

Curriculum Vitae

Personal Information

Name: Dipanjan Dey
Sex : Male
Date and Place of Birth: 14th July 1987 ; Birbhum, West-Bengal, India.
Nationality: Indian
Marital Status: Married
Affiliation: Beijing Institute of Mathematical Sciences and Applications (BIMSA), Beijing, China
Present Address: Yanqi International Talent Community, Building 9, Unit: 202, Huairou, China
Official Address: Office No. A3-4-210, Beijing Institute of Mathematical Sciences and Applications (BIMSA), Beijing, China

Current Designation: Postdoctoral Fellow at BIMSA
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Education:

2002 10th Grade, West Bengal Board of Secondary Education.
2004 10+2 Grade, West Bengal Board of Higher Secondary Education.
2007–2011 B.Sc.(Honors) in Physics, Netaji Subhas Open University, West Bengal, India.
2011–2013 M.Sc. Physics, Indian Institute of Technology, Kanpur, India.
2013–2014 PhD, Physics, course-work,
June 2019 PhD in Physics, Indian Institute of Technology, Kanpur, India.
Thesis Title: Space-times Related to Gravitational Collapse in The Cosmological Setup (**Supervisor:** Prof. Kaushik Bhattacharya).

Job Experience:

Aug, 2024- Present Postdoctoral fellow (**mentors:** Prof. Lars Andersson and Prof. Shing-Tung Yau), Beijing Institute of Mathematical Sciences and Applications, Beijing, China

Main duties:

- Research
- Teaching

October, 2022- Aug, 2024 AARMS Postdoctoral fellow (**mentor:** Prof. Alan A. Coley), Dalhousie University, Halifax, Canada

Main duties:

- Research

March, 2020- Aug, 2022 Assistant Professor, International Center for Cosmology (ICC), CHARUSAT, Gujarat, India.

Main duties:

- Academic work like teaching, evaluation etc.
- Research and consultancy work.
- University development and administration.
- Community service and extension.

Aug 2018 - Feb, 2020 Post Doctoral fellow (**mentor:** Prof. Pankaj S. Joshi), International Center for Cosmology (ICC), CHARUSAT, Gujarat, India.

Main duties:

- Participation of ongoing research activities and various academic events.
- Teaching.

Research Interests:

Gravitational Collapse, Global and local visibility of singularity, Cosmic censorship, Quantum Gravity and Singularity Resolution, Naked singularity, Primordial Black holes (PBH), Gravitational lensing and shadow, Small scale structure formation.

Publications:

- [1] P. Saha, D. Dey and K. Bhattacharya, “Cosmological effect of coherent oscillation of ultralight scalar fields in a multicomponent universe,” Eur. Phys. J. C **85**, 1454 (2025).
- [2] Koushiki, D. Dey and P. S. Joshi, “A bonafide model of structure formation from gravitational collapse,” Eur.Phys.J.C **85**, 5, 493, (2025).
- [3] P. Saha, D. Dey and K. Bhattacharya, “Non-minimal coupling of scalar fields in the dark sector and generalization of the top-hat collapse,” Eur.Phys.J.C **85**, 4, 384, (2025).
- [4] D. Debnath, D. Dey and K. Bhattacharya, “End equilibrium state of a spherical gravitational collapse in the presence of matter and scalar field,” Phys. Rev. D **111**, no.2, 2 (2025).
- [5] A. B. Joshi, D. Dey, P. S. Joshi and V. R. Tank, “Tidal forces in collapsing compact objects,” Phys. Rev. D **110**, no.12, 124066 (2024).
- [6] D. Dey, A. A. Coley and N. T. Layden, “The Definition of a Photon Surface in an Invariant Spin Frame,” Phys. Rev. D **109**, no.6, 064021 (2024).
- [7] P. Saha, D. Dey and K. Bhattacharya, “Gravitational collapse of matter in the presence of non-minimally coupled Quintessence and Phantom-like scalar fields,” Phys. Rev. D **109**, no.10, 104023 (2024).
- [8] N. T. Layden, A. A. Coley and D. Dey, “Invariant description of static and dynamical Brans–Dicke spherically symmetric models,” Gen. Rel. Grav. **56**, no.1, 10 (2024).

- [9] P.Bambhaniya, A.B.Joshi, D.Dey, P.S.Joshi, A.Mazumdar, T.Harada and K.i.Nakao, “Relativistic orbits of S2 star in the presence of scalar field,” *Eur. Phys. J. C* **84**, no.2, 124 (2024).
- [10] D. Arora, P. Bambhaniya, D. Dey and P. S. Joshi, *Phys. Dark Univ.* **44**, 101487 (2024).
- [11] D. Dey, Koushiki and P. S. Joshi, “Equilibrium states from gravitational collapse of a minimally coupled scalar field with a nonzero potential,” *Phys. Rev. D* **108**, no.10, 104045 (2023).
- [12] A. B. Joshi, D. Tahelyani, D. Dey and P. S. Joshi, “Observational aspects of a class of dark matter spacetimes,” *Phys. Rev. D* **108**, no.10, 104034 (2023).
- [13] D. Dey, N. T. Layden, A. A. Coley and P. S. Joshi, “The equilibrium condition in gravitational collapse and its application to a cosmological scenario,” *Phys. Rev. D* **108**, no.4, 044046 (2023).
- [14] P. Saha, D. Dey and K. Bhattacharya, “Gravitational collapse of matter in the presence of Quintessence and Phantom-like scalar fields,” *Phys. Rev. D* **108**, no.8, 084025 (2023).
- [15] S.Vagnozzi, R.Roy, Y.D.Tsai, L. Visinelli, M.Afrin, A.Allahyari, P.Bambhaniya, D.Dey, S.G.Ghosh and P.S.Joshi, *et al.* “Horizon-scale tests of gravity theories and fundamental physics from the Event Horizon Telescope image of Sagittarius A*,” *Class. Quant. Grav.* **40**, no.16, 165007 (2023).
- [16] K. Mosani, D. Dey, P. S. Joshi, G. C. Samanta, H. Menon and V. D. Patel, “On the visibility of singularities in general relativity and modified gravity theories,” *Class. Quant. Grav.* **40**, no.14, 145015 (2023).
- [17] P. Bambhaniya, J. S. Verma, D. Dey, P. S. Joshi and A. B. Joshi, “Lense-Thirring effect and precession of timelike geodesics in slowly rotating black hole and naked singularity spacetimes,” *Phys. Dark Univ.* **40**, 101215 (2023).
- [18] V.Patel, D.Tahelyani, A.B.Joshi, D.Dey and P.S.Joshi, “Light trajectory and shadow shape in the rotating naked singularity,” *Eur. Phys. J. C* **82**, no.9, 798 (2022).
- [19] D.Dey, P.S.Joshi, K.Mosani and V.Vertogradov, “Causal structure of singularity in non-spherical gravitational collapse,” *Eur. Phys. J. C* **82**, no.5, 431 (2022).
- [20] D. N. Solanki, P. Bambhaniya, D. Dey, P. S. Joshi and K. N. Pathak, “Shadows and precession of orbits in rotating Janis-Newman-Winicour spacetime,” *Eur. Phys. J. C* **82**, no.1, 77 (2022).
- [21] K. Mosani, D. Dey, K. Bhattacharya and P. S. Joshi, “Singularity resolution in gravitational collapse,” *Phys. Rev. D* **105**, no.6, 064048 (2022).
- [22] D.Tahelyani, A.B.Joshi, D.Dey and P.S.Joshi, “Comparing thin accretion disk properties of naked singularities and black holes,” *Phys. Rev. D* **106**, no.4, 044036 (2022).
- [23] K. Mosani, D. Dey and P. S. Joshi, “Globally visible singularity in an astrophysical setup,” *Monthly Notices of the Royal Astronomical Society*, **504**, 4, 4743–4750 (2021).
- [24] C. N. Gandevikar, D. N. Solanki and D. Dey, “Post-Newtonian properties of EMRI with Power Law Potential,” *Eur. Phys. J. C* **81**, no.49, 693 (2021).
- [25] P. Bambhaniya, D. N. Solanki, D. Dey, A. B. Joshi, P. S. Joshi and V. Patel, “Precession of timelike bound orbits in Kerr spacetime,” *Eur. Phys. J. C* **81**, no.3, 205 (2021).
- [26] D. Dey, R. Shaikh and P. S. Joshi, “Shadow of nulllike and timelike naked singularities without photon spheres,” *Phys. Rev. D* **103**, no.2, 024015 (2021).
- [27] P. Bambhaniya, D. Dey, A. B. Joshi, P. S. Joshi, D. N. Solanki and A. Mehta, “Shadows and negative precession in non-Kerr spacetime,” *Phys. Rev. D* **103**, no.8, 084005 (2021).
- [28] D. Dey, R. Shaikh and P. S. Joshi, “Perihelion Precession and Shadows near Blackholes and Naked Singularities,” *Phys. Rev. D* **102**, no.4, 044042 (2020).

