Abdulai Gassama

Brown University, Physics Ph.D. Candidate

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Education

- **Brown University** — Providence, RI, USA
  Doctor of Philosophy – Physics — *exp. May 2027*
  Focus in topological studies of disordered systems
  Coadvised by Prof. Xinsheng "Sean" Ling and Prof. J. Michael Kosterlitz (Nobel 2016)

- **Clark University** — Worcester, MA, USA
  Bachelor of Arts – Physics — *grad. Spring 2022*
  Minor - Actuarial and Financial Mathematics
  Thesis: *Pattern Formation in Multicomponent Lipid Membranes*
  Notable Courses: Proseminar Quantum Computing, Proseminar Geometric Analysis and its Applications in General Relativity

Research Experiences

- **Brown University** — Hybrid
  Research Assistant — *May 2022 – Present*
  - **Non-equilibrium statistical physics of disordered low-dimensional systems**: Investigate how order can arise from disorder in low-dimensional systems where classical symmetry-breaking theory predicts its absence — combining Monte Carlo, renormalization-group theory, and exact state enumeration to map reentrant and nontrivial phases beyond the Imry–Ma paradigm.
  - **Colloidal matter as a programmable analog simulator of statistical physics**: Engineer microfluidic colloidal platforms to directly emulate random-field Ising and Kosterlitz–Thouless physics in real space, extracting defect fugacity, correlation lengths, and non-Gaussian fluctuation statistics from particle dynamics.

- **Syros Pharmaceuticals** — Hybrid
  Computational Chemist (Full-time · Summer Position) — *June 2022 – August 2022*
  - **Structure and Ligand-based virtual screening**: Support building and performing molecular dynamics simulations of chosen protein/DNA-ligand complexes via Maestro.

- **Clark University** — Hybrid
  Mathematical Physics Research Fellowship — *May 2021 - August 2021*
  - **Intensive Paid Summer Research**: Recipient of LEEP Fellowship Award for research on graphical manifolds.
  - **Monograph**: Written a 52-page monograph explaining calculations for asymptotically flat manifolds and asymptotically hyperbolic manifolds, titled "Positive Mass In All Dimensions." Supervised by Prof. Aghil Alaee, Harvard CMSA associate.
  - **Impact**: Worked towards a graphical solution for the Horowitz-Myers conjecture.

Publications

- **On the Criticality of the One-Dimensional Ising Model with Inverse-Squared Interactions**: O. Tower, **A. Gassama**, L. Ding, J. Tobochnik, J. Eick, R. A. Pelcovits, J. M. Kosterlitz, and X. S. Ling — In preparation for *Phys. Rev. Lett.* (2026).
- **Finite-Temperature Reentrance and Order-by-Disorder in the One-Dimensional Long-Range Ising Model with Random Fields**: **A. Gassama**, O. Tower, L. Ding, J. Eick, R. A. Pelcovits, J. M. Kosterlitz, and X. S. Ling — In preparation for *Phys. Rev. Lett.* (2026).
- **Controlled Disorder in Two-Dimensional Colloidal Crystals: Defect Dynamics and Random-Field Analogs**: O. Tower, **A. Gassama**, and X. S. Ling — In preparation for *Phys. Rev. Lett.* (2026).
- **Review of A Short Course in Computational Geometry and Topology**: **A. Gassama** and F. Green, *SIGACT News* 52(4):11–14 (2021).

Technical Background

- **Experimental Methods**: Experienced with optical microscopy, video-based particle tracking, and basic micro-/nanofabrication techniques. Hands-on with SU-8 and PDMS photolithography, maskless patterning, O_2 plasma treatment, and fused-silica cleaning. Competent in fabricating and operating 1D/2D microfluidic channels for colloidal experiments.
- **Computational & Programming**: C++, Python, Julia
- **Statistical & Mathematical Modeling**: Monte Carlo and Markov-Chain methods, stochastic process modeling, data fitting, Bayesian inference, and numerical optimization.
- **Machine Learning**: Working familiarity with PyTorch and TensorFlow; interest in physics-informed neural networks and stochastic optimization algorithms.
- **Software Tools**: Git, Linux/Unix environments, Maestro (Schrödinger), LaTeX, and data visualization pipelines.
- **Languages**: English (Native), Japanese (Proficient), Korean (Conversational).

Coursework

Quantum Computing · Solid State Physics · General Relativity · Quantum Field Theory · Quantum Many-Body Physics · Advanced Statistical Mechanics · Differential Geometry · Experimental Physics