Sattwik Deb Mishra

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SUMMARY

- Ph.D. candidate with computational and theory research experience in the fields of quantum computing, numerical optimization, photonics (including inverse design), and quantum optics
- Author of 7 publications (including two first-author papers) and inventor of a patent

EDUCATION

Stanford University   Stanford, CA, USA
M.S./Ph.D., Electrical Engineering (Dissertation advisor: Prof. Jelena Vučković)   *Jan 2024*
GPA: 3.93/4.00

Indian Institute of Technology (I.I.T.) Bombay   Mumbai, India
B.Tech., Electrical Engineering   *Jul 2018*
GPA: 9.88/10.0 (Ranked **1st** in the department and **3rd** in the institute by GPA)

TECHNICAL SKILLS

- Programming languages: Python (~8 years of experience), C++ (~ 8 yrs.), MATLAB (~8 yrs.), Bash (~8 yrs.)
- Relevant libraries and tools: QuTiP, google/JAX, google/TensorNetwork, Lumerical, COMSOL

RESEARCH EXPERIENCE

Graduate Researcher, Nanoscale and Quantum Photonics Lab   2018-2023
Dept. of Electrical Engineering, Stanford University   *Stanford, CA, USA*

Performance bounds on noisy quantum circuits [Open-source code]
- Devised an optimization-based numerical method for efficiently computing certifiable performance bounds on noisy quantum circuits (e.g. variational quantum algorithms implemented on noisy quantum computers) to answer if they can outperform classical computers at finding ground states of Hamiltonians
- Computed bounds for 1D and 2D quantum circuits by tensor network numerical simulations using Python

Optimized quantum transduction [Associated patent]
- Developed a gradient-based optimization strategy to improve the efficiency (~10x) of microwave-to-optical single photon quantum transducers, crucial for quantum communication over optical fiber links
- Simulated open quantum system dynamics of the transducer using Python & C++ and used Google Cloud machines for CPU-intensive numerical experiments

Quantum optics
- Collaborated with experimentalists in the research group to simulate and design nanophotonic devices using Lumerical and in-house photonic optimization software (SPINS)
- Explained experimental phenomena through quantum optics modeling and numerical simulations (using Python and C++), leading to publications in peer-reviewed journals

- [Classically computing performance bounds on depolarized quantum circuits](#)
  Sattwik D. Mishra[*], Miguel Frías-Pérez[*], Rahul Trivedi
  arXiv:2306.16360 (2023, in review at PRX Quantum) [Open-source [code](#) for tensor network simulations]

- [Control Design for Inhomogeneous-Broadening Compensation in Single-Photon Transducers](#)
  Sattwik D. Mishra[*], Rahul Trivedi[*], Amir H. Safavi-Naeini, Jelena Vučković
  Phys. Rev. Applied 16, 044025 (2021) [Associated [patent](#)]

- [Two-emitter multimode cavity quantum electrodynamics in thin-film silicon carbide photonics](#)
  Daniil M. Lukin[*], Melissa A. Guidry[*], Joshua Yang, