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"*.

Yukawa Institute for Theoretical Physics (YITP), Kyoto University, Japan.

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.** An operator growth hypothesis in open quantum systems, B. Bhattacharjee, X. Cao, **P. Nandy**, T. Pathak, [arXiv:2212.06180 [quant-ph]].

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

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.

Computational skills

1. Mathematica, 2. Python.

Schools/Workshops/Conferences attended (offline/online)

Sept 2022 Quantum extreme universe from quantum information, YITP, Kyoto, Japan.

Aug 2021 (Online) (**Speaker**) Quantum Information in QFT and AdS/CFT-II, IIT Gandhinagar, India.

Jun 2021 (Online) Strings-2021, ICTP-SAIFR, Sao Paulo, Brazil.

Aug-Sep 2020 (Online) Summer School on Superstring Theory and Related Topics, ICTP, Trieste, Italy.

Aug 2020 (Online) (**Speaker**) Quantum Information in QFT and AdS/CFT-I, IIT Gandhinagar, India.

Jul 2020 (Online) (**Speaker**) Students talk on trending topics (ST4)-2020, India.

Jan 2020 (**Gong Show and poster presentation**) 14th Kavli Asian Winter School on Strings, Particles and Cosmology, Tohoku University, Sendai, Japan.

Academic visits

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.

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

Last updated: Saturday 17th December, 2022