Pratik Nandy

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Homepage, INSPIRE-HEP
Google Scholar, Researchgate

Current affiliation

2022-present Extreme Universe (ExU) Postdoctoral fellow, *JSPS Grant-in-Aid for Transformative Research Areas (A) "Extreme Universe"*.

Center for Gravitational Physics and Quantum Information, Yukawa Institute for Theoretical Physics (YITP), Kyoto University, Japan.

2023-present RIKEN Interdisciplinary Theoretical and Mathematical Sciences Program (iTHEMS).

Wako and Kyoto University campus, Japan.

Research experiences

2024 Visitor (RIKEN-Berkeley ASPIRE program), *Berkeley Center for Theoretical Physics (BCTP)*, University of California, Berkeley, CA, USA.

2023 Visitor (ExU overseas program), *Princeton Center for Theoretical Science (PCTS)*, Princeton University, Princeton, New Jersey, USA.

Education

2017-2022 PhD in Physics, *Centre for High Energy Physics, Indian Institute of Science*, Bangalore, India.

PhD thesis: Complexity and Entanglement: From quantum gravity to many-body systems.

Supervisor: Prof. Aninda Sinha.

2015-2017 Master of Science (M.Sc) in Physics, *Indian Institute of Technology Kanpur*, India.
(received academic excellence award).

2012-2015 Bachelor of Science (B.Sc) in Physics, *Presidency University*, Kolkata, India.

Research interests

1. Quantum information in quantum gravity, 2. Holography and many-body quantum chaos, 3. Non-Hermitian and open quantum systems, 4. Quantum teleportation and wormholes.

Publications/Preprints

[All papers (except marked with *) are arranged in the alphabetical order of the authors' name, which is conventional in high-energy theory (hep-th) community and signifies equal contribution].

2024 **18.** Krylov fractality and complexity in generic random matrix ensembles, B. Bhattacharjee, **P. Nandy**, [arXiv:2407.07399 [quant-ph]].

17. Probing quantum chaos through singular-value correlations in sparse non-Hermitian SYK model, **P. Nandy**, T. Pathak, M. Tezuka, [arXiv:2406.11969 [quant-ph]].

*__16.__ Quantum Dynamics in Krylov Space: Methods and Applications, **P. Nandy**, A. S. Matsoukas-Roubeas, P. Martínez-Azcona, A. Dymarsky, A. del Campo, [arXiv:2405.09628 [quant-ph]].

2023 **15.** Operator dynamics in Lindbladian SYK: a Krylov complexity perspective, B. Bhattacharjee, **P. Nandy**, T. Pathak, JHEP 01 (2024) 094, [arXiv:2311.00753 [quant-ph]].

14. On Krylov complexity in open systems: an approach via bi-Lanczos algorithm, A. Bhattacharya, **P. Nandy**, P. P. Nath, H. Sahu, JHEP 12 (2023) 066, [arXiv:2303.04175 [quant-ph]].

2022 **13.** Operator growth in open quantum systems: lessons from the dissipative SYK, B. Bhattacharjee, X. Cao, **P. Nandy**, T. Pathak, JHEP 03 (2023) 054, [arXiv:2212.06180 [quant-ph]].

12. Krylov complexity in large-q and double-scaled SYK model, B. Bhattacharjee, **P. Nandy**, T. Pathak, JHEP 08 (2023) 099, [arXiv:2210.02474 [hep-th]].

***11.** Probing quantum scars and weak ergodicity-breaking through quantum complexity, B. Bhattacharjee, S. Sur, **P. Nandy**, Phys. Rev. B **106**, 205150 (2022), [arXiv:2208.05503 [quant-ph]].

10. Operator growth and Krylov construction in dissipative open quantum systems, A. Bhattacharya, **P. Nandy**, P. P. Nath, H. Sahu, JHEP 12 (2022) 081, [arXiv:2207.05347 [quant-ph]].

9. Krylov complexity in saddle-dominated scrambling, B. Bhattacharjee, X. Cao, **P. Nandy**, T. Pathak, JHEP 05 (2022) 174, [arXiv:2203.03534 [quant-ph]].

