Jacob Bringewatt

Curriculum Vitae
Sept. 23, 2024

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Harvard Quantum Initiative   www.jacobbringewatt.com
Department of Physics

EDUCATION

2024	Ph.D., Physics, University of Maryland, College Park
2018	B.S., Physics, University of Maryland, College Park

PROFESSIONAL APPOINTMENTS

2024	Postdoctoral Fellow in Physics, Harvard Quantum Initiative, Harvard University

PUBLICATIONS

Highlights: 20 papers, 225+ citations, 4 Phys. Rev. Lett., h-index 8, i10-index 8

Under Review

4. *J Bringewatt*, Z Steffen, M Ritter, A Ehrenberg, H Wang, B S Palmer, A Kollar, A V Gorshkov, L P García-Pintos. "Generalized geometric speed limits for quantum observables." Preprint. (2024)

3. L P García-Pintos, T O'Leary, T Biswas, *J Bringewatt*, L T Brady, Y-K Liu. "Resiliance-runtime tradeoff relations for quantum algorithms." Preprint. (2024)

2. J D Watson, *J Bringewatt*, A F Shaw, A M Childs, A V Gorshkov, Z Davoudi. "Quantum algorithms for simulating nuclear effective field theories." Preprint. (2023)

1. *J Bringewatt*, M Jarret, T C Mooney. "On the stability of solutions to Schrodinger's equation short of the adiabatic limit." Preprint. (2023)

First Author Publications

10. *J Bringewatt*, J Kunjummen, N Mueller. "Randomized measurement protocols for lattice gauge theories." Quantum 8, 1300 (2024)

9. *J Bringewatt**, A Ehrenberg*, T Goel*, A V Gorshkov. "Optimal function estimation with photonic quantum sensor networks." Phys. Rev. Research 6, 013246 (2024)

8. A Ehrenberg*, *J Bringewatt**, A V Gorshkov. "Minimum entanglement protocols for function estimation." Phys. Rev. Research 5, 033228 (2023)

7. *J Bringewatt*, Z Davoudi. "Parallelization techniques for quantum simulation of fermionic systems." Quantum 7, 975 (2023)

6. *J Bringewatt*, L T Brady. "Simultaneous stoquasticity." Phys. Rev. A 105, 062601 (2022)

5. *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)

4. *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)

3. *J Bringewatt*, M Jarret. "Effective gaps are not effective: quasipolynomial classical simulation of obstructed stoquastic Hamiltonians." Phys. Rev. Lett. 125, 170504 (2020)

2. *J Bringewatt*, W Dorland, SP Jordan. "Polynomial time algorithms for estimating spectra of adiabatic Hamiltonians." Phys. Rev. A 100 (3), 032336 (2019) Editors' Suggestion.

1. *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)

Additional Publications

6. P Niroula, J Dolde, X Zheng, *J Bringewatt*, A Ehrenberg, K Cox, J Thompson, M Gullans, S Kolkowitz, A V Gorshkov. "Quantum sensing with erasure qubits." Phys. Rev. Lett. 133, 080801 (2024)

5. L P García-Pintos, K Bharti, *J Bringewatt*, H Dehghani, A Ehrenberg, N Y Halpern, A V Gorshkov. "Estimation of Hamiltonian parameters from thermal states." Phys. Rev. Lett. 133, 040802 (2024)

4. L P García-Pintos, L T Brady, *J Bringewatt*, Y-K Liu. "Lower bounds on quantum annealing times." Phys. Rev. Lett. 130, 140601 (2023)

3. 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)

2. 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)

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)

Patents and Patent Applications

3. T. Qian, J. Bringewatt, I. Boettcher, P. Bienias, A. V. Gorshkov, Systems and Methods for Measurement of Field Properties Using Quantum Sensor Networks, U.S. Patent Application 17/978,420, filed Aug. 17, 2023.

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.

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.

TEACHING AND ADVISING EXPERIENCE

Courses

2023   Adjunct Professor, General Physics I, United States Naval Academy

2023   Substitute Lecturer, Advanced Electromagnetism, University of Maryland

2016	Teaching Assistant, Philosophy of Quantum Mechanics, University of Maryland

Pedagogical Training
2021	Course, Physics Education Research for Teaching Quantum Mechanics
2021	Workshop: Intuition, Reasoning, and Conceptual Understanding in Physics
2020	Course: Introduction to Physics Education Research
2020	Workshop: Science Communication

Mentorship and Advising
Zhelun Zhang, graduate student at Harvard University
Jin Ming Koh, graduate student at Harvard University
Alan Bu, undergraduate at Harvard University
David Kong, undergraduate at Lycoming College
Andrew Zheng, undergraduate at University of Maryland
Anisah Khattak, undergraduate at Notre Dame of Maryland University
Othello D. Gomes, undergraduate at University of Maryland
Tarushii Goel, undergraduate at MIT
Timothy (Connor) Mooney, undergraduate at George Mason University
Akshita Gorti, undergraduate at Cornell University
Victoria Adebayo, undergraduate at Howard University
Timothy Qian, high schooler at Montgomery Blair High School

