Krishnamohan Parattu

Personal Data

Current Address	Chitrakam, Nadavaramba, Thrissur, Kerala, India, 680 661
Nationality	Indian
Date and Place of Birth	21-1-1986, Kerala, India
Email	mailofkrishnamohan@gmail.com
Mobile	+91 8698457163
Marital Status	Married

Timeline

Oct 2018- Aug 2021	Fondecyt Postdoctoral Fellow, **PUCV, Valparaiso, Chile** Mentor: Prof. Dumitru Astefanesei
Apr 2018- Aug 2018	DGAPA Postdoctoral Fellow, **UNAM, Mexico City, Mexico** Mentor: Prof. Chryssomalis Chryssomalakos
Sep 2017- Mar 2018	SERB National Postdoctoral Fellow, **IIT Madras, Chennai, India** Mentor: Prof. L. Sriramkumar
Dec 2016- Aug 2017	Institute Postdoctoral Fellow, **IIT Madras, Chennai, India** Mentor: Prof. L. Sriramkumar
Sep 2016- Nov 2016	Visiting Postdoctoral Fellow, **Perimeter Institute, Canada**
2015-2016	Research Scholar post PhD, **IUCAA, Pune, India**
2010-2015	PhD, **IUCAA, Pune, India** Advisor: Prof. Thanu Padmanabhan
2009-2010	Project Assistant, **IISc, Bangalore, India** under DST[1] project of Prof. Sudhir Vempati Worked with Dr. Akin Wingerter

[1]Department of Science and Technology, India

2007-2009	MSc Physics, **IIT Bombay, Mumbai, India** *First in batch, Institute Silver Medal*
2004-2007	BSc (Physics, Chemistry, Maths), **Christ College, Bangalore, India**

Selected Academic Distinctions

High School	♦ Among top 25 in National Science Olympiad
10+2	♦ School topper in science stream in CBSE +2 exam
BSc	♦ Selected under Young Science Fellowship Programme to undertake a project at Indian Institute of Science, Bangalore ♦ All India Rank 15 in JAM examination for admission to MSc Physics at IITs [2]
MSc	♦ Silver Medal for topper of MSc Physics 2007-2009 batch, IIT Bombay ♦ All India Rank 1 in GATE and JEST examinations, 2009[3] ♦ 990/990 in Physics GRE, 2009 ♦ 1580/1600 in GRE, 2009 ♦ Selected under Indian Academy of Science Summer Fellowship programme, 2009, for a two month summer project
PhD	♦ Awarded Junior Research Fellow (JRF) by qualifying through the National Eligibility Test (NET) [4] ♦ Recipient of Shyama Prasad Mukherjee Fellowship [5] as a Junior Research Fellow in 2011. Upgraded to the status of Senior Research Fellow in 2014.

[2] IIT - Indian Institute of Technology

[3] Two national level examinations whose scores are accepted for entrance to PhD programmes in physics at premier institutes across India.

[4] A national level eligibility exam conducted by the Indian government for aspiring teachers and researchers

[5] A government fellowship awarded by Council of Scientific and Industrial Research to less than ten exceptional PhD scholars in each discipline every year and reviewed after two years for promotion

Research interests

Primarily, I consider myself a mathematical physicist applying mathematical techniques to various aspects of physics. I worked on particle physics early in my career. My first few papers were on the application of discrete symmetries to neutrino mixing. During my PhD, my research focus shifted to gravity and some aspects of quantum mechanics. I studied the dynamics of gravity, focusing on Einstein's general relativity and a particular generalization to higher dimensions known as Lanczos-Lovelock gravity. In particular, I explored the structure of the action and the boundary terms (total derivative terms) required in gravitational theories. A main result obtained by our group in this direction was the generalization of boundary terms in the literature to the case of null boundaries (when the boundary is formed by a light front). I have also worked on various aspects of quantum mechanics during my PhD and as a postdoc. Currently, I am working on the structure of the actions for various theories of gravity and on the application of quantum information theory to cosmological scenarios.

Publications

Published in Journals

[1] S. Chakraborty and K. Parattu, "Null boundary terms for Lanczos–Lovelock gravity," *Editor's Choice, Gen.Rel.Grav.* **51** (2019) no.2, 23, arXiv:1806.08823.

[2] S. Chakraborty, K. Parattu, and T. Padmanabhan, "A Novel Derivation of the Boundary Term for the Action in Lanczos-Lovelock Gravity," *Gen.Rel.Grav.* **49** (2017) no.9, 121, arxiv:1703.00624.

