Jacob Bringewatt *Curriculum Vitae*

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Summary

I am a PhD candidate in theoretical physics at the University of Maryland, College Park. My research interests span many aspects of quantum information and quantum computing. Current areas of focus include adiabatic quantum computation and quantum annealing, quantum metrology, and quantum algorithms for nuclear theory.

Education

University of Maryland, College Park — College Park, Maryland

PhD in Physics — *2018 – 2024 (Expected)*
Advisor: Alexey Gorshkov

Bachelor of Science in Physics — *2014 – 2018*
Cum laude with high honors in physics.

Fellowships, Honors, and Awards

Research Fellowships

KITP Graduate Fellow — *2022*
Kavli Institute for Theoretical Physics

Computational Science Graduate Fellow (CSGF) — *2018-2022*
Department of Energy

Lanczos Graduate Fellow — *2018-2020*
Joint Center for Quantum Information and Computer Science (QuICS),
University of Maryland, College Park

Banneker/Key Scholar — *2014-2018*
University of Maryland, College Park

Awards

Charles T. Husar Fellowship in Physics — *2023*
For excellence in research and service to the department.
Department of Physics, University of Maryland, College Park

Board of Visitors Outstanding Graduate Student Award — *2023*
College of Computer, Mathematical, and Natural Sciences (CMNS)
University of Maryland, College Park

University of Maryland Invention of the Year Finalist — *2023*
For minimum entanglement protocols for quantum sensing.
University of Maryland, College Park

Three Minute Thesis (3MT) Contest Winner — *2022*
College and University Level, University of Maryland, College Park

DOE CSGF Communicate Your Science Contest Winner — *2019*

Grants

QuICS Seed Grant — *2022-2023*

Purpose: Funding for an undergraduate researcher during the academic year and a summer student for the 2023 GRAD-MAP Summer Scholars program (see Mentorship below).
Funding Agency: Joint Center for Quantum Information and Computer Science (QuICS)
Amount awarded: $16.5k

Institute for Robust Quantum Simulation (RQS) Seed Grant *2022-2023*

Purpose: Research project on an experiment/theory collaboration to test quantum speed limits using superconducting qubits and explore the possibilities for use speed limits for noise characterization.
Funding Agency: National Science Foundation (NSF)
Amount awarded: $33k

Publications

Highlights: 14 publications and preprints, 10 first author/co-first author, 2 Physical Review Letters, 1 Physical Review A Letter, 1 Editors' suggestion, h-index 5 (Google scholar)

* denotes equal contribution, † denotes alphabetical order

14. *J Bringewatt*, J Kunjummen, N Mueller. "Randomized measurement protocols for lattice gauge theories." Preprint. (2023) [arXiv:2303.15519]
13. *J Bringewatt**, Michael Jarret*, T C Mooney*.† "On the stability of solutions to Schrodinger's equation short of the adiabatic limit." Preprint. (2023) [arXiv:2303.13478]
12. A Ehrenberg*, *J Bringewatt**, A V Gorshkov. "Minimum entanglement protocols for function estimation." Preprint. (2022) [arXiv:2110.07613]
11. *J Bringewatt*, Z Davoudi. "Parallelization techniques for quantum simulation of fermionic systems." Quantum 7, 975 (2023) [arXiv:2207.12470]
10. L P García-Pintos, L T Brady, *J Bringewatt*, Y-K Liu. "Lower bounds on quantum annealing times." Phys. Rev. Lett. 130, 140601 (2023) [arXiv:2210.15687]
9. T C Mooney, *J Bringewatt*, N C Warrington, L T Brady. "Lefschetz thimble quantum Monte Carlo for spin systems." Phys. Rev. B 106, 214416 (2022) [arXiv:2110.10699]
8. *J Bringewatt*, L T Brady. "Simultaneous stoquasticity." Phys. Rev. A 105, 062601 (2022) [arXiv:2202.08863]
7. *J Bringewatt*, I Boettcher, P Niroula, P Bienias, A V Gorshkov. "Protocols for estimating multiple functions with quantum sensor networks: geometry and performance." Phys. Rev. Research 3, 033011. (2021) [arXiv:2104.09540]
6. T Qian, *J Bringewatt*, I Boettcher, P Bienias, A V Gorshkov. "Optimal measurement of field properties with quantum sensor networks." Phys. Rev. A (Letter) 103, L030601. (2021) [arXiv:2011.01259]
5. *J Bringewatt*, N Sato , W Melnitchouk, J Qiu, F Steffens, M Constantinou. "Confronting lattice parton distributions with global QCD analysis." Phys. Rev. D. 103, 016003 (2021) [arXiv:2010.00548]
4. *J Bringewatt**, M Jarret*.† "Effective gaps are not effective: quasipolynomial classical simulation of obstructed stoquastic Hamiltonians." Phys. Rev. Lett. 125, 170504 (2020) [arXiv:2004.08681]
3. *J Bringewatt*, W Dorland, SP Jordan. "Polynomial time algorithms for estimating spectra of adiabatic Hamiltonians." Phys. Rev. A 100 (3), 032336 (2019) [arXiv:1905.07461]. Editors' Suggestion.

