Tianyu Kong

Updated November 7, 2023

Email: kong0226@umn.edu **GitHub**: timkong98 **Website**: timkong98.github.io

Research interests

Mathematical modeling, numerical analysis, partial differential equations, mathematical physics, quantum physics and optimization

Education

University of Minnesota Twin Cities Minneapolis, MN
PhD in Applied Mathematics 08.2021 – Present
Advisor: Professor Mitchell Luskin. *GPA: 3.96.*

University of Chicago Chicago, IL
Honors BS in Applied Mathematics & Physics 09.2017 – 06.2021
GPA: 3.73.

Publications

Modeling of electronic dynamics in twisted bilayer graphene
T Kong, D Liu, M Luskin, AB Watson
arXiv preprint arXiv:2308.10430

Bistritzer-MacDonald dynamics in twisted bilayer graphene
AB Watson, T Kong, AH MacDonald, M Luskin
Journal of Mathematical Physics 64.3 (2023). Editor's Choice

Research experience

Graduate Research Assistant, UMN
Advisor: Mitchell Luskin 06.2021 – Present
My research is on mathematical modeling and numerical analysis for incommensurate 2D materials, specifically twisted bilayer graphene. The main focus of my research is the band structure and single electron dynamics in tight binding models of such systems. I use multi-scale analysis to identify a regime where the discrete aperiodic model can be reduced to a periodic continuum model. I also derive a domain truncation scheme to approximate the electron dynamics in an infinite system. I implement Python code to numerically verify my findings.

Student Assistant, Lawrence Berkeley National Laboratory
Advisor: Chao Yang and Lin Lin 06.2023 – 08.2023
I studied exotic quantum phases in magic angle twisted bilayer graphene using interacting models that accounts for electron-electron correlation. I implemented methods including Hartree-Fock and coupled cluster theory with Python-based Simulation of Chemistry Framework (PySCF). I developed an accurate continuum model to compute the electron dispersion, and computed long range Coulomb interaction between electrons. I preformed

various numerical experiments, and tried to identify the phase of the ground states of such systems. I also utilized the NERSC supercomputer for accelerating the computations.

Undergraduate Research Assistant, UChicago
Advisor: Mary Silber 04.2020 – 05.2021
I studied different types of Minimum Action Methods to determine the transition of states in a dynamical system subject to random perturbation. I also implemented MATLAB code and used steepest descent and quasi-Newton methods to calculate the Minimum Action Path in Lorenz systems.

Teaching experience

Teaching assistant, School of Mathematics, UMN Fall 2021 – Present
Calculus I – II for College of Science and Engineering
I held 2 workshop sessions per week for 3 hours total. In these sessions I lectured and organized group discussions on challenging concepts and problems, and responded to students' questions in an engaging manner. I also utilized various activities in class to enhance their understanding and spark their interest. I graded weekly homework, quizzes and final exams promptly, and provided valuable feedback.

Grader, School of Mathematics, UMN Fall 2022 – Spring 2023
Mathematical modeling and applied mathematics I – II
Promptly graded weekly homework and exams for $\sim$ 30 students.

Grader, Department of Mathematics, UChicago Fall 2018 – Spring 2020
Math Methods for Physical Sciences I - II
Honors Calculus I - III
Promptly graded weekly homework and exams for $\sim$ 30 students.

Conference presentations

A Comparison of Minimum Action Methods for Computing Noise-induced Transitions of the Lorenz System 05.2021
Poster, SIAM Conference on Applications of Dynamical Systems (DS21)
Tianyu Kong, Justin M. Finkel, Mary Silber

Skills

Programming
Python, MATLAB, Julia, R, MySQL

Languages
Chinese (native), English (professional)

Professional memberships

SIAM student chapter, UMN 07.2023 – Present