

Kevin D. Stubbs

1735 Highland Place, Apt 6, Berkeley, California 94709

(240)-475-4518 \diamond kevin.d.stubbs@gmail.com

RESEARCH INTERESTS

My main research interest lies in developing practical and mathematically justified algorithms for analyzing high dimensional problems with a focus on materials science and many-body quantum systems.

Topics: Topological phases of matter, interacting electrons, Wannier functions, numerical linear algebra, high dimensional optimization.

POSITIONS

Postdoctoral Researcher *2022 - present*

Department of Mathematics
University of California, Berkeley

Simons Postdoctoral Fellow *2021 - 2022*

Institute for Pure and Applied Mathematics
University of California, Los Angeles

EDUCATION

Duke University *2015 - 2021*
PhD. Mathematics

University of Maryland – College Park *2011 - 2015*
B.S., Mathematics (High Honors) and B.S, Computer Engineering (cum laude)

PUBLICATIONS AND PREPRINTS

- [1] Woochang Kim, Raehyun Kim, Kevin D Stubbs, Steve Louie, and Lin Lin. “DFT Based Ab Initio Modelling of Twisted Bilayer Graphene”. In: *preparation* (2024).
- [2] Jianfeng Lu and Kevin D Stubbs. “Algebraic localization of Wannier functions implies Chern triviality in non-periodic insulators”. In: *Annales Henri Poincaré*. Springer. 2024, pp. 1–16.
- [3] Kevin D Stubbs, Simon Becker, and Lin Lin. “On the Hartree-Fock Ground State Manifold in Magic Angle Twisted Graphene Systems”. In: *arXiv preprint arXiv:2403.19890* (2024).
- [4] Kevin D Stubbs, Michael Ragone, Allan H MacDonald, and Lin Lin. “The Many-Body Ground State Manifold of Chiral Twisted Bilayer Graphene”. In: *in preparation* (2024).
- [5] Abhijeet Alase, Kevin D Stubbs, Barry C Sanders, and David L Feder. “Exponential suppression of Pauli errors in Majorana qubits via quasiparticle detection”. In: *arXiv preprint arXiv:2307.08896* (2023).
- [6] Simon Becker, Lin Lin, and Kevin D Stubbs. “Exact ground state of interacting electrons in magic angle graphene”. In: *arXiv preprint arXiv:2312.15314* (2023).
- [7] Fabian M Faulstich, Kevin D Stubbs, Qinyi Zhu, Tomohiro Soejima, Rohit Dilip, Huanchen Zhai, Raehyun Kim, Michael P Zaletel, Garnet Kin-Lic Chan, and Lin Lin. “Interacting models for twisted bilayer graphene: A quantum chemistry approach”. In: *Physical Review B* 107.23 (2023), p. 235123.
- [8] Sarah Brandsen, Kevin D. Stubbs, and Henry D. Pfister. “Reinforcement Learning with Neural Networks for Quantum Multiple Hypothesis Testing”. In: *Quantum* 6 (2022). DOI: 10.22331/q-2022-01-26-633.

- [9] Jianfeng Lu, Kevin D Stubbs, and Alexander B Watson. “Existence and computation of generalized Wannier functions for non-periodic systems in two dimensions and higher”. In: *Archive for Rational Mechanics and Analysis* (2022), pp. 1–55.
- [10] Jianfeng Lu and Kevin D Stubbs. “Algebraic localization implies exponential localization in non-periodic insulators”. In: *arXiv preprint arXiv:2101.02626* (2021).
- [11] Kevin D Stubbs, Alexander B Watson, and Jianfeng Lu. “Iterated projected position algorithm for constructing exponentially localized generalized Wannier functions for periodic and nonperiodic insulators in two dimensions and higher”. In: *Physical Review B* 103.7 (2021), p. 075125.
- [12] Sarah Brandsen, Mengke Lian, Kevin D Stubbs, Narayanan Rengaswamy, and Henry D Pfister. “Adaptive Procedures for Discriminating Between Arbitrary Tensor-Product Quantum States”. In: *2020 IEEE International Symposium on Information Theory (ISIT)*. IEEE. 2020, pp. 1933–1938.
- [13] Anna N Morozovska, Eugene A Eliseev, Kevin D Stubbs, Rama Vasudevan, Yunseok Kim, and Sergei V Kalinin. “Phase diagrams of single-layer two-dimensional transition metal dichalcogenides: Landau theory”. In: *Physical Review B* 101.19 (2020), p. 195424.
- [14] Zhenning Cai, Jianfeng Lu, and Kevin Stubbs. “On discrete Wigner transforms”. In: *arXiv preprint arXiv:1802.05834* (2018).
- [15] Wojciech Czaja, Benjamin Manning, James M Murphy, and Kevin Stubbs. “Discrete directional Gabor frames”. In: *Applied and Computational Harmonic Analysis* 45.1 (2018), pp. 1–21.

TALKS AND PRESENTATIONS

International Workshop on 2D and Moiré Materials, “Exact Many-Body Ground States in Twisted Bilayer Graphene”, July 2024.

Mathematical Models of Electronic Transport & Phases in Low-Dimensional Materials. “Ferromagnetic Ground States in Twisted N -Layer Graphene”, March 2024.

APS March Meeting 2024. “Ferromagnetic Ground States in Twisted N -Layer Graphene”, March 2024.

Advancing Quantum Mechanics with Mathematics and Statistics Reunion Conference. “Exact ground state of interacting electrons in magic angle graphene”, December 2023.

