Aadarsh Singh

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Website

RESEARCH INTERESTS

- Physics : I am interested in the following fields of physics:
  Quantum Field Theory, BSM, String theory and other unification theories, Theoretical Particle Physics, General Relativity and fundamentals of Quantum Mechanics.
  I am also interested in the problem of non unitary transformation of wave function on observation and it's philosophical consequences on everyday experience.
- Machine Learning : I am interested in the Differentiable programming and its applications in simulating the physical world scenarios, GNN and its applicability in particle physics. I am also interested in the problem of AGI and its philosophical relevance in understanding the nature of intelligence.

EDUCATION

- **Indian Institute of Science**, Bangalore
  Degree - PhD ,
  Department - Centre for High Energy Physics (CHEP)
  Oct. 2020 - Present

- **Indian Institute of Science Education and Research Bhopal**,
  Degree - BS-MS (Integrated Bachelor of Science and Master of Science),
  Major - Physics, Minor - Mathematics
  Aug. 2015 - May, 2020
  CPI : 9.30/10.00

- **Sarvodya Saraswati Academy**, Amroha, U.P.
  Class XII (Senior Secondary Examination), UP Board
  July 2014 Aggregate 87.60%
- **Sarvodya Saraswati Academy**, Amroha, U.P.
  Class X (Secondary Examination), UP Board
  July 2012 Aggregate 85.00%

PROJECTS AND INTERNSHIPS

- August 2021 - Present
  Project on clockwork fermion and Anderson model for Neutrino Mass at IISc
  Supervisors - Dr. Sudhir K. vempati
  In this project we explored several modifications in standard model lagrangian to ensure theoretical prediction of neutrino masses in agreement with experimental results.

- Feb 2021 - June 2021
  Project on Neutrino Mass and Oscillation at IISc
  Supervisors - Dr. Biplob Bhattacherjee
  In this project we explored the nature of neutrino particles, limitations of standard model and its possible extension to explain several experimental results.

- May 2019 - May 2020
  MS Thesis Research - Symmetries of asymptotically flat spacetime at IISERB
  Supervisors - Dr. Nabamita Banerjee
  In this project asymptotic symmetries of spacetime are found on introduction of vector fields on metric. This project can be further extended to include higher order tensor fields on metric.

- 18 June 2018 - 07 July 2018
  Summer Programme in Mathematics at HRI
  In this programme, I was introduced to master's level mathematics. The programme involved intensive lectures on Algebra (Group Theory, Field Theory and Galois Theory), Analysis (Measure Theory, Basic Complex Analysis) and Topology (Set Topology up to homotopy theory)

- 15 May 2017 - 30 June 2017
  Summer Internship - Quantum Foundation, Quantum Information and Quantum Computation at ISI Kolkata
  Supervisor - Prof. Guru Prasad Kar
  In this project, I studied EPR paradox and hidden variable theories, quantum teleportation, superdense coding, projective and POVM measurements, Krauss operators, measures of entanglement, quantum key distribution and other protocols in quantum cryptography. I also learned important concepts in quantum information theory like the Shannon entropy, Von Neumann entropy, the Holevo bounds etc.

COURSES TAKEN

- Physics
  Mechanics, Electromagnetism, Modern Physics, Basic Electronics, Mathematical Methods I, Quantum Mechanics I, Classical Mechanics, Thermal Physics, Quantum Mechanics II, Statistical Mechanics, Quantum Field Theory I, Electrodynamics and Special Relativity, Atomic and Molecular Physics, Condensed Matter Physics, Decoherence and Open Quantum Systems, Nonlinear Dynamics and Chaos, Magnetism and Superconductivity, Cosmology I, Many-body Quantum Mechanics of Degenerate Gases, Quantum Information Theory, Quantum Field Theory II, General Theory of Relativity, Nuclear and Particle Physics, Cosmology II, Understanding Einstein: The Special Theory of Relativity by Stanford University(Certificate)

- Mathematics
  Calculus of One Variable, Linear Algebra, Multivariable Calculus, Probability and Statistics, Real Analysis , Group Theory, Elementary Number Theory, Advanced Linear Algebra, Ordinary Differential Equations, Topology, Lie Groups and Lie Algebras, Partial Differential Equations, Complex Analysis, Differential Geometry of Curves and Surfaces, Numerical Analysis.
  I have studied following topics: Algebra (Group Theory, Field Theory and Galois Theory), Analysis (Measure Theory, Basic Complex Analysis) and Topology (Set Topology up to homotopy theory) at SPIM.

