

Subhobrata Chatterjee

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Citizenship: India

Research interests

Quantization of manifolds/supermanifolds, supergeometry, Markov processes, discrete dynamics, geometric quantization, deformation quantization, quantum Darboux theorems x

Education

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| 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

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| 2023 | UC Davis Dean's Graduate Summer Fellowship |
| 2022 | UC Davis Physics Department Summer Fellowship |
| 2019 | Best master's thesis award (NISER, India)
<i>Computed and characterized novel non-local divergences arising in renormalization of non-unitary open quantum field theories.</i> |
| 2018 | S N Bhatt Fellow (International Center for Theoretical Sciences, Bengaluru)
<i>Worked on triangle loops in open quantum field theory under the guidance of Dr. Loganayagam R.</i> |
| 2017 | Indian Academy of Sciences Summer Student Research Fellow (Delhi University, India)
<i>Worked on supersymmetric quantum mechanics under the guidance of Dr. Debajyoti Choudhury</i> |
| 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

Current Research

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

Present Mentor: Andrew Waldron (UC Davis).

The goal is to develop a geometric description of classical measurements for discrete state systems like bits on a computer or faces of a coin. While supermanifolds encode discrete degrees of freedom, superfunctions that correspond to states of such systems do not have a natural probabilistic interpretation. We therefore equip our system with geometric data sufficient to construct a positive definite inner product on the space of superfunctions whose positivity is preserved by evolution.

June 2021 – **Quantization beyond formality**

Present 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 more readily admit Maurer-Cartan forms, and in turn, bonafide connections. We want to investigate this phenomenon for more general class of manifolds.

Undergraduate Research

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

Aug 2019 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, **Instructor, PHY 7A,7C: Introduction to Physics for bio majors**

Winter 2023,

Spring 2023,

Winter 2024

Spring 2022 **Teaching assistant, PHY 110B: Electricity and Magnetism**

Winter 2022 **Teaching assistant, PHY 104B: Computational Methods in Physics**

Winter 2022 **Teaching assistant, PHY 155: General Relativity (undergrad)**

Fall 2021 **Teaching assistant, PHY 260: Introduction to General Relativity (grad)**

Spring 2021 **Teaching assistant, PHY 115A: Foundations of Quantum Mechanics**

Winter 2020, **Teaching assistant, PHY 7A: Introduction to Physics for bio majors**

Spring 2020,

Summer 2020,

Fall 2020, 2022

Fall 2019, **Teaching assistant, PHY 7B: Introduction to Physics for bio majors**

Winter 2021,

Summer 2021

Talks and Seminars

- Feb 20, 2024 **Probabilities and Supergeometry: Measurement theory for dynamical discrete systems** UC Berkeley Representation theory and tensor categories seminar
- Jan 22, 2024 **Probabilities and Supergeometry: Measurement theory for dynamical discrete systems** UC Davis Mathematical physics seminar
- Dec 4, 2023 **Supergeometry and Discrete-state dynamics** UC Davis graduate student colloquium
- May 22, 2023 **Supergeometry and Measurement theory of Discrete Dynamics** poster presentation at Geometry & Physics (GAP) 2023 on “Homotopy Algebras and Higher Structures” at IHP, Paris
- Jan 11, 2023 **Quantization and Geometry** at the Student-Run Research Seminar at the math department, UC Davis
- 2021-2022 Internal research group seminars on Fedosov quantization, classical BRST, Sasakian geometry, Batchelor’s theorem

Preprints and Publications

- Nov 9, 2023 **Discrete dynamics and supergeometry** with Andrew Waldron and Cem Yetismisoglu, arXiv:2311.05711

Mentorship

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

References

Andrew Waldron

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University of California, Davis
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Roger Casals

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University of California, Davis
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