SciDAC Principle Investigator’s Meeting Poster Session “Interacting models for twisted bilayer graphene”, September 2023

APS March Meeting 2023, “Interacting models for twisted bilayer graphene: Towards a quantum chemistry approach”, March 2023

Solid Math 2022, “On topological triviality in non-periodic systems”, September 2022.

Solid Math 2021, “The localization-topology correspondence via projected position operators”, August 2021.

SIAM Mathematical Aspects of Materials Science 2021, “The localization-topology correspondence via projected position operators”, May 2021.

UC Berkeley Virtual Quantum Many-Body Seminar, “Projected Position Operators for Constructing Well Localized Bases”, January 2021.

Oak Ridge National Laboratory, “Machine Learning for Ferroelectrics”, August 2019.

February Fourier Talks Student Poster Session, “A Novel Approach to Discretizing the Wigner transform”, February 2018.

ECE 587 Final Presentation, “Upper Bounding Matrix Determinants with Random Sampling”, December 2017.

Boise State University CAD REU Invited Talk, “Matrices, Tensors, and their Spectral Decompositions : A Presentation in Two Acts”, July 2017.

Triangle Area Graduate Mathematics Conference (TAGMaC), “Non-linear Representations for TEM Crystal Image Analysis”, April 2017.

Duke MathSlam, “Manifolds and Pretty Pictures: Leveraging Geometry for Image Processing”, March 2017.

Towson University Regional Undergraduate Mathematics Research Conference, “Discrete Directional Gabor Frames”, March 2015.

Joint Math Meeting Student Poster Session, “Generalized AES-based Hash Functions”, January 2014.

Council on Undergraduate Research Research Experiences for Undergraduates Symposium Poster Session, “Generalized AES-based Hash Functions”, October 2014.

Idaho Conference on Undergraduate Research Poster Session, “Generalized AES-based Hash Functions”, July 2014.

AWARDS AND HONORS

Advanced Short-Term Research Opportunity at Oak Ridge National Lab	<i>May 2019</i>
February Fourier Talks Travel Award	<i>February 2018</i>
8th Gene Golub SIAM Summer School Travel Award	<i>May 2017</i>
National Science Foundation Graduate Research Fellowship	<i>March 2016</i>
James B. Duke Fellowship	<i>Fall 2015</i>
University of Maryland ECE Chair’s Award	<i>Spring 2015</i>
RISE Leadership Academy	<i>Fall 2013 - Spring 2015</i>
A. James Clarke School of Engineering Dean’s List	<i>Fall 2011 - Spring 2015</i>
Daniel Sweet Undergraduate Research Fellowship	<i>May 2014</i>
Eagle Scout	<i>March 2011</i>
University of Maryland Dean’s Scholarship	<i>January 2011</i>

TEACHING EXPERIENCE

LBLN Summer Research Mentor	<i>Summer 2023, 2024</i>
Supervised a summer intern from the Lawrence Berkeley National Lab on developing continuum models for twisted bilayer graphene with electron-electron interactions.	
IPAM RIPS Research Mentor – IBM Team	<i>Summer 2022</i>
Worked with a team of four undergraduate as part of the Institute for Applied Mathematics Research in Industrial Projects for Students. Collaborated with researchers from IBM Quantum using midcircuit measurement to improve algorithms. Gave introductory lectures on quantum computing.	
Calculus I Instructor	<i>Spring 2020</i>
DOMath Project Manager	<i>Summer 2019</i>
Worked with three advanced undergraduate students from Duke University on the research topic of Floquet topological insulators under the guidance of Dr. Alexander Watson	
Information Theory Teaching Assistant	<i>Fall 2018</i>
Calculus II Instructor	<i>Fall 2016</i>
Calculus Lab Assistant	<i>Fall 2015</i>

Math Hoops Volunteer*Summer 2015*

Introduced the game NBA Math Hoops to elementary and middle school students. NBA Math Hoops is a basketball based board game for teaching the four basic arithmetic operations (+, -, *, ÷) and basic probability. Taught weekly lessons to elementary and middle school classes on topics ranging from multiplication by zero to divisibility rules.

Math Tutor at Northwestern High School*Fall 2013 - Spring 2015*

Tutored two to five students per week for one and a half hours on topics ranging from pre-Algebra to Calculus. Northwestern High School is composed of over 90% minority students and over 50% of the students get financial aid for lunches. Only 6% of the students from Northwestern complete calculus; half the national average

SERVICE

CIQC Quantum Gathering Organizer*Winter 2023 - present*

Served as the math department liaison. Organized speakers to give “spark talks”, provocative talks designed to spark discussions in the quantum computing community at Berkeley.

AMS Graduate Student Chapter Executive Board*Spring 2017 - Fall 2020*

Served as secretary. Duties included taking notes for meetings, managing the website, in charge of email communications.

WORK EXPERIENCE

Boise State University Research Experience for Undergraduates*Summer 2014*

Collaborated with faculty from Boise State University and undergraduates from other institutions to research the group theoretic properties of the Advanced Encryption Standard (AES).

Toyon Research Corporation*Summer 2013*

Collaborated with a graduate student from Pennsylvania State University to implement a statistical model for classifying different visual vehicle tracks in C++.

SKILLS

Programming Languages:**Highly Proficient:** Python, MATLAB, L^AT_EX**Proficient:** C, C++, Java, Lisp**Experienced:** Ruby, Javascript, OCaml, Verilog**Applications:** Autodesk Inventor, Cadence PSpice, Xilinx Design Suite, Microsoft Office Suite