

Pratik Nandy

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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.

Research experiences

2023-present Visiting researcher, *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

Complexity and entanglement in quantum field theory, holography and many-body systems, operator-growth and quantum chaos, SYK model, quantum teleportation and wormholes, black hole information problem.

Publications/Preprints

[The papers below follow (mostly) the alphabetical order of the authors' name, which is conventional in the high energy theory community].

- 2022 **13.** Operator growth in open quantum systems: lessons from the dissipative SYK, B. Bhattacharjee, X. Cao, **P. Nandy**, T. Pathak, [arXiv:2212.06180 [quant-ph]].
(accepted in JHEP)
- 12.** Krylov complexity in large-q and double-scaled SYK model, B. Bhattacharjee, **P. Nandy**, T. Pathak, [arXiv:2210.02474 [hep-th]].
- 11.** Probing quantum scars and weak ergodicity-breaking through quantum complexity, B. Bhattacharjee, S. Sur, **P. Nandy**, T. Pathak, [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

- Jan 2023 Gong Show and Poster presentation on "An operator growth hypothesis on open quantum systems" at the 17th Kavli Asian Winter School on Strings, Particles and Cosmology, IBS, Daejeon, Korea.
- Dec 2022 Gong Show and Poster presentation on "An operator growth hypothesis on open quantum systems" at the ExU annual conference, Kobe, Japan.
- Sept 2022 Invited talk on "Complexity in the SYK: some analytic results" 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 (Online) Invited talk on "Quantum information: from quantum gravity to condensed matter physics" in Department of Computer Science, Texas Tech. University, Lubbock, Texas, USA.
- Aug 2021 (Online) Invited talk on "Q-curvature and Path Integral Complexity" in Quantum Information in QFT and AdS/CFT-II.
- Feb 2021 (Online) Talk on "Renormalized Circuit Complexity" in CHEP in-house symposium, IISc Bangalore.
- Aug 2020 (Online) Invited talk on "Renormalized Circuit Complexity" in Quantum Information in QFT and AdS/CFT-I.
- Jul 2020 (Online) Invited lectures (3 pedagogical lectures) on tensor networks and complexity in ST4-2020.
- Jan 2020 Gong Show and Poster presentation on "Renormalized Circuit Complexity" at the 14th Kavli Asian Winter School on Strings, Particles and Cosmology, Tohoku University, Sendai, Japan.

Teaching experiences

- 2019-2020 Graduate course: General relativity.
Course instructor: Prof. Justin R. David, Indian Institute of Science, Bangalore.

Organizing experiences

- 2022 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

- Feb/Mar. 2023 Princeton Center for Theoretical Science (PCTS) and Department of Physics, Princeton University, New Jersey, USA.
Host: Prof. Shinsei Ryu.
- Aug. 2022 Department of Physics, Indian Institute of Technology, Gandhinagar, India.
Host: Prof. Arpan Bhattacharyya.
- June 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

- 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: 28), Male.

Citizenship India.

Residence Japan.

Languages English, Bengali (native), Hindi, Japanese (basic).

Comp. skills Mathematica, Python.

Last updated: Friday 24th February, 2023