



# Shraddha Sharma

## Curriculum Vitae

### Education

- 2009-2016 **Ph.D. Physics**, *Indian Institute of Technology Kanpur, India, 1st Division*  
**Courses:** Review of Quantum and Classical Mechanics- I II, Condensed Matter II, Transport in Mesoscopic systems.
- 2007-2009 **M.Sc. Physics**, *University of Delhi, Delhi, India, 1st Division*  
**Courses:** Classical Mech., Quantum Mech., Solid state physics, Electromagnetic theory and electrodynamics, Nuclear and particle phy, Stat. Mech., Radiation theory, Mathematical Physics, Plasma Phys, Atomic and Nuclear Physics.
- 2004-2007 **B.Sc. Physics (hons)**, *University of Delhi, Delhi, India, 1st Division*  
**Courses:** Mathematical Physics- I II III, Mechanics, Linear and digital integrated circuits, Thermal Physics, Electromagnetic theory, Electricity and Magnetism, Waves and Optics, Real Analysis, Statistical Mechanics, Electronics, Solid State Physics.

### Ph.D. Thesis

- Title **Fidelity and Loschmidt Echo: quenches, non-analyticities and emergent thermodynamics**
- Supervisor Late Prof. Amit Dutta  
Department of Physics,  
Indian Institute of Technology, Kanpur, India

### Experience

#### Industry

- 04/2023- **Data Science Fellow, Lead @ Machine Learning**, Berlin
- 07/2023 During this tenure, I learned essential skills in various areas crucial to the field of machine learning and data science. These include data manipulation and exploration techniques, which enabled me to efficiently process and analyze complex datasets. I gained proficiency in designing and implementing machine learning models, utilizing advanced algorithms for predictive and classification tasks. Moreover, I acquired expertise in calculating relevant metrics to assess model performance and ensure accurate results. Additionally, I mastered the art of creating user-friendly Streamlit applications, effectively translating complex data insights into interactive and visually appealing dashboards, thereby enhancing data-driven decision-making processes.

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## Research

- 09/2019- **Post-Doctoral Fellow**, *CMSP, The Abdus Salam ICTP*, Trieste, Italy
- 04/2022 The scaling behavior of quantum information theoretic measures like entanglement negativity, bipartite and tripartite mutual information and von-Neumann entanglement entropy are probed in long-ranged hybrid quantum circuits. These circuits explore the competition between the measurements and unitary evolution leading to a quantum phase transition in certain cases depending on the nature of interactions. Our published research articles targeted the long-ranged Ising model and Clifford unitaries to get a deeper understanding of these phase transitions.
- 12/2016- **Post-Doctoral Fellow**, *Prof. Giovanna Morigi, University of Saarland*, Germany
- 09/2019 The project dealt with cavity-induced long-range interacting Bose-Hubbard models. The cavity field being incommensurate (/commensurate) with optical lattice leads to phases like Bose-glass, and Super-glass (/ Charge-density wave, and Supersolid) in addition to Mott-insulator and Superfluid. We investigated the transitions between these phases by examining how Entanglement-entropy behaves in these systems with long-range interactions.
- 01/2016- **Project Scientist**, *Late Prof. Amit Dutta, IIT Kanpur*, India
- 11/2016 The project was titled 'Quantum Criticality, Dynamics and Quantum Information Studies in Quantum Many-Body Systems'. This experience was an extension of my Ph.D. project with M.Sc. and Ph.D. students. The primary focus was on two of the interconnected quantum information theoretic measures, the ground state fidelity and the Loschmidt echo (LE). Where we further explored the behavior of dynamical phase transitions in different spin-chain models using LE.

## Research Interest

- Broad Area: Theoretical condensed matter physics and quantum statistical mechanics.
- Specific Area: Strongly correlated many-body systems, equilibrium, and non-equilibrium quantum phase transitions, and quantum information.

