Arpit Das

Curriculum Vitae

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Inspire HEP page

Academic Career

08/26–02/27 *Senior Project Associate*, Department of Astrophysics and High Energy Physics, S.N. Bose National Centre for Basic Sciences, Kolkata, India

Research focus: *Entanglement bootstrap, CFTs and related dynamics.* Mentor: Dr. Parijat Dey.

10/23–07/26 *Postdoctoral Research Associate*, School of Maths and The Higgs Centre for Theoretical Physics, University of Edinburgh, UK

Research focus: *Generalised symmetries, Effective field theories and Hydrodynamics.* Mentors: Prof. Joan Simon Soler, Dr. Sašo Grozdanov and Prof. Richard A. Davison.

10/19–09/23 *Ph.D. in Mathematical Sciences*, Centre for Particle Theory, Department of Mathematical Sciences, Durham University, UK

Thesis: *Generalised symmetries, anomalous magnetohydrodynamics and holography.* Supervisors: Prof. Nabil Iqbal and Prof. Ruth Gregory.

08/18–10/19 *Visitor*, School of Physical Sciences, NISER Bhubaneswar, India

Research work: *Rational Conformal Field Theories and Modular Forms.* Collaborators: Dr. Chethan N. Gowdigere and Dr. Jagannath Santara.

08/13–06/18 *5 Year BS-MS Dual Degree*, Department of Physical Sciences, IISER Kolkata, India

M.Sc. thesis: *Aspects of Unitarity in Black Hole physics.* Supervisor: Prof. Narayan Banerjee.

Summary of Ph.D. and Postdoctoral Research

10/19–09/23 **Ph.D. research:** I have developed a symmetry-based framework for anomalous finite-temperature systems, focusing on ABJ anomalies, higher-form symmetries, chiral magnetohydrodynamics and holography. This included constructing a holographic model of chiral plasma, computing chiral charge relaxation rate, and developing hydrodynamic effective descriptions constrained by generalised/non-invertible symmetries that describe chiral MHD phenomenology of *chiral separation effect* and *chiral magnetic effect*. In parallel, I have worked on the holomorphic modular bootstrap programme for rational CFTs, including solving modular linear differential equations, investigating meromorphic cosets and modular tensor categorical structures.

10/23–07/26 **Postdoctoral research I:** I have extended the concept of symmetry-resolved entanglement entropy to categorical/non-invertible symmetries in 2D CFTs, showing how anyonic sectors diagnose the breakdown of *equipartition of entropy*. I have also developed further directions on quasi-characters in the holomorphic modular bootstrap programme and defect partition functions in RCFT. Furthermore, I have studied hydrodynamic fluctuations and anomalous transport in chiral MHD. Currently, I am involved in ongoing works on studying curved-space OPEs, understanding novel quantum matter phases such as Mott metals using generalised symmetries & anomalies, and deriving hydrodynamic effective actions from gravity.

08/26–02/27 **Postdoctoral research II:** Currently, I am working on extending the *entanglement bootstrap* programme for CFTs developed by Lin and McGreevy to states beyond the vacuum, and on testing generalisations of their prescription in driven CFTs, boundary CFTs, defect CFTs, together with their possible holographic interpretations. I am also involved in identifying and constructing CFTs that describe transitions in Mott systems, such as the transition from a Mott metallic phase to a Mott insulating phase through a pseudogap regime. The broader goal is to characterise such transitions using techniques from generalised symmetries, and to develop CFT-based criteria that can help elucidate the structure and dynamics of *quantum critical Fermi surfaces*.

