

Kartiek Agarwal

PERSONAL DATA

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Born March 27, 1989, New Delhi, India
Nationality USA

RESEARCH INTERESTS

Thermalization, transport, and non-equilibrium dynamics in quantum many-body systems
Dynamics of quantum information
Protocols for stabilizing quantum information, and quantum state preparation
Low-dimensional quantum systems
Quantum Hall physics
Novel probes of quantum matter
Computational methods for quantum many-body systems

EMPLOYMENT AND EDUCATION HISTORY

01/2019 **Assistant Professor, Department of Physics, McGill University**, Montreal, QC
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09/2018 **Visiting Researcher, City University of New York**, New York City, NY
– 12/2018
09/2016 **Postdoctoral Researcher, Princeton University**, Princeton, NJ
– 12/2018 Advisor: Prof. Ravindra N. Bhatt
06/2016 **Postdoctoral Researcher, Harvard University**, Cambridge, MA
– 09/2016 Advisor: Prof. Eugene Demler
08/2010 **Ph.D. in Physics, Harvard University**, Cambridge, MA
– 05/2016 Specialization in theoretical condensed matter physics; GPA: 3.87/4
Thesis title : *Slow dynamics in quantum matter: The role of dimensionality, disorder and dissipation*
Advisor: Prof. Eugene Demler
08/2006 **B.Tech. in Electrical Engineering, Indian Institute of Technology at Kanpur**, Kanpur, India
– 04/2010 Thesis title: *An attempt at the resolution of the Abraham-Minkowski controversy*; GPA: 9.5/10
Advisor: Prof. Manoj K. Harbola
1994-2006 School education at schools in Moscow in Russia, Sharjah in UAE, Singapore, and New Delhi in India

AWARDS

10/2020 Tomlinson Science Award, McGill University, Canada
04/2019 Discovery Grant, National Science and Engineering Research Council, Canada
– 04/2024

- 08/2010 Amartya Sen Fellowship, Government of India
- 08/2011 *Awarded to select graduate students from India at Harvard*
- 08/2010 Purcell Fellowship, Harvard University
- 08/2011 *Awarded for graduate studies in Physics at Harvard*
- 05/2008 Academic Excellence Award, Indian Institute of Technology at Kanpur
Awarded for perfect GPA score
- 05/2007 Academic Excellence Award, Indian Institute of Technology at Kanpur
Awarded for perfect GPA score
- 06/2006 AIEEE Scholarship, Government of India
- 06/2010 *Awarded for ranking amongst the top 250 candidates (119 out of 6,00,000) in the All-India engineering entrance examination; to help with undergraduate education expenses*