## Programming Languages

Python, Matlab, Fortran, Mathematica, Julia

## Additional Info

Google Scholar <https://scholar.google.com/citations?user=IXjKZVUAAAAJ&hl=en>,  
*h-index: 12*,  
citations: 672

## Certified Course

- 07/2022- **Quantum Computing and Machine Learning**
- 12/2022 The course helped in revising the basics of quantum computing and quantum machine learning. We worked in a team of three on the project titled 'Quantum Convolutional Neural Network for Classical Data Classification'.

## References

**Associate Prof. Uma Divakaran,**  
*Department of Physics,*  
*Indian Institute of Technology Palakkad, Kerala, India,*  
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**Prof. Giovanna Morigi,**  
*Universitat des Saarlandes, Germany,*  
ph:+4968130257472,  
mail id: giovanna.morigi@physik.uni-saarland.de

**Prof. Rosario Fazio,**  
*The Abdus Salam ICTP, Italy,*  
ph: +390402240182,  
mail id: rfazio@ictp.it

**Research Scientist Dr. Marcello Dalmonte,**  
*The Abdus Salam ICTP, Italy,*  
ph: +390402240350,  
mail id: mdalmont@ictp.it

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## Publications

- [1] *Study of Loschmidt Echo for a qubit coupled to an XY-spin chain environment*, **Shraddha Sharma**, Victor Mukherjee and Amit Dutta, EPJB **85** 143, (2012). **Impact factor: 1.5.**
- [2] *Loschmidt echo with a non-equilibrium initial state: early time scaling and enhanced decoherence*, Victor Mukherjee, **Shraddha Sharma** and Amit Dutta, Phys. Rev. B **86**, 020301 (R) (2012). **Impact factor: 4.036.**
- [3] *Study of Loschmidt Echo for two-dimensional Kitaev model*, **Shraddha Sharma**, and Atanu Rajak, J. Stat. Mech., **08**, P08005 (2012). **Impact factor: 2.83.**
- [4] *Role of marginality in quantum fidelity and Loschmidt echo: Dirac points in 2-D*, Aavishkar A. Patel, **Shraddha Sharma**, Amit Dutta, EPL, **102**, 46001 (2013). **Impact factor: 1.947.**
- [5] *Quench Dynamics of Edge States in 2-D Topological Insulator Ribbons*, Aavishkar A. Patel, **Shraddha Sharma**, Amit Dutta, EPJB **86**: 367 (2013). **Impact factor: 1.5.**
- [6] *Loschmidt echo and dynamical fidelity in periodically driven quantum system*, **Shraddha Sharma**, Angelo Russomanno, Giuseppe E. Santoro, Amit Dutta, EPL **106**, 67003 (2014). **Impact factor: 1.947.**
- [7] *Asymptotic work statistics of periodically driven Ising chains*, Angelo Russomanno, **Shraddha Sharma**, Amit Dutta, Giuseppe E. Santoro, J. Stat. Mech., P08030 (2015). **Impact factor: 2.83.**
- [8] *One-and two-dimensional quantum models: Quenches and the scaling of irreversible entropy*, **Shraddha Sharma**, Amit Dutta, Phys. Rev. E **92**, 022108 (2015). **Impact factor: 2.529.**