Research Interests

Generalised Symmetries, Hydrodynamics, Holography & Gravity

- Holographic study of anomalous systems using higher-form symmetries
- Hydrodynamic effective theories with generalised global symmetries
- Fluid-gravity duality and near-horizon symmetries of hydrodynamic actions

Conformal Field Theory

- Entanglement entropic aspects of categorical symmetries & entanglement bootstrap
- Order parameters, symmetry breaking patterns and quantum phases of matter associated with categorical symmetries
- Curved space OPE, generally covariant correlation functions and conformal geometry

Holomorphic Modular Bootstrap

- Classification of RCFTs via MLDEs satisfied by their characters
- Meromorphic RCFTs for $c > 24$
- Coset constructions and modular tensor categorical structures
- MLDEs for congruence subgroups of $\mathrm{SL}(2,\mathbb{Z})$ and Fricke groups

Publications

Authorship convention: *In high-energy theoretical physics (hep-th), author names are conventionally listed alphabetically by surname. Author order does not indicate relative contribution; unless explicitly stated otherwise, all co-authors are understood to have contributed equally.*

Journal Publications

[1] Arpit Das, Javier Molina-Vilaplana and Pablo Saura-Bastida (2024), *Generalized symmetry resolution of entanglement in conformal field theory for twisted and anyonic sectors*, **Phys. Rev. D 110 (2024) 12**, arXiv:2409.02162 [hep-th]. [Scopus Q: Q1; JIF: 5.3]

[2] Arpit Das, Nabil Iqbal and Napat Poovuttikul (2024), *Hydrodynamic fluctuations and topological susceptibility in chiral magnetohydrodynamics*, **SciPost Phys. 17 (2024) 042**, arXiv:2403.16957 [hep-th]. [Scopus Q: Q1; JIF: 5.6]

[3] Pablo Saura-Bastida, Arpit Das, German Sierra and Javier Molina-Vilaplana (2024), *Categorical-Symmetry Resolved Entanglement in CFT*, **Phys. Rev. D 109 (2024) 10**, arXiv:2402.06322 [hep-th]. [Scopus Q: Q1; JIF: 5.3]

[4] Arpit Das, Adrien Florio, Nabil Iqbal and Napat Poovuttikul (2023), *Higher-form symmetry and chiral transport in real-time Abelian lattice gauge theory*, **SciPost Phys. 17 (2024) 085**, arXiv:2309.14438 [hep-th]. [Scopus Q: Q1; JIF: 5.6]

[5] Arpit Das, Chethan N. Gowdigere, Sunil Mukhi and Jagannath Santara (2023), *Modular Differential Equations with Movable Poles and Admissible RCFT Characters*, **JHEP 12 (2023) 143**, arXiv:2308.00069 [hep-th]. [Scopus Q: Q1; JIF: 4.9]

[6] Arpit Das, Chethan N. Gowdigere and Sunil Mukhi (2022), *Meromorphic Cosets and the Classification of Three-Character CFT*, **JHEP 03 (2023) 023**, arXiv:2212.03136 [hep-th]. [Scopus Q: Q1; JIF: 4.9]

[7] Arpit Das, Chethan N. Gowdigere and Sunil Mukhi (2022), *New meromorphic CFTs from cosets*, **JHEP 07 (2022) 152**, arXiv:2207.04061 [hep-th]. [Scopus Q: Q1; JIF: 4.9]

[8] Arpit Das, Ruth Gregory and Nabil Iqbal (2022), *Higher-form symmetries, anomalous magnetohydrodynamics, and holography*, **SciPost Phys. 14 (2023) 163**, arXiv:2205.03619 [hep-th]. [Scopus Q: Q1; JIF: 5.6]

[9] Arpit Das, Chethan N. Gowdigere and Jagannath Santara (2021), *Classifying three-character RCFTs with Wronskian Index equalling 0 or 2*, **JHEP 11 (2021) 195**, arXiv:2108.01060 [hep-th]. [Scopus Q: Q1; JIF: 4.9]

[10] Arpit Das, Chethan N. Gowdigere and Jagannath Santara (2021), *Wronskian indices and rational conformal field theories*, **JHEP 04 (2021) 294**, arXiv:2012.14939 [hep-th]. [Scopus Q: Q1; JIF: 4.9]

[11] Arpit Das and Narayan Banerjee (2019), *Unitary black hole radiation: Schwarzschild-global monopole background*, **Eur. Phys. J. C 79 (2019) 8, 704**, arXiv:1908.09616 [gr-qc]. [Scopus Q: Q1; JIF: 4.9]

[12] Arpit Das and Narayan Banerjee (2019), *Unitarity in Reissner–Nordström background: striding away from information loss*, **Eur. Phys. J. C 79 (2019) 6, 475**, arXiv:1902.03378 [gr-qc]. [Scopus Q: Q1; JIF: 4.9]