Additional Teaching
2016-18	Math tutor, University of Maryland
2013-16	Martial arts instructor

FELLOWSHIPS AND AWARDS

Fellowships
2024	Harvard Quantum Initiative Postdoctoral Fellowship, Harvard University
2024	NRC Postdoctoral Fellowship (declined), NIST Boulder
2022	Graduate Fellow, Kavli Institute for Theoretical Physics
2018-22	Computational Science Graduate Fellow, United States Department of Energy
2018-20	Lanczos Graduate Fellow, University of Maryland
2014-18	Banneker/Key Scholar, University of Maryland

Academic Recognition
2024	Young Scientist, 73rd Lindau Nobel Laureate Meeting
2023	Board of Visitors Outstanding Graduate Student Award, University of Maryland
2022	Charles T. Husar Fellowship in Physics, University of Maryland

Prizes
2023	Invention of the Year Finalist, University of Maryland
2022	Three Minute Thesis Finalist, University of Maryland
2019	Communicate Your Science Contest Winner, Krell Institute

Grants
2022	Institute for Robust Quantum Simulation Seed Grant
2022	Joint Center for Quantum Information and Computer Science Seed Grant

PRESENTATIONS

Invited Talks

12. "Uncertainty relations for metrology and computation." Perimeter Institute. Dec. 2023.
11. "Uncertainty relations for metrology and computation." MIT Special Quantum Seminar. Dec. 2023.
10. "Uncertainty relations for metrology and computation." Harvard Quantum Initiative Quantum Fest. Dec. 2023.
9. "Uncertainty relations for metrology and computation." JILA Science Seminar. University of Colorado, Boulder. Nov. 2023.
8. "Randomized measurement protocols for lattice gauge theories." Glancy/Knill Group Meeting, NIST Boulder. July 2023.
7. "Towards (spin) coherent resolutions of the sign problem." George Mason University Quantum Computing Seminar. Apr. 2023.
6. "The role of entanglement for function estimation with quantum sensor networks." Caltech/ AWS Seminar. Dec. 2022.
5. "The role of entanglement for function estimation with quantum sensor networks." George Mason University Quantum Computing Seminar. Feb. 2022.
4. "Lefschetz thimble quantum Monte Carlo for spin systems." USC Condensed Matter Seminar. Nov. 2021
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.

Conference Talks

5. "Weighting God's dice: exploiting symmetry in randomized measurement protocols." DOE CSGF Annual Program Review. July 2023.
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.

Local Talks

20. "A geometric toolbox for quantum information theory." Yelin Group Meeting. Sept. 2024.
19. "Harnessing quantum systems for sensing, simulation, and optimization." Dissertation Defense. May 2024.
18. "The quantum Fisher information zoo and its applications. Gorshkov Group Meeting.

May 2024.

17. "Quantum algorithms for optimization." Davoudi Group Meeting. Feb. 2024.

16. "Uncertainty relations for metrology and computation." United States Naval Academy Physics Seminar. Oct. 2023.

15. "Randomized measurement protocols for lattice gauge theories." Davoudi Group Meeting. Apr. 2023.

14. "The geometry and algebra of quantum Fisher information." Gorshkov Group Meeting. Mar. 2023.

13. "Quantum metrology: An introduction." Davoudi Group Meeting. Mar. 2023.

12. "Simultaneous stoquasticity." KITP Condensed Matter/Quantum Physics Seminar. Aug. 2022.

11. "The sign problem and quantum advantage." KITP Locals Lunch Seminar. Aug. 2022.

10. "Ultimate limits for function estimation in quantum metrology." Gorshkov Group Meeting. Jan. 2022.

 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.

PROFESSIONIAL SERVICE

Committee Experience

2021-23   UMD Physics Department Graduate Student Colloquium Committee

Educational Outreach

2020-24   Skype a Scientist
2023   Judge for Communicate Your Science Essay Contest, Krell Institute
2021-23   Mentor and panelist, GRAD-MAP Winter Workshop and Summer Scholars
2022   Proctor for U.S. Physics Olympiad F=ma exam
2021   Panelist, Conference for Undergraduate Underrepresented Minorities in Physics

Departmental Service

2020-21   Organizer, QuICS-JQI-CMTC Friday Seminar

2019-21   Volunteer, University of Maryland Prospective Graduate Student Open Houses

Peer Review

Journal referee for ACM Transactions on Quantum Computing, npj Quantum Information, Physical Review A, Physical Review Applied, Physical Review Letters, Quantum, Quantum Information Processing, Quantum Science and Technology

Conference referee for QIP, TQC