Adhip Agarwala

CONTACT INFORMATION

FB-382,
Department of Physics,
Indian Institute of Technology Kanpur
Kanpur, Uttar Pradesh-208016, India

OFFICE: 0512 - 679 2313 (+91 7259754652)
E-MAIL: adhip.agr@gmail.com
adhip@iitk.ac.in
HOMEPAGE: https://adhipagarwala.wordpress.com/

DATE OF BIRTH

23^{rd}October, 1989

RESEARCH INTERESTS

Theoretical Quantum Condensed Matter
(topological phases, strongly correlated systems, driven systems)

DESIGNATION

Assistant Professor (March, 2022 onwards)

ASSOCIATE

Faculty Associate (2023-2026)
International Centre for Theoretical Sciences,
Tata Institute of Fundamental Research, Bangalore.

EDUCATION AND EXPERIENCE

Postdoctoral Fellow (April, 2021 - March, 2022),
Max Planck Institute for the Physics of Complex Systems,
Dresden-01187, Germany

Max Planck Prize Postdoctoral Fellow (December, 2017 - March, 2021),
International Centre for Theoretical Sciences,
Tata Institute of Fundamental Research, Bangalore.

Postdoctoral Fellow (July, 2017 - November, 2017),
International Centre for Theoretical Sciences,
Tata Institute of Fundamental Research, Bangalore.

Ph.D. (2018)
Thesis title: *"Excursions in ill-condensed quantum matter."*
Department of Physics,
Indian Institute of Science, Bangalore.
(*Thesis submitted: June, 2017. Thesis defence: March, 2018. Degree received: June, 2018)*

Master of Science in Physics (2012)
Indian Institute of Technology Delhi (IITD), New Delhi, India
Cumulative Performance Index (CPI) : **9.47** on a scale of 10

B.Sc in Physics with Honours (2010)
Hindu College, University of Delhi, New Delhi, India
Aggregate Percentage : **88**/100.

ACADEMIC AWARDS AND ACHIEVEMENTS

PhD Thesis published as a monograph under **"Springer Thesis"**
as *Recognizing outstanding PhD research* (2019).

Jagat Ram Chopra Award for **Best Master's Project** in 2011-2012
among Master of Science in Physics/Chemistry/Mathematics in IIT Delhi.

CSIR Junior Research Fellowship 2012

Teaching Assistantship

1. Introduction to Topological Insulators and Topological Superconductors ($Aug', 2017$)
   Lectured by Prof. S. L. Sondhi, Princeton University
   GIAN School, IIT Delhi-110016.
2. Advanced Statistical Physics(PH325) ($Aug'2013 - Dec'2013$)
   Lectured by Prof. Vijay B. Shenoy, Indian Institute of Science
   Indian Institute of Science, Bangalore-560012
3. Advanced Statistical Physics(PH325) ($Aug'2014 - Dec'2014$)
   Lectured by Prof. Vijay B. Shenoy, Indian Institute of Science
   Indian Institute of Science, Bangalore-560012
4. Advanced Condensed Matter Physics(PH320) ($Aug'2015 - Dec'2015$)
   Prof. Vijay B. Shenoy, Indian Institute of Science
   Indian Institute of Science, Bangalore-560012
5. Advanced Condensed Matter Physics(PH320) ($Aug'2016 - Dec'2016$)
   Prof. Vijay B. Shenoy, Indian Institute of Science
   Indian Institute of Science, Bangalore-560012

Courses Taught

Advanced Statistical Mechanics [PG Elective] (Aug, 2024)
Indian Institute of Technology Kanpur (India)

Introduction to Quantum Materials [UG Elective] (Jan, 2024)
Indian Institute of Technology Kanpur (India)

Novel Phases of Quantum Matter [PG Elective] (Aug, 2023)
Indian Institute of Technology Kanpur (India)

Quantum Processes in Low Dimensional Semiconductors [UG elective] (Jan, 2023)
Indian Institute of Technology Kanpur (India)

Refresher Course on Statistical Mechanics for B.Sc teachers (December, 2019)
Talent Development Centre, IISc, Bangalore (India)

Academic Visits

Guest Scientist (1^{st} Oct-25^{th} Oct, 2017)
Max Planck Institute for the Physics of Complex Systems, Dresden (Germany)