Pre-prints

[1] Mike Blake, Arpit Das and Richard A. Davison (2026), *Horizon symmetries of exact hydrodynamic actions*, arXiv:2610.12262 [hep-th]. *(under review at JHEP).*

[2] Arpit Das, Anatoly Konechny and Naveen B. Umasankar (2026), *OPE and correlation functions in a generally covariant form*, arXiv:2608.28743 [hep-th]. *(under review at JHEP).*

[3] Arpit Das and Sunil Mukhi (2026), *Unlocking the Wronskian Tower: A Simplification of the Holomorphic Modular Bootstrap*, arXiv:2607.18375 [hep-th]. *(under review at JHEP).*

[4] Mike Blake, Arpit Das and Richard A. Davison (2026), *Dissipative hydrodynamic actions and horizon symmetries in gravity*, arXiv:2607.00866 [hep-th]. *(accepted at JHEP).*

[5] Naveen B. Umasankar and Arpit Das (2026), *Verlinde lines, anyon permutations and commutant pairs inside $E_{8,1}$ CFT*, arXiv:2602.02700 [hep-th].

[6] Arpit Das and Sunil Mukhi (2025), *Signs, growth and admissibility of quasi-characters and the holomorphic modular*

bootstrap for RCFT, arXiv:2507.07170 [hep-th]. *(under review at SIGMA).*

[7] Arpit Das (2023), *Meromorphic CFTs have central charges $c = 8\mathbb{N}$: a proof by the MLDE approach*, arXiv:2312.02129 [hep-th].

[8] Arpit Das, Nabil Iqbal and Napat Poovuttikul (2022), *Towards an effective action for chiral magnetohydrodynamics*, arXiv:2212.09787 [hep-th].

[9] Arpit Das and Naveen B. Umasankar (2022), *Two- & Three-character solutions to MLDEs and Ramanujan–Eisenstein Identities for Fricke Groups*, arXiv:2211.15369 [hep-th]. *(under review at CNTP).*

