

THOMAS G. KIELY

ADDRESS: 8 Country Club Rd, Apt 27
Ithaca, NY 14853
PHONE: (973) 508-9076
EMAIL: tgk37@cornell.edu
PUBLICATION LISTS: [Google Scholar](#), [ORCID](#)

EDUCATION

Aug. 2018 – Present	PH.D. IN PHYSICS Cornell University Thesis Advisor: Erich Mueller
Aug. 2018 – Mar. 2021	M.S. IN PHYSICS Cornell University A Exam: Debanjan Chowdhury , Brad Ramshaw , Erich Mueller
Aug. 2014 – May 2018	B.S. IN PHYSICS, B.A. IN ITALIAN, MINOR IN PHILOSOPHY Georgetown University <i>Summa Cum Laude</i> GPA: 3.96 Overall; 4.0 Physics; 4.0 Italian Senior Thesis <i>Quantum Simulators with Trapped Ions: Two Examples</i> Thesis Advisor: James Freericks
Aug. 2016 – Dec. 2016	SEMESTER AT University of Bologna Direct Matriculation GPA: 4.0 (equivalent)

HONORS AND AWARDS

May 2023	Douglas Fitch Memorial Award to enable international travel to study, pursue research, or partake in Physics-related events
April 2023	DAMOP Travel Award to attend the APS DAMOP 2023 meeting in Spokane, Washington
May 2018	Undergraduate Research Award for depth and impact of written and oral presentation of undergraduate senior thesis
May 2018	Kidwell Medal for excellence in undergraduate Physics coursework
May 2018	Dante Award for excellence in undergraduate Italian coursework
May 2018	Phi Beta Kappa
April 2013	National Merit Finalist

RESEARCH EXPERIENCE

Aug. 2018 – Present	Laboratory of Atomic and Solid State Physics, Cornell University Graduate Research Assistant with Erich Mueller
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- Studied a wide range of problems related to quantum simulation in current ultracold atom experiments. Among these are transport properties in both 1D and 2D fermionic lattice models and low-energy properties of bosonic lattice models, which we modeled using a combination of analytic and numerical techniques. Worked extensively with matrix product state simulations in the thermodynamic limit, studying the interplay of block-sparsity constraints with quasi-long-range order and developing my own implementation of the VUMPS algorithm using the iTensor C++ library.
- Collaborated with Brad Ramshaw on modeling the behavior of ultrasound attenuation across the superconducting transition of Sr_2RuO_4 .
- Collaborated with Debanjan Chowdhury on a study of metal-insulator transitions out of Wigner-Mott insulators, with a particular focus on the $\nu = 1/5$ insulating state in moiré TMD bilayers.

Jan. 2015 – May 2018

Georgetown University

Undergraduate Research Assistant with James Freericks

- Studied two problems with direct relevance to ongoing trapped-ion quantum simulators. (1) Studied a stroboscopic mapping between the transverse-field Ising model and the XY model. Presented an intuitive picture of the mapping and put bounds on its experimental utility. (2) Modeled kinetics of trapped-ion Coulomb crystal transition between two locally-stable configurations, with reference to ongoing experiments in Wes Campbell's group.

June 2016 – Aug. 2016

Institute for Molecular Engineering, University of Chicago

Undergraduate Research Assistant with David Awschalom

- Set up optical experiments involving long-time coherent quantum states in defects of SiO_2 and designed a custom magnet-bearing goniometer on SolidWorks.

TEACHING EXPERIENCE

Spring 2022

PHYS-2213: PHYSICS II: ELECTROMAGNETISM

Course Instructor: Alan Giambattista (Cornell)

Lead three discussion sections and twice weekly office hours, graded homework, proctored and graded exams

Fall 2020

PHYS-2213: PHYSICS II: ELECTROMAGNETISM

Course Instructor: Ivan Bazarov (Cornell)

Course held entirely online; lead three discussion sections and twice weekly office hours, graded homework, proctored and graded exams

Spring 2020

PHYS-1102: GENERAL PHYSICS II

	Course Instructor: Nick Taylor (Cornell) Staffed a flipped, self-taught classroom for 15hrs per week, set up student-run labs, graded lab notebooks, proctored and graded exams. Taught extensively over Zoom due to COVID-19
Spring 2019	PHYS-2208: FUNDAMENTALS OF PHYSICS II Course Instructor: Glenn Case (Cornell) Lead two discussion sections and a lab section, created weekly quizzes, graded homework, proctored and graded exams
Fall 2018	PHYS-1101: GENERAL PHYSICS I Course Instructor: Nick Taylor (Cornell) Staffed a flipped, self-taught classroom for 15hrs per week, set up student-run labs, graded lab notebooks, proctored and graded exams
Fall 2017	PHYS-251: INTERMEDIATE MECHANICS Course Instructor: Peter Olmsted (Georgetown) Held office hours, lead a weekly tutorial, graded problem sets, proctored exams
Fall 2015	PHYS-153: RELATIVITY AND QUANTUM PHYSICS Course Instructor: Joseph Serene (Georgetown) Held office hours, graded problem sets