Guest Scientist (16^{th} Oct-13^{th} Nov, 2018)
Max Planck Institute for the Physics of Complex Systems, Dresden (Germany)

Guest Scientist (23^{rd} Aug, 2019 - 8^{th} November, 2019)
Max Planck Institute for the Physics of Complex Systems, Dresden (Germany)

Professional activities

Referee for Phys. Rev. Lett.; Phys. Rev. A,B,M,X; Nano Letters; *Science*

Co-organiser

International Conference on Highly Frustrated Magnetism (HFM) 2024, (8^{th}Jan-15^{th} Jan, 2024)
Chennai, India

Physics of Quantum Matter School, (22^{nd}May-2^{nd} June, 2023)
NISER Bhubaneshwar, India

National Conference on Quantum Condensed Matter, ($18^{th} - 22^{nd}$ September, 2022)
Indian Institute of Technology Kanpur, India

first ICTS-Inhouse Symposium (2019), (23^{rd} April, 2019)
ICTS, Bangalore, India

Novel Phases of Quantum Matter (2020), (23^{rd} December, 2019 - 2^{nd} January, 2020)
ICTS, Bangalore, India

Publications

1. Surface Tension of a Topological Phase
   Saikat Mondal, Adhip Agarwala
   arXiv 2408.11102
2. Entanglement signatures of a percolating quantum system
   Subrata Pachhal, Adhip Agarwala
   Phys. Rev. B **110** , L041112 (2024) (Letter)
3. Tunable Topological Phases in Quantum Kirigamis
   Rahul Singh, Adhip Agarwala
   arXiv:2406.14645
4. Pinning Disfavors Nucleation in Colloidal Vapor Deposition
   Noman Hanif Barbhuiya, Pritam K. Mohanty, Saikat Mondal, Aminul Hussian, Adhip Agarwala, Chandan K. Mishra
   arXiv:2404.19425
5. Spectral Form Factors of Topological Phases
   Anurag Sarkar, Subrata Pachhal, Adhip Agarwala, Diptarka Das
   Phys. Rev. B **109** , 155126 (2024)
6. Signatures of quantum phases in a dissipative system
   Rohan Joshi, Saikat Mondal, Souvik Bandyopadhyay, Sourav Bhattacharjee and Adhip Agarwala
   J. Phys. Cond. Mat. **36** 275601 (2024) (Emerging Leaders 2023)
7. Dimensional reduction of Kitaev spin liquid at quantum criticality
   Shi Feng, Adhip Agarwala, Nandini Trivedi
   Phys. Rev. Research **6**, 013298 (2024)
8. Evidence of enhanced thermopower from emergent local moments in flatbands of magic-angle twisted bilayer graphene
   Ayan Ghosh, Souvik Chakraborty, Ranit Dutta, Adhip Agarwala, K. Watanabe, T. Taniguchi, Sumilan Banerjee, Nandini Trivedi, Subroto Mukerjee, Anindya Das
   arXiv 2403.08686
9. Quasicrystalline Spin Liquid
   Sunghoon Kim, Mohammad Saad, Dan Mao, Adhip Agarwala, Debanjan Chowdhury
   arXiv 2402.07971
10. Percolation Transition in a Topological Phase
    Saikat Mondal, Subrata Pachhal, Adhip Agarwala
    Phys. Rev. B **108**, L220201 (2023) (Letter)
11. Symmetry-Enriched Criticality in a Coupled Spin-Ladder
    Suman Mondal, Adhip Agarwala, Tapan Mishra, Abhishodh Prakash
    Phys. Rev. B **108** , 245135 (2023) (Editor's Suggestion)
12. Correlation-driven non-trivial phases in single bi-layer Kagome intermetallics
    Aabhaas Vineet Mallik, Adhip Agarwala, Tanusri Saha-Dasgupta
    Phys. Rev. B **108** , 205125 (2023)
13. Amit Kumar Chatterjee, Adhip Agarwala
    Classical and quantum facilitated exclusion processes
    arXiv:2302.08849
14. Shi Feng, Adhip Agarwala, Subhro Bhattacharjee, Nandini Trivedi
    Anyon dynamics in field-driven phases of the anisotropic Kitaev model
    Phys. Rev. B **108**, 035149 (2023)
15. Sunghoon Kim, Adhip Agarwala, Debanjan Chowdhury
    Fractionalization and topology in amorphous electronic solids
    Phys. Rev. Lett. **130**, 026202 (2023)

