

# Pratik Nandy

Yukawa Institute for Theoretical Physics  
Kyoto University

Kitashirakawa Oiwakecho,  
Sakyo-ku, Kyoto, Japan  
✉ [pratik@yukawa.kyoto-u.ac.jp](mailto:pratik@yukawa.kyoto-u.ac.jp)  
INSPIRE-HEP, Google Scholar

## 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, 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.

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## 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.

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## 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.

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## Personal

DOB, Gender 30 June 1994 (Age: 28), Male.  
Citizenship India.  
Languages English, Bengali, Hindi, Japanese (basic).

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## 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

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