14602 (2023). Under review at Phys. Rev. B.

[5] M. E. H. Bahri, S. Sarkar and A. Košmrlj, *Mechanical properties of fluctuating elastic membranes under uni-axial tension*, arXiv:2209.09350 (2022). Under review at Phys. Rev. B.

[6] M. E. H. Bahri and Ya. G. Sinai, *Statistical mechanics of freely fluctuating two-dimensional elastic crystals*, J. Stat. Phys. **180** (2020), 739–748, doi:10.1007/s10955-020-02512-4. Special issue in honor of Joel L. Lebowitz.

In preparation

- M. E. H. Bahri, I. Jauslin and J. L. Lebowitz, *The occurrence of a phase transition from the limiting density of Lee–Yang zeros*.

Thesis

- M. E. H. Bahri, *Thermal fluctuations of active and anisotropic elastic membranes*, Ph.D. thesis, Princeton University (2023). Available on ProQuest.

Talks

Oct 2023	*A new perspective on thermally fluctuating 2D elastic membranes: introducing odd elastic moduli and non-equilibrium effects*. New Trends in Nonequilibrium Statistical Mechanics, 2nd Course, Ettore Majorana Foundation and Centre for Scientific Culture, Erice, Italy.
Oct 2023	*Critical properties of fluctuating elastic membranes*. Seminar, Department of Mathematics and Physics, Università Roma Tre, Rome, Italy.
Mar 2023	*Scaling of moduli of active and thermal elastic membranes*. APS March Meeting, Las Vegas, NV.
Dec 2022	*Perturbing the elastic Aronovitz–Lubensky fixed point with odd elastic moduli*. Statistical Mechanics Conference, Rutgers University.
Mar 2022	*Statistical mechanics of thermalized odd elastic membranes*. APS March Meeting, Chicago, IL.
Mar 2021	*Statistical mechanics of 2D sheets under uniaxial tension*. APS March Meeting, virtual.
May 2019	*Influence of thermal fluctuations on the mechanical properties of 2D anisotropic materials*. Statistical Mechanics Conference, Rutgers University.
Mar 2019	*Statistical mechanics of anisotropic 2D sheets*. APS March Meeting, Boston, MA.

Dec 2018 *Renormalization of elastic moduli of 2D crystals*. Statistical Mechanics Conference, Rutgers University.

Mar 2018 *Poisson's ratio of thermalized sheets*. APS March Meeting, Los Angeles, CA.

Poster

2019 *Influence of thermal fluctuations on the mechanical properties of 2D anisotropic materials*. Frontiers in Applied and Computational Mathematics (FACM '19) and 11th Northeast Complex Fluids and Soft Matter Workshop (NCS 11).

Teaching

2024–present **Rutgers University**, Department of Mathematics
Calculus I (01:640:135), Fall 2024, Fall 2025 and Fall 2026 (two sections).
Introductory Linear Algebra (01:640:250), Spring 2025, Fall 2025 and Spring 2026.
Differential Equations for Engineering and Physics (01:640:244), Spring 2025.

2018–2020 **Princeton University**, Department of Mechanical and Aerospace Engineering, Assistant in Instruction
Modern Solid Mechanics (MAE 223, Prof. Andrej Košmrlj), Fall 2018, Fall 2019 and Fall 2020.
Introduction to Engineering Dynamics (MAE 206, Prof. Anirudha Majumdar), Spring 2019.
Biomechanics and Biomaterials (MAE 344, Prof. Daniel Cohen), Spring 2018.

2014–2015 **Rutgers University**, Department of Physics and Astronomy, laboratory instructor
Analytical Physics Laboratory in electrodynamics for engineering students, one section in 2014 and two sections in Fall 2015.
General Physics Laboratory in electrodynamics for biology and chemistry students, two sections in Spring 2015.

Research Mentoring

2018–2021 Mentor of undergraduate summer researchers at Princeton in the Mechanical and Aerospace Engineering Practical Research Experience and the PRISM/PCCM Research Experience for Undergraduates, summers of 2018, 2019, 2020 and 2021.

Service and Outreach

2024–present Helped organize four Statistical Mechanics Conferences at Rutgers University.

2022–present Volunteer letter writer for the Committee of Young Scientists of the Committee of Concerned Scientists, which writes to governments and organizations on behalf of imprisoned or persecuted scientists and academics.

2023 Volunteer tutor in the adult education program of the Trenton Area Soup Kitchen, January to February 2023, teaching arithmetic, basic algebra and English comprehension to adults preparing for a high school equivalency diploma.