16. Ayan Banerjee, Suraj S. Hegde, Adhip Agarwala, Awadhesh Narayan
Chiral metals and entrapped insulators in a one-dimensional topological non-Hermitian system
Phys. Rev. B **105**, 205403 (2022)

17. Arup Kumar Paul, Ayan Ghosh, Souvik Chakraborty, Ujjal Roy, Ranit Dutta, K. Watanabe, T. Taniguchi, Animesh Panda, Adhip Agarwala, Subroto Mukerjee, Sumilan Banerjee, Anindya Das
Interaction driven giant thermopower in magic-angle twisted bilayer graphene
Nat. Phys. 1-8 (2022)

18. Animesh Nanda, Adhip Agarwala, and Subhro Bhattacharjee
Phases and Quantum Phase Transitions in Anisotropic Antiferromagnetic Kitaev-Heisenberg-Γ magnet Phys. Rev. B **104**, 195115 (2021)

19. Saikat Santra, Adhip Agarwala and Subhro Bhattacharjee
Statistics tuned entanglement of the boundary modes in coupled Su-Schrieffer-Heeger chains
Phys. Rev. B **103**, 195134 (2021)

20. Adhip Agarwala, Subhro Bhattacharjee, Johannes Knolle and Roderich Moessner
Gapless state of interacting Majorana fermions in a strain-induced Landau level
Phys. Rev. B **103**, 134427 (2021) (Editor's Suggestion)

21. Prateek Mukati, Adhip Agarwala, Subhro Bhattacharjee
Topological and conventional phases of a three dimensional electron glass
Phys. Rev. B **101**, 035142 (2020)

22. Adhip Agarwala, Vladimir Juricic, Bitan Roy
Higher Order Topological Insulators in Amorphous Solids
Phys. Rev. Research **2**, 012067 (2020) (Rapid Communication)

23. Adhip Agarwala, Gaurav Kr. Gupta, Vijay B. Shenoy and Subhro Bhattacharjee
Statistics-tuned phases of pseudofermions in one dimension
Phys. Rev. B **99**, 165125 (2019)

24. Adhip Agarwala, Shriya Pai and Vijay B. Shenoy
Fractalized Metals
arXiv 1803.01404 (2018)

25. Adhip Agarwala and Diptiman Sen
Effects of local periodic driving on transport and generation of bound states
Phys. Rev. B **96**, 104309 (2017)

26. Adhip Agarwala and Vijay B. Shenoy
Topological Insulators in Amorphous Systems
Phys. Rev. Lett. **118**, 236402 (2017) (Editor's Suggestion) (Featured in Physics)

27. Amogh Kinikar, T. Phanindra Sai, Semonti Bhattacharya, Adhip Agarwala, Tathagata Biswas, Sanjoy Sarker, H. R. Krishnamurthy, Manish Jain, Vijay B. Shenoy, and Arindam Ghosh
Quantized edge modes in atomic-scale graphitic point contacts
Nature Nanotechnology **12**, 564568 (2017)

28. Adhip Agarwala
Killing the Hofstadter butterfly, one bond at a time
Eur. Phys. J. B **90**, 15 (2017)

29. Adhip Agarwala and Diptiman Sen
Effects of interactions on periodically driven dynamically localized systems
Phys. Rev. B **95**, 014305 (2017)

30. Adhip Agarwala, Arijit Haldar, and Vijay B. Shenoy
The tenfold way redux: Fermionic systems with N-body interactions
Annals of Physics **385**, 469 (2017)

31. Adhip Agarwala and Vijay B. Shenoy
Quantum impurities develop fractional local moments in spin-orbit coupled systems
Phys. Rev. B **93**, 241111 (2016) (Rapid Communication)
32. Adhip Agarwala, Utso Bhattacharya, Amit Dutta, and Diptiman Sen
Effects of periodic kicking on dispersion and wave packet dynamics in graphene
Phys. Rev. B **93**, 174301 (2016)
33. Fock space exploration by angle resolved transmission through quantum diffraction grating of cold atoms in an optical lattice
Adhip Agarwala, Madhurima Nath, Jasleen Lugani, K Thyagarajan and Sankalpa Ghosh
Phys. Rev. A **85**, 063606 (2012)