8. Balanced Partial Entanglement and Mixed State Correlations, H. A. Camargo, **P. Nandy**, Q. Wen, H. Zhong, SciPost Phys. 12 (2022) 137, [arXiv:2201.13362 [hep-th]].

7. Q-curvature and Path Integral Complexity, H. A. Camargo, P. Caputa, **P. Nandy**, JHEP 04 (2022) 081, [arXiv:2201.00562 [hep-th]].

2021 **6.** Bath deformations, islands and holographic complexity, A. Bhattacharya, A.Bhattacharyya, **P. Nandy**, A. K Patra, Phys. Rev. D **105**, 066019, [arXiv:2112.06967 [hep-th]].

5. Partial islands and subregion complexity in geometric secret-sharing model, A. Bhattacharya, A.Bhattacharyya, **P. Nandy**, A. K Patra, JHEP 12 (2021) 091, [arXiv:2109.07842 [hep-th]].

4. Eigenstate capacity and Page curve in fermionic Gaussian states, B. Bhattacharjee, **P. Nandy**, T. Pathak, Phys. Rev. B **104**, 214306 (2021), [arXiv:2109.00557 [quant-ph]].

3. Capacity of entanglement in local operators, **P. Nandy**, JHEP 07 (2021) 019, [arXiv:2106.00228 [hep-th]].

2. Islands and complexity of eternal black hole and radiation subsystems for a doubly holographic model, A. Bhattacharya, A. Bhattacharyya, **P. Nandy**, A. K Patra, JHEP 05 (2021) 135, [arXiv:2103.15852 [hep-th]].

2019 **1.** Renormalized Circuit Complexity, A. Bhattacharyya, **P. Nandy**, A. Sinha, Phys. Rev. Lett. **124**, 101602 (2020), [arXiv:1907.08223 [hep-th]].

Presentations, Talks, and Lectures

Sept 2024 Invited talk at workshop "Focus Week on Non-equilibrium Quantum Dynamics" at Kavli IPMU, University of Tokyo, Japan.

Aug 2024 Short talk and Poster presentation at workshop "Quantum Information, Quantum Field Theory and Gravity" at International Centre for Theoretical Sciences (ICTS), Bangalore, India.

July 2024 Invited talk at workshop "Holography in Beijing 2024" at Kavli Institute of Theoretical Sciences (KITS), UCAS, Beijing, China.

Jun 2024 Invited talk at Department of Physics, University of Kentucky, USA.

Feb 2024 Invited talk at the 2nd Young researchers workshop, Shirahama-so, Shiga, Japan.

Feb 2024 Invited talk at the Osaka University, Osaka, Japan.

Jan 2024 Invited talk at the Department of Physics and Material Science, University of Luxembourg, Luxembourg.

Jan 2024 Invited seminar and Invited talk at Kobayashi-Masakawa Institute, Nagoya University, Nagoya, Japan.

Dec 2023 Invited seminar at Saitama University, Saitama, Japan.

Nov 2023 Contributed talk at KEK Theory Workshop, Tsukuba, Ibaraki, Japan.

Nov 2023 Contributed talk at Quantum Gravity Gatherings, RIKEN, Wako, Japan.

Nov 2023 Invited talk at the Department of Physics, The University of Tokyo, Tokyo, Japan.

Oct 2023 Invited talk at Saha Institute of Nuclear Physics, Kolkata, India

Sept 2023 Contributed talk at the conference Quantum Information, Quantum Matter and Quantum Gravity, YITP, Kyoto, Japan.

July 2023 Invited talk at the conference Integrability, Deformations, and Chaos, Okinawa Institute of Science and Technology, Okinawa, Japan.

May 2023 Invited talk at the workshop Entanglement, Large N and Black Hole, APCTP, Pohang, Korea.

Jan 2023 Gong show and poster presentation at the 17th Kavli Asian Winter School on Strings, Particles and Cosmology, IBS, Daejeon, Korea.

Dec 2022 Gong show and poster presentation at the ExU annual conference, Kobe, Japan.

