

# Hersh Kumar

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CONTACT	e-mail: <a href="mailto:hekumar@umd.edu">hekumar@umd.edu</a>	web: <a href="http://hershkumar.com">hershkumar.com</a>
RESEARCH INTERESTS	My research focuses on theoretical and computational physics, specifically quantum simulation of lattice gauge theories. I work on methods for preparing and simulating scattering processes on quantum computers, such as digital quantum simulation and dissipative state preparation.  I am also interested in the application of machine learning to many-body quantum systems, particularly the use of neural networks as ansatze for interacting quantum systems.	
EDUCATION	<b>University of Maryland, College Park</b> , College Park, MD USA <i>Ph.D Student</i> , Physics, Advisor: Prof. Zohreh Davoudi <b>2024 – present</b>  <b>University of Maryland, College Park</b> , College Park, MD USA <i>B.S in Physics with High Honors</i> <b>2020 – 2024</b> minor in Computer Science High Honors thesis: <i>Neural Network Ansätze for Bosonic and Fermionic Quantum Systems in One Dimension</i>	
PUBLICATIONS	Paulo F. Bedaque, Jacob Cigliano, <b>Hersh Kumar</b> , Srijit Paul, Suryansh Rajawat. <i>Trapped Fermions Through Kolmogorov-Arnold Wavefunctions</i> . <a href="#">Preprint on arXiv</a> . (2025)  Paulo F. Bedaque, Jacob Cigliano, <b>Hersh Kumar</b> , Srijit Paul, Suryansh Rajawat. <i>Kolmogorov-Arnold Wavefunctions</i> . <i>Phys. Rev. C</i> <b>112</b> , 054002 (2025)  Paulo F. Bedaque, <b>Hersh Kumar</b> , Andy Sheng. <i>A Machine Learning Approach to Trapped Many-Fermion Systems</i> . <i>Phys. Rev. C</i> <b>112</b> (1), 014002 (2025)  Paulo F. Bedaque, <b>Hersh Kumar</b> , Andy Sheng. <i>Neural Network Solutions of Bosonic Quantum Systems in One Dimension</i> . <i>Phys. Rev. C</i> <b>109</b> , 034004 (2024)  Edison M. Murairi, Michael J. Cervia, <b>Hersh Kumar</b> , Paulo F. Bedaque, Andrei Alexandru. <i>How many quantum gates do gauge theories require?</i> <i>Phys. Rev. D</i> <b>106</b> , 094504 (2022)	
CODE	<i>Languages</i> : Python, C++, L <sup>A</sup> T <sub>E</sub> X, HTML/CSS, Javascript, Java <i>Tools</i> : Linux, git, Jupyter Notebook, Excel, Jax, MPI, OpenMP, CUDA <i>GitHub</i> : <a href="https://github.com/hershkumar">github.com/hershkumar</a>	
TALKS	<b>Introduction to Machine Learning</b> <i>Neural Networks, Gradient Descent, and Backpropagation</i> <b>June 12th, 2025</b> Invited to give a pedagogical talk on neural networks, gradient descent, and backpropagation for the University of Maryland Particle Astrophysics group. Slides for the talk can be found <a href="#">here</a> .  <b>Undergraduate High Honors Presentation</b> <i>Neural Network Ansätze for Quantum Systems in One Dimension</i> <b>May 10th, 2024</b> Delivered a senior thesis talk on the usage of neural networks as variational ansatze for bosonic and fermionic systems in one dimension. Slides for the talk can be found <a href="#">here</a> , and my senior thesis can be found <a href="#">here</a> . <i>Advisor: Prof. Paulo Bedaque</i>	

## University of Maryland Physics Undergraduate Colloquium

*Variational Monte Carlo with a Neural Network Ansatz*

**October 10th, 2023**

Delivered an informal talk on the applications of neural networks as ansatzes for many-boson systems in one dimension. The talk was geared towards undergraduate physics students. The slides I created for the talk can be found [here](#).

### TEACHING

*Graduate Teaching Assistant:* University of Maryland

**Aug. 2024 – Dec. 2024**

Quantum Physics II (Fall 2024). Wrote and graded homeworks and exams, held office hours, and gave lectures.

*Undergraduate Teaching Assistant:* University of Maryland

**2022 – 2023**

Quantum Physics II (Fall 2023), Introduction to Thermodynamics and Statistical Mechanics (Fall 2022, Spring 2023). Graded homeworks, held office hours, assisted with problem solving sections.