[3] K. Parattu, S. Chakraborty, and T. Padmanabhan, "Variational Principle for Gravity with Null and Non-null boundaries: A Unified Boundary Counter-term," *Eur. Phys. J.* **C76** (2016) 129, arxiv:1602.07546.

[4] S. Chakraborty, K. Parattu, and T. Padmanabhan, "Gravitational Field Equations near an Arbitrary Null Surface expressed as a Thermodynamic Identity," *JHEP* **10** (2015) 097, arxiv:1505.05297.

[5] K. Parattu, S. Chakraborty, B. R. Majhi, and T. Padmanabhan, "A boundary term for the gravitational action with null boundaries," *Gen. Rel. Grav.* **48** (2016), no. 7, 94, arxiv:1501.01053.

[6] K. Lochan, K. Parattu, and T. Padmanabhan, "Quantum Evolution Leading to Classicality: A Concrete Example," *Gen. Rel. Grav.* **47** (2015), no. 1, 1841, arxiv:1404.2605.

[7] K. Parattu, B. R. Majhi, and T. Padmanabhan, "Structure of the gravitational action and its relation with horizon thermodynamics and emergent gravity paradigm,"

Phys.Rev. **D87** (2013), no. 12, 124011, arxiv:1303.1535.

[8] C. Luhn, K. M. Parattu, and A. Wingerter, "A Minimal Model of Neutrino Flavor," *JHEP* **12** (2012) 096, arxiv:1210.1197.

[9] K. M. Parattu and A. Wingerter, "Tribimaximal Mixing From Small Groups," *Phys. Rev.* **D84** (2011) 013011, arxiv:1012.2842.

Contributions to Books

[10] K. Parattu, "Einstein Equations from/as Thermodynamics of Spacetime," *Fundam. Theor. Phys.* **187** (2017) 339-352, Contribution to the volume in honour of Prof. Padmanabhan's 60th birthday.

Conference Proceedings

[11] A. Wingerter and K. M. Parattu, "A Scan for Models of Neutrino Mixing from Non-Abelian Discrete Symmetries," Proceedings, 21st International Europhysics Conference on High energy physics (EPS-HEP 2011), *PoS* **EPS-HEP2011** (2011) 92, arXiv:1110.6762.

Conferences Attended

1. *"Mini-workshop on black holes and symmetries"*, 15 November 2019, Instituto de Fisica, PUCV, Valparaiso, Chile.
2. *"Quantum Information and String Theory 2019" and "It from Qubit school/workshop"*, 27 May-28 June, 2019, Yukawa Institute for Theoretical Physics, Kyoto University, Kyoto, Japan.
3. *"School on Supergravity, Black Holes and String Theory"*, 19-30 November, 2018, Universidad Adolfo Ibañez, Viña del Mar, Chile.
4. *"29th Meeting of Indian Association for General Relativity and Gravitation"*, 18-20 May, 2017, IIT Guwahati, Guwahati, India.
5. *"Workshop on Aspects of Gravity and Cosmology (conference in honour of Prof. Padmanabhan's 60th birthday)"*, 7-9 March, 2017, IUCAA, Pune, India.
6. *"Fundamental Problems of Quantum Physics (FPQP)"*, 5-9 December, 2016, ICTS, Bengaluru, India.
7. *"8th International Conference on Gravitation and Cosmology (ICGC)"*, 14-18 December, 2015, IISER Mohali, Mohali, India.
8. *"Conceptual and Technical Challenges for Quantum Gravity"*, 8-12 September, 2014, Sapienza University of Rome, Italy.

9. *"Workshop on Experimental Search for Quantum Gravity"*, 1-5 September, 2014, SISSA/International School for Advanced Studies, Trieste, Italy.
10. *"GDR Terascale@Paris"*, 5-7 November, 2012, LPNHE Paris, France.
11. *"GDR Neutrino Caen"*, 30-31 October, 2012, Université de Caen Basse-Normandie, Caen, France.
12. *"Neutrinos at the forefront of elementary particle physics and astrophysics"*, 22-24 October, 2012, INSA, Lyon, France.