PUBLICATIONS

5. *Role of conservation laws in the density matrix renormalization group*
TGK and Erich J. Mueller
[Phys. Rev. B **106**, 235126 \(2022\)](#)
[arXiv:2207.03465](#)
4. *Strong Increase in Ultrasound Attenuation Below T_c in Sr_2RuO_4 : Possible Evidence for Domains*
Sayak Ghosh, **TGK**, Arkady Shekhter, F. Jerzembeck, N. Kikugawa, Dmitry A. Sokolov, A. P. Mackenzie and B. J. Ramshaw
[Phys. Rev. B **106**, 024520 \(2022\)](#)
[arXiv:2109.00041](#)
3. *Superfluidity in the one-dimensional Bose-Hubbard model*
TGK and Erich J. Mueller
[Phys. Rev. B **105**, 134502 \(2022\)](#)
[arXiv:2202.0066](#)
2. *Transport in the 2D Fermi-Hubbard Model: Lessons from Weak Coupling*
TGK and Erich J. Mueller.
[Phys. Rev. B **104**, 165143 \(2021\) \[Editor's Suggestion\]](#)
[arXiv:2106.04479](#)
1. *Relationship between the transverse-field Ising model and the XY model via the rotating-wave approximation*
TGK and J. K. Freericks
[Phys. Rev. A **97**, 023611 \(2018\)](#)
[arXiv:1711.04386](#)

PRESS ON RESEARCH

- Phys. Rev. B **104**, 165143 (2021) [Editor's Suggestion]
- "Weak coupling shows flaw in strange metal model" (Cornell Chronicle)
 - "Weak coupling shows flaw in strange metal model" (Phys.org)

CONFERENCE TALKS AND POSTERS

TGK and Erich J. Mueller. "Transport in the 2D Fermi-Hubbard Model: Lessons from Weak Coupling." (Contributed Talk)

TGK and Erich J. Mueller. "Transport in the mass-imbalanced 1D Fermi-Hubbard model." (Poster)

- APS DAMOP Meeting, Jun. 5-9, 2023, Spokane, WA

TGK and Erich J. Mueller. “Transport in the 2D Fermi-Hubbard Model: Lessons from Weak Coupling.” (Poster)

- ICAP, Jul. 18-22, 2022, Toronto, ON

TGK and Erich J. Mueller. “Superfluidity in the 1D Bose-Hubbard model.” (Poster and Contributed Talk)

- APS March Meeting, Mar. 14-18, 2022, Chicago, IL

TGK and Erich J. Mueller. “Superfluidity in the 1D Bose-Hubbard model.” (Poster)

- Boulder School for Condensed Matter and Materials Physics: Ultracold Matter, Jul. 5-30, 2021, Boulder, CO

TGK and Erich J. Mueller. “Umklapp Scattering gives rise to T-Linear Resistivity in the Hubbard Model.” (Poster)

- ARO/AFOSR MURI Quantum Matter Grant Review, Oct. 15, 2019, Amherst, MA

PREPRINTS AND UNPUBLISHED RESEARCH

- *Bandwidth-tuned Wigner-Mott Transition at $\nu = 1/5$: an Infinite Matrix Product State Study*

TGK and Debanjan Chowdhury

[arXiv:2305.13355](https://arxiv.org/abs/2305.13355)

- *Anomalous Resistivity at Weak Coupling*

TGK and Erich J. Mueller

[arXiv:2108.11428](https://arxiv.org/abs/2108.11428)

EXTRACURRICULAR ACTIVITIES

April 2020	CORNELL EXPANDING YOUR HORIZONS CONFERENCE Workshop Co-Leader: “Physics of Bubbles”
Aug. 2014 – May 2018	GEORGETOWN MEN’S VARSITY LIGHTWEIGHT ROWING
Aug. 2014 – May 2018	GEORGETOWN CIRCOLO ITALIANO Treasurer (2017-2018)
June 2015 – Dec. 2015	GEORGETOWN PHYSICS PEER ADVISOR

TECHNICAL SKILLS

Programming Languages	Python, C++, Julia, Java, Mathematica
CAD	SolidWorks

LANGUAGES

English: Native

Italian: Fluent (non-Native)