Karpur Shukla

Graduate Research Assistant, Department of Electrical and Computer Engineering, Brown University

https://centre.santafe.edu/thermocomp/Karpur_Shukla • contact@karpurshukla.com • +1 646 580-5277

https://orcid.org/0000-0002-7775-6979 • https://scholar.google.com/citations?user=NxRloBgAAAAJ

300 Wedgewood Road, Morganville, New Jersey, 07751 • U.S. Citizen (native-born)

Education and Awards

Doctor of Philosophy: Department of Electrical and Computer Engineering, Brown University — *May 2028 (Anticipated)*

Master of Engineering: Department of Electrical and Computer Engineering, Brown University — *May 2022 (Anticipated)*

- *GPA*:
- *Awards:*

Master of Science: Department of Physics, Carnegie Mellon University — *May 2016*

- *GPA*: 3.28 / 4.00
- *Awards:* Associate Member, Sigma Xi (Scientific Research Honors Society)

Bachelor of Science: Department of Physics, Carnegie Mellon University — *May 2014*

- *Awards:* Science and Humanities Scholar
  Senior Leadership Award, Department of Physics, Carnegie Mellon University

Publications

Quantum Foundations of Classical Reversible Computing

Entropy **23**, *6*, 701 (2021); Invited, featured article.

Michael P. Frank and **Karpur Shukla**

Special Session: Exploring the Ultimate Limits of Adiabatic Circuits

Proc. IEEE 38th Intl. Conf. Comp. Design **1**, 21 (2020)

Michael P. Frank, Robert Brocato, Tom Conte, Anirudh Jain, Nancy Missert, **Karpur Shukla**, Brian Tierney

Synergistic Biophysical Techniques Reveal Structural Interactions of Engineered Cationic Antimicrobial Peptides with Membrane Mimics

Chemistry – A European Journal **26**, 6247 (2020)

Frank Heinrich, Aria Salyapongse, Akari Kumagai, Fernando G. Dupuy, **Karpur Shukla**, Anja Penke, Daniel Husterd, Robert K. Ernst, Anna Pavlova, James C. Gumbart, Berthony Deslouches, Peter Y. Di, Stephanie Tristram-Nagle

Publications Submitted, Publications in Preparation, and Reviewed Position Papers

Fundamental Thermodynamic Limits of Classical Reversible Computing via Open Quantum Systems

(Reviewed position paper, submitted for the Computing Community Consortium Workshop on Physics & Engineering Issues in Adiabatic/Reversible Classical Computing, Oct. 2020)

Karpur Shukla, Victor V. Albert, Michael P. Frank, Jimmy Xu

Invited, Workshop, and Conference Talks

Interplay of Negative Quantum and Ferroelectric Capacitances for Low-Power Transistor Operations — *Apr. 2021*
Submitted talk, *2012 Materials Research Society Spring Meeting*
Host: Materials Research Society

Foundations of the Lindbladian Approach to Adiabatic and Reversible Computing — *Oct. 2020*
Plenary talk, *Physics & Engineering Issues in Adiabatic/Reversible Classical Computing Workshop* [🔗,🎙]
Host: Computing Research Association

Asynchronous Ballistic Reversible Computing Using Superconducting Elements — *Feb. 2020*
Advanced Computing Systems Broad Agency Announcement Portfolio Review [🔗]
Authors: Michael P. Frank, Rupert M. Lewis, Nancy Missert, **Karpur Shukla**
Host: Laboratory for Physical Sciences, University of Maryland

Nonequilibrium Dynamics and Superadiabatic Fluxon Motion for Reversible Computing — *Feb. 2020*
Invited talk [🔗]
Host: Center for Computing Research, Sandia National Laboratories

Pathfinding Thermodynamically Reversible Quantum Computation — *Jan. 2020*
Authors: **Karpur Shukla**, Michael P. Frank
Invited talk, *NSF Quantum Leap Challenge Institute Workshop on the Identification and Control of Fundamental Properties of Quantum Systems* [🔗]
Host: Department of Physics, Brown University

Implementing the Asynchronous Reversible Computing Paradigm in Josephson Junction Circuits — *Oct. 2019*
Authors: Michael P. Frank, Rupert M. Lewis, **Karpur Shukla**
Submitted talk, *21st U.S. Workshop on Superconductor Electronics, Devices, Circuits, and Systems* [🔗]
Host: Department of Electrical and Computer Engineering, Stony Brook University

Review of Holographic Second Laws for Conformal Field Theories Out of Equilibrium — *Mar. 2019*
Submitted talk, *II Workshop on Quantum Information and Thermodynamics* [🔗,🎙]
Host: International Institute of Physics, Federal University of Rio Grande do Norte

Nonequilibrium Disorder Operators and Topological Quantum Computation — *Aug. 2017*
Invited talk, *Thermodynamics and Computation: Towards a New Synthesis*
Host: Thermodynamics of Computation Group, Santa Fe Institute

Physical Aspects of Topological Quantum Computation — *Aug. 2017*
Invited talk
Host: Center for Computing Research, Sandia National Laboratories

Posters

Thermodynamic Dissipation Bounds on Classical and Quantum Reversible Information Processing — *Feb. 2020*
Authors: **Karpur Shukla**, Michael P. Frank
Submitted poster, *22nd Southwest Quantum Information and Technology Conference*

Host: Center for Quantum Information and Control, University of New Mexico

Information Flows in Reversible Computing Out of Equilibrium, with Applications to Models of Topological Quantum Computing — *Feb. 2019*

Authors: **Karpur Shukla**, Michael P. Frank

Submitted poster, 21st Southwest Quantum Information and Technology Conference [🔗]

Host: Center for Quantum Information and Control, University of New Mexico

Scientific Community Service

- **Member, Organizing Committee**, *Physics & Engineering Issues in Adiabatic/Reversible Classical Computing Workshop* (Host: Computing Research Association)

Grants and Contracts Awarded

- **Sandia National Laboratories Purchase Order 2178181, 0**: ($50k/yr. for 3 years)
  - Includes **Advanced Simulation and Computing Grant** ($30k/yr. for 3 years), National Nuclear Security Administration

Work and Research Experience

Graduate Research Assistant: Laboratory for Emerging Technologies, Brown University — *Aug. 2020 – Present*

Visiting Professor: Department of Applied Mathematics, Flame University — *Dec. 2017 – Aug. 2020*

Research Assistant: Biological Physics Group, Carnegie Mellon University — *Jan. 2016 – May 2016*

Research Assistant: Quantum Condensed Matter Theory Group, Carnegie Mellon University — *Aug. 2013 – Dec. 2013*

Programming Languages and Software Packages

- Python *(with NumPy, SciPy, PyLab, and Matplotlib)* {fluent}
- MATLAB / Octave {fluent}
- Mathematica 10 {fluent}
- Origin 2020 {fluent}

Natural Languages

- English {fluent}
- Hindi {fluent}
- Gujarati {fluent}
- Spanish {fluent}