

# Jacob Bringewatt *Curriculum Vitae*

jbringew@umd.edu • [www.jacobbringewatt.com](http://www.jacobbringewatt.com)

University of Maryland, College Park, Atlantic Building 3303

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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.

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## Education

University of Maryland, College Park

COLLEGE PARK, MARYLAND

**PhD in Physics**

2018 – 2023 (*Expected*)

Advisor: [Alexey Gorshkov](#)

**Bachelor of Science in Physics**

2014 – 2018

Cum laude with high honors in physics.

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## 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

**Board of Visitors Outstanding Graduate Student Award—Physics Nominee**

2023

College of Computer, Mathematical, and Natural Sciences (CMNS)

University of Maryland, College Park

**University of Maryland Invention of the Year—Finalist**

2023

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

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

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## Publications

\* denotes equal contribution, <sup>†</sup> denotes alphabetical order

14. *J Bringewatt*, J Kunjummen, N Mueller. "Randomized measurement protocols for lattice gauge theories." Preprint. (2023), [arXiv:]
13. *J Bringewatt\**, Michael Jarret\*, T C Mooney\*.<sup>†</sup> "On the stability of solutions to Schrodinger's equation short of the adiabatic limit." Preprint. (2023), [arXiv:2303.13478]
12. *J Bringewatt*, Z Davoudi. "Parallelization techniques for quantum simulation of fermionic systems." Quantum. (Accepted) (2023) [arXiv:2207.12470]
11. 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]
10. A Ehrenberg\*, *J Bringewatt\**, A V Gorshkov. "Minimum entanglement protocols for function estimation." Preprint. (2022) [arXiv:2110.07613]
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\*.<sup>†</sup> "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]

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## 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.

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## Teaching Experience

<b>Substitute Lecturer</b>	2023
A week of lectures for a junior-level E&M course, University of Maryland, College Park	
<b>Designed and wrote “challenge questions” on quantum information/computing</b>	2022
GRAD-MAP Winter Workshop, University of Maryland, College Park	
<b>Designed and wrote a self-study packet on quantum computing for high schoolers</b>	2021
Girls Talk Math Program, University of Maryland, College Park	
<b>Math Tutor</b>	2016-2018
University of Maryland, College Park	
<b>Teaching Assistant for Philosophy of Quantum Mechanics</b>	2016
University of Maryland, College Park	

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## Mentorship

<b>Research</b>	
<b>Anisah Khattak</b>	2023
Undergraduate at Notre Dame of Maryland University	
<b>Othello D. Gomes</b>	2022-2023
Undergraduate at University of Maryland	
<b>Tarushii Goel</b>	2022
Undergraduate at MIT	
<b>Timothy (Connor) Mooney</b>	2021-2022
Undergraduate at George Mason University, now a graduate student at University of Maryland	
<b>Akshita Gorti</b>	2021-2022
Undergraduate at Cornell University	
<b>Timothy Qian</b>	2020
High schooler at Montgomery Blair High School, now an undergraduate at MIT, won 5 <sup>th</sup> place Regeneron Science Talent Search for work done with me.	

<b>Ivy Liang</b> High schooler at Montgomery Blair High School.	2020
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### 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.

<b>Anisah Khattak</b> Undergraduate at Notre Dame of Maryland University	2023
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<b>Othello D. Gomes</b> Undergraduate at Montgomery Community College, now an undergraduate at University of Maryland	2022
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<b>Victoria Adebayo</b> Undergraduate at Howard University	2021
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## Service to the Scientific Community

### Peer Review

Journals: npj Quantum Information, Quantum  
Conferences: QIP, TQC

<b>Judge for Communicate Your Science Essay Contest</b> Krell Institute	2023
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<b>Member of UMD Physics Department Graduate Student Colloquium Committee</b> University of Maryland, College Park	2021–2023
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<b>Volunteer for GRAD-MAP Winter Workshop and Summer Scholars Programs</b> University of Maryland, College Park	2021–2023
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<b>Co-organizer of Journal Club/Reading Group on Geometry of Quantum States</b> University of Maryland, College Park	2021–2022
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<b>Organizer of QuICS-JQI-CMTC Friday Seminar</b> University of Maryland, College Park	2020–2021
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<b>Panelist for Conference for Undergraduate Underrepresented Minorities in Physics (cu2mip)</b> University of Maryland, College Park	2021
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<b>Volunteer at University of Maryland Prospective Graduate Student Open Houses</b> University of Maryland, College Park	2019–2021
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## Education-related Training and Workshops

<b>Seminar Course on Physics Education Research for Teaching Quantum Mechanics</b> University of Maryland, College Park	2021
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<b>Workshop on Relationships Among Intuition, Reasoning, and Conceptual Understanding in Physics</b> American Association of Physics Teachers	2021
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<b>Seminar Course on Introduction to Physics Education Research</b> University of Maryland, College Park	2020
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## Outreach

### 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)

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## 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

15. "The geometry and algebra of quantum Fisher information." Gorshkov 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)
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