Santanu Pradhan

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Personal Profile

A self-motivated and passionate individual looking to pursue a PhD in Astro and High-Energy Physics. A current MSc. student at IIT INDORE with a profound desire to research into Astrophysics, specifically the Gravitational wave, Black Hole & Cosmology, Quantum Gravity area. Extensive drive and ambition for research which was further amplified after obtaining the highest grades in the 'Quantum Mechanics & Mathematical Physics' module in a class of over 30 physics students and ranking within the top three of my first-year cohort. Experience in mathematical and physical research as well as presenting at conferences and constructing research papers.

Education

Indian Institute of Technology, Indore **July 2022 – Present**

- Master of Science in Physics *GPA: 8.57/10.0 (till now)*
- **Relevant Modules:** Quantum Field Theory & Standard Model, Quantum Mechanics, Electrodynamics, Mathematical physics, Nuclear and Particle Physics, Classical Mechanics, Statistical Mechanics, Solid State Physics, Atomic & Molecular Physics, Electronics, Physics Laboratory-I & II, Seminar Course, Research Project-I, Research Project-II.

Ramakrishna Mission Residential College, Narendrapur **June 2019 – June 2022**

- University of Calcutta
- Bachelor of Science in Physics (Hons.) *CGPA: 8.57/10.0 (First class Hons)*
- **Coursework:** Mathematical Physics-I & II, Wave and Optics, Elements of Modern Physics, Thermal Physics, Quantum Mechanics & Applications, Nuclear & Particle Physics, Statistical Mechanics, Electromagnetic Theory, Classical Dynamics, Electricity & Magnetism, Advanced Mathematical Physics, Mechanics, Digital Systems & Applications, Solid State Physics, Nano Materials & Applications, Analog Systems & Applications, Linear Algebra, Integral Calculus, Modern Algebra, Differential Calculus, Differential Equations, Linear Programming, Essentials of Chemistry-I & II, Lab experiments with all these relevant courses.

Lalat Gangadhar Pathsala High School **April 2017 – April 2019**

- Higher Secondary Education in Science, WBCHSE Board *Marks: 95.6 % (1st in District level)*
- **Subjects Taken:** Physical Sciences, Mathematics, Chemistry, Biological Sciences, English, Bengali

Research Interests

- **Astrophysics and Cosmology**
- **High Energy Physics**
- **Dark Matter and Dark Energy**
- **Quantum Gravity**
- **Gravitation**
- **Quantum Field Theory**

Research Experience

A Brief Study of Quasi-Normal Modes of Different Kinds of Black Holes **January 2024 – Present**

Supervisor: *Dr. Manavendra Mahato* *IIT INDORE*

- Calculated QNMs for Kerr Black hole with a new technique and compared the result with Leaver.
- Studying about Kerr Sen Black hole and calculating QNMs and love numbers for Kerr black hole from AdS_2 Black Holes.
- Trying to calculate The QNMs for Kerr Newman Black Hole.
- Presented all the works in a seminar organized by the Physics Department, IIT Indore. *PDF*

Properties of Anti De Sitter Black Holes **July 2023 – December 2023**
Supervisor: *Dr. Manavendra Mahato* *IIT INDORE*

- Studied about AdS/CFT correspondence, Black hole thermodynamics, Holographic duality, large N expansion as a string theory, Physics of D-branes.
- Trying to calculate some correlation functions for finite-temperature field theories & explore its properties .
- Studying on AdS space-time, thermal phase transition, trying to explore some properties of anti de sitter black holes.
- All the works involved a written report in LaTeX. *PDF*
- Presented all the works in a seminar organized by the Physics Department, IIT Indore.

Unruh Radiation **January 2023 – June 2023**
Supervisor: *Dr. Manavendra Mahato* *IIT INDORE*

- Learned briefly about General relativity, Cosmology & Black holes and performed some mathematical calculations regarding *QFT in curved space time.*
- Within this time period, went through some research papers in order to complete this project.
- Presented all the works in seminar organized by Physics Department, IIT Indore.