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- [9] *Quenches and dynamical phase transitions in a nonintegrable quantum Ising model*, **Shraddha Sharma**, Sei Suzuki, Amit Dutta Phys. Rev. B **92**, 104306 (2015). **Impact factor: 4.036**.
- [10] *Slow quenches in a quantum Ising chain: dynamical phase transitions and topology*, **Shraddha Sharma**, Uma Divakaran, Anatoli Polkovnikov, Amit Dutta, Phys. Rev. B **93**, 144306 (2016). **Impact factor: 4.036**.
- [11] *Tuning the presence of dynamical phase transitions in a generalized XY-spin chain*, Uma Divakaran, **Shraddha Sharma**, Amit Dutta, Phys. Rev. E. **93**, 052133 (2016). **Impact factor: 2.529**.
- [12] *Mean-field phase diagram of the extended Bose-Hubbard model of many-body cavity quantum electrodynamics*, Lukas Himbert, Cecilia Cormick, Rebecca Kraus, **Shraddha Sharma**, Giovanna Morigi Physical Review A **99**, 043633 (2019). **Impact factor: 3.140**.
- [13] *Dissipative Floquet Dynamics: from Steady State to Measurement Induced Criticality in Trapped-ion Chains*, Piotr Sierant, Giuliano Chiriacò, Federica M. Surace, **Shraddha Sharma**, Xhek Turkeshi, Marcello Dalmonte, Rosario Fazio, Guido Pagano, Quantum **6**, 638, (2022). **Impact factor: 11.99**.
- [14] *Measurement-induced criticality in extended and long-range unitary circuits*, **Shraddha Sharma**, Xhek Turkeshi, Rosario Fazio, Marcello Dalmonte, SciPost Phys. Core **05**, 023 (2022). **Impact factor: 5.5**.
- [15] *Quantum Critical Behavior of Entanglement in Lattice Bosons with Cavity-Mediated Long-Range Interactions* **Shraddha Sharma**, Simon B. Jäger, Rebecca Kraus, Tommaso Roscilde, and Giovanna Morigi, Phys. Rev. Lett. **129**, 143001 (2022). **Impact factor: 8.93**.

## Conferences and Workshop

- Conference on Low Dimensional Quantum Systems at Harish Chandra Research Institute, October 10-13, 2011. (Presented Poster)
- International Non-equilibrium Winter School IISER, Kolkata, 27th Dec 2011 - 11th Jan 2012 (Presented Poster).
- Conference on Diversity and Complexity: Realm of Today's Statistical Physics, 14-17th January 2013 SINP, Kolkata (Oral Presentation and Presented Poster).
- Frontiers in Condensed Matter Physics, 12-14 April 2013, Delhi University (Presented Poster).
- Indian Statistical Physics Community Meeting 2016, 12-14 February 2016, ICTS, Bangalore, India (Presented Poster).
- Quantum-classical transition in many-body systems: Indistinguishably, Interference and Interactions, 13 - 17 February 2017, Max Planck Institute for the Physics of Complex Systems (MPIPKS) in Dresden, Germany (Presented Poster).
- DPG spring meeting Erlangen Atomic, Molekular, Plasma Physics and Quantum Optics Section (2018), Erlangen, Germany (Oral Presentation).

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- 83rd annual conference of the DPG and DPG spring conference (2019), Rostock, Germany (Oral Presentation; Chaired a session).
- Real-time Dynamics in Strongly Correlated Quantum Matter, Virtual International Workshop, 08 - 09 April 2020, Max Planck Institute for the Physics of Complex Systems (MPIPKS) in Dresden, Germany
- Dynamics, criticality, and universality in random quantum circuits, Virtual Workshop 30 September - 02 October 2020, Max Planck Institute for the Physics of Complex Systems (MPIPKS) in Dresden, Germany
- Adriatic Conference on Strongly Correlated Systems (22 - 24 March 2021), The Abdus Salam ICTP, Trieste, Italy (Oral Presentation; Chaired a session).
- Korrelationstage 2021, Virtual Workshop 15 - 20 April 2021, Max Planck Institute for the Physics of Complex Systems (MPIPKS) in Dresden, Germany (Oral Presentation)
- Stochastic Thermodynamics: Recent Developments (ONLINE), 14 June 2022 to 17 June 2022, ICTS Bangalore, India.

