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# P. SHUBHANG SHARMA

**RESEARCH INTERESTS**

Broadly in Geometry and Mathematical Physics. In particular, open to explore topics in differential geometry, quantum geometry and quantum topology – including directions like Gauge Theory, Mirror Symmetry, Symplectic Geometry, Quantization, Topological Quantum Field Theories e.t.c.

**EDUCATION**

National Institute of Science Education and Research (NISER) 2020-2025
*Integrated M.Sc. in Physics* | *Bhubaneswar, India* CGPA: 8.69/10

FIITJEE Junior College 2018-2020
*Higher Secondary Education* | *Hyderabad, India* Score: 98.2%
Top 1% in State (Telangana, India).

**MASTER'S DISSERTATION**

AdS/CFT Correspondence and Conformal Geometry Fall 2024, Spring 2025
*Advisor: Dr. Yogesh K. Srivastava*

Studied Riemannian geometry, AdS geometry, structure of 2d CFTs, and their connections. Computed boundary CFT correlation functions via bulk AdS gravity using two equivalent AdS/CFT prescriptions. Related Fefferman & Graham *conformal invariants* (the ambient metric framework) to some formal aspects of conformal boundary in AdS/CFT.

**RELEVANT COURSEWORK**

Mathematics
· Metric spaces
· Calculus of Several Variables
· Rings and Modules
· Geometry of Curves and Surfaces
· Differential equations
· Introduction to Manifolds

Physics
· Special Relativity
· Quantum Field Theory I & II
· General Relativity
· Particle Physics (audited)
· Astronomy and Astrophysics

**PROJECTS**

Notes on Differential Geometry (*in progress*) Spring & Fall 2025
*Course: Introduction to Manifolds, Instructor: Dr. Chitrabhanu Chowdhury*

Detailed notes on manifolds, tangent spaces, submanifolds, vector bundles, vector fields, differential forms, integration on manifolds and Stokes' theorem.

Semester Reading project on Gauge Theory Spring 2024
*Course: Quantum Field Theory II, Instructor: Dr. Yogesh K. Srivastava*

Studied Lagrangian construction for a non abelian type gauge theory, gauge field geometry and differential geometric formulation of Electromagnetism. Delivered as a chalkboard presentation followed by viva voce.

Open Lab experiment on Energy Transfer in Electric Circuits Fall 2023
*Course: Integrated Physics Laboratory I, Instructor: Dr. Kartikeswar Senapati*

Built a $39m$ long transmission-line model to demonstrate the artefacts of a field-based (Poynting vector) energy transfer. Recorded nanosecond level voltage steps ($40 - 140ns$) across the load using a GHz oscilloscope.

Term Paper on Finite Difference Methods Spring 2023
*Course: Computational Physics, Instructor: Dr. Subhasish Basak*

Implemented finite difference methods for PDEs, including the schemes of Gauss–Seidel, SOR, and Multigrid to improve convergence. Demonstrated these methods on a Laplace equation with specified boundary constraints.

## AWARDS /SCHOLARSHIP

**DST-INSPIRE Scholar** 2020 – 2025
*National Scholarship for Higher Education (SHE) awarded for ranking in the top 1% of performers in Higher Secondary Education*

## PROGRAMMING SKILLS

### Computational Physics — Library

*Int. MSc. Coursework*

- Built a numerical-methods Python library with ODE/PDE solvers (like RK4), numerical integration (like Monte Carlo), polynomial fitting, interpolation, and custom RNGs.
- Also worked on non-linear root finding (Newton-Raphson, bisection), and linear system solvers like Gauss-Jordan, LU, Cholesky, Jacobi and Gauss-Seidel.

### Creative Coding — Past projects

*Art* × *Code* × *Science* — p5.js

- Experience in the JavaScript library **p5.js**: a *sketch with code* tool to make artistic, interactive visualizations.
- Math + Physics $\xleftarrow{\text{Code}}$ Art

### Web Development (HTML, CSS) — Personal webpage

*Communication* × *Code* × *Art* — *Source Code*

Self-taught HTML and CSS to build minimal websites with an eye towards an artistic appeal for scientific and personal blogging.

## SCI-COMM. + DESIGN

**Re-counting numbers: An abstract trail to Reals** Fall 2025
*[1], [2], [3], [4], [5], 6th in progress*
*A 6-part article series communicating the abstract beauty of number systems.*

**Vector Illustrations using INKSCAPE** Fall 2025
*Some mathematical expressions using vector art.*

**On the Geometry of Curves and Surfaces** Spring 2024
*Narrating the key highlights of classical differential geometry.*

**Representations of Lorentz Group à la Quantum Field Theory** Spring 2024
*Reconciling the relation between representation of Lorentz group and the quantum fields.*

**Hydrogen Atom: The final take?** Fall 2023
*Revisiting hydrogen atom, with all its fine structures.*

## MANAGERIAL ROLES

Undergraduate Committee of the Institute 2022-2023
*Student representative for the School of Physical Sciences, NISER*

NISER Film Club's Interview with Dr. Ritwick Das Spring 2023
*Co-producer, editor and interviewer*

## LANGUAGES

English, Hindi, Telugu (fluent) and Kannada (conversational)

## HOBBIES

### Outdoors — *Strava profile*

Long-distance running/cycling/walking, Hiking and badminton

### Indoors

Music, Origami, Cooking