Publication Profiles

- Inspire HEP
- arXiv
- Google Scholar

Talks, Presentations & Lecture series

1. **IISER Kolkata Department of Physics: Mini lecture series (2026)** 3 lectures (2 hours each) – *Generalised symmetries and anomalies: From quantum mechanics to quantum matter.*
2. **IISER Kolkata Physics Seminar (2026)** 60 min – *Horizon symmetries of exact hydrodynamic actions.*
3. **Kolkata Strings and Fields Journal Club (2026)** 60 min blackboard – *OPE in a generally covariant form.*
4. **University of Warwick, UK (2026)** poster – *Horizon symmetries of exact hydrodynamic actions.*
5. **YITP Kyoto, Japan (2026)** poster – *Hydrodynamic EFT for chiral MHD.*
6. **Stringy seminar, online (2026)** 60 min – *Generalised global symmetries and applications in 2D CFTs.*
7. **COEP-Tech, Pune (2026)** 60 min – *Modularity in Physics: a number-theoretic approach to 2D CFTs.*
8. **IISER Pune HEP Journal Club (2026)** 90 min blackboard – *Non-invertible symmetries in QFTs.*
9. **IISER Pune HEP Seminar (2026)** 180 min, two parts – *Hydrodynamic EFT for chiral MHD.*
10. **IISER Kolkata Physics Seminar (2026)** 60 min – *Generalised global symmetries and applications in 2D CFTs.*
11. **SNBNCBS Early Career Talk, Kolkata (2026)** 60 min – *Generalised global symmetries and applications in 2D CFTs.*
12. **ITER-SOA, Bhubaneswar (2025)** 60 min – *Entanglement entropy, twist fields and anomalies of non-invertible symmetries.*
13. **IOP Bhubaneswar (2025)** 60 min – *Entanglement entropy, twist fields and anomalies of non-invertible symmetries.*
14. **IISER Berhampur (2025)** 60 min blackboard – *Entanglement entropy, twist fields and anomalies of non-invertible symmetries.*
15. **ICTS-TIFR, Bengaluru (2025)** 15 min – *Hydrodynamic EFT for chiral MHD.*
16. **BIRS-CMI Workshop, Chennai (2025)** 30 min – *Entanglement entropy, twist fields and anomalies of non-invertible symmetries.*
17. **IIT Chennai (2025)** 60 min blackboard – *Generalised symmetry resolved entanglement in CFT.*
18. **IMSc Chennai (2025)** 60 min blackboard – *Generalised symmetry resolved entanglement in CFT.*
19. **INI Cambridge, UK (2025)** poster – *Entanglement entropy, twist fields and anomalies of non-invertible symmetries.*
20. **INI Cambridge, UK (2025)** 2 min gong show – *Generalised symmetry resolved entanglement in CFT.*
21. **YITP Kyoto, Japan (2025)** 30 min – *Entanglement entropy, twist fields and anomalies of non-invertible symmetries.*
22. **ICFT 2025, London (2025)** 30 min – *Frobenius bootstrap of rational CFTs.*
23. **ECT* Trento, Italy (2025)** 20 min – *Hydrodynamic fluctuations and topological susceptibility in chiral MHD.*
24. **EMPG group meeting, Edinburgh (2025)** 45 min blackboard – *Entanglement entropy, twist fields and anomalies of non-invertible symmetries.*
25. **University of Murcia, Spain (2024)** 90 min blackboard – *The Mathur-Mukhi-Sen classification of rational CFTs.*
26. **Bangkok Workshop on HET, Chulalongkorn (2025)** 60 min blackboard – *The Mathur-Mukhi-Sen classification of rational CFTs.*
27. **Strings 2025, NYU Abu Dhabi (2025)** gong show & poster – *Generalised symmetry resolved entanglement in CFT.*
28. **IISER Pune (2024)** 90 min blackboard – *Generalised symmetry resolved entanglement in CFT.*
29. **IHES Summer School, Paris (2024)** 22 min – *Generalised symmetries, anomalous MHD and holography.*
30. **ICMS Summer School, Edinburgh (2024)** 5 min gong show – *Categorical-symmetry resolved entanglement in CFT.*
31. **ITP TU Wien (2024)** 60 min blackboard – *Categorical-symmetry resolved entanglement in CFT.*
32. **Durham University Journal Club (2024)** 60 min – *The Mathur-Mukhi-Sen classification of rational CFTs.*
33. **CERN GenHET Meeting (2024)** 20 min – *Generalised symmetries: from hydrodynamics to entanglement resolution.*
34. **YRS2024, Maynooth University (2024)** poster – *Categorical-symmetry resolved entanglement in CFT.*
35. **Structure & Symmetry Day, Edinburgh (2023)** 30 min – *The Mathur-Mukhi-Sen classification of rational CFTs.*
36. **EMPG group meeting, Edinburgh (2023)** 45 min blackboard – *Generalised symmetries and holography in QED.*
37. **FPUK, Durham (2023)** gong show & poster – *Chiral MHD, symmetries and holography.*
38. **ECT* Trento, Italy (2023)** 20 min – *Chiral magnetohydrodynamics, holography and EFT.*
39. **ICFT 2022, Durham (2022)** 30 min – *The Mathur-Mukhi-Sen classification of RCFTs.*
40. **EMPG seminar, Edinburgh (2022)** 60 min + pre-talk

– *Chiral MHD, symmetries and holography.*

41. **FPUK and the City, London (2022)** gong show & poster – *Chiral MHD, symmetries and holography.*
42. **University of Bristol (2022)** 60 min – *Chiral MHD, symmetries and holography.*
43. **HoloClub Seminar, IFT Madrid (2022)** 90 min – *Chiral MHD, symmetries and holography.*
44. **Stringfest@Swansea, FPUK (2022)** gong show & poster – *Higher-form symmetries, anomalous MHD and holography.*
45. **STAG School, Southampton (2022)** gong show – *Higher-form symmetries, anomalous MHD and holography.*
46. **Defects and Symmetry, KCL (2022)** gong show & poster – *Higher-form symmetries, anomalous MHD and holography.*
47. **Durham CPT Student Seminar (2022)** 60 min – *Higher-form symmetries, anomalous MHD and holography.*
48. **YTF, Durham (2021)** 20 min – *Holomorphic modular bootstrap.*
49. **YTF, Durham (2021)** gong show – *Higher-form symmetries, anomalous MHD and holography.*
50. **Durham CPT Student Seminar (2020)** 60 min – *Entanglement Islands and Page curve.*
51. **Durham CPT Student Seminar (2019)** 60 min blackboard – *RCFTs and modular forms.*