- [29] A. B. Joshi, D. Dey, P. S. Joshi and P. Bambhaniya, “Shadow of a Naked Singularity without Photon Sphere,” *Phys. Rev. D* **102**, no.2, 024022 (2020).
- [30] K. Mosani, D. Dey and P. S. Joshi, “Global visibility of a strong curvature singularity in non-marginally bound dust collapse,” *Phys. Rev. D* **102**, no.4, 044037 (2020).
- [31] K. Mosani, D. Dey and P. S. Joshi, “Strong curvature naked singularities in spherically symmetric perfect fluid collapse,” *Phys. Rev. D* **101**, no. 4, 044052 (2020).
- [32] K. Bhattacharya, D. Dey, A. Mazumdar and T. Sarkar, “New class of naked singularities and their observational signatures,” *Phys. Rev. D* **101**, no. 4, 043005 (2020).
- [33] D. Dey, P. S. Joshi, A. B. Joshi and P. Bambhaniya, “Towards an Observational test of Black Hole versus Naked Singularity at the Galactic Center,” *IJMPD* **28**, no. 14, 1930024 (2019).
- [34] P. Bambhaniya, A. B. Joshi, D. Dey and P. S. Joshi, “Timelike geodesics in Naked Singularity and Black Hole Spacetimes,” *Phys. Rev. D* **100**, 124020 (2019).
- [35] D. Dey, P.S Joshi, “Gravitational Collapse of Baryonic and Dark Matter,” *AJM*, 1-24, (2019).
- [36] U. Banik, D. Dey, K. Bhattacharya and T. Sarkar, “Self-gravitating fluid systems and galactic dark matter,” *Gen. Rel. Grav.* **49**, 116 (2017).
- [37] D. Dey, K. Bhattacharya and T. Sarkar, “Galactic space-times in modified theories of gravity,” *Gen. Rel. Grav.* **47**, 103 (2015).
- [38] D. Dey, K. Bhattacharya and T. Sarkar, “Astrophysics of Bertrand Space-times,” *Phys. Rev. D* **88**, 083532 (2013).
- [39] D. Dey, K. Bhattacharya and T. Sarkar, “Galactic Dark Matter and Bertrand Space-times,” *Phys. Rev. D* **87**, no. 10, 103505 (2013).

Preprints:

- [1] D. Dey, P.S Joshi, “General Relativistic Approach to Small-Scale Structure Formation,” arXiv:1907.12792 [gr-qc] (2019).
- [2] A. B. Joshi, P. Bambhaniya, D. Dey and P. S. Joshi, “Timelike geodesics in Naked Singularity and Black Hole Spacetimes II,” arXiv:1909.08873 [gr-qc], (2019).
- [3] K. Mosani, D. Dey and P. S. Joshi, “On viability of isentropic perfect fluid collapse with a linear equation of state,” arXiv:1910.13678 [gr-qc], (2020).
- [4] K. P. Kaur, P. S. Joshi, D. Dey, A. B. Joshi and R. P. Desai, “Comparing Shadows of Blackhole and Naked Singularity,” arXiv:2106.13175 [gr-qc], (2021).
- [5] K. Bhattacharya, D. Dey and P. Saha, “The initial value problem in cosmology: An alternative derivation for beginners,” arXiv:2404.13332 [gr-qc], (2024).

(Total 39 published papers, and 5 communicated.)

Book Chapters:

D. Dey, K. Mosani, “Spherical and Aspherical Gravitational Collapse: Locally and Globally Naked Singularities”, In: Malafarina, D., Joshi, P.S. (eds) *New Frontiers in Gravitational Collapse and Spacetime Singularities*. Springer Series in Astrophysics and Cosmology. Springer, Singapore, (2024).

Teaching Experiences:

In YMSC, Tsinghua University:

From February 19, 2025 to May 7, 2025, I taught a **graduate-level learning seminar** titled “Gravitational Collapse and Spacetime Singularities” at YMSC. The course met once per week on Wednesdays from 16:30 to 18:30, totaling 20 hours of teaching.

The seminar was designed for graduate students with prior knowledge of General Relativity and differential geometry. Its aim was twofold: (1) to develop a rigorous mathematical understanding of when and why singularities form in gravitational collapse, and (2) to investigate the causal and geometric nature of the resulting singularities.

Across the semester, the course covered deformation tensor kinematics, Raychaudhuri’s equation and focusing theorems, causal structure and global hyperbolicity, conjugate points, singularity theorems, cosmic censorship, and both homogeneous and inhomogeneous collapse models including the stability and instability of naked singularities.

In International Center for Cosmology, CHARUSAT, India:

- Title: Special Theory of Relativity (2 credit course for MSc students),
Institute/University: International Center for Cosmology (CHARUSAT), Duration: 40 hrs, Number of Students: 25 (Year: M.Sc. 1st semester 2019, 2020, 2021).
- Title: Astrophysics, Space and Cosmology -I (4 credit course for MSc student),
Institute/University: International Center for Cosmology (CHARUSAT), Duration: 60 hrs, Number of Students: 25 (Year: M.Sc. 1st semester 2020, 2021)
- Title: Astrophysics, Space and Cosmology -II (4 credit course for MSc student),
Institute/University: International Center for Cosmology (CHARUSAT), Duration: 60 hrs, Number of Students: 25 (Year: M.Sc. 2nd semester 2020, 2021, 2022)
- Title: General Relativity, Black holes and Cosmology I (4 credit course for MSc student),
Institute/University: International Center for Cosmology (CHARUSAT), Duration: 60 hrs, Number of Students: 25 (Year: M.Sc. 2nd semester 2020, 2021, 2022)
- Title: General Relativity, Black holes and Cosmology II (4 credit course for MSc student),
Institute/University: International Center for Cosmology (CHARUSAT), Duration: 60 hrs, Number of Students: 25 (Year: M.Sc. 3rd semester 2020, 2021, 2022).