Pedagogical articles

1. Exploring ideas in topological quantum phenomena: A journey through the SSH model
Anantha Hegde, Adarsh Kumar, Adhip Agarwala, Bhaskaran Muralidharan
https://arxiv.org/abs/2108.01460
    1. Exploring Ideas in Topological Phenomena -I Resonance 27 (10), 1761-1776 (2022)
    2. Exploring Ideas in Topological Phenomena -II Resonance 27 (11), 1913-1921 (2022)
    3. Exploring Ideas in Topological Phenomena -III Resonance 27 (12), 2139-2151 (2022)
    4. Exploring Ideas in Topological Phenomena -IV Resonance 28 (1), 55-70 (2023)
    5. Exploring Ideas in Topological Phenomena -V Resonance 28 (3), 371-388 (2023)

Popular science writing

Articles in The Hindu

Outreach talks

1. Physics Demonstrations on National Science Day (with Prof. Aditya Kelkar), on 2nd March 2024 Indian Institute of Technology Kanpur.
2. Physics Around Us National Science Day Lecture (with Prof. Aditya Kelkar) Christ Church College on 28th Feb 2024

Selected Talks, posters

(**Colloquium)** "Exploring novel phases of quantum matter, in strange landscapes" 9th October, 2024 Birla Institute of Technology and Science Pilani (Goa)

(**Theoretical Physics Seminar)** Percolation Transition in a Topological Phase, July 12th, 2024 Raman Research Institute (Bangalore)

(**Invited Lecturer)** "Topical School on Condensed Matter Physics", May 20th - May 31st, 2024, Institute of Physics, Bhubaneshwar (India)

(**Invited Talk)** "Field Driven Physics in Kitave Magnets" Condensed Matter Meets Quantum Information 2023, September 25th - October 6th, 2023, ICTS Bangalore (India)

(**Invited Talk)** "Spectral Form Factors In Topological Phases" Discussion Meeting on Non-Equilibrium Physics 2023, June 5th - 8th, 2023, HRI Allahabad (India)

(**Invited Talk)** "Steady states in quantum non-Hermitian systems and classical equivalences" MeetStatPhys2023, June 5th - 8th, 2023, IIT Kharagpur (India)

(**Invited Talk)** Novel Phases of Matter in Frustrated Magnets, October 17th - 20th, 2022. University of Bordeaux (France)

(**Budapest Integrability Webinar)** "Fermions, bosons and anything in between", 6^{th} October (2022), Department of Physics, Eötvös Loránd University Budapest (Hungary)

(**Theoretical Physics Seminar)** " Exploring novel phases of quantum matter: Role of topology, entanglement and interactions", 7^{th} October (2021),
Saha Institute for Nuclear Physics, Kolkata (India)

(**Sabarmati Talk)** "Topological phases in electron glass, and other stories", 21^{st} July (2021), Indian Institute of Technology, Gandhinagar (India)

(Webinar) "Gapless state of interacting Majorana fermions in a strain-induced Landau level", 27^{th} January (2021), waiting for Highly Frustrated Magnetism 2021, MPIPKS, Dresden (Germany)

(Webinar) "Topological phases in electron glasses" 5^{th} November (2020)

Department of Physics, Pennsylvania State University (USA)

(Webinar) "Exploring novel phases of quantum condensed matter" 16^{th} September (2020)

Indian Institute of Science Education and Research, Pune, India

(Webinar) "Gapless state of interacting Majorana fermions in a strain-induced Landau level", 8^{th} September (2020), 3^{rd} Annual conference on quantum condensed matter,
SNBCBS, Kolkata (India)

(Talks) "Topological phases in electron glasses"

21^{st} August, (2019) Indian Institute of Technology Delhi (India)
20^{th} August, (2019) Ashoka University, Sonepat (India)
19^{th} August, (2019) Jawaharlal Nehru University, New Delhi (India)
16^{th} August, (2019) Indian Institute of Science Education and Research, Mohali (India)
10^{th}-14^{th} June, (2019) Discussion Meeting: Edge dynamics in topological phases, ICTS, Bangalore (India)

(Poster) " 'Fractional Quantum Hall effect' of a fractionalized liquid" 8^{th}-10^{th} July, (2019) 2^{nd} Annual conference on quantum condensed matter, IISc, Bangalore (India)