2. *J Bringewatt*, W Dorland, SP Jordan, A Mink. "Diffusion Monte Carlo approach versus adiabatic computation for local Hamiltonians." Phys. Rev. A 97 (2), 022323 (2018) [arXiv:1709.03971]

1. K Pushkin, C Akerlof, D Anbajagane, J Armstrong, M Arthurs, *J Bringewatt*, T Edberg, C Hall, M Lei, R Raymond, M Reh, D Saini, A Sander, J Schaefer, D Seymour, N Swanson, Y Wang, W Lorenzon. "Study of radon reduction in gases for rare event search experiments." Nucl. Instrum. Methods Phys. Res., Sect. A 903, 267-276 (2018) [arXiv:1805.11306]

Patents/Provisional Patents

3. T. Qian, J. Bringewatt, I. Boettcher, P. Bienias, A. V. Gorshkov, Systems and Method for Measurement of Field Properties Using Quantum Sensor Networks, U.S. Patent Application 17/978,420, filed Nov 1, 2022. Based on publication [6] above.

2. A. Ehrenberg, J. Bringewatt, A. V. Gorshkov, Minimum Entanglement Protocols for Function Estimation, U.S. Provisional Patent Application 63/397546, filed August 12, 2022. Based on publication [11] above.

1. J. Bringewatt, I. Boettcher, P. Niroula, P. Bienias, A. V. Gorshkov, Measurement of Multiple Functions with Quantum Sensor Networks, U.S. Provisional Patent Application 63/363171, filed April 18, 2022. Based on publication [7] above.

Teaching Experience

Substitute Lecturer *2023*
A week of lectures for a junior-level E&M course
University of Maryland, College Park

Designed and wrote "challenge questions" on quantum information/computing *2022*
GRAD-MAP Winter Workshop
University of Maryland, College Park

Designed and wrote a self-study packet on quantum computing for high schoolers *2021*
Girls Talk Math Program
University of Maryland, College Park

Math Tutor *2016-2018*
University of Maryland, College Park

Teaching Assistant for Philosophy of Quantum Mechanics *2016*
University of Maryland, College Park

Mentorship

Research

Anisah Khattak *2023*
Undergraduate at Notre Dame of Maryland University

Othello D. Gomes *2022-2023*
Undergraduate at University of Maryland

Tarushii Goel *2022*
Undergraduate at MIT

Timothy (Connor) Mooney *2021-2022*
Undergraduate at George Mason University, now a graduate student at University of Maryland

Akshita Gorti *2021-2022*
Undergraduate at Cornell University

Timothy Qian *2020*
High schooler at Montgomery Blair High School, now an undergraduate at MIT, won 5^{th} place Regeneron Science Talent Search for work done with me.

Ivy Liang *2020*
High schooler at Montgomery Blair High School.

GRAD-MAP Winter Workshop

GRAD-MAP Winter Workshop is a professional development and research skill-building workshop organized via the University of Maryland's Graduate Resources for Advancing Diversity with Maryland Astronomy and Physics program.

Anisah Khattak *2023*
Undergraduate at Notre Dame of Maryland University

Othello D. Gomes *2022*
Undergraduate at Montgomery Community College, now an undergraduate at University of Maryland

Victoria Adebayo *2021*
Undergraduate at Howard University

Service to the Scientific Community

Peer Review
Journals: npj Quantum Information, Quantum, Physical Review Letters
Conferences: QIP, TQC

Member of UMD Physics Department Graduate Student Colloquium Committee *2021–2023*
University of Maryland, College Park

Volunteer for GRAD-MAP Winter Workshop and Summer Scholars Programs *2021–2023*
University of Maryland, College Park

Co-organizer of Journal Club/Reading Group on Geometry of Quantum States *2021–2022*
University of Maryland, College Park

Organizer of QuICS-JQI-CMTC Friday Seminar *2020–2021*
University of Maryland, College Park

Panelist for Conference for Undergraduate Underrepresented Minorities in Physics (cu2mip) *2021*
University of Maryland, College Park

Volunteer at University of Maryland Prospective Graduate Student Open Houses *2019–2021*
University of Maryland, College Park

Education-related Training and Workshops

Seminar Course on Physics Education Research for Teaching Quantum Mechanics *2021*
University of Maryland, College Park

Workshop on Relationships Among Intuition, Reasoning, and Conceptual Understanding in Physics *2021*
American Association of Physics Teachers

Seminar Course on Introduction to Physics Education Research *2020*
University of Maryland, College Park

Workshop on Science Communication *2020*
Skype a Scientist organization

Outreach

Judge for Communicate Your Science Essay Contest *2023*
Krell Institute

Skype a Scientist *2020-2022*
Conversations with students (elementary, middle, and high school) on physics.

