RATNA KOLEY

Department of Physics, Presidency University
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West Bengal, India
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EMPLOYMENT

Assistant Professor | **Physics** — 2013 - Present
Presidency University — Kolkata, India

Assistant Professor | **Physics** | ***W.B.E.S.*** — 2009 - 2013
Bethune College — Kolkata, India

RESEARCH EXPERIENCE & EDUCATION

Young Scientist | ***DST Fast Track*** — September 2008 - June 2009
IACS — Kolkata, India

Research Associate - II — February 2008 - September 2008
IACS — Kolkata, India

Post Doctoral Fellow — Noveber 2006 - January 2008
IUCAA — Pune, India

Research Fellow — August 2001 - August 2006
IIT Kharagpur — Kharagpur, India

Ph.D. | ***Physics*** — 2006
IIT Kharagpur — Kharagpur, India

Master of Science | ***Physics*** — 2001
Jadavpur University — Kolkata, India

Bachelor of Science | ***Honours: Physics*** — 1999
University of Burdwan — Burdwan, India

RESEARCH INTERESTS

- **Early Universe Cosmlogy** - Magnetic Fields, Black Holes, Gravitational Waves
- **Blackholes & Exotic Compact Objects** : Shadow, Quasi Normal Modes
- **Particle Physics** : Particles in Braneworld, Stability, Field Localization
- **Physics Teaching** : Pedagogical Study in Quantum Mechanics

SPONSORED RESEARCH PROJECTS

- Project Title : Primordial Magnetic Fields and their imprints on successive phases of evolution
  Funding Agency : Department of Science and Technology (DST), Govt. of West Bengal
  Period : March 2018 to April 2022 Sanctioned Fund $\sim$ Rs. 11, 95, 800/-
  Role : **Principal Investigator**

- Project Title : Gravity, cosmology and phenomenology in higher dimensions
  Funding Agency : Department of Science and Technology (DST), India
  Period : Sep 2008 to June 2009 Sanctioned Fund : Rs. 12, 17,700/-
  Role : **Principal Investigator**

TEACHING EXPERIENCE

- **Research Level**:
  - Advanced Quantum Field Theory for PhD Coursework at Presidency University
  - Research Methodology for PhD Coursework at Presidency University

- **Postgraduate Level** :
  - Classical Mechanics for M.Sc. 1st year at Presidency University
  - General Theory of Relativity for M.Sc. final year at Presidency University
  - Advanced Quantum Mechanics for M.Sc. 1st year at Presidency University
  - Quantum Field Theory for M.Sc. final year at Presidency University
  - Classical Field Theory for M.Sc. first year at Presidency University
  - Electrodynamics Tutorial for M.Sc. 1st year course at I.I.T. Kharagpur in Spring 2003
  - Physics Laboratory for M.Sc. 1st year at I.I.T. Kharagpur in Spring 2003, 2004 and 2005

- **Undergraduate Level** :
  - Fluid mechanics for B. Sc. 1st Yr. at Presidency University
  - Statistical Mechanics Lab. for B.Sc. 3rd Yr. at Presidency University
  - Introduction to Python for B.Sc. 1st Yr. at Presidency University
  - Special Theory of Relativity for B.Sc. 1st/3rd Yr. at Presidency University
  - Physical Optics for B.Sc. 2nd/3rd Yr. at Presidency University
  - Classical Mechanics for B.Sc. 1st Yr at Presidency University
  - Classical Electrodynamics for B.Sc. 3rd Yr. at Presidency University
  - Statistical Mechanics Lab. for B.Sc. 3rd Yr. at Presidency University
  - Electromagnetic Physics Lab. for B.Sc. 3rd Yr. at Presidency University
  - Classical Mechanics Lab. for B.Sc. 1st Yr. at Presidency University
  - Optics Lab. for B.Sc. 2nd Yr. at Presidency University
  - Electronics and Electrical Lab. for B.Sc. 3rd Yr. at Presidency University
  - Special Theory of Relativity for B.Sc. 3rd Yr. at Bethune College
  - Mathematical Methods for B.Sc. 1st Yr. at Bethune College
  - Quantum Mechanics for B.Sc. 3rd Yr. at Bethune College
  - Elementary Particle Physics for B.Sc. 3rd Yr. at Bethune College
  - Physical Optics for B.Sc. 2nd Yr. at Bethune College

