Subhayan Sahu

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I am a postdoctoral researcher at the Perimeter Institute of Theoretical Physics. I study the structure and dynamics of information in quantum many-body systems.

Experience

Sep, 2022 - present **Perimeter Institute**
Postdoctoral Researcher in Quantum Information and Quantum Matter groups.

Sep, 2024 - Jul, 2025 **Perimeter Institute**
Perimeter Scholars International Fellow, Academic staff.

Education

2017-2022 **University of Maryland, College Park**
Doctor of Philosophy, Department of Physics | GPA 4.0/4.0
Advisor: Dr. Brian Swingle

2013-17 **Indian Institute of Science, Bangalore**
Bachelor of Science (Research)
Major: Physics | CGPA 7.7/8.0 | Graduated top of class

Preprints / Publications

*Equal contribution

14. Entanglement cost hierarchies in quantum fragmented mixed states
Subhayan Sahu, Yahui Li, Pablo Sala. *ArXiv:2506.04637*.

13. Fractal decompositions and tensor network representations of Bethe wavefunctions
Subhayan Sahu, Guifre Vidal. *ArXiv:2412.00923*.

12. Symmetry enforced entanglement in maximally mixed states
Amin Moharramipour, Leonardo A. Lessa, Chong Wang, Timothy H. Hsieh, Subhayan Sahu *PRX Quantum 5, 040336*, *ArXiv:2406.08542*.

11. Phase transitions in sampling and error correction in local Brownian circuits
Subhayan Sahu, Shao-Kai Jian. *Phys. Rev. A 109, 042414 (2024)*, *ArXiv:2307.04267*.

10. Measurement-induced phase transitions in the toric code
Amir-Reza Negari, Subhayan Sahu, Timothy H. Hsieh. *Phys. Rev. B 109, 125148 (2024)*, *ArXiv:2307.02292*.

9. Charge transport, information scrambling and quantum operator-coherence in a many-body system with U(1) symmetry
Lakshya Agarwal, Subhayan Sahu, Shenglong Xu. *J. High Energ. Phys. 2023, 37 (2023)*, *ArXiv:2210.14828*.

8. Efficient tensor network simulation of quantum many-body physics on sparse graphs
Subhayan Sahu, Brian Swingle. ArXiv:2206.04701.

7. Entanglement Phases in large-N hybrid Brownian circuits with long-range couplings
Subhayan Sahu, Shao-Kai Jian*, Gregory Bentsen, Brian Swingle. Phys. Rev. B 106, 224305 (2022)*, **Editors' Suggestion**, *ArXiv:2109.00013*.

6. Measurement-induced purification in large-N hybrid Brownian circuits
Gregory Bentsen, Subhayan Sahu*, Brian Swingle. Phys. Rev. B 104, 094304 (2021)*, *ArXiv:2104.07688*.

5. Information scrambling at finite temperature in local quantum systems
Subhayan Sahu, Brian Swingle. Phys. Rev. B 102, 184303 (2020), **Editors' Suggestion**, *ArXiv:2005.10814*.

4. Many body localization due to correlated disorder in Fock space
Soumi Ghosh, Atithi Acharya, Subhayan Sahu, Subroto Mukerjee. Phys. Rev. B 99, 165131 (2019), *ArXiv:1901.04384*.

3. Scrambling dynamics across a thermalization-localization quantum phase transition
Subhayan Sahu, Shenglong Xu, Brian Swingle. Phys. Rev. Lett. 123, 165902 (2019), *ArXiv:1807.06086*.

2. The lengthening pendulum: Adiabatic invariance and bursting solutions
Subhayan Sahu, Shriya Pai, Naren Manjunath, Janaki Balakrishnan . Physics Open, Volume 7, 2021.

1. Maximal entanglement and state transfer using Arthurs-Kelly interaction for qubits
Subhayan Sahu, S.M. Roy. Eur. Phys. J. D (2018) 72: 211, *ArXiv:1612.03405*.

Talks and Posters

† Invited talks, ∘ Contributed talks, ☐ Posters

13. Symmetry enforced entanglement at high temperatures

    † Caltech Condensed Matter seminar, *Jul 2025*

12. Fractal decompositions and tensor network representations of Bethe wavefunctions

    † Google Quantum AI, *Feb 2025*

11. Symmetry enforced entanglement in maximally mixed states

    ∘ Perimeter Institute Quantum Information Seminar, *Aug 2024* [Video]
    † National University of Singapore Condensed Matter seminar, *Oct 2024* [Video]

10. Introduction to Belief Propagation for Tensor Networks

    ∘ Google Quantum AI, *Sep 2024*

9. Bethe ansatz as an exact tree tensor network

    ∘ APS March Meeting, *Mar 2024, Minneapolis*

8. Measurement-induced phase transitions in the toric code

† Google Quantum AI, *Feb 2024*
† Tata Institute of Fundamental Research, *Jan 2024*
☐ International Center for Theoretical Sciences, *Jan 2024*

7. Phase transitions in sampling and error correction in local Brownian circuits

† University of Nottingham, *Nov 2023*
☐ Boulder School of condensed matter and material physics, *Jul 2023, CU Boulder*