PUBLICATIONS. H-INDEX: 13

1. K. Agarwal and I. Martin
Dynamical Enhancement of Symmetries in Many-Body systems,
Phys. Rev. Lett. **125**, 080602 (2020)
2. I. Martin and K. Agarwal
'Draiding' majoranas for Hamiltonian engineering and quantum computing,
arXiv:2004.11385, Apr 2020, Submitted to Phys. Rev. X Quantum
3. S. Ganeshan, K. Agarwal, and R. N. Bhatt
Floquet dynamics of disordered bands with isolated critical energies,
Phys. Rev. B **102**, 134212 (2020)
4. K. Agarwal and N. Bao
A toy model for decoherence in the black hole information problem,
Phys. Rev. D **102**, 086017 (2020)
5. T.I. Anderson, B.L. Dwyer, J.D. Sanchez-Yamagishi, J.R. Nieva, K. Agarwal, K. Watanabe, T. Taniguchi, E.A. Demler, P. Kim, H. Park, and M.D. Lukin
Electron-phonon Cerenkov instability in graphene revealed by global and local noise measurements ,
Science **364**, Apr 2019
6. P. Mitra, M. Ippoliti, R. N. Bhatt, S. L. Sondhi, and K. Agarwal
Cooling arbitrary near-critical systems using hyperbolic quenches,
Phys. Rev. B **99**, 104308 (2019)
7. M.T. Randeria, K. Agarwal, B.E. Feldman, H. Ding, H. Ji, R.J. Cava, S.L. Sondhi, S.A. Parameswaran, and A. Yazdani
Interacting multi-channel topological boundary modes in a quantum Hall valley system
Nature 566, 363-367 Feb 2019
8. K. Agarwal, M.T. Randeria, A. Yazdani, S.L. Sondhi, and S.A. Parameswaran
Symmetry-protected Luttinger liquids at domain walls in quantum Hall nematics
ArXiv:1807.10293; Accepted in Phys. Rev. B
9. J.F. Rodriguez-Nieva, K. Agarwal, T. Giamachi, B.I. Halperin, M.D. Lukin, and E. Demler
Probing one-dimensional systems via noise magnetometry with single spin qubits
Phys. Rev. B, **98**, 195433 (2018)
10. K. Agarwal, R.N. Bhatt, and S.L. Sondhi.
Fast preparation of critical ground states using superluminal fronts
Phys. Rev. Lett. **120**, 210604
11. K. Agarwal, S. Ganeshan, and R. N. Bhatt
Localization and transport in a strongly driven Anderson insulator,
Phys. Rev. B **96**, 014201 (2017)
12. K. Agarwal, E. Altman, E. Demler, S. Gopalakrishnan, D.A. Huse, and M. Knap

Rare region effects and dynamics near the many-body localization transition,

Published as invited review article in Annalen Der Physik topical issue, Vol. 529, Issue 7, July 2017

13. K. Agarwal, E.G. Dalla Torre, J. Schmiedmayer, and E. Demler
Quantum heat waves in a one-dimensional condensate,
Phys. Rev. B **95**, 195157 (2017)
14. K. Agarwal, R. Schmidt, B. Halperin, V. Oganesyan, G. Zaránd, M.D. Lukin, and E. Demler
Magnetic noise spectroscopy as a probe of local electronic correlations in two-dimensional systems,
Phys. Rev. B **95**, 155107 (2017)
15. S. Gopalakrishnan, K. Agarwal, D.A. Huse, E. Demler, and M. Knap
Griffiths effects and slow dynamics in nearly many-body localized systems,
Phys. Rev. B **93**, 134206 (2016)
16. K. Agarwal, E. Demler, and I. Martin,
 $1/f^\alpha$ noise and generalized diffusion in random Heisenberg spin systems,
Phys. Rev. B **92**, 184203 (2015)
17. K. Agarwal, S. Gopalakrishnan, M. Knap, M. Muller, and E. Demler,
Anomalous Diffusion and Griffiths Effects Near the Many-Body Localization Transition,
Phys. Rev. Lett. **114**, 160401 (2015)
18. K. Agarwal, E.G. Dalla Torre, R. Bernhard, T. Langen, J. Schmiedmayer, and E. Demler,
Chiral Prethermalization in Supersonically Split Condensates,
Phys. Rev. Lett. **113**, 190401 (2014)
19. K. Agarwal, I. Martin, M.D. Lukin and E. Demler,
Polaronic model of two-level systems in amorphous solids,
Phys. Rev. B **87**, 144201 (2013)
20. K. Agarwal, J.A. Jr. Polo, and A. Lakhtakia,
Theory of Dyakonov-Tamm waves at the planar interface of a sculptured nematic thin film and an isotropic dielectric material,
J. Optics A: Pure and Applied Optics **11**, 074003 (2009)

