Subhobrata Chatterjee

sbhchatterjee@ucdavis.edu • https://www.subhophy.com
Citizenship: India

Research interests

Quantization of manifolds/supermanifolds, geometric quantization, deformation quantization, quantum Darboux theorems

Education

2019 – Present **University of California** – Davis, United States
PhD in Physics
Advisor: Andrew Waldron.

2014 – 2019 **National Institute of Science Education and Research** – Jatni, India
Integrated Masters (BSc+MSc) in Physics
Advisor: Loganayagam R.

Honors and scholarships

2022 Departmental fellowship during the summer (UC Davis)

2019 Best thesis award for master's thesis (NISER, India)
Computed and characterized novel non-local divergences arising in renormalization of non-unitary open quantum field theories.

2018 S N Bhatt Fellow (International Center for Theoretical Sciences, Bengaluru)
Worked on triangle loops in open quantum field theory under the guidance of Dr. Loganayagam R.

2017 Indian Academy of Sciences Summer Student Research Fellow (Delhi University, India)
Worked on supersymmetric quantum mechanics under the guidance of Dr. Debajyoti Choudhury

2017 Finished in top 1% at the national level of National Graduate Physics Examination, India

2015 Represented India in the 9th Asian Science Camp, Thailand

2015 Awarded Certificate of Merit for outstanding academic performance in the first semester of undergrad at NISER

2014-2019 INSPIRE fellow throughout undergrad (NISER, India)

2014 Awarded gold medal for outstanding academic performance in grade 12

Research projects

Feb 2022 – Present **Classical measurement theory and discrete systems**

Mentor: Andrew Waldron (UC Davis).

The goal is to develop a geometric description of classical measurements for discrete systems like bits on a computer or spin chains. While supermanifolds encode discrete degrees of freedom, superfunctions that correspond to states of such systems do not have a natural probabilistic interpretation. In order to extract probabilistic information from superfunctions, we consider a bundle connection on a representative vector bundle associated to the supermanifold and use it to define a positive definite inner product on the space of superfunctions.

June 2021 – Present **Exact quantization: beyond formality**

Mentor: Andrew Waldron (UC Davis).

We want to characterize sufficient conditions for exact solvability of an abelian (Fedosov) connection on the Hilbert bundle/Weyl algebra bundle. Fedosov's deformation quantization procedure only guarantees a formal solution to the quantization problem. There are examples where we can go beyond formality. Lie groups admit Maurer-Cartan frames with Lie algebra structure constants and more generally parallelizable manifolds admit global frames with structure functions. Thus such manifolds most readily admit Maurer-Cartan forms (bonafide connection). We want to investigate this phenomenon for more general class of manifolds.

June 2018 – Aug 2019 **Renormalization of open quantum field theories**

Mentor: Loganayagam R (ICTS)

Non-unitary open quantum field theories seem to be plagued with novel non-local divergences that do not allow usual Wilsonian renormalization. The goal of this project was to compute and characterize all non-local divergences arising in open scalar field theories. We found interesting geometric interpretations of these divergences reminiscent of the amplitudehedron program.

Teaching experience

Summer 2022, Winter 2023 — **Instructor, PHY 7A: Introduction to Physics for bio majors**
Lecturing and conducting exams on different forms of energy, energy conservation, heat, work and thermodynamics.

Spring 2022 — **Teaching assistant, PHY 110B: Electricity and Magnetism**
Held office hours and graded homework and exams

Winter 2022 — **Teaching assistant, PHY 104B: Computational Methods in Physics**
Held office hours and graded homework and exams

Winter 2022 — **Teaching assistant, PHY 155: General Relativity (undergrad)**
Held office hours and graded homework and exams

Fall 2021 — **Teaching assistant, PHY 260: Introduction to General Relativity (grad)**
Held office hours and graded homework and exams

Spring 2021 — **Teaching assistant, PHY 115A: Foundations of Quantum Mechanics**
Held office hours and graded homework and exams

Winter 2020, Spring 2020, Summer 2020, Fall 2020, Fall 2022 — **Teaching assistant, PHY 7A: Introduction to Physics for bio majors**
Held discussion labs, office hours and graded homework and exams

Fall 2019, Winter 2021, Summer 2021 — **Teaching assistant, PHY 7B: Introduction to Physics for bio majors**
Held discussion labs, office hours and graded homework and exams

Talks and Seminars

Jan 11, 2023 — Talked about **Quantization and Geometry** at the Student-Run Research Seminar

2021-2022 — Talked about a variety of topics in the internal research group seminar like Fedosov quantization, classical BRST, Sasakian geometry, Batchelor's theorem etc

Mentorship

Oct 2021 – Feb 2022 **Directed Reading Program (DRP) Mentor**
Guided an undergraduate student in a reading project on differential geometry