

Pratik Nandy

Yukawa Institute for Theoretical Physics
Kyoto University

Kitashirakawa Oiwakecho,
Sakyo-ku, Kyoto, Japan
✉ pratik@yukawa.kyoto-u.ac.jp
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.
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, 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 (mostly) 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]].

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) Invited lectures (3 pedagogical 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 (invited): 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: Tuesday 6th September, 2022