

Connor MOONEY

PERSONAL DATA

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RESEARCH EXPERIENCE

AUG 2021 - PRESENT	Mason Experimental Geometry Lab (MEGL) Undergraduate Intern <i>Combinatorics of Cohomology Rings of Peterson Varieties</i>
COLLABORATORS	Prof. Rebecca GOLDIN, Swan KLEIN, and Quincy FRIAS Investigating images of Schubert classes of the flag variety under the pullback of the Peterson's inclusion onto the Flag variety. Expressing these images in terms of Peterson classes, the basis of the Peterson variety's equivariant cohomology. Verifying conjecture about the decomposition of the image of the Schubert classes associated with transposition permutations.
MAY - AUG 2021	SURF Fellow at National Institute of Standards and Technology (NIST) <i>Lefschetz Thimble Quantum Monte Carlo for Spin Systems</i>
COLLABORATORS	Dr. Lucas BRADY and Jacob BRINGEWATT Modified Lefschetz Thimble Monte Carlo methods, known to be effective in mitigating sign problems, numerical instabilities due to oscillating phase in Boltzmann weights, in high energy physics, to work with spin systems, which have Hilbert spaces spanned by a discrete basis set. Evaluated and ameliorated complications emerging due to the discrete basis set and demonstrated the method's efficacy on simple spin systems. Paper under review.
JAN 2021- PRESENT	Undergraduate Research Assistant at George Mason University Quantum Science and Engineering Center (QSEC) <i>Adiabatic Evolution on Subspaces and Cheeger Constants</i>
COLLABORATORS	Dr. Michael JARRET, Dr. Andrew GLAUDELL, and Jacob BRINGEWATT Established how a Hamiltonian's isoperimetric constant induced by a subspace controls how much low energy states receive interference across the boundary under time evolution. Explaining theoretically developments in quantum annealing which see improvements from allowing transitions to excited states.
NOV 2020 - PRESENT	Undergraduate Research Assistant at QSEC <i>Optimal Two-Qubit Clifford+T Gate Synthesis</i>
COLLABORATORS	Prof. Mingzhen TIAN, Dr. Andrew GLAUDELL, Dr. Michael JARRET, Swan KLEIN, and Jacob WESTON Catalogued all possible classes of exactly-synthesizable two-qubit gates up to residue class, and populated each class with example elements up to T-count 10. Analyzing strategies to synthesize over each class, and come up with bespoke methods for those classes which cannot be synthesized in "normal-form" fashion.
AUG 2020 - JAN 2021	Undergraduate Research Assistant at QSEC <i>Discrete Time Quantum Walks and Pathfinding</i>
COLLABORATORS	Dr. Michael JARRET Researched discrete time quantum walk algorithms, the quantum analog to a random walk, and their use for pathfinding on bipartite graphs. Constructed an algorithm for returning a short path, but the method did not adequately generalize to shortest paths without discarding the advantages of quantum algorithms.

PUBLICATIONS

OCT. 20, 2021 Lefschetz Thimble Quantum Monte Carlo for Spin Systems
CO-AUTHORS: Dr. Lucas BRADY and Jacob BRINGEWATT
[arXiv:2110.10699](https://arxiv.org/abs/2110.10699) (under review)

EDUCATION

AUG 2020 - MAY 2022 (est.)	Bachelor of Science in MATHEMATICS, George Mason University , Fairfax, Virginia Concentration in Applied Mathematics Minor in Physics Thesis: “Equivariant cohomology, Peterson varieties, and combinatorics” Advisor: Prof. Rebecca GOLDIN GPA: 4.0/4.0 Entered via early admissions policy for rising high-school seniors
MAY - AUG 2021	Undergraduate School in Experimental Quantum Information Processing, Institute of Quantum Computing, University of Waterloo , Waterloo, Ontario
JUL 2020	International Summer School for Young Physicists, Perimeter Institute for Theoretical Physics , Waterloo, Ontario
AUG 2017 - JUNE 2020	Thomas Jefferson High School for Science and Technology , Fairfax, Virginia GPA: 4.45/4.0 National Merit Scholarship finalist and National AP Scholar

POSTERS AND TALKS

OCT. 14, 2021	Southwest Quantum Information and Technology Workshop Lefschetz Thimble Quantum Monte Carlo for Spin Systems (Poster)
AUG. 20 & 27, 2021	Gorshkov Group Meeting Lefschetz Thimble Quantum Monte Carlo for Spin Systems
AUG. 4, 2021	NIST SURF Colloquium Lefschetz Thimble Quantum Monte Carlo for Spin Systems
APR. 22, 2021	QSEC Quantum Week With Jacob WESTON Optimal Two-Qubit Quantum Circuit Synthesis

LANGUAGES

ENGLISH:	Native
JAPANESE:	Intermediate

COMPUTER SKILLS

Programming Languages:	Python, Java, C++, Mathematica (basic), R (basic)
Other software:	\LaTeX , Git and GitHub

INTERESTS

Physics: Quantum Information, Quantum Computing, Adiabatic Quantum Computing, Quantum Annealing, Many Body Physics, Mathematical Physics

Math: Functional Analysis, Geometry