

# 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).  
Wako and Kyoto University campus, Japan.

## Research experiences

- 2024 Visitor (RIKEN-Berkeley ASPIRE program), *Berkeley Center for Theoretical Physics (BCTP)*, University of California, Berkeley, CA, USA.
- 2023 Visitor (ExU overseas program), *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

1. Quantum information, entanglement in quantum gravity, 2. Holography and many-body quantum chaos, 3. Non-Hermitian and open quantum systems, 4. Quantum teleportation and wormholes.

## Publications/Preprints

[All papers (except marked with **\***) are arranged in the alphabetical order of the authors' name, which is conventional in high-energy theory (hep-th) community and signifies equal contribution].

- 2024 **19.** Tridiagonal Hamiltonians modeling the density of states of the Double-Scaled SYK model, **P. Nandy**, [arXiv:2410.07847 [hep-th]].
- 18.** Krylov fractality and complexity in generic random matrix ensembles, B. Bhattacharjee, **P. Nandy**, [arXiv:2407.07399 [quant-ph]].
- 17.** Probing quantum chaos through singular-value correlations in sparse non-Hermitian SYK model, **P. Nandy**, T. Pathak, M. Tezuka, [arXiv:2406.11969 [quant-ph]].
- \*16.** Quantum Dynamics in Krylov Space: Methods and Applications, **P. Nandy**, A. S. Matsoukas-Roubeas, P. Martínez-Azcona, A. Dymarsky, A. del Campo, [arXiv:2405.09628 [quant-ph]].

- 2023 **15.** Operator dynamics in Lindbladian SYK: a Krylov complexity perspective, B. Bhattacharjee, **P. Nandy**, T. Pathak, [JHEP 01 \(2024\) 094](#), [arXiv:2311.00753 [quant-ph]].
- 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**, [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 2024 Invited talk at workshop “Focus Week on Non-equilibrium Quantum Dynamics” at Kavli IPMU, University of Tokyo, Japan.
- Aug 2024 Short talk and Poster presentation at workshop “Quantum Information, Quantum Field Theory and Gravity” at International Centre for Theoretical Sciences (ICTS), Bangalore, India.
- July 2024 Invited talk at workshop “Holography in Beijing 2024” at Kavli Institute of Theoretical Sciences (KITS), UCAS, Beijing, China.
- Jun 2024 Invited talk at Department of Physics, University of Kentucky, USA.
- Feb 2024 Invited talk at the 2nd Young researchers workshop, Shirahama-so, Shiga, Japan.
- Feb 2024 Invited talk at the Osaka University, Osaka, Japan.
- Jan 2024 Invited talk at the Department of Physics and Material Science, University of Luxembourg, Luxembourg.
- Jan 2024 Invited seminar and Invited talk at Kobayashi-Masakawa Institute, Nagoya University, Nagoya, Japan.

- Dec 2023 Invited seminar at Saitama University, Saitama, Japan.
- Nov 2023 Contributed talk at KEK Theory Workshop, Tsukuba, Ibaraki, Japan.
- Nov 2023 Contributed talk at Quantum Gravity Gatherings, RIKEN, Wako, Japan.
- Nov 2023 Invited talk at the Department of Physics, The University of Tokyo, Tokyo, Japan.
- Oct 2023 Invited talk at Saha Institute of Nuclear Physics, Kolkata, India
- Sept 2023 Contributed talk at the conference Quantum Information, Quantum Matter and Quantum Gravity, YITP, Kyoto, Japan.
- July 2023 Invited talk at the conference Integrability, Deformations, and Chaos, Okinawa Institute of Science and Technology, Okinawa, Japan.
- May 2023 Invited talk at the workshop Entanglement, Large  $N$  and Black Hole, APCTP, Pohang, Korea.
- Jan 2023 Gong show and poster presentation at the 17th Kavli Asian Winter School on Strings, Particles and Cosmology, IBS, Daejeon, Korea.
- Dec 2022 Gong show and poster presentation at the ExU annual conference, Kobe, Japan.
- Sept 2022 Invited talk 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 at the Department of Computer Science, Texas Tech. University, Lubbock, Texas, USA.
- Aug 2021 Invited (online) talk in Quantum Information in QFT and AdS/CFT-II.
- Aug 2020 Invited (online) talk 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 at the 14th Kavli Asian Winter School on Strings, Particles and Cosmology, Tohoku University, Sendai, Japan.

## Refereed journals

Journal of High Energy Physics (JHEP), SciPost Physics, Physical Review D, Physical Review Research.

## Teaching experiences

- 2019-2020 Graduate course: General relativity.  
Course instructor: Prof. Justin R. David, Indian Institute of Science, Bangalore.

## Organizing experiences

- 2022 Workshop on 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

- Jun. 2024 Department of Physics, University of Kentucky, Lexington, USA.  
Host: Prof. Anatoly Dymarsky.
- May/Jun. 2024 Berkeley Center for Theoretical Physics (BCTP), University of California, Berkeley, CA, USA.  
Host: Prof. Yasunori Nomura.
- Feb 2024 Department of Physics, University of Basque Country, Bilbao, Spain  
Host: Prof. Adolfo del Campo and Prof. Inigo L. Egusquiza.
- Jan./Feb 2024 Department of Physics, University of Luxembourg, Luxembourg.  
Host: Prof. Adolfo del Campo.

- Jan. 2024 Department of Physics, Kobayashi-Masakawa Institute, Nagoya University, Japan.  
Host: Prof. Masamichi Miyaji.
- Dec. 2023 Department of Physics, Saitama University, Japan.  
Host: Prof. Kentaroh Yoshida.
- Nov. 2023 Department of Physics, The University of Tokyo, Japan.  
Host: Prof. Hosho Katsura.
- Feb/Mar. 2023 Princeton Center for Theoretical Science (PCTS), Princeton University, New Jersey, USA.  
Host: Prof. Shinsei Ryu.
- Jun. 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

- 2024 Adopting Sustainable Partnerships for Innovative Research Ecosystem (ASPIRE) fellowship, iTHEMS, RIKEN, Japan, and University of California, Berkeley, USA, Japan Science and Technology Agency (JST), Grant Number JPMJAP2318..
- 2023 Extreme Universe Overseas visiting researchers grant, KAKENHI No. 21H05182.
- 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), [\[link here\]](#).

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