Pratik Nandy

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Kyoto University

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INSPIRE-HEP, Google Scholar

Current affiliation

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

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

Research group: Quantum information theoretic approach to the dynamics of quantum field theory (D01), Principal Investigator: Prof. Tatsuma Nishioka.

Education

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

Supervisor: Prof. Aninda Sinha.

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

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, quantum simulation and information-theoretic exploration of renormalization and effective field theories, black hole information problem.

Publications/Preprints (in chronological order)

(The papers below follow the alphabetical order of the surnames, which is conventional in the high energy theory community).

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

2021 **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]].

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

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]].

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]].

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

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]].

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

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

11. Probing quantum scars and weak ergodicity-breaking through quantum complexity, B. Bhattacharjee, S. Sur, **P. Nandy**, [arXiv:2208.05503 [quant-ph]].

(to appear) **12.** Krylov complexity in periodically driven systems, P. Caputa, **P. Nandy**.

Presentations, Talks and Lectures

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.

Jul 2020 (Online) Pedagogical lectures (3 lectures) on tensor networks and complexity in ST4-2020.

Aug 2020 (Online) Invited talk on "Renormalized Circuit Complexity" in Quantum Information in QFT and AdS/CFT-I.

Feb 2021 (Online) Talk on "Renormalized Circuit Complexity" in CHEP in-house symposium, IISc Bangalore.

Aug 2021 (Online) Invited talk on "Q-curvature and Path Integral Complexity" in Quantum Information in QFT and AdS/CFT-II.

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.

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

Teaching experiences

2019-2020 Graduate course: General relativity.

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

Organizing experiences

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

2022 Students talk on trending topics (ST4) - 2022.

Computational skills

1. Mathematica, 2. Python.

Schools/Workshops/Conferences attended (offline/online)

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

Mar-Apr 2020 (Online) Holography: from high-energy physics to quantum information, Steklov Mathematical Institute, Moscow, Russia.

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

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

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

Nov 2020 (Online) Island Hopping 2020: From Wormholes to Averages, CERN, Geneva, Switzerland.

Mar 2021 (Online) Recent progress in theoretical physics based on quantum information theory, YITP, Kyoto, Japan.

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

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

Aug 2021 (Online) Strings and Fields 2021, YITP, Kyoto, Japan.

Academic visits

June 2022 Department of Mathematics and Applied Mathematics, University of Cape Town, South Africa.

Aug 2022 Department of Physics, Indian Institute of Technology, Gandhinagar, India.

Academic achievements, awards and scholarships

2022-2025 Extreme Universe (ExU) Postdoctoral fellowship, MEXT-JSPS Grant-in-Aid for Transformative Research Areas (A) "Extreme Universe", 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.

Personal

DOB, Gender 30 June 1994 (Age: 28), Male.

Citizenship India.

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

References

1. Prof. Aninda Sinha, Indian Institute of Science, Bangalore, India.
   Email: asinha@iisc.ac.in
2. Prof. Pawel Caputa, University of Warsaw, Warsaw, Poland.
   Email: pawel.caputa@fuw.edu.pl
3. Prof. Arpan Bhattacharyya, IIT Gandhinagar, Gujarat, India.
   Email: abhattacharyya@iitgn.ac.in
4. Prof. Chethan Krishnan, Indian Institute of Science, Bangalore, India.
   Indian Institute of Science, Bangalore, India.
   Email: chethan@iisc.ac.in

Last updated: Friday 12th August, 2022