6. Measurement-induced entanglement transition in large-N solvable quantum circuits

† University of Toronto Quantum Matter Seminar, *Mar 2023*
† Indian Institute of Science Physics seminar, *Jan 2023*

5. Tensor networks on sparse graphs

∘ APS March Meeting, *Mar 2023, Las Vegas*
∘ David Gosset group meeting, *Dec 2022, Institute for Quantum Computing, University of Waterloo*
∘ Quantum Matter Journal Club, *Oct 2022, Perimeter Institute*
∘ CMTC graduate student symposium, *Jun 2022, University of Maryland*

4. Large-N solvable models of measurement-induced criticality

∘ MPIPKS conference: Probing Complex Quantum Dynamics (Poster), *Oct 2021, MPIPKS*
∘ JQI/QuICS/CMTC seminar, *Oct 2021, University of Maryland*
† Perimeter Institute, *Nov 2021, Perimeter Institute* [Video]

3. Measurement-induced purification in large-N hybrid Brownian circuits

∘ APS March Meeting 2021 (Contributed talk), *Mar 2021, virtual*
∘ JQI/QuICS/CMTC seminar, *April 2021, University of Maryland*

2. Quantum Information Scrambling in gapped local systems at finite temperature

∘ PhD Candidacy talk, *Jun 2020, CMTC, University of Maryland*
† Indian Institute of Science Physics seminar, *Jan 2020, Indian Institute of Science*

1. Scrambling dynamics across a thermalization-localization quantum phase transition

☐ Les Houches Summer School, *Aug 2019, Ecole de Physique des Houches*
∘ JQI/QuICS/CMTC seminar, *March 2019, University of Maryland*
∘ APS March Meeting 2019 (Contributed talk), *March 2019, Boston*

Schools and Conferences

May 2024	Perimeter Institute, Conference: Physics of Quantum Information
Jan 2024	International Center for Theoretical Sciences, Conference: Stability of Quantum Matter
Aug 2023	Aspen Center for Physics, Workshop: New Frontiers for Quantum Dynamics.
Jul 2023	Boulder School 2023, Topic: Non-equilibrium quantum dynamics
Mar 2023	APS March Meeting, Las Vegas, USA
Mar 2022	APS March Meeting, Chicago, USA
Oct 2021	PROTOC21, MPIPKS, Conference: 'Probing Complex Quantum Dynamics through Out-of-time-ordered Correlators'
Mar 2021	APS March Meeting, online
Aug 2020	Online Ultra-Quantum Matter Summer School
Aug 2019	Les Houches Summer School, Topic: Dynamics and Disorder in Quantum Many Body Systems far from Equilibrium
Mar 2019	APS March Meeting, Boston, USA
May 2018	Quantum Leaps: Quantum information in quantum many body physics, Columbia University
Jul 2017	Bangalore School of Statistical Physics VIII
Aug 2014	Asian Science Camp (2014) Nanyang Technological University, Singapore.

Jun 2014 NIUS Physics Camp (2014), HBCSE, Tata Institute of Fundamental Research, Mumbai.

Dec 2012 Vijyoshi Camp (2012), held at IISc, Bangalore.

Academic Highlights

2021 **Best TA award** Department of Physics, University of Maryland, for Spring and Fall '21.

2017-19 **Dean's fellowship** University of Maryland, College Park

2017 **Institute Gold medal for Physics**: Graduated top of class of Physics majors at the Indian Institute of Science

2016 DAAD WISE Fellowship: Recipient of the DAAD scholarship for 3 month internship in Universität Siegen, Germany

2012-17 Kishore Vaigyanik Protsahan Yojana (KVPY) Fellowship: scholarship awarded by the Department of Science and Technology, Government of India

2014 Participated in Asian Science Camp, as part of the Indian delegate of 20 students

Teaching

2024-25 Co-taught Masters level courses in Perimeter Institute on **Statistical physics**, **Quantum Matter, Numerical Methods**, and **Machine Learning in physics.**

Summer '24, '25 Offered a minicourse on Tensor Networks at the Perimeter Scholars International START

Spring '24 Mentored 3 Masters student for winter project at Perimeter Institute

Fall '21 TA for Undergraduate Electrodynamics and Sophomore general physics
Best TA Award

Summer '21 Prepared a packet on Tensor Network for high-schoolers for Girls Talk Math - UMD

Spring '21 TA for Graduate Quantum Mechanics II and Graduate Statistical Mechanics at UMD
Best TA Award

Fall '17 TA for Phys 260: Vibrations, Waves, Heat, Electricity and Magnetism at UMD

Skills

- **Computing**: Python, Matlab, Julia, Mathematica, LaTeX, basic Shell

Professional Service

- Reviewer for Phys. Rev. Lett. (2), Quantum Journal (1), SciPost Physics (2), Phys. Rev. B. (2), Phys. Rev. Research (1)
- Organizer of Quantum Matter Journal club (Spring 2023) and Quantum Matter Seminar (Fall 2023 and Spring 2024) at Perimeter Institute.