Research project guided as a supervisor:

MSc Thesis: 11 completed

Conferences and Schools:

17th June – 13th July, 2013	SERC Preparatory school on Theoretical High Energy Physics, Tezpur University, Tezpur, Assam, India.
November 2014	International conference on new trends in field theories, Banaras Hindu University, Varanasi, India.
20th December, 2014 – 8th January, 2015	XXIX SERC Main school on Theoretical High Energy Physics, BITS Pilani, GOA, India.
12th October to 17th October, 2015	Advances in Astroparticle Physics and Cosmology (AAPCOS), Saha Institute of Nuclear Physics, Kolkata, India. Title of talk- "Space-time of Dark-matter".
16th November to 5th December, 2015	XXX SERC Main school on Theoretical High Energy Physics, BITS Pilani, Pilani, India.
18th May, 2017–20th May, 2017	29th meeting of Indian Association for General Relativity and Gravitation (IAGRG), "The era of gravitational wave", Indian Institute of Technology, Guwahati, Assam, India. Talk title: "Primordial Structure formation and Dark-matter."
14th November, 2017	HEP seminar, IIT Kanpur, India. Talk Title: "On The Validity of Cosmic Censorship Conjecture in a Cosmological Scenario".
24th November, 2017	Departmental seminar, Tata Institute of Fundamental Research (TIFR), Mumbai, India. Talk Title: "On The Validity of Cosmic Censorship Conjecture in a Cosmological Scenario".
19th November- 26th November, 2017	Departmental Visit (Invited by Prof. Pankaj Joshi), Tata Institute of Fundamental Research (TIFR), Mumbai, India.
December, 2018	Departmental talk on LIGO and Gravitational waves, International Center for Cosmology (ICC), CHARUSAT, Gujarat, India.
December, 2018	Departmental talk on "Gravitational Lensing, Relativistic Einstein Rings and Shadows", International Center for Cosmology (ICC), CHARUSAT, Gujarat, India.
24th September-26th September, 2020	Selected talk on "Shadow of Naked Singularity", Virtual Conference of the Polish Society on Relativity, University of Warsaw, Poland.
4th December, 2020	Invited for a seminar talk on "Shadow of Naked Singularity", University of Warsaw, Poland.
19th - 20th December, 2020	IAGRG 2020 conference, IIT Gandhinagar, talk on "Shadow of Naked Singularity".

22nd - 26th February, 2021	Science at the horizon: The next generation EHT, talk on “Shadow of Naked Singularity”.
16th -19th May, 2022	Atlantic General Relativity 2022, Canada
15th -17th June, 2023	Theory Canada 15, Mount Allison University, Canada.
18th -19th June 2024	Atlantic General Relativity conference at the University of New Brunswick, Canada. Talk: “Invariant definition of photon surfaces”.
23rd - 24th November 2024	Postdoctoral Workshop VI, YMSC, Tsinghua University, China. Talk: “Causal structure of singularities formed in gravitational collapse”.
13th - 21st January 2025	Departmental visit to the School of Physical Sciences in the Indian Association for the Cultivation of Science (IACS), Kolkata, India (Invited by Dr. Sumanta Chakraborty).
13th - 14th September 2025	Postdoctoral Workshop V, YMSC, Tsinghua University, China. Talk: “Invariant definition of photon surfaces in general relativity”.
12th - 30th September 2025	Departmental visit to the Department of Mathematics, Jadavpur University, Kolkata, India (Invited by Professor Farook Rahaman).

Conference organized:

One of the organizing secretaries of ‘**International workshop on Astrophysics and Cosmology’ 20-24 Dec, 2019 (Venue: ICC, CHARUSAT).**

Awards:

Atlantic Association for Research in the Mathematical Sciences (AARMS) postdoctoral fellowship, 2022.

Notable Achievements:

- All India Rank-27 in the Joint Admission Test for M.Sc (JAM) in IITs.
- Main organizer of Research Scholar day (2015), Department of Physics, IIT Kanpur.
- 2015–President of Physics Society, IIT Kanpur, India.
- Main organizer of Research Scholar day (2017), Department of Physics, IIT Kanpur.
- AARMS Postdoctoral fellow 2022 (<https://aarms.math.ca/pdf/>).