Sept 2022 Invited talk in ExU circular meeting, YITP, Kyoto University, Japan.

June 2022 NITHeCS webinar (invited): Two lectures on "Recent progress on Krylov complexity" in the Department of Mathematics and Applied Mathematics, University of Cape Town, South Africa.

Dec 2021 Invited (online) talk at the Department of Computer Science, Texas Tech. University, Lubbock, Texas, USA.

Aug 2021 Invited (online) talk in Quantum Information in QFT and AdS/CFT-II.

Aug 2020 Invited (online) talk in Quantum Information in QFT and AdS/CFT-I.

Jul 2020 Invited (online) lectures (3 pedagogical lectures) on tensor networks and complexity in ST4-2020.

Jan 2020 Gong show and poster presentation at the 14th Kavli Asian Winter School on Strings, Particles and Cosmology, Tohoku University, Sendai, Japan.

Refereed journals

Journal of High Energy Physics (JHEP), SciPost Physics, Physical Review D, Physical Review Research.

Teaching experiences

2019-2020 Graduate course: General relativity.

Course instructor: Prof. Justin R. David, Indian Institute of Science, Bangalore.

Organizing experiences

2022 Workshop on Students talk on trending topics (ST4) - 2022, Indian Institute of Technology, Indore, India.

2021-2022 Math-Physics seminar series, CHEP, Indian Institute of Science, Bangalore, India.

Research visits

Jun. 2024 Department of Physics, University of Kentucky, Lexington, USA.
Host: Prof. Anatoly Dymarsky.

May/Jun. 2024 Berkeley Center for Theoretical Physics (BCTP), University of California, Berkeley, CA, USA.
Host: Prof. Yasunori Nomura.

Feb 2024 Department of Physics, University of Basque Country, Bilbao, Spain
Host: Prof. Adolfo del Campo and Prof. Inigo L. Egusquiza.

Jan./Feb 2024 Department of Physics, University of Luxembourg, Luxembourg.
Host: Prof. Adolfo del Campo.

Jan. 2024	Department of Physics, Kobayashi-Masakawa Institute, Nagoya University, Japan. Host: Prof. Masamichi Miyaji.
Dec. 2023	Department of Physics, Saitama University, Japan. Host: Prof. Kentaroh Yoshida.
Nov. 2023	Department of Physics, The University of Tokyo, Japan. Host: Prof. Hosho Katsura.
Feb/Mar. 2023	Princeton Center for Theoretical Science (PCTS), Princeton University, New Jersey, USA. Host: Prof. Shinsei Ryu.
Jun. 2022	Department of Mathematics and Applied Mathematics, University of Cape Town, South Africa. Host: Prof. Shajid Haque and Prof. Jeff Murugan.

Academic achievements, grants, awards, and scholarships

2024	Adopting Sustainable Partnerships for Innovative Research Ecosystem (ASPIRE) fellowship, iTHEMS, RIKEN, Japan, and University of California, Berkeley, USA, Japan Science and Technology Agency (JST), Grant Number JPMJAP2318..
2023	Extreme Universe Overseas visiting researchers grant, KAKENHI No. 21H05182.
2022-2025	Extreme Universe (ExU) Postdoctoral fellowship, JSPS Grant-in-Aid for Transformative Research Areas (A) "Extreme Universe" No. 21H05190, Japan.
2019-2022	SRF-Senior Research Fellowship (PhD), University Grants Commission (UGC), India.
2017-2019	JRF-Junior Research Fellowship (PhD), University Grants Commission (UGC), India.
2017	Academic Excellence Award (M.Sc), IIT Kanpur.
2012–2015	INSPIRE Scholarship (B.Sc), Department of Science and Technology, India.

Press releases and media coverage

2020	Optimizing efficiency of quantum circuits at Phys.org, [link here].
2020	IISc team proposes efficient design for quantum circuits (IISc press release), [link here]. (NDTV), [link here].

Personal

DOB, Gender	30 June 1994 (Age: 29), Male.
Citizenship	India.
Residence	Japan.
Languages	English, Bengali (native), Hindi, Japanese (basic).
Comp. skills	Mathematica, Python.

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