Teaching, Mentoring & Professional Service

2026	**Summer internship**: supervised **1** mechanical engineering student from COEP-Tech, Pune (3-month long) on the Mathur-Mukhi-Sen classification of rational CFTs. (project report).
2026	**EPSRC Vacation Scholarship programme**: supervised **1** mathematics undergraduate student from University of Edinburgh (2.5-month long) on the Mathur-Mukhi-Sen classification of rational CFTs. (project report).
2025-26	**ICTP PWF: Physics for Bangladesh**: lectured **6** introductory QFT lectures to undergraduates; supervised **4** postgraduate internship projects (each 3-month long) on the Mathur-Mukhi-Sen classification of rational CFTs and on generalised symmetries, anomalies and hydrodynamics. (lec vids), (lec notes), (project report-I)
2025-2026	**MIORPA, Oxford University**: supervised **2** mathematics postgraduate student from Africa (each 2-month long) on the Mathur-Mukhi-Sen classification of rational CFTs. (project report-I), (project report-II).
2020	**Semester Project Guide, IISER Kolkata**: supervised **8** postgraduate students on Hawking radiation and black-hole thermodynamics in a QFT course.
2018	**Paid Teaching Assistant, IISER Kolkata**: General Relativity and Cosmology, postgraduate level; prepared assignments and notes, conducted tutorials and graded scripts. (lec notes).
2022–Present	**Reviewer**: Physics Letters B, Physical Review D, Nuclear Physics B, Journal of High Energy Physics, Communications in Number Theory and Physics
2021	**Co-organiser**: Young Theorists' Forum 2021, Durham University.
2020–2021	**Co-organiser**: Black Hole and Islands Journal Club, Holography group, Durham University.
2024–2025	**Organiser**: Generalised Global Symmetries Journal Club, EMPG group, University of Edinburgh.

Fellowships, Achievements, Skills & Volunteering

- Postdoc grant from the research grant: ANRF/ECRG/2024/000247/PMS by Anusandhan National Research Foundation, India (Aug 2026–Feb 2027).
- STFC Consolidated Grant ST/T000600/1, "Particle Theory at the Higgs Centre", University of Edinburgh (Oct 2023–Sept 2026).
- Summer Intern with scholarship, Fields and Strings Laboratory, EPFL, Lausanne (Jun–Aug 2017).
- Indian Academy of Sciences Fellow, selected for BARC, India (2015; declined).
- INSPIRE SHE Fellowship, DST, Government of India (2013–2018).
- Awarded A+ (highest grade) in M.Sc. Thesis.
- Scored 2nd highest marks (30/40) in SISSA Astro-Particle Physics PhD written exam from a cohort of 40 students.
- Secured top 1% (rank 473) in NSEP 2012–13; top 1% in CBSE 12th exam 2012–13.
- Secured rank 6 all India and rank 3 in Odisha in CISCE 10th exam 2010–11.
- **Computational skills:** Python, SageMath, Mathematica, C, C++, Java.
- **Volunteering:** represented Durham HET group for Cambridge prospective graduate students; mentored a few hep-th postgraduate & graduate students and postdocs through the Strings Mentoring programme for over two years.

References

Prof. Nabil Iqbal, AMLab, University of Amsterdam, Netherlands, n.iqbal@uva.nl

Prof. Mike Blake, School of Mathematics, University of Bristol, UK, mike.blake@bristol.ac.uk

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Prof. Ruth Gregory, Department of Physics, King's College London, UK, ruth.gregory@kcl.ac.uk

Prof. Sunil Mukhi, Nayanta University, Pune, India, sunil.mukhi@gmail.com

Prof. Anatoly Konechny, Department of Mathematics, Heriot-Watt University, UK, A.Konechny@hw.ac.uk

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