Proctor for U.S. Physics Olympiad F=ma Exam *2022*

Writing for Non-scientific Audience
"Spherical cows: Using barnyard animals to understand quantum computing." (2019) – won Communicate Your Science Essay Contest, published in Deixis Magazine (magazine on computational science at DoE national labs)

Presentations

Invited Talks

5. "Towards (spin) coherent resolutions of the sign problem." George Mason University Quantum Computing Seminar. (Apr. 2023)
4. "The role of entanglement for function estimation with quantum sensor networks." George Mason University Quantum Computing Seminar. (Feb. 2022)
3. "Lefschetz thimble quantum Monte Carlo for spin systems." MIT Computational Research in Boston and Beyond (CRIBB) seminar. (Nov. 2021)
2. "Lattice data in the JAM framework." Amherst Center for Fundamental Interactions (ACFI) Workshop on QCD Real-Time Dynamics and Inverse Problems. (Oct. 2020)
1. "Confronting lattice parton densities with global QCD analysis." AI for Nuclear Physics Workshop. (Mar. 2020)

Contributed Talks

4. "Measuring functions with quantum sensor networks." 23rd Annual SQuInT Workshop. (Oct. 2021)
3. "Effective gaps are not effective: quasipolynomial simulation of obstructed stoquastic Hamiltonians." DOE Computational Science Graduate Fellowship Annual Program Review. (July 2021)
2. "Optimal measurement of field properties with quantum sensor networks." March Meeting 2021. (Mar. 2021)

1. “Confronting lattice parton densities with global QCD analysis." DNP2019. (Oct. 2019)

Seminar Talks

17. “Randomized measurement protocols for lattice gauge theories." Davoudi Group Meeting. (Apr. 2023)
16. “The geometry and algebra of quantum Fisher information." Gorshkov Group Meeting. (Mar. 2023)
15. “Quantum metrology: An introduction." Davoudi Group Meeting. (Mar. 2023)
14. “The role of entanglement for function estimation with quantum sensor networks.” Caltech/ AWS Seminar. (Dec. 2022)
13. “Simultaneous stoquasticity.” KITP Condensed Matter/Quantum Physics Seminar. (Aug. 2022)
12. “The sign problem and quantum advantage.” KITP Locals Lunch Seminar. (Aug. 2022)
11. “Ultimate limits for function estimation in quantum metrology.” Gorshkov Group Meeting. (Jan. 2022)
10. “Lefschetz thimble quantum Monte Carlo for spin systems." USC Condensed Matter Seminar. (Nov. 2021)
9. “Minimum entanglement protocols for function estimation." QuICS/JQI Friday Quantum Seminar. (Oct. 2021)
8. “Fermionic mappings, qubit architectures, and graph coloring." Davoudi Group Meeting. (Aug. 2021)
7. “Estimating multiple functions with quantum sensor networks." Gorshkov Group Meeting. (Jan. 2021)
6. “Effective gaps are not effective." Gorshkov Group Meeting. (April 2020)
5. “Quantum sensor networks and Fisher information." Gorshkov Group Meeting. (Aug. 2019)
4. “Confronting lattice parton densities with global QCD analysis." Jefferson Lab Theory Seminar. (July 2019)
3. “Diffusion Monte Carlo approach versus adiabatic computation for local Hamiltonians." Gorshkov Group Meeting. (Aug. 2018)
2. “Diffusion Monte Carlo approach versus adiabatic computation for local Hamiltonians." University of Maryland Undergraduate Research Showcase. (May 2018)
1. “Diffusion Monte Carlo approach versus adiabatic computation for local Hamiltonians." Undergraduate Thesis Defense. (May 2018)

Posters

12. “Simultaneous stoquasticity." QIP2023. (Feb. 2022)
11. “Testing and utilizing quantum speed limits in superconducting systems." Institute for Robust Quantum Simulation NSF Site Visit. (Aug. 2022)
10. “Simultaneous stoquasticity." QuICS Stakeholder Day. (Apr. 2022)
9. “Lefschetz thimble quantum Monte Carlo for spin systems." QIP2022. (Mar. 2022)
8. “Optimal measurement of field properties with quantum sensor networks." QuICS Admitted Students Days. (Apr. and May 2021)
7. “Optimal measurement of field properties with quantum sensor networks." QuICS Stakeholder Day. (Mar. 2021)
6. “Estimating multiple functions with quantum sensor networks." QuICS 5 Year Anniversary Symposium. (Jan. 2020)

5. “Effective gaps are not effective." FARQC Kickoff Meeting. (Nov. 2019)
4. “Polynomial time algorithms for estimating spectra of adiabatic Hamiltonians." DOE Computational Science Graduate Fellowship Annual Program Review. (July 2019)
3. “Polynomial time algorithms for estimating spectra of adiabatic Hamiltonians." QIP2019. (Jan. 2019)
2. “Polynomial time algorithms for estimating spectra of adiabatic Hamiltonians." STAQ Kickoff Meeting. (Nov. 2018)
1. “Diffusion Monte Carlo approach versus adiabatic computation for local Hamiltonians." QIP2018. (Jan. 2018)