

# Arohan PAUL

## PERSONAL DATA

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DATE OF BIRTH: 15 September 1995

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## EDUCATION

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May 2019	Integrated M.Sc Mathematics, <b>National Institute of Technology</b> , Rourkela GPA: 8.56/10 (3 times awardee of the <b>Certificate of Merit</b> )
MAY 2013	Intermediate in Science, <b>Joy Senior Secondary School</b> , Jabalpur Percentage: 87.4
MAY 2011	Matriculation <b>Joy Senior Secondary School</b> , Jabalpur CGPA: 9.6

## WORK EXPERIENCE

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READING PROJECT	<b>National Institute of Technology, Rourkela</b> Guide: Prof. Debajyoti Choudhuri In this reading project, I covered the fundamental principles of Special Relativity, minkowski's spacetime and related concepts, the lorentz transformation and their consequences, and vector analysis in special relativity. I mainly concentrated on the book <b>A first course in General Relativity</b> by <i>Bernard Schutz</i> studying the first two chapters along with the exercises.
VISITING STUDENT	<b>Harishchandra Research Institute</b> I Attended the Annual Foundation School(AFS-1). The courses taught were Algebra, Analysis and Topology. I mainly concentrated on Topology, covering the first eight sections of second chapter and the first three sections of third chapter, from the book <b>Topology</b> by <i>James R Munkres</i> .

**SUMMER RESEARCH FELLOW****Jawaharlal Nehru Centre for Advanced Scientific Research**

Guide: Dr. Meheboob Alam

Aim of this reading project was to understand the phenomenon of Chimera States in Coupled Oscillators. The research papers that I worked on were → **Chimera States for Coupled Oscillators** by *Daniel M Abrams* and *Steven H Strogatz*, **Coexistence of coherence and incoherence in nonlocally coupled phase oscillators** by *Yoshiki Kuramoto* and *Dorjsuren Battogtokh*, **Solvable model for chimera states of coupled oscillators** by *Daniel M. Abrams*, *Renato E. Mirollo*, *Steven H. Strogatz*, and *Daniel A. Wiley*, **Low dimensional behavior of large systems of globally coupled oscillators** by *E. Ott* and *T. M. Antonsen*. Some of the topics that I went through were - Kuramoto's Model for identical oscillators, Bifurcations of Chimera States, Stability of Chimera States, Chimeras on arbitrary networks, Poincare Bendixon Theorem.

**READING PROJECT****National Institute of Technology, Rourkela**

Guide: Prof. Debajyoti Choudhuri

Aim of this reading project was to understand the basics of Differentiable Manifolds. I mostly followed the book **Introduction to Smooth Manifolds** by *John M. Lee* and some lecture notes provided by my professor. As a part of the project, I covered the first two chapters and a part of the third chapter of Lee's book i.e., the concepts of topological manifolds, smooth structures on manifolds, examples of smooth manifolds, manifolds with boundary, smooth functions and smooth maps, tangent vectors on manifolds, and the differential of a smooth map.

**VISITING STUDENT****Indian Institute of Science.**

Guide: Prof. Harish Seshadri

Aim of this reading project was to understand the concepts of Multi-variable Differential Calculus- frechet derivative, inverse function theorem, implicit function theorem, local study of immersions and submersions, mean value inequalities. I mostly followed the book **A course in Differential Geometry and Lie Groups** by *S. Kumaresan*.

**SUMMER RESEARCH FELLOW****National Institute of Science Education and Research**

Guide: Prof. Ritwik Mukherjee

Aim of this project was to work on the paper **On Manifolds Homeomorphic to the 7-Sphere** by *John Milnor*. To supplement the reading of this paper, I went through several sources → **Notes on Smooth Manifolds and Vector Bundles** by *Aleksey Zinger*, **Milnor's Construction of Exotic 7-Spheres** by *Rachel Mcenroe*. this reading project, I studied the following topics- definition of manifolds, examples of manifolds ( $\mathbb{S}^n$ ,  $\mathbb{RP}^n$ ), smooth maps between manifolds, fiber bundles, examples of fiber bundles(mobius strip, cylinder, tautological line bundle), complex hopf fibration, quaternionic hopf fibration, examples of exotic  $\mathbb{S}^7$ .

