



ARNOB MUKHERJEE

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I am a Postdoctoral Researcher at the Uppsala University, Sweden, with 9 years of experience in condensed matter physics. My expertise in combining physics-based modeling with mathematical and statistical algorithms has enabled me to tackle complex real-world problems effectively. I am constantly motivated by challenging problems and strive to stay at the forefront of innovation by incorporating cutting-edge research developments in quantitative data analysis and machine learning.

EDUCATION

Ph.D. (2014 - 2021)	Physics, Indian Institute of Science Education and Research (IISER), Mohali, India
M.Sc. (2010 - 2012)	Applied Physics, Indian Institute of Technology (IIT) Dhanbad, India
B.Sc. (2006 - 2009)	Physics (Honors), University of Calcutta, India

RESEARCH EXPERIENCES

Postdoctoral Research (Nov. 2023 - Present) at Uppsala University, Sweden

Topic: The study of spin-orbit torque-driven magnetization switching in 2D magnets based on ab-initio electronic structure calculations and model Hamiltonian.

Supervisor: [Prof. Biplab Sanyal](#)

Postdoctoral Research Project (May 2022 – July 2023) at University of Tennessee, Knoxville, USA

Topic: Emergent Majorana Zero Modes in topological superconductivity and magnetism

Supervisor: [Prof. Elbio Dagotto](#)

- Self-consistent Mean-Field Simulation: Developed algorithm and code for self-consistency calculations to obtain converged solutions of quantum materials.
- Developing an improved iterative Lanczos algorithm to handle large sparse matrix diagonalization.
- Used high-performance computing environments at advanced facilities to solve complex numerical problems.

Doctoral Research Project (Aug. 2014 – Nov. 2021) at IISER, Mohali, India

Thesis Title: Antiferromagnetic skyrmions in spin-orbit coupled Hund's insulators and metals

Advisor: [Prof. Sanjeev Kumar](#)

- Markov Chain Hybrid Monte-Carlo Simulation: Developed improved Markov chain Monte-Carlo simulation based on repeated random sampling to obtain converged solutions for electronic problems to study quantum magnetism.
- Performed error analysis of Monte-Carlo data using variational methods.
- Model Designing: Analytical and numerical modeling of material systems based on the statistical analysis of experimental data on the planar Hall effect.

Master's degree Project (2011 - 2012) at the IIT, Dhanbad, India

Title: Blue light-up-conversion luminescence studies of Yb³⁺ doped Yttrium Oxide (Y₂O₃) nanophosphors under 980 nm excitation radiation ; Advisor: [Prof. Kaushal Kumar](#)

Summer Project (May 2011 - July 2011) at the Variable Energy Cyclotron Center, Kolkata, India

Title: Measurement of cyclotron beam energy using the Time-Of-Flight technique ; Advisor: [Prof. S. R. Banerjee](#)

COMPUTATIONAL SKILLS

Programming Languages: Python, Fortran 90, Julia, C++, Bash, SQL, Mathematica, OpenMP

Numerical Simulations: Classical Monte Carlo, Hybrid Monte Carlo, Self-consistency, Machine Learning, Stochastic Solver

Technical: NumPy, SciPy, Pandas, Scikit-Learn, Matplotlib, Numba JIT, Microsoft Excel, Word, PowerPoint, Latex, Version control (Git), SSH, Jupyter notebook, Gnuplot

Operating System: Linux, Windows

Numerical and statistical methods: Differential equations, Linear algebra, Fourier analysis, Probability distribution function, Statistical analysis, Error analysis, Prediction model, Hypothesis testing, Regression analysis

