ASMEETA PRAKASH SAYAJI

Quantum Information Theory – Noise, Verification, and Quantum Advantage

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RESEARCH PROFILE

Independent researcher in quantum information theory studying how realistic noise constrains the computational power of quantum systems. Integrates analytical modeling with numerical simulation to assess verification complexity, classical simulability, and information-theoretic limits of quantum advantage. Experience at ISRO enables hardware-grounded insight into physical noise constraints.

DOCTORAL OBJECTIVE

To pursue PhD under Prof. Dominik Hangleiter and Prof. Renato Renner at ETH Zürich. Goal: Develop rigorous noise-sensitive frameworks linking physical decoherence, channel divergences, and resource-theoretic noise models to limits in quantum verification and computational advantage.

RESEARCH INTERESTS

- Quantum foundations: smooth entropies, quantum channel divergences
- Noise and verification: fault-tolerance thresholds, verification complexity
- Open quantum systems: Lindbladian models, non-Markovian dynamics
- Quantum advantage: classical simulability transitions, complexity bounds
- Error mitigation: zero-noise extrapolation, leakage suppression

RESEARCH OUTPUTS

- *Noise-induced classical simulability thresholds in shallow circuits* — In preparation
- ISRO noise-analysis reports — Contributed to three subsystem-level studies

TECHNICAL EXPERTISE

Quantum Theory: open quantum systems, Lindbladian models, smooth entropies, quantum complexity theory

Mathematics: linear algebra, probability, information theory, optimization, group theory

Programming: Python, Qiskit, QuTiP, NumPy, SciPy, Git, LaTeX; working knowledge of C, C++, Java, SQL

ADDITIONAL RESEARCH SKILLS

Tools: LaTeX, Jupyter, VS Code, Git

Methods: Analytical modeling, numerical simulation, reproducible workflows

INDEPENDENT RESEARCH CONTRIBUTIONS (2022–PRESENT)

Theoretical Analysis

- Derived bounds linking T1 and T2 decay, leakage, and drift to verification-complexity scaling
- Solved Lindblad equations and analyzed entropy production via smooth entropies
- Identified noise-induced transitions between quantum advantage and classical simulability

Hardware-Informed Modeling

- Predicted noise-parameter drift using machine learning over synthetic time-series data
- Quantified recoverability under composite noise channels using divergence measures

TECHNICAL PROJECTS

Code available: GitHub Workspace

- Noise-Bench QC — structured-noise verification benchmarking suite
- Lindblad-Sim — non-Markovian and leakage-aware simulation toolkit
- ZNE Toolkit — 20% fidelity improvement via zero-noise extrapolation
- DRAG Pulse Optimization — >90% leakage suppression

PROFESSIONAL EXPERIENCE

Senior Assistant — Procurement Division, Space Applications Centre (ISRO) Sept 2018 – Present

- Evaluated cryogenic/microwave components for physics-enabled payloads
- Analyzed stability metrics including T1 and T2 and phase noise
- Translated hardware specifications into quantum noise-model parameters

Assistant — Library and Information Division, Space Applications Centre (ISRO) Jan 2014 – Sept 2018

- Curated and analyzed over 1000 scientific publications
- Developed research synthesis and documentation skills

EDUCATION

M.Sc. Computer Science — North Maharashtra University July 2009
Relevant coursework: Quantum Computing, Algorithms & Complexity, Linear Algebra, Optimization

B.Sc. Computer Science (Physics & Mathematics core) — North Maharashtra University July 2006
Rank: 1 of 80 students

AWARDS

Rank 1 — B.Sc. Computer Science
JNU Merit Scholarship