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EDUCATION

Indian Institute of Technology (I. I. T.) Gandhinagar — Gandhinagar, India
Ph. D. in Theoretical Physics — *2015- 2020*

Indian Institute of Technology (I. I. T.) Bombay — Mumbai, India
M. Sc. Physics — *August 2015*

Govt. College Madappally (University of Calicut) — Kozhikode, India
B. Sc. Physics — *May 2013*

RESEARCH INTERESTS

My research focuses on general relativity and its extensions, including modified theories of gravity like Lanczos-Lovelock and Einstein-Gauss-Bonnet gravity. I am particularly interested in the thermodynamics of black holes, exploring phenomena such as phase transitions and entropy. Additionally, I investigate the quantum mechanical aspects of black hole thermodynamics, aiming to deepen our understanding of gravity's quantum nature.

RESEARCH EXPERIENCE

Doctor of Philosophy

Title: "Aspects of Black Hole Thermodynamics in General Relativity & Beyond"
Advisor: Dr. Sudipta Sarkar

Understanding the physics of black holes is expected to reveal hints about the quantum nature of gravity. One of the promising tools in this regard is to study the thermodynamic properties of black holes. My thesis explores certain aspects of black hole thermodynamics in general relativity and higher curvature gravity theories. Quantum general relativity is perturbatively non-renormalizable. As a result, it may make sense as an effective theory with new interactions at higher energies. This is the primary motivation for considering higher curvature theories of gravity. Also, string theory calculations suggest that these higher-order terms can arise from the quantum corrections to the Einstein-Hilbert action. In this thesis, we consider a well-motivated higher curvature theory, i.e., the Lanczos-Lovelock theory of gravity.

Master of Science, Physics

Title: "Study on Vertex Based Cell Model"
Advisor: Prof. Mandar M. Inamdar

This project developed a novel computational model for cellular motion using the CHASTE framework, focusing on tissue development through a mechanical, vertex-based model. We explored the kinematics of cellular structures under realistic boundary conditions and simulated circulating cell colonies in the presence of a polarization field. The simulation results aligned well with experimental observations.

ACADEMIC HONORS

- Indian Academy of Science Summer Research Fellowship 2024 (completed)
- Atlas Research Travel Grant (ARTG) for attending IAGRG (Indian Association for General Relativity and Gravitation), 2019.

- Honorable Mention in the 2018 Gravity Research Foundation Essay Competition for the paper: *Boundary Conservation from Bulk Symmetry* by **C. Fairoos**, A. Ghosh, and S. Sarkar.
- Junior Research Fellowship by University Grand Commission (UGC) India, 2017.
- Joint Entrance Screening Test (JEST), Rank -572, 2015.
- Graduate Aptitude Test in Engineering (GATE), 2015
- Joint Admission Test for Masters (JAM), Rank - 189, 2013

TEACHING EXPERIENCE

- **Assistant Professor of Physics.** T. K. M. College of Arts and Science Kollam, Kerala, India-691005, December 2021- Present.
- **Assistant Professor of Physics** (on contract) Govt. Arts and Science College Nadapuram, Chiyyoor, Kerala, India- 673506, June 2021 - September 2021.
- **Assistant Professor of Physics** (on contract) Malabar Christian College, MCC Cross Rd, Kozhikode, Kerala 673001, November 2020 - March 2021.
- **Assistant Professor of Physics** (on contract) Farook College (Autonomous), Farook College Rd, Kozhikode, Kerala 673632, July 2020 - October 2020.
- **Teaching Assistant.** PH 505 Classical Electrodynamics, Dr. Anand Sengupta, Semester II 2018-19, Indian Institute of Technology Gandhinagar, India.
- **Teaching Assistant.** PH510 Condensed Matter Physics, Prof. R. R. Puri and Dr. Rupak Banerjee, Semester I 2017-18, Indian Institute of Technology Gandhinagar, India.
- **Teaching Assistant.** PH607 Topics in Quantum and Statistical Mechanics, Prof. R. R. Puri, Semester II 2016-17, Indian Institute of Technology Gandhinagar, India.
- **Teaching Assistant.** PH 508 Classical Mechanics, Dr. Sudipta Sarkar and Dr. Barun Majumdar, Semester I 2016-17, Indian Institute of Technology Gandhinagar, India.
- **Teaching Assistant.** [Special Course] Special Theory of Relativity, Dr. Sandipan Sengupta, Semester II 2015-16, Indian Institute of Technology Gandhinagar, India.

