Soumyajit Datta

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Education

2020 - 2025 (Expected) **BS-MS**, *Indian Institute of Science Education and Research*, Kolkata
Current CGPA – 8.28/10

2020 **Higher Secondary**, *Birbhum Zilla School*
Class 12 – 97.8 %

Research Interest

My interest broadly is in particle physics and particle cosmology, specifically in beyond standard model Physics. I am particularly interested in the formal aspects and phenomenological applications of Effective Field Theory (EFT) in Higgs physics, dark matter, and neutrino physics.

Master's Thesis

Sept 2024 – Present **Probing Lepton Number Violating Operators in Colliders**
Supervisor: Prof. Subhaditya Bhattacharya, IIT Guwahati
My master's thesis is on probing lepton number violation in the future same-sign lepton collider. I am currently working to give bounds to the dimension seven lepton number violating (LNV) SMEFT operators in the proposed same-sign muon collider.

Projects

May 2024 **Applications of Heat-Kernel Method**
Supervisor: Prof. Joydeep Chakrabortty, IIT Kanpur
I worked on the Heat-Kernel method. I studied the book 'Heat Kernel Method and its Applications' by I. Avramidi and learned the ingredients of heat kernel method and its applications in different systems. (Report)

May 2023 **Electroweak Interactions and Effective Field Theory**
Supervisor: Prof. Subhaditya Bhattacharya, IIT Guwahati
I studied the standard model electroweak theory and calculated the Fermi constant (G_F^2) in terms of the full theory. I also studied a bit of effective field theory and its application to dark matter.

May 2022 **Some Topics In Lie Algebra and Field Quantization**
IAS-INSA-NASI Summer Research Fellow, 2022
Supervisor: Prof. Urjit A. Yajnik, IIT Bombay
I studied some aspects of Lie algebra, specifically $SU(2)$ and $SU(3)$ groups, and the Lorentz and Poincaré groups. I also explored a bit of field quantization – the free scalar field and scalar field with ϕ^4 potential. (Report4, Report8)

Scholarship

Mar 2021 – Present **Inspire Scholarship** awarded by Department of Science and Technology, Govt. of India.

Schools and Camps

Dec 2024 **Standard Model Effective Field Theories and Applications to Higgs, Neutrinos and Dark Matter,** *Organized by IIT Guwahati*
We learned the formal developments of EFT, in particular SMEFT, and its applications in Higgs, neutrino, and dark matter physics from Prof. Jose Wudka (UC, Riverside) and Prof. Subhaditya Bhattacharya (IIT Guwahati)

Dec 2021 **NIUS Physics 18.1 camp,** *Organized by HBCSE, TIFR*
The camp was conducted online due to the Covid-19 pandemic. We participated in theory sessions covering a range of topics, including nuclear physics, solar astrophysics, particle physics, superconductivity, etc.

Other Projects

May 2023 **Path Integrals in Quantum Mechanics,** *Term Paper*
We studied the path integral formulation of quantum mechanics and applied this formalism to perturbation theory to derive the Fermi Golden rule. (Report, Presentation)

Fall 2024 **The Physics of Flocking ,** *Independent Study*
I studied how flocking occurs, despite the Mermin-Wagner-Hohenberg theorem preventing it in two or lower dimensions. (Presentations & Report)

Teaching Experience

Spring 2024 Teaching Assistant of the course PH1201: Electricity and Magnetism (Certificate)

Fall 2023 Teaching Assistant of the course CS1101: Introduction to Computer Programming (Certificate)

Relevant Courses

Physics
- High Energy Physics
- Quantum Field Theory I-II
- Quantum Mechanics I-III
- Classical Electrodynamics
- General Relativity & Cosmology
- Statistical Mechanics
- Computational Physics
- Nuclear Physics Laboratory

Mathematics
- Real Analysis
- Linear Algebra
- Probability I
- Algebra I
- Numerical Analysis

Software Skills

Languages Python, Matlab, Mathematica

Tools LaTeX, Numpy, FeynCalc, FeynRules, MadGraph, GNU Plot

Other Interests

- I like to listen to rock and Indian classical music. I am an amateur guitarist.
- I enjoy designing posters. I have designed many for various events at IISER Kolkata.