INVITED TALKS

1. *A new architecture for quantum computing with majorana fermions,*
Colloquium, McMaster University (Virtual), Hamilton, ON (May 19, 2020)
2. *Draiding majoranas for quantum computing and Hamiltonian engineering,*
INTRIQ Fall Meeting (Virtual), QC (May 19, 2020)
3. *Draiding majoranas for quantum computing and Hamiltonian engineering,*
RQMP Grand Conference (Virtual), QC (May 19, 2020)
4. *Symmetry protected Luttinger liquids on the surface of Quantum Hall Nematics,*
QMD Seminar (Virtual), University of Toronto, Toronto, ON (April 27, 2020)
5. *Non-equilibrium phases of matter, and how to engineer them,*
Colloquium, University of Alberta, Edmonton, AB (February 7, 2020)
6. *Symmetry protected Luttinger liquids on the surface of Quantum Hall Nematics,*
Colloquium, Université de Montreal, Montreal, QC (February 3, 2020)
7. *Symmetry protected Luttinger liquids on the surface of Quantum Hall Nematics,*
Quantum Fluids Conference, City University of New York, New York City, NY (Dec 13, 2019)
8. *Symmetry protected Luttinger liquids on the surface of Quantum Hall Nematics,*
Colloquium, Université de Sherbrooke, Sherbrooke, QC (November 20, 2019)
9. *Creating new non-equilibrium phases of matter by "polyfractal" driving,*
Quantum Seminar, IST Austria, Vienna, Austria (June 24, 2019)

10. *Polyfractal driving for engineering Hamiltonians and symmetries*,
Conference: Engineering nonequilibrium Dynamics of open quantum Systems, Max Planck Institute for Complex Systems, Dresden, Germany (June 18, 2019)
11. *Symmetry protected Luttinger liquids on the surface of Quantum Hall Nematics*,
Canadian Association for Physicists Congress 2019, Vancouver, BC (June 6, 2019)
12. *Spatio-temporal quenches for fast preparation of ground states of critical models*,
APS March Meeting, Boston, MA (March 4, 2019)
13. *Spatio-temporal quenches for fast preparation of ground states of critical models*,
INTRIQ Meeting, Bromont, QC (November 13, 2018)
14. *Interacting multi-channel topological boundary modes in a quantum Hall valley system*,
Material Science Weekly Seminar, Argonne National Laboratories, Argonne, IL (October 29, 2018)
15. *Preparing ground states of critical models using hyperbolic quenches*,
Quantum Group Meeting Seminar, Princeton University, Princeton, NJ (September 29, 2018)
16. *Spatio-temporal quenches for fast preparation of ground states of critical models*,
KITP Conference talk, KITP, Santa Barbara, CA (August 23, 2018)
17. *New perspectives on the dynamics of quantum systems*,
Colloquium, McGill University, Montreal, QC (February 8, 2018)
18. *Non-adiabatic methods for fast preparation of critical states*,
Special Seminar, Cornell University, Ithaca, NY (January 10, 2018)
19. *Fast preparation of critical ground states using superluminal fronts*,
CAMP Seminar, Penn State University, State College, PA (November 7, 2017)
20. *Adiabatic approach to creating the ground state of certain critical models*,
Condensed Matter Theory Seminar, Boston University, Boston, MA (October 6, 2017)
21. *Localization and dynamics in a strongly driven Anderson insulator*,
CUNY Hydrodynamics seminar, City University of New York, NY (March 25, 2016)
22. *Using noise spectroscopy to infer dynamics of quantum many-body systems*,
Department of Electrical Engineering Seminar Series, Princeton University, Princeton, NJ (January 22, 2016)
23. *Using noise spectroscopy to infer dynamics of quantum many-body systems*,
Special Condensed Matter Physics Seminar, California Institute of Technology, Pasadena, CA (January 15, 2016)
24. *Using noise spectroscopy to understand ballistic, diffusive and localization-ridden dynamics in quantum many-body systems*,
Special CAMP Seminar, Pennsylvania State University, PA (November 6, 2015)
25. *$1/f$ noise and marginal localization in Heisenberg spin-networks*,
CUA Seminar, Massachusetts Institute of Technology, Cambridge, MA (October 12, 2015)
26. *Generalized Diffusion, $1/f$ noise and Many-body Localization*,
CUNY AQC/MBL Workshop, City University of New York, NY (April 5, 2015)
27. *Griffiths effects near the Many-Body Localization (MBL) transition*,
Triple Feature Series, Harvard-MIT Center for Ultracold Atoms, Cambridge, MA (September 30, 2014)
28. *The Mori-Lee Formalism and its Connection to Many-Body Localization*,
Material Science Weekly Postdoctoral Seminar, Argonne National Laboratory, Argonne, IL (June 11, 2014)

