Keerthi Kumaran A M

West Lafayette, United States

+1 765 479 2375 | kalagars@purdue.edu | https://www.linkedin.com/in/keerthikumaran/ |

https://scholar.google.com/citations?hl=enuser=DK3QFcQAAAAJ

Summary

I am a fourth-year PhD student in Physics specializing in Quantum Computing, with expertise in quantum simulations, error mitigation, and quantum circuit optimization. My research focuses on developing scalable quantum algorithms and improving hardware-aware techniques for simulating complex quantum systems. I have contributed to high-impact projects at IBM Quantum and Purdue University, implementing advanced error suppression methods and designing efficient quantum ansätze for near-term devices. Passionate about pushing the boundaries of quantum technology, I actively collaborate with interdisciplinary teams and also develop open-source tools for the research community.

Education

Purdue University, West Lafayette campus — *United States*

Physics graduate student (GPA 3.9/4.0) — *Aug-2022 - Present*

Indian Institue of Science (IISc) — *Bengaluru, India*

BS-Physics (CGPA-9.3/10.0) — *Aug-2018 - July 2022*

Maharishi Vidya Mandir — *Chennai, India*

High School (486/500) — *Apr 2016 - Apr 2018*

Skills

Programming	Python, R, C/C++, Matlab, Mathematica
Libraries	*Machine learning:* Pandas, PyTorch, NumPy, Scikit-learn, Keras, TensorFlow; *Hardware simulation:* qutip, scqubits; *Quantum-Programming:* Qiskit, PennyLane, Cirq
Software & Tools	LaTeX(Overleaf/R Markdown),Github, Origin, SciDavis

Relevant Research Experience

Improving Sample-Based Quantum Diagonalization (SQD)techniques (In progress, details are not be disclosed yet) — *Yorktown Heights, New York*

IBM Quantum — *May 2025 - July 2025*

- Explored advantages of performing SQD on square lattice geometry.
- Applied error mitigation techniques, including Probabilistic Error Cancellation and Amplification.
- Built an internal software package for correlation function computations, incorporating Travis and tox testing.

Quantum Simulation of Superdiffusive Breakdown (arxiv.org/abs/2503.14371) — *Yorktown Heights, New York*

IBM Quantum — *May 2024 - Feb 2025*

- Simulated superdiffusion breakdown in 2D Heisenberg chains with quantum circuits.
- Applied error mitigation techniques, including Probabilistic Error Cancellation and Amplification.
- Built an internal software package for correlation function computations, incorporating Travis and tox testing.

Transmon Qutrit-Based Simulation of Spin-1 AKLT Systems (arxiv.org/abs/2412.19786) — *Yorktown Heights, New York*

IBM Quantum — *Aug 2023 - Dec 2024*

- Performed qutrit gate calibration using Rabi and Ramsey techniques on IBM superconducting transmons.
- Simulated the spin-1 AKLT model using calibrated qutrit gates.
- Used tensor network simulations to demonstrate qutrits' advantages over qubits in a simplified noise model.

Physics-Inspired Quantum Simulation of Resonating Valence Bond States (pubs.acs.org/doi/10.1021/acs.jpca.3c05172) — *West Lafayette, Indiana*

Purdue University — *April 2023 - June 2023*

- Used Density-Matrix Renormalization Group (DMRG) to identify ground state properties via matrix-product states.
- Designed an auxiliary Hamiltonian with reduced measurables and a modular, gate-efficient ansatz.
- Achieved <1% ground-state energy accuracy on IBMQ hardware with robust error mitigation.

Random Projection Using Random Quantum Circuits
(journals.aps.org/prresearch/abstract/10.1103/PhysRevResearch.6.013010) *West Lafayette, Indiana*

Purdue University *Nov 2022 - June 2023*

- Applied local random quantum circuits for dimensionality reduction of large low-rank datasets.
- Benchmarked quantum random projection against classical PCA on MNIST and CIFAR-100.
- Used variational quantum SVD to extract dominant singular vectors post-quantum projection.

Other Quantum Computing Experience

MIT-iQuHack *Virtual*

MIT-IonQ *Jan-23*

- Image Classification using Quantum Classifier post encoding classicaly prepocessed image into quantum circuits.

QHack-2023 *Virtual*

Xanadu *Feb-23*

- Our team was placed 112th out of 800 teams that participated

PennyLane Coding Camp 2022 *Virtual*

Xanadu *Nov-22*

- Successfuly finished 14 out of 16 coding challenges. My team was placed 59th position out of 450+ teams that participated

IBM Fall 2022 Quantum Challenge *Virtual*

IBM-Q *Nov-22*

- Successfuly finished 4 out of 4 labs and secured the Advanced(best) badge.

IBM 2021 Quantum Machine Learning Summer School *Virtual*

IBM-Q *July-21*

- Got an in depth understanding of all the Quantum Machine Learning Algorithms from the experts.

Achievements

2023	**Reviewer**, Journal of Physics A: Mathematical and Theoretical	-
2021	**Research Scholar**, DAAD WISE Scholar	*Germany-India*
2018-2022	**Student Scholar**, KVPY	*India*
2018	**All India Rank -850**, Joint Entrance Examination (JEE)	*India*
2016	**Student Scholar**, National Talent Search Examination	*India*
2021	**106/120**, TOEFL	*India*

Publications

JOURNAL ARTICLES

Robust Chiral Edge Dynamics of a Kitaev Honeycomb on a Trapped Ion Processor (arXiv:2507.08939)
Ammar Ali, Joe Gibbs, Keerthi Kumaran, Varadharajan Muruganandam, Bo Xiao, Paul Kairys, Gábor Halász, Arnab Banerjee, Phillip C. Lotshaw
2025

Quantum simulation of superdiffusion breakdown in Heisenberg chains via 2D interactions (arXiv:2503.14371)
Keerthi Kumaran, Manas Sajjan, Bibek Pokharel, Joe Gibbs, Jeffrey Cohn, Barbara Jones, Sarah Mostame, Sabre Kais, Arnab Banerjee
2025

Transmon qutrit-based simulation of spin-1 AKLT systems (arXiv:2412.19786)
Keerthi Kumaran, Faisal Alam, Norhan Eassa, Kaelyn Ferris, Xiao Xiao, Lukasz Cincio, Nicholas Bronn, Arnab Banerjee
2025

Random projection using random quantum circuits
Keerthi Kumaran, Manas Sajjan, Sangchul Oh, Sabre Kais
Phys. Rev. Res. 6 (1 Jan. 2024) p. 013010. American Physical Society, 2024

Physics-Inspired Quantum Simulation of Resonating Valence Bond States: A Prototypical Template for a Spin-Liquid Ground State
Manas Sajjan, Rishabh Gupta, Sumit Suresh Kale, Vinit Singh, Keerthi Kumaran, Sabre Kais
Journal of Physical Chemistry A 127.41 (Oct. 2023) pp. 8751–8764. 2023