Seminars and Talks

Conferences and Other institutes

1. *"Gravitational waves and LIGO: a brief history"*, Talk given at IIT Ropar, Rupnagar, India, 20 February 2020.
2. *"Gravitational waves and LIGO: a brief history"*, Talk given at the National Seminar on Recent Advances in Astronomy and Astrophysics, Department of Physics, Bharata Mata College, Thrikkakara, India, 14 February 2020.
3. *"Variational Principle for Gravity with Null Boundaries"*, Talk given at ICN, UNAM, Mexico City, Mexico, 13 September 2018.
4. *"Variational Principle for Gravity with Null Boundaries"*, Talk given at IIT Kanpur, Kanpur, India, 31 May 2017.
5. *"Variational Principle for Gravity with Null Boundaries"*, Talk given at the 29th Meeting of Indian Association for General Relativity and Gravitation, IIT Guwahati, Guwahati, India, 18-20 May, 2017.
6. *"Einstein Equations and Thermodynamics"*, Talk given at Workshop on Aspects of Gravity and Cosmology (conference in honour of Prof. Padmanabhan's 60th birthday), IUCAA, Pune, India, 7 March 2017.
7. *"Variational Principle for Gravity with Null Boundaries"*, Talk given at IIT Madras, Chennai, India, 24 August 2016.
8. *"Variational Principle for Gravity with Null Boundaries"*, Talk given at Manipal Centre for Natural Sciences, Manipal, India, 27 July 2016.
9. *"Variational Principle for Gravity with Null Boundaries"*, Talk given at Institute of Physics, Bhubaneswar, India, 14 June 2016.
10. *"Variational Principle for Gravity with Null Boundaries"*, Talk given at Raman Research Institute, Bengaluru, India, 1 June 2016.

11. *"Variational Principle for Gravity with Null Boundaries"*, Talk given at Perimeter Institute, Waterloo, Canada, 17 March 2016.
[Video available at http://pirsa.org/.]
12. *"Gibbons-Hawking-York Counter-term for a Null Surface"*, Talk given at the 8th International Conference on Gravitation and Cosmology (ICGC), IISER Mohali, Mohali, India, 14 December 2015.
13. *"Structure of the Gravitational Action and its Relation with Horizon Thermodynamics"*, Seminar at IIT Guwahati, Guwahati, India, 7 October 2015.
14. *"Thermodynamics of Null Surfaces and Emergent Paradigm"*, Seminar at Centre for Theoretical Physics, Jamia Millia Islamia, New Delhi, India, 27 August 2015.
15. *"Structure of the Gravitational Action and its Relation with Horizon Thermodynamics"*, Seminar at Centre for Theoretical Physics, Jamia Millia Islamia, New Delhi, India, 25 August 2015.
16. *"Quantum Mechanics in Phase Space"*, Talk given to IUCAA Radio Astronomy Winter School students, 30 December 2014.
17. *"Quantum Mechanics in Phase Space"*, Invited talk at Sacred Heart Collage, Thevara, Kerala, India, 18 December 2014.
18. *"Accelerated Observers in Relativity"*, Talk given as part of the IUCAA Introductory Summer School in Astronomy and Astrophysics, 30 May 2014.
19. *"A Minimal Model of Neutrino Flavor"*, Seminar at LPSC Grenoble, 9 November 2012.
20. *"A Minimal Model of Neutrino Flavor"*, Talk given at the conference GDR Terascale@Paris, 5 November 2012.
21. *"Neutrino Mixing and Discrete Groups"*, Talk given at LPSC Journal Club, LPSC Grenoble, 28 October 2012.
22. *"Tribimaximal Mixing From Small Groups"*, Seminar at IISc Bangalore, 8 August 2011.

Public Talks

1. *"Vectors and Tensors"*, Talk given at Cochin College, Kochi, India, 25th February, 2020.
2. *"Scalars, Vectors, Tensors: Facts of the Universe"*, 2nd Saturday talk organized by IUCAA Science Popularisation Program, 13th December, 2014.

Projects supervised

- Guided a student in an MSc project on "Decoherence and the quantum-to-classical transition" under the supervision of Prof. L. Sriramkumar at IIT Madras in the year 2017-18

- Mentored a group of 4-6 high school students for a week as part of IUCAA School Students' Summer Programme in 2012, 2013 and 2014 on the project "Galaxy Rotation Curves"

Teaching Experience

IIT Madras

- Grader, Physics I (Classical Mechanics and Vector Calculus) for B.Tech students
- Teaching assistant, 1st year lab for B.Tech students
- Teaching assistant, Statistical Physics course for M.Sc Physics, taught by Prof. Ashwin Joy

IUCAA

- Tutor for quantum mechanics and general relativity courses taken by Prof. Padmanabhan for IUCAA-NCRA graduate school[6]

[6] One year coursework for PhD scholars