

Abdulai Gassama

Brown University, Physics Ph.D. Candidate

Email: abdulai_gassama@brown.edu

Website: <https://gilliesk.github.io/>

EDUCATION

- **Brown University** Providence, RI, USA
exp. May 2027
 - *Doctor of Philosophy – Physics*
Focus in topological studies of disordered systems
Coadvised by Prof. Xinsheng "Sean" Ling and Prof. J. Michael Kosterlitz (Nobel 2016)
GPA: 4.0/4.0
- **Clark University** Worcester, MA, USA
grad. Spring 2022
 - *Bachelor of Arts (Honors) – Physics*
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
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
June 2022 – August 2022
 - *Computational Chemist (Full-time · Summer Position)*
 - **Structure and Ligand-based virtual screening:** Support building and performing molecular dynamics simulations of chosen protein/DNA-ligand complexes via Maestro.
- **Clark University** Hybrid
May 2021 - August 2021
 - *Mathematical Physics Research Fellowship*
 - **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:** J. Eick, O. Tower, L. Ding, **A. Gassama**, J. Tobochnik, R. A. Pelcovits, J. M. Kosterlitz, and X. S. Ling — In preparation for *Phys. Rev. Lett.* (2025).
- **Finite-Temperature Reentrance and Order-by-Disorder in the One-Dimensional Long-Range Ising Model with Random Fields:** O. Tower, L. Ding, **A. Gassama**, J. Eick, R. A. Pelcovits, J. M. Kosterlitz, and X. S. Ling — In preparation for *Phys. Rev. Lett.* (2025).
- **Controlled Disorder in Two-Dimensional Colloidal Crystals: Defect Dynamics and Random-Field Analogs:** O. Tower, **A. Gassama**, J. Eick, J. M. Kosterlitz, and X. S. Ling — In preparation for *Phys. Rev. Lett.* (2025).
- **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, O₂ 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 · Applied AI & ML · Advanced Statistical Mechanics · Differential Geometry · Experimental Physics