PUBLICATIONS

1. C. Fairoos, T. K. Safir, and Deepak Mishra, "Phase-space path integral approach to the kinetics of black hole phase transition in massive gravity", *Annals of Physics*, October 2024.
2. C. Fairoos, "Topological interpretation of black hole phase transition in Gauss-Bonnet gravity", *International Journal of Modern Physics A (IJMPA)*, February 2024.
3. C. Fairoos and T. Sharqui, "Topological Nature of Black Hole Phase Transitions in dRGT Massive gravity", *International Journal of Modern Physics A (IJMPA)*, September 2023.
4. T.K. Safir, A. Naveena Kumara, Shreyas Punacha, C.L. Ahmed Rizwan, C. Fairoos, Deepak Vaid, "Dynamic phase transition of black holes in massive gravity", *Annals of Physics*, November 2023.
5. T. K. Safir, C. Fairoos, Deepak Vaid, "Physical process first law and the entropy change of Rindler horizons", *Annals of Physics*, March 2023.
6. R. Ghosh, C. Fairoos, S. Sarkar, "Overcharging higher curvature black holes", *Phys. Rev. D*, December 2019.
7. C. Fairoos, A. Ghosh and S. Sarkar, "Boundary Conservation from Bulk Symmetry", *Int. J. Mod. Phys. D*, October 2018.
8. C. Fairoos, A. Ghosh and S. Sarkar, "Black Hole Entropy production and Transport coefficients in Lovelock Gravity", *Phys. Rev. D*, July 2018.
9. C. Fairoos, A. Ghosh and S. Sarkar, "Massless charged particles: Cosmic censorship, and the third law of black hole mechanics", *Phys. Rev. D*, October 2017.
10. C. Fairoos, S. Sarkar and K. P. Yogendran, "Higher curvature self-interaction corrections to Hawking Radiation", *Phys. Rev. D*, July 2017.

TALKS

CONFERENCE TALKS

1. "Massless charged particles: Cosmic censorship and the third law of black hole mechanics", *30th meeting of the Indian Association for General Relativity and Gravitation (IAGRG)*, BITS Pilani Hyderabad Campus, January 2019.
2. "Black hole entropy production And transport coefficients", *Young Physicist's Meet (YPM-17)*, Physical Research Laboratory, Gujarat, April 2018.
3. "Higher curvature self-interaction corrections to Hawking Radiation", *30th meeting of the Indian Association for General Relativity and Gravitation (IAGRG)*, IIT Guwahati, Assam, May 2017.
4. "Self-interaction correction to black hole radiation for Einstein-Gauss-Bonnet gravity", *Young Physicist's Meet (YPM-17)*, Physical Research Laboratory, Gujarat, March 2017.

OTHER TALKS

5. "Uniformly accelerated charge and related paradoxes", Inter-University Centre for Astronomy and Astrophysics (IUCAA), Pune, India June 2024.
6. *(various venues)* "Thermodynamics of Black Holes",
   - *(Invited)* Dept. of Physics, Shree Viduadhiraja College of Arts and Science, Karunagappally, Kerala India, March 2024.
   - *(Invited)* "Refresher Course in Physics and Nano-technology", Bharathiyar University , Coimbatore, Tamil Nadu 641046, September 2021.
   - *(Invited)* Department of Physics, A. V. A. H. Arts and Science College, Kozhikode, Kerala, India, September 2021
   - *(Invited)* "20 Weeks with Physics Alumni", Govt. College Madappally, Vadakara, Kerala, India, January 2021.
7. "Physics of Black holes", Lecture Series at Dept. of Physics, Malabar Christian College, Kozhikode, Kerala, India, February-March 2021.
8. "Physics Nobel- 2020", Department of Physics, T. K. M. College of Arts and Science Kollam, Kerala, India, September 2020.
9. "Hamiltonian Formulation of General Relativity" Physics Talk Series, Discipline of Physics, I. I. T. Gandhinagar, Gujarat, India, January 2017.

SUPERVISED MASTER'S PROJECTS

- "A Simple Derivation of Hawking Radiation", S. Shahana, T. K. M. College of Arts and Science Kollam, August 2023.
- "Accelerated Observer and the Unruh effect", V. S. Aiswarya, T. K. M. College of Arts and Science Kollam, August 2023.
- "Hawking Radiation- An introduction to Black Hole Thermodynamics", J. Gopikrishnan, MMNSS College Kottiyam, September 2022.
- "Relativistic contributions to Mercury's perihelion precession", A. Bismi, T. K. M. College of Arts and Science Kollam, July 2022.
- "Uniformly accelerating charged particle and conservation of energy", R. S. Reshma, T. K. M. College of Arts and Science Kollam, July 2022.

CERTIFICATE COURSES

- Refresher Course on Astronomy and Astrophysics, Inter-University Centre for Astronomy and Astrophysics (IUCAA), May 15 - June 13, 2024
- Re-energizing Higher Education: Faculty Development Program, Teaching Learning Centre, T. K. M. College of Arts and Science Kollam 4-12 July 2023
- Science Academies' refresher course in Theoretical Physics, Bishop Moore College Mavelikkara, 15 June - 1 July 2023.
- Teaching-Learning Methods: From Micro-Teaching to Peer Learning, Faculty Development Program, Teaching Learning Centre, Ramanujan College, University of Delhi, 11-17 June 2022.

PROFESSIONAL ACTIVITIES

- Core Committee Member, Kerala Theoretical Physics Initiative (KTPI), March 2024- Present
- President, Institution's Innovation Council (IIC), T. K. M. College of Arts and Science Kollam June 2022-Present.
- Coordinator, Atal Ranking of Institutions on Innovation Achievements (ARIIA), T. K. M.College of Arts and Science Kollam, February 2022- Present.
- Nodal Officer, Innovation and Entrepreneur Development Centre, T. K. M. College of Arts and Science Kollam, February 2022- August 2023.

SERVICE

- Reviewer (Journals) - *Modern Physics Letters A and American Journal of Astronomy and Astrophysics(AJAA).*