MASTER'S THESIS | My Master's thesis was on **Poisson Equation over Manifolds** under the guidance of Prof. **Bata Krishna Ojha** and Prof. **Debajyoti Choudhuri**. I did a detailed study of the fundamentals of smooth manifolds mostly following the book **Introduction to Smooth Manifolds** by **John M. Lee**. I covered important concepts like Tangent Spaces, Vector Bundles, Differential Forms, Integration over Manifolds. I further used these ideas to review the paper **Poisson Equation on Closed Manifolds** by **Andrew MacDougall**.

READING PROJECT | I did a reading project on **Hamiltonian Dynamics over Symplectic Manifolds** with Professor **Tatyana Barron** at Western University. I went through a detailed study of Hamiltonian and Lagrangian formalism of mechanics over  $\mathbb{R}^n$  and the Legendre Transformation that gives a way to switch between the two formalisms. Followed by this, I went through a study of Symplectic Manifolds in a way that allows the introduction of Hamiltonian Dynamics. Some of the references that I have worked on are → **Classical Mechanics** by *Herbert Goldstein*, **Quantum Theory for Mathematicians** by *Brian C. Hall*, **Introduction to Smooth Manifolds** by *John M. Lee*, **Quantization Methods: A Guide For Physicists And Analysts** by *S. Twareque Ali And Miroslav Engliš*,

## RELEVANT COURSES

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MATHEMATICS | Real Analysis and Multivariable Calculus, Complex Analysis, Mathematical Methods, Algebra, Number Theory, Numerical Analysis, Linear Programming, Probability and Statistics, Topology, Linear Algebra, Partial Differential Equations, Measure Theory, Functional Analysis, Homotopy Theory, Differentiable Manifolds, Fluid Dynamics, Finite Difference Methods. Topics in Category Theory, Rings and Modules, Differential Geometry, Introduction to General Relativity, Introduction to Lie Groups, Field Theory, Algebraic Topology, Functional Analysis.

COMPUTATIONAL COURSES | Data Structures and Algorithms, Computing Laboratory, Numerical Methods Laboratory, Simulation Laboratory, Numerics of Ordinary Differential Equations, Numerics of Partial Differential Equations, Statistics Laboratory using R, Laboratory work on Wavelets, Soft Computing Laboratory, Computational Fluid Dynamics Laboratory, Laboratory work on Matrix Theory, Optimization Laboratory.

ONLINE CERTIFICATIONS | Advanced Certification in Data Science and AI (IIT Madras), Introduction to Machine Learning (IIT Kharagpur (NPTEL)), Neural Network and Deep Learning (Stanford (Coursera)), Currently ongoing course on Data Mining by IIT Kharagpur (NPTEL).

## TECHNICAL SKILLS

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GENERAL PROGRAMMING | C,C++, Python  
OTHER SOFTWARE | MATLAB, R

## TEACHING EXPERIENCE

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I worked as a Graduate Teaching Assistant at Western University, Canada. As a teaching assistant, I mentored students for the specific assigned courses - **Calculus, Applied Mathematics, Algebra, and Analysis**. Created marking schemes and graded exams and assignments. I also supervised a student project titled **Construction of the Real Number System** as part of the Directed Reading Program.

Attended a workshop titled **Teacher Assistant Training Program** which involved giving lectures to my peers and attending courses on curriculum design and innovative teaching methods.

## CURRENT TUTORING

Currently I am working as a **Chegg Subject Matter Expert** for Advanced Mathematics. I am also working part-time as a tutor with **Ellys Academy**.

## LANGUAGES

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ENGLISH	Fluent
HINDI	Fluent
BENGALI	Mother Tongue