CONTRIBUTED TALKS

1. *$1/f$ noise and Many-Body Localization*,
Conference: Non-equilibrium Matter, Aspen, CO (March 28, 2015); Speaker: Ivar Martin
2. *Real Space RG approach to $1/f$ noise*,

March Meeting 2015, San Antonio, TX (March 2, 2015)

3. *Polaronic model of Two Level Systems in amorphous solids*,
March Meeting 2013, Baltimore, MD (March 18, 2013)

SERVICE

1. Referee for articles in Physical Review Letters, Physical Review B, Europhysics Letters, SciPost physics, Annalen Der Physik, Philosophical Transactions A
2. U2 Year Undergraduate Advisor, McGill University (May 2020-present)
3. Author of an invited review article on rare-region effects in many-body localized systems
4. Thesis defence committee member for 3 students at McGill
5. PhD Advisory committee member for 3 students; March 2019-present
6. Supervision of 3 undergraduate students for summer research projects; May 2019-present
7. Supervision of 3 Master's student; May 2019-present
8. Organization (as a graduate student) of Eugene Demler group seminars at Harvard University

TEACHING EXPERIENCE

- Winter 2021 Instructor, *Physics 457: Honors Quantum Physics 2*, McGill University
- Winter 2021 Instructor, *Physics 660: Quantum Condensed Matter 1*, McGill University
- Winter 2020 Instructor, *Physics 457: Honors Quantum Physics 2*, McGill University
- Winter 2019 Instructor, *Physics 660: Quantum Condensed Matter 1*, McGill University
- Spring 2013 Teaching Fellow, *Physics 295b: Quantum Theory of Solids*, Harvard University
- Fall 2012 Teaching Fellow, *Physics 295a: Introduction to Quantum Theory of Solids*, Harvard University
- Fall 2011 Teaching Fellow, *Applied Mathematics 104: Complex and Fourier Analysis*, Harvard University

POSTERS

1. *1/f noise and generalized diffusion in Heisenberg spin systems: A real-space RG approach*, Non-Equilibrium Quantum Matter, Aspen, CO (March 28, 2015)
2. *Anomalous Diffusion and Griffiths effects near the MBL Transition*, Muri-Atomtronics Meet, Massachusetts Institute of Technology, Cambridge, MA (2014)
3. *Chiral Prethermalization in Supersonically Split Condensates*, Muri-Atomtronics Meet, Massachusetts Institute of Technology, Cambridge, MA (2014)
4. *Chiral Prethermalization in Supersonically Split Condensates*, Conference: Non-equilibrium physics in one-dimensional systems, Harvard University, Cambridge, MA (2014)
5. *Polaronic Model of Two-Level Systems*, Muri-Atomtronics Meet, Massachusetts Institute of Technology, Cambridge, MA (2013)

ATTENDED CONFERENCES, WORKSHOPS, SCHOOLS

- 04/2015 School, *Adiabatic Quantum Computing and Many-Body Localization*, CUNY, NY
- 03/2015 Conference, *Non-Equilibrium Quantum Matter*, Aspen, CO
- 07/2014 Workshop, *Quantum Matter at Ultralow Temperatures*, Varenna, Italy
- 07/2012 School, *New Insights about Quantum Matter*, Princeton, NJ

SKILLS

Programming Languages:
Matlab, C++, OpenMP, MPI-2

Tools:
Mathematica, L^AT_EX