

# Jacob Bringewatt

Curriculum Vitae

Aug. 27, 2024

Harvard University  
Harvard Quantum Initiative  
Department of Physics

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## APPOINTMENTS

Postdoctoral Fellow, Harvard Quantum Initiative, 2024

## EDUCATION

University of Maryland, College Park  
Ph.D., Physics, 2024  
Advisor: Alexey V. Gorshkov

University of Maryland, College Park  
B.S., Physics, *cum laude* with high honors in physics, 2018

## FELLOWSHIPS

Harvard Quantum Initiative Postdoctoral Fellowship, Harvard, 2024  
NRC Postdoctoral Fellowship (declined), NIST Boulder, 2024  
Charles T. Husar Fellowship in Physics, University of Maryland, 2023  
Graduate Fellow, Kavli Institute for Theoretical Physics, 2022  
Computational Science Graduate Fellow, United States Department of Energy, 2018-22  
Lanczos Graduate Fellow, Joint Center for Quantum Information and Computer Science, 2018-20  
Banneker/Key Scholar, University of Maryland, 2014-18

## AWARDS AND HONORS

Young Scientist, 73rd Lindau Nobel Laureate Meeting, 2024  
Board of Visitors Outstanding Graduate Student Award, University of Maryland, 2023  
Invention of the Year Finalist, University of Maryland, College Park, 2023  
Three Minute Thesis Finalist, University of Maryland, College Park, 2022  
Communicate Your Science Contest Winner, Krell Institute, 2019

## FUNDED GRANT PROPOSALS

Quantum Speed Limits, and Noise Characterization for Artificial Open Quantum Systems  
Institute for Robust Quantum Simulation 2022 Seed Proposal.  
Awarded \$33k for experimental equipment and travel funding.

Undergraduate Research in Collaboration with University of Maryland GRAD-MAP Program  
Joint Center for Quantum Information and Computer Science 2022 Seed Proposal.  
Awarded \$16k to support two undergraduate researchers.

## PUBLICATIONS

Highlights: 20 papers (11 first author), 200+ citations, h-index 7, 4 Physical Review Letters, 1 Editors' Suggestion (Physical Review A), 1 Physical Review A Letter

\* denotes equal contribution, † denotes alphabetical order

20. L P García-Pintos, T O'Leary, T Biswas, *J Bringewatt*, L T Brady, Y-K Liu. "Resilience-runtime tradeoff relations for quantum algorithms." Preprint. (2024) [arXiv:2408.02764]
19. 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) [arXiv:2312.05344]

18. *J Bringewatt\**, M Jarret\*, T C Mooney\*.† “On the stability of solutions to Schrodinger’s equation short of the adiabatic limit.” Preprint. (2023) [arXiv:2303.13478]
17. 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) [arXiv:2310.01512]
16. 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) [arXiv:2401.10343]
15. *J Bringewatt*. “Harnessing quantum systems for sensing, simulation, and optimization.” Ph.D. Dissertation. (2024)
14. *J Bringewatt*, J Kunjummen, N Mueller. “Randomized measurement protocols for lattice gauge theories.” Quantum 8, 1300 (2024) [arXiv:2303.15519]
13. *J Bringewatt\**, A Ehrenberg\*, T Goel\*, A V Gorshkov. “Optimal function estimation with photonic quantum sensor networks.” Phys. Rev. Research 6, 013246 (2024) [arXiv:2401.16472]
12. A Ehrenberg\*, *J Bringewatt\**, A V Gorshkov. “Minimum entanglement protocols for function estimation.” Phys. Rev. Research 5, 033228 (2023) [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 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.

## 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

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.

## TEACHING EXPERIENCE

United States Naval Academy

General Physics I (adjunct professor), Fall 2023

University of Maryland, College Park

Advanced Electromagnetism (substitute lecturer), Spring 2023

Philosophy of Quantum Mechanics (teaching assistant), Spring 2016

Tutor (calculus, differential equations), 2016-18

## ADDITIONAL TRAINING/TEACHING

Seminar course: Physics Education Research for Teaching Quantum Mechanics, 2021

Workshop: Intuition, Reasoning, and Conceptual Understanding in Physics, 2021

Seminar course: Introduction to Physics Education Research, 2020

Workshop on science communication, 2020

Martial arts instructor, 2010-16

## MENTORSHIP

David Kong, undergraduate at Lycoming College, Summer 2024

Andrew Zheng, undergraduate at University of Maryland, Summer 2024

Yash Anand, undergraduate at University of Maryland, 2023-24

Anisah Khattak, undergraduate at Notre Dame of Maryland University, Summer 2023

Othello D. Gomes, undergraduate at University of Maryland, 2022-23

Tarushii Goel, undergraduate at MIT, Summer 2022

Timothy (Connor) Mooney, undergraduate student at George Mason University, 2021-22

Akshita Gorti, undergraduate at Cornell University, 2021-22

Victoria Adebayo, undergraduate at Howard University, GRAD-MAP Winter Workshop 2021

Timothy Qian, high schooler at Montgomery Blair High School, Summer 2020

## SERVICE TO THE PROFESSION

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, 2022-23  
TQC, 2022-23  
Institute of Physics (IOP) Trusted Reviewer

## **DEPARTMENTAL SERVICE**

Member, UMD Physics Department Graduate Student Colloquium Committee, 2021-23  
Mentor and Panelist, GRAD-MAP Winter Workshop and Summer Scholars Programs, 2021-24  
Organizer, QuICS-JQI-CMTC Friday Seminar, 2020-21  
Panelist, Conference for Undergraduate Underrepresented Minorities in Physics (cu2mip), 2021  
Volunteer, University of Maryland Prospective Graduate Student Open Houses, 2019-21

## **OUTREACH/COMMUNITY INVOLVEMENT**

Judge for Communicate Your Science Essay Contest, Krell Institute, 2023  
Various talks, Skype a Scientist, 2020-22  
Proctor for U.S. Physics Olympiad F=ma exam, 2022