(Talk) "A Kitaev liquid, under strain" 23^{rd} April, (2019) ICTS-Inhouse, Bangalore (India)

(Two Lectures) on "Toy models and topological phases", 29^{th} March and 5^{th} April (2019), TQFT Series, ICTS, Bangalore (India)

(Talk) 'Fermions, Bosons and anything in between'; National Conference On Quantum Condensed Matter @ IISER Mohali, India 25th-27th July (2018)

(Poster) 'Fermions, Bosons and anything in between'; Topological phases in condensed matter and cold atom systems, 1st-13th October (2018) Cargese, (France).

(Poster) 'Fractional local moments in spin-orbit coupled systems'; School and Conference on Quantum Disordered Systems, Institute of Mathematical Sciences, Chennai, India(2016)

Selected Schools and conferences

"Focus Meeting on thermal transport and microscopic descriptions of alpha-RuCl3" 23^{rd}-24^{th} November (2021) MPIPKS, Dresden (Germany).

"Gapless Fermions - from Fermi liquids to strange metalss" $17^{th} - 28^{th}$ February (2020) MPIPKS, Dresden (Germany).

"Conference on Signatures of Topology in Condensed Matter" $21^{st} - 25^{th}$ October (2019) ICTP, Trieste (Italy).

"New Developments in Topological Condensed Matter" $2^{nd} - 13^{th}$ September (2019) Les Houches (France).

10^{th}-14^{th} June, (2019) Discussion Meeting: Edge dynamics in topological phases, ICTS, Bangalore (India)

"The 2nd Asia Pacific Workshop on Quantum Magnetism" 29^{th}Nov-7^{th}Dec(2018), Bangalore (India)

International conference "Correlated Magnetism: From Frustration To Topology" 31st October - 2nd November (2018), Dresden (Germany)

Global Young Scientists Summit in Singapore, 22nd-26th January (2018)

International Workshop on Emergent Phenomena in Quantum Hall Systems
Tata Institute of Fundamental Research, Mumbai, India (2016)

Quantum Entanglement in Macroscopic Matter
ICTS and Department of Physics, IISc, Bangalore, India (2015)

School on Topological Quantum Matter
Harish-Chandra Research Institute, Allahabad, India (2015)

Positions of Responsibility

Outreach Committee Coordinator, Physics Department, IIT Kanpur (2023-24)
Colloquium Committee, Physics Department, IIT Kanpur (2022-23)

co-founded **STHAYI**(**2018**),
A forum for policy, science and society.
ICTS, Bangalore.

PRESIDENT (2009-10)
STUDENT COORDINATOR(2008-09)
VOLUNTEER(2007-08)
National Service Scheme (NSS),
Hindu College, Delhi University

CO-CONVENER
Quantum Condensed Matter Journal Club,
Department of Physics,
Indian Institute of Science, Bangalore-560012

GROUP LEADER (2010)
100 Member Youth Delegation to China
Ministry of Youth Affairs and Sports, Government of India

Referees

- **Prof. Roderich Moessner**
  Max Planck Institute for the Physics of Complex Systems, Dresden-01187
  Phone(s): +(49) 351 871-1103
  Email: moessner@pks.mpg.de

- **Prof. Subhro Bhattacharjee**
  International Centre for Theoretical Sciences, Bangalore-560089
  Phone(s): +(91)-80-6730-6250
  Email: subhro@icts.res.in

- **Prof. Vijay B. Shenoy**
  Department of Physics, IISc, Bangalore-560012
  Phone(s): +(91)-80-2293-2888
  Email: shenoy@iisc.ac.in

- **Prof. Diptiman Sen**
  Centre for High Energy Physics, IISc, Bangalore-560012
  Phone(s): +(91)-80-2293-2974
  Email: diptiman@iisc.ac.in

- **Prof. H. R. Krishnamurthy**
  Department of Physics, IISc, Bangalore-560012
  Phone(s): +(91)-80-2293-3282
  Email: hrkrish@physics.iisc.ernet.in

- **Prof. Subroto Mukerjee**
  Department of Physics, IISc, Bangalore-560012
  Phone(s): +(91)-80-2293-2864
  Email: smukerjee@physics.iisc.ernet.in