Additional Experience

A Brief Study of Green's Function and It's Application in Physics **January 2022 – July 2022**
Supervisor: *Prof. Amit Ray* *RKM Residential College*

- Learned various techniques of Green's function to solve differential equations.
- As applications, tried to solve different kinds of problems that usually arise in physics and mainly focused on Quantum Scattering Theory.
- All the calculations involved a written report in LaTeX.

Competencies & Languages

Operating Systems: Linux, Windows
Programming: Python, C++
Tools: LaTeX
Data Analysis: Mathematica, Matplotlib, OriginLab
Languages: English, Bengali, Hindi

Conferences & Seminar

- Public lecture on *Type Ia Supernovae in the Near Infrared: A Unique constraint on Dark Energy (2^{nd} March, 2023)* – by Prof. Robert Kirshner, Executive Director, Thirty Meter Telescope International Observatory.
- Seminar topic *Can Spirals help the Milky Way 'breathe'? - A Quest with Simulations & Gaia Mission (2^{nd} January, 2023)* – by Dr. Soumavo Ghosh, Max Planck Institute for Astronomy (MPIA), Heidelberg, Germany.
- Seminar on *A Mechanism for Black Hole Microstate Level Spacing (13^{th} January, 2023)* – by Dr. Chetan Krishnan, Center for High Energy Physics (CHEP) at IISc, Bengaluru.
- *Young Physicists' Meet (28^{th} December, 2022)* – All the young renowned physicists gave their talk briefly on their research experience and current research topics.
- Seminar on *Descriptive Archaeoastronomy and Ancient Indian Chronology (29^{th} December, 2022)* – by Prof. Amitabha Ghosh, IIEST, Shibpur.
- Online Conference on *Penrose diagrams for different black hole geometries (SC, RN, Kerr et. al) in various backgrounds (Flat-Minkowski and AdS) (4 Aug, 2022)* – by Dr. Sabir Ali, IISER, Kolkata.

Honours and Awards

JM Sethia Charitable Trust Merit Scholarship **2023 – Present**

- Selected in top 47 students in all India.

INSPIRE Scholar **2019 – Present**

- Awarded by Govt. of India as selected in top 1% meritorious students.

Swami Vivekananda Merit-cum-Means Scholarship **2019 – 2022**

- Awarded by State Government for Academic Excellence.

Swami Vivekananda Merit-cum-Means Scholarship **2017 – 2019**

- From State Government for Academic Excellence.

National Means-Cum-Merit Scholarship **2016 – 2019**

- Secured 2nd position in district level out of 500,000+ students.

Academic Excellence Award **2020**

- For securing top position during freshman year of undergrad college.

Academic Excellence Award **2019**

- For securing 1st postion in HSE Exam in District level.

Bhagabati Devi Memorial Prize **2019**

- For securing 1st postion in HSE Exam in Block level.

Extracurricular Activities

- One of the core member of organising committee of *Sci-Phy Quiz event* in undergrad college.
- Secured 3rd position among 15,000+ examinees in *Paschim Banga Vigyan Mancha Exam.*
- Always ranked 1st out of 100+ students since class 5 to class 12 in my School.
- Participated in *General Knowledge Quiz Competition (in 2018)* and selected in top 16 teams out of 500+ teams and got a chance to play with famous 'Dadagiri 'quiz master Mr. Santu Jana.
- Studied *The Bhagavad Gita* and can recite with melody. Also familiar with multiple Sanskrit mantras, showcasing cultural and linguistic proficiency.
- Engaged in *Environmental Studies*, gaining a deep grasp of ecosystem dynamics and human-environment interplay.
- Successfully completed an intensive course on *Sensible Citizens*', honing essential skills in civic responsibility, community engagement, and ethical decision-making.

Interests

- Playing Cricket, Golf, Video Games
- Listening Hollywood Hip Hop, K-pop Music
- Watching K-drama, Hollywood Sci-fi movies
- Watching Football
- Reading Biological Science books, Physics Research Papers.

References

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