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## Oral Presentation

- Conference on Diversity and Complexity: Realm of Today's Statistical Physics, 14-17th January 2013 SINP, Kolkata, '*Loschmidt Echo for two-dimensional Kitaev model*'.
- Group seminar at Quantum and Nano-science group, Tokyo Institute of Technology, Tokyo, 16th May 2014, Japan, '*Fidelity in periodically driven quantum systems and Floquet dynamics*'.
- Mini-workshop on the real-time dynamics of quantum many-body systems, Tokyo University, 20th May 2014, Japan, '*Role of marginality in quantum fidelity*'.
- Enreiso Lecture: Department of applied physics, Hokkaido University, 25th June 2014, Hokkaido University, Japan, '*Quantum Fidelity: scaling and role of marginality*'.
- New Cycle Of Condensed Matter seminars, 1st July 2015, SISSA, Italy, '*Quenches and dynamical phase transitions in a non-integrable and integrable quantum Ising model*'.
- Research Workshop, 6th-7th Feb, 2016, IIT Kanpur, India, '*Dynamical phase transitions: non-equilibrium real-time quantum phase transitions*'.
- DPG spring meeting Erlangen Atomic, Molekular, Plasma Physics and Quantum Optics Section (2018), Erlangen, Germany (Oral Presentation).
- 83rd annual conference of the DPG and DPG spring conference (2019), Rostock, Germany.
- Adriatic Conference on Strongly Correlated Systems (22 - 24 March 2021), The Abdus Salam ICTP, Trieste, Italy.
- Korrelationstage 2021, Virtual Workshop 15 - 20 April 2021, Max Planck Institute for the Physics of Complex Systems (MPIPKS) in Dresden, Germany.

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## Visits and collaborations

- Visited and collaborated with Prof. G.E. Santoro, Abdus Salam ICTP, and SISSA, Trieste, Italy during a visit to CMSP group of Abdus Salam ICTP, Italy, 17th June-21st July 2013 (EPL 106, 67003 (2014), J. Stat. Mech., P08030 (2015)).
- Visited the group of Prof. Hidetoshi Nishimori, at Tokyo Institute of Technology, Tokyo, Japan, 7th May-22nd May 2014.
- Visited Complex Systems Engineering, Graduate School of Information Science and Technology, Hokkaido University, Japan, 22nd May-2nd July, 2014.
- Collaborated with Prof. Sei Suzuki Saitama Medical University, Japan, during the visit to Japan (Phys. Rev. B 92, 104306 (2015)).
- Visited and collaborated with Prof. G.E. Santoro, Abdus Salam ICTP, and SISSA, Trieste, Italy, during the visit to CMSP group of Abdus Salam ICTP, Italy, 11th June - 12th July, 2015 (J. Stat. Mech., P08030 (2015)).
- Visited and collaborated with Prof. Tommaso Roscilde, École normale supérieure de Lyon, France, 13-15 May 2018 (led to two collaborations, one of which is published in PRL, second is in the pipeline).

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## Graduate Teaching Experience

- Graduate teaching assistant in Mechanics course, IIT Kanpur, July 2014 - December 2014.
- Graduate teaching assistant in Introduction to Atomic and Nuclear Physics course, IIT Kanpur, January 2014- May 2014.
- Graduate teaching assistant in Advanced Statistical Mechanics course, IIT Kanpur, July 2013- December 2013.
- Graduate teaching assistant in Electrostatics and electrodynamics course, IIT Kanpur, January 2013 - May 2013.
- Graduate teaching assistant in Physics Preparatory Lab, IIT Kanpur, January 2012 - May 2012. Taught 3-hour laboratory sessions, once a week to preparatory students  
Experiments taught: calculate the frequency of the tuning fork using a sonometer.
- Graduate teaching assistant in Physics 101 Lab, IIT Kanpur, January 2010 - December 2011. Taught 3-hour laboratory sessions, once a week to 1st-year undergraduate students of B.Tech and integrated M.Sc. The experiment taught: current balance.
- Graduate teaching assistant in Condensed Matter Physics course, IIT Kanpur, July 2010-December 2011.
- Graduate teaching assistant in Physics 461 Lab, IIT Kanpur, January 2009- May 2010. Taught 4-hour laboratory sessions, once a week to fourth-year undergraduate students on integrated M.Sc. The experiment taught: superconductivity.

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## Non-academic pursuits

Hobbies: Playing badminton, listening to music, dancing.

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## Declaration

I hereby declare that all the information furnished above is true to the best of my knowledge.

Shraddha Sharma