LIST OF PUBLICATIONS

- **A. Mukherjee**, Amit Bikram Sanyal, Elbio Dagotto, “*Unconventional skyrmions in an interfacial frustrated triangular lattice*”, under review in PRB Letter (2023)
- **A. Mukherjee**, Narayan Mohanta, and Elbio Dagotto, “*Emergence of localized Majorana states in skyrmion controlled Josephson junctions*”, manuscript under preparation (2023)
- **A. Mukherjee**, “*Antiferromagnetic skyrmions in spin-orbit coupled Hund's insulators and metals*”, Dspace@IISERMohali, (2021)
- **A. Mukherjee**, D. S. Kathyat, and S. Kumar, “*Engineering antiferromagnetic skyrmions and antiskyrmions at metallic interfaces*”, [Physical Review B **105**, 075102 \(2022\)](#)
- D. S. Kathyat, **A. Mukherjee**, and S. Kumar, “*Antiskyrmions and Bloch skyrmions in Dresselhaus double exchange metals*”, [Physical Review B **104**, 184434 \(2021\)](#)
- Anshu Gupta, D. S. Kathyat, **A. Mukherjee**, Anamika Kumari, Ruchi Tomar, Yogesh Singh, Sanjeev Kumar, and S. Chakraverty, “*Unique Signatures of Rashba Effect in Angle-Resolved Magnetoresistance*”, [Advanced Quantum Technologies **2100105** \(2021\)](#)
- **A. Mukherjee**, D. S. Kathyat, and S. Kumar, “*Antiferromagnetic skyrmion crystals in the Rashba Hund's insulator on triangular lattice*”, [Scientific Reports **11**, 9566 \(2021\)](#)
- **A. Mukherjee**, D. S. Kathyat, and S. Kumar, “*Antiferromagnetic skyrmions and skyrmion density wave in a Rashba Hund's insulator*”, [Physical Review B **103**, 134424 \(2021\)](#)
- D. S. Kathyat, **A. Mukherjee**, and S. Kumar, “*Electronic mechanism for nanoscale skyrmions and topological metals*”, [Physical Review B **103**, 035111 \(2021\)](#)
- D. S. Kathyat, **A. Mukherjee**, and S. Kumar, “*Microscopic magnetic Hamiltonian for exotic spin textures in metals*”, [Physical Review B **102**, 075106 \(2020\)](#)

AWARDS AND FELLOWSHIPS

- Awarded Young Scientist Training Fellowship for Postdoctoral Research at the Asia Pacific Center for Theoretical Physics (APCTP), South Korea.
- The best presentation award in “Quantum Matter Heterostructures 2 (2021)”, organized by INST, Mohali, and IIT, Roorkee.
- Senior research fellowship by the Ministry of Human Research and Development (MHRD), Government of India (Aug. 2017 - Aug. 2019).
- Junior research fellowship by the Ministry of Human Research and Development (MHRD), Government of India (Aug. 2014 - Aug. 2017).
- Awarded the IIT(ISM) Merit-Cum-Mean Scholarship (2011).

TEACHING AND LEADERSHIP EXPERIENCES

- Demonstrated and assisted in advanced physics laboratory sessions designed for undergraduate students. Nuclear Physics (PHY401), Mechanics (PHY101), Modern Physics (PHY212), Modern Physics (PHY112)
- Assisted in supervising a master thesis on “Dynamical Structure Factor Analysis of Chiral magnetism” 2020. Mentored project Ph.D. candidate during postdoctoral tenure leading to research publication.
- Volunteered and organized numerous seminars, conferences, and outreach programs in different cities across India during 2013-2021.

PRESENTATIONS

- Oral presentation on “*Engineering antiferromagnetic skyrmions and antiskyrmions at metallic interfaces*”, at the International conference on [Strongly Correlated Electron Systems \(SCES\), 2022](#), Amsterdam, 24 - 29 July 2022.
- Oral presentation on “*Antiferromagnetic antiskyrmions and skyrmions in magnetic Dresselhaus metals*”, at the International conference on [Strongly Correlated Electron Systems \(SCES\), 2021](#), Brazil, 27 September - 19 October 2021.
- Oral presentation on “*Antiferromagnetic skyrmions and skyrmion density wave in Rashba Hund's Insulator*”, at [APS March Meeting, 2021](#), Washington, DC, USA, 15-19 March 2021.
- Poster presentation on “*Antiferromagnetic Skyrmions and Skyrmion Density Wave in Rashba Hund's Insulator*”, at [Theory Winter School \(TWS\), 2021](#), National High Magnetic Field lab, Florida, USA (11-15 January 2021)