- Physics Laboratory Experience
  General Physics Laboratory-I, General Physics Laboratory-II, Condensed Matter Physics Laboratory, Nuclear Laboratory

- Philosophy
  Philosophy of Science(Certificate)
  Philosophy, Science and Religion: Science and Philosophy(Certificate)
  Philosophy and the Sciences I: Introduction to the Philosophy of Cognitive Sciences(Certificate)
  Philosophy and the Sciences II: Introduction to the Philosophy of Physical Sciences(Certificate)

TECHNICAL SKILLS

- Programming languages
  I have medium knowledge of GitHub, Linux and following programming languages:
  Python, SQL, matlab, Mathematica and C

- Machine Learning using Matlab
  Machine Learning by Stanford University(Certificate)

- Information technology
  Technical Support Fundamentals by Google(Certificate)
  The Bits and Bytes of Computer Networking by Google(Certificate)
  Operating Systems and You: Becoming a Power User by Google(Certificate)
  System Administration and IT Infrastructure Services by Google(Certificate)
  IT Security: Defense against the digital dark arts by Google(Certificate)
  Build a Modern Computer from First Principles: From Nand to Tetris(Certificate)
  Operating Systems and You: Becoming a Power User by Google(Certificate)

TEST SCORES

- Council for Scientific and Industrial Research, National Eligibility Test (CSIR Net) - 11^{th} all india rank in Physics June 2019
- Council for Scientific and Industrial Research, National Eligibility Test (CSIR Net) - 16^{th} all india rank in Physics Dec 2018
- Tata Institute of Fundamental Research (TIFR) - GS 2020 Qualified (list of Qualified candidates) and written test II Qualified (list of Qualified candidates)
- ONGC-BARC national competition exam 2020 cleared.
- Joint Entrance Screening Test (JEST) - 16^{th} all india rank in Physics Feb 2020
- Graduate Aptitude Test Engineering (GATE) - 57^{th} all india rank in Physics Feb 2020

SEMINARS, CONFERENCES AND WORKSHOPS ATTENDED

- 2 June 2017 - 15 June 2017
  Partial diffrential equation - IISER Bhopal, India
- 6 May 2018 - 12 May 2018
  Modern Physics and Ancient Indian Wisdom - NIAS Bangalore, India
- 18 June 2018 - 07 July 2018.
  Summer Programme in Mathematics (SPIM) in Mathematics - HRI Allahabad, India
- 16 Feb 2019
  Science Communication workshop (SciComm 101) by Wellcome Trust DBT India Alliance - IISER Bhopal, India
- 09 Nov 2019
  MATLAB Workshop - IISER Bhopal, India
- 22 Dec 2019 - 27 Dec 2019
  National Strings Meeting 2019 - IISER Bhopal, India
- 27 Jan 2020 - 30 Jan 2020
  The Fourth Paradigm : From Data to Discovery - IISER Bhopal, India

TALKS AND PRESENTATIONS

- Abbe Refractometer - 06^{th} Nov. 2017, Physics Laboratory, IISER Bhopal (Slides)
- Atomic Force Microscopy - 10^{th} April 2018, Physics Laboratory, IISER Bhopal (Slides)
- Hall Effect - 01^{st} Nov. 2018, Physics Laboratory, IISER Bhopal.(Slides)
- GM (Geiger–Muller) Counter - 07^{th} April 2019, Physics Laboratory, IISER Bhopal.(Slides)
- Symmetries of Asymptotically flat space-time - 18^{th} Nov 2019, Physics Department, IISER Bhopal.(Slides)
- Neutrino Mass and Oscillation - 25^{th} May 2021, CHEP, IISc Bengaluru. (Slides)
- Hierarchical mass from Abstract Structures - 06^{th} Nov 2022, CHEP, IISc Bengaluru.