

# Pratik Nandy

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Homepage, [INSPIRE-HEP](#)  
[Google Scholar](#), [Researchgate](#)

## 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.
- 2023-present RIKEN Interdisciplinary Theoretical and Mathematical Sciences Program (iTHEMS).  
RIKEN, Wako and Kyoto University campus, Japan.

## Research experiences

- 2023-2023 Visiting postdoc., *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 and related models, quantum teleportation and wormholes.

## Publications/Preprints

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

15. Operator dynamics in Lindbladian SYK: a Krylov complexity perspective, B. Bhattacharjee, **P. Nandy**, T. Pathak, [arXiv:2311.00753 [quant-ph]].
- 2023 14. On Krylov complexity in open systems: an approach via bi-Lanczos algorithm, A. Bhattacharya, **P. Nandy**, P. P. Nath, H. Sahu, [JHEP 12 \(2023\) 066](#), [arXiv:2303.04175 [quant-ph]].
- 2022 13. Operator growth in open quantum systems: lessons from the dissipative SYK, B. Bhattacharjee, X. Cao, **P. Nandy**, T. Pathak, [JHEP 03 \(2023\) 054](#), [arXiv:2212.06180 [quant-ph]].
12. Krylov complexity in large- $q$  and double-scaled SYK model, B. Bhattacharjee, **P. Nandy**, T. Pathak, [JHEP 08 \(2023\) 099](#), [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

- Nov 2023 Contributed talk on “Operator dynamics of Lindbladian SYK” at KEK Theory Workshop, Tsukuba, Ibaraki, Japan.
- Nov 2023 Contributed talk on “Operator dynamics of Lindbladian SYK” at Quantum Gravity Gatherings, RIKEN, Wako, Japan.
- Nov 2023 Invited talk on “An operator growth hypothesis on open quantum systems” at the Department of Physics, The University of Tokyo, Tokyo, Japan.
- Oct 2023 Invited talk on “An operator growth hypothesis on open quantum systems” at Saha Institute of Nuclear Physics, Kolkata, India
- Oct 2023 Invited talk on “Recent progress on Krylov complexity” at Centre for High Energy Physics, Indian Institute of Science, Bengaluru, India.
- Sept 2023 Contributed talk on “Operator growth and quantum chaos: lessons from SYK” at the conference Quantum Information, Quantum Matter and Quantum Gravity, YITP, Kyoto, Japan.
- July 2023 Invited talk on “An operator growth hypothesis on open quantum systems” at the conference Integrability, Deformations, and Chaos, Okinawa Institute of Science and Technology, Okinawa, Japan.
- May 2023 Invited talk on “Dissipative quantum chaos: lessons from SYK” at the workshop Entanglement, Large  $N$  and Black Hole, APCTP, Pohang, Korea.
- Feb 2023 Gong show and poster presentation on “An operator growth hypothesis on open quantum systems” at the young researchers’ workshop, Nagoya University, Japan.
- 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 Invited (online) talk on “Quantum information: from quantum gravity to condensed matter physics” in the Department of Computer Science, Texas Tech. University, Lubbock, Texas, USA.
- Aug 2021 Invited (online) 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 Invited (online) talk on “Renormalized Circuit Complexity” in Quantum Information in QFT and AdS/CFT-I.
- Jul 2020 Invited (online) 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.

## Refereed journals

[SciPost Physics](#).

## 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

- Nov. 2023 Department of Physics, The University of Tokyo, Japan.  
Host: Prof. Hosho Katsura.
- Feb/Mar. 2023 (Visiting postdoc.) Princeton Center for Theoretical Science (PCTS),  
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.

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## 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), [\[link here\]](#).

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## Personal

DOB, Gender 30 June 1994 (Age: 28), Male.  
Citizenship India.  
Residence Japan.  
Languages English, Bengali (native), Hindi, Japanese (basic).  
Comp. skills Mathematica, Python.

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