- **Teaching Assistantship at IUCAA** :
  - Refreshers' Course tutorial for College Teachers at IUCAA for "Introduction to General Relativity"
  - Refreshers' Course tutorial for College Teachers at IUCAA for "Introduction to Cosmology"

SUPERVISION OF PROJECTS & RESEARCH GUIDANCE

- **Research Level:**

  Pabitra Gayen (UGC Research Fellow) (2021 – Present)
  Topic of Research: *Geometrical and Observational Aspects of Different Theories of Gravity*

  Abhisek Das (WBHESTBT Project Fellow) (2018 – 2021)
  Topic of Research: *Primordial Magnetic Fields and Their Imprints on Successive Phases of Evolution*

- **Post Graduate Level:**

2025-2026	Paramita Patra (Project Title: Finding Signatures of Exotic Compact Objects)
2024-2025	Sagnik Roy (Project Title: Gravitational waves from the merger events of primordial black holes)
	Soham Chatterjee (Project Title: Distinguishing probe of massive compact objects
2023-2024	Saikat Sinha (Project Title: Field Theory in Curved Background and it's Application in Early Universe Cosmology)
2022-2023	Sampurna Bhar (Project Title: Black Hole and Wormhole shadows: a tool to test gravity)
	Tanmay Mandal (Project Title: Gravitational Waves on Cosmological Background)
	Mehedi Hassan Mollah (Project Title: Early Universe Through Gravitational Wave)
2021-2022	Setabuddin (Project Tile: Probing GR and Modified Gravity Theory with Gravitational Waves)
2020-2021	Alorika Kar (Project Title: Analysis of Inflationary Potentials to explore Primordial Black Holes as Possible Candidate for Dark Matter)
	Santanu Sarkar (Project Title: Single Field Inflation Model which Favours The Formation of Primordial Black Holes)
2019-2020	Soumendra Kishore Roy (Project Title: Post Minkowskian Approximation from Self Interactins and Hawking radiation from Blackhole Binary Merger)
	Pratyusava Baral (Project Title: Radiation with Phase Structure in Electromagnetism and Gravity)
	Soumanti Chakraborty (Project Title: Blackhole production in the inflationary universe)
	Anupreet Ghosh (Project Title: Primordial Magnetic Field, its effect on CMB and Faraday rotation)
2018-2019	Anarya Ray (Project Title: Gravitational Radiation From Relativistic Sources (joint supervisor)
2018	Amitabha Banerjee (Project Title: BACTERIA AROUND A BLACK HOLE : Analogue Gravity with Active Nematic Fluid (joint supervisor))
2017	Abhisek Das (Project Title: Particle creation in expanding background)
	Shahbaz Akhter (Project Title: Distinction between R^2 inflation and Higgs inflation)
	Surajit Biswas (Project Title: The quantum Higgs phenomenon in massless scalar electrodynamics (joint supervisor))
2016	Bhaskar Biswas (Project Title: How much inflation is there - a study by phase space analysis)
	Pritam Palit (Project Title: Addressing the eta problem in inflationary cosmology (joint supervisor))
2015	Argha Banerjee (Project Title: Inflation in Brane World Gravity)
	Arpan Kundu (Project Title: Study of Inflationary Magnetogenesis)
2014	Subhankar Mandal (Project Title: Geodesic Flow in Black Hole Spacetime)

- **Bachelor's Level:**

2025	Srotoshi Ghosh (Project Title: Data Analysis Techniques in Gravitation and Cosmology)
2024	Paramita Patra (Project Title: Squeezed state of light and its application in interferometers)
2023	Sagnik Roy (Project Title: Geodesic Motion and Matter Perturbation in Witten Bubble Spacetime)
	Soham Chatterjee (Project Title: Scalar and Gravitational Perturbation in Extra Dimensional Schwarzschild and Morris-Thorne Spacetime)
2022	Rounak Nath (Project Tile: Quantum Mechanics in Curved Spacetime)
2021	Sagnik Bhattacharjee (Project Title: Gravitational Collapse)
	Sauvik Chatterjee (Project Title: Highly Oscillatory Second Order Linear Differential Equations(SOLDE) in Physics : Homogeneous and Inhomogeneous)
	Tanbir Islam (Project Title: Comparison of Electromagnetic and Gravitational Field: with the help of visualization)
2020	Arit Bala (Project Title: The Hamilton-Jacobi formalism: in geometry and cosmology)
2019	Dwaipayan Mukherjee (Project Title: The Late Universe Acceleration: Dark Energy)
	SAGAR DAM (Project Title: Study About the Early Universe Acceleration: Cosmic Inflation)
2018	Pratyusava Baral (Project Title: Gravitational Waves as Tetrad Fluctuation)
	Sagnik Chaudhuri (Project Title: Aspects of the Dirac Monopole)
	Soumendra Kishore Roy (Project Title: Black Hole as Particle Accelerator)
	Soumik Goswami (Project Title: A Study of Modified Newtonian Dynamics)
2017	Aratrika Dey (Project Title: Does Nature Allow Superluminal Motion?)
2016	Arnab Laha (Project Title: Dynamics of a Particle in Curved Spacetime)
	Deep Ghosh (Project Title: Solution of Geodesic Equations in Curved Spacetime)

RESEARCH PUBLICATIONS IN REFEREED JOURNALS

1. P. Gayen and R. Koley, Gravitational shadow as a probe of specifically warped extra dimension, Eur. Phys. J. Plus **141**, no.2, 127 (2026)
2. P. Gayen and R. Koley, Decoding horizonless spacetime: plasma-induced features in a rotating wormhole shadow, Eur. Phys. J. C **86**, no.1, 49 (2026)
3. S. Roy, S. Chatterjee and R. Koley, Shadow of higher dimensional collapsing dark star and blackhole, Eur. Phys. J. C **84**, no.1, 47 (2024)
4. P. Gayen and R. Koley, Scalar and spinor quasi normal modes of a 2D dilatonic blackhole, Gen. Rel. Grav. **55**, no.11, 129 (2023)
5. S. K. Roy, **R. Koley** and P. Majumdar, Probing the post-Minkowskian approximation using recursive addition of self-interactions, Phys. Rev. D. 102 (2020) 084045
6. P. Baral, A. Ray, **R. Koley** and P. Majumdar, Gravitational Waves with Orbital Angular Momentum, Eur. Phys. J. C 80 (2020) 4, 326
7. S. K. Roy, **R. Koley** and P. Majumdar, Kinematics of Two-particle Scattering in Black Hole Backgrounds, Phys. Rev. D 100 (2019) 6, 064052
8. **R. Koley** and S. Samtani, Magnetogenesis in Matter-Ekpyrotic bouncing universe, JCAP 04 (2017) 030

9. A. Banerjee and **R. Koley**, Inflationary field excursion in broad classes of scalar field models, Phys. Rev. **D 94**, 123506 (2016)

10. **R. Koley**, J. Mitra and S. SenGupta, Scalar Kaluza-Klein modes in a multiply warped braneworld, Europhys. Lett. **91**, 31001 (2010)

11. **R. Koley**, J. Mitra and S. SenGupta, Fermion localisation in generalised Randall Sundrum model, Phys. Rev. **D (Rapid Communications)**, **79**, 041902 (2009)

12. **R. Koley**, J. Mitra and S. SenGupta, Modulus stabilization of generalized Randall Sundrum model with bulk scalar field, Europhys. Lett. **85**, 41001 (2009)

13. **R. Koley**, J. Mitra and S. SenGupta, Chiral fermions in a spacetime with multiple warping, Phys. Rev. **D 78**, 045005 (2008)

14. **R. Koley** and S. Kar, Exact bound states in volcano potentials, Phys. Lett. **A363** (2007) 369-373

15. **R. Koley** and S. Kar, Braneworlds in six dimensions: new models with bulk scalars, Class. Quant. Grav. **24** (2007) 79-94

16. **R. Koley** and S. Kar, A novel braneworld model with a bulk scalar field, Phys. Lett. **B623** (2005) 244-250; *Erratum: ibid.* **B631** *(2005) 199*

17. **R. Koley** and S. Kar, Bulk phantom fields, increasing warp factors and fermion localisation, Mod. Phys. Lett. **A5** (2005) 363-371

18. **R. Koley** and S. Kar, Scalar kinks and fermion localisation in warped spacetimes, Class. Quant. Grav. **22** (2005) 753-768

19. **R. Koley**, S. Pal and S. Kar, Geodesics and geodesic deviation in a two-dimensional black hole, Am. J. Phys. **71** (2003) 1037-1042

Research Publications in Conference Proceedings

1. **R. Koley**, Localization of fields on brane, Proceedings of the workshop on "Physics of warped extra dimensions" (February 21 - 23, 2008), Page 19 - 25 held at I.I.T. Kharagpur, India

2. **R. Koley** and S. Kar, Brane world models with bulk scalars: Examples, Proceedings of 23^{rd} Conference of IAGRG (Dec. 7 - 10, 2004) held at Jaipur, India, Page No. 111-115

Selected Presentation in Conferences/ Workshops/ Seminars / Academic Visits

2026 **Delivered an invited lecture** at Platinum Jubilee Conference on Contemporary Physics, organised by IIT Kharagpur, 29–31 March 2026

2025 **Delivered an invited lecture** at the Conference on "Recent aspects of Gravitation and Cosmology" organised by the Relativity and Cosmology Research Centre (RCRC) of Department of Physics of Jadavpur University, Kolkata, held on March 18th, 2025

2022 **Delivered an invited lecture** at the Conference on "Beyond Standard Models in Particle Physics and Gravity" organised by the Indian Association for the Cultivation of Science, Kolkata (22- 23 December, 2022).

2022 **Presented** poster, 23rd International Conference on General Relativity and Gravitation, Beijing, China (Online) (3 - 8 July, 2022)

2020 **Delivered an invited lecture** at the workshop on "Astrophysics and Astronomy for Women in India" organised by the Department of Physics, Diamond Harbour Women's University in association with ICARD, University of North Bengal and sponsored by IUCAA, Pune held at Diamond Harbour, February 1, 2020.

2020 **Delivered a talk** and participated in the international conference "Emerging Issues in Cosmology and Particle Physics (EICP2)" organised by the Department of Physics, Visva-Bharati held at Shantiniketan, Jan 12 - 14, 2020.

2017 **Presented** poster on "Magnetogenesis in Matter-Ekpyrotic Bouncing Universe" at the 35th Meeting of Astronomical Society of India held at Jaipur, March 6 - 10, 2017.

2016 **Invited talk** at the Topical Conference on Gravitation, Cosmology and Astrophysics, Eastern Region, 2016 at Visva Bharati, Shnatiniketan (Sep 24, 2016)

2015 **Delivered a talk** at the international conference COSMOCRUISE 2015: At the Edge of Discovery at Barcelona, Spain (Sep 2 - Sep 9, 2015)

2013 **Invited talk** at Bethune College, Kolkata (January 10, 2013)

2010 **Invited talk** at 2^{nd} BCTP Workshop at Bonn University, Germany (Oct 4 - Oct 8, 2010)

2009 **Invited talk** at North Bengal University on February 12, 2009

2008 **Invited talk and visit** at Harish-Chandra Research Institute (HRI) on September 18, 2008

2008 **Invited talk** at Workshop Physics of Warped Extra Dimensions at IIT, Kharagpur, 21-23 February, 2008

2007 **Talk** at 24th Conference of the IAGRG (IAGRG-24) at Jamia Milia Islamia, New Delhi (Feb 5 - Feb 8, 2007)

2005 **Talk** at Young Astronomer's Meet (YAM) at Inter-University Center for Astronomy and Astrophysics (IUCAA), Pune (Nov 29 - Dec 2, 2005)

2004 **Participated in and presented a paper** at 23rd Conference of the IAGRG and Symposium on "Recent Trends in General Relativity, Cosmology and Astrophysics" at Rajasthan University, Jaipur (Dec 7 - Dec 10, 2004)

2004 **Talk** at International Conference on Gravitation and Cosmology (ICGC-04) at Cochin University of Science and Technology, Kochi (Jan 5 - Jan 10, 2004)

Academic Visits

2017 Academic Visit at the Astrophysics and Cosmology Research Unit (ACRU), School of Mathematics, Statistics and Computer Sciences, University of KwaZulu-Natal, Durban (November, 2017)

2015 Academic Visit at the Center for Theoretical Physics, Visitor's Programme at IIT Kharagpur (February and May, 2015).

2011 Academic Visit at the Theoretical High Energy Physics Group at Physikalisches Institut, Bonn University, Germany (Apr 22 - May 27, 2011)

2010 Academic Visit at the Theoretical High Energy Physics Group at Physikalisches Institut, Bonn University, Germany (Oct 11 - Nov 12, 2010)

Public Talks/ Popular Science Talks

2024 Popular Talk for School Students delivered on April 19, 2024 at Birla Industrial and Technological Museum (BITM), Kolkata, NCSM, Govt. of India, Title of Talk: Warped Spacetime Symphony & Gravitational Waves

2024 Public Lecture delivered at Presision 2024 on April 20, 2024 at Presidency University, Kolkata, Title of Talk: Large Scale Magnetic Fields in the Universe

2023 Popular Talk delivered in regional language "Bangla" for School students at Islampur, Uttar Dinajpur District organized by Islampur Sub-divisional Administration, Govt. of West Bengal, on 22nd July, 2023, Title of Talk: "Anu Paramanur Andar Mahale"

Organisation: School, Conference, Workshop

Member, Organising Committee — Workshop
Modern Trends in Particle Physics, at Presidency University, Kolkata — 31 October 2025

Member, Organising Committee — International Conference
Universe after the first 200 million years - cosmic dawn, reionization and post reionization, at Presidency University, Kolkata — 11 - 13 December 2017

Member, Organising Committee — Advanced School
Advanced School on Gravity Waves at Presidency University, Kolkata — 12 - 16 December 2016

Member, Organising Committee — In-house Preparatory School
On Basics of GR and Gravity Waves at Presidency University, Kolkata — Bi Weekly, August - October, 2016

Member, Organising Committee — Topical Conference
Second meeting of TCGC at Presidency University, Kolkata — August, 2014

Other Relevant Professional Activities

Reviewer
Physics Journals, Cambridge University Press, World Scientific

Member, Indian Association for General Relativity and Gravitation
Life Member

Administrative Responsibilities

Board of Studies, Physics Department | **Member**
Physics Department — Presidency University

Departmental Examination Committee | **Member**
Physics Department — Presidency University

Departmental Academic Committee | **Member**
Physics Department — Presidency University

Departmental Library Committee | **Convenor**
Physics Department — Presidency University

Departmental Admission Committee | **Member**
Physics Department — Presidency University

PUCASH | **Member**
Presidency University

Presidency University

College Admission Committee | **Co-Convenor**
Bethune Collge

Bethune College

Teachers' Committee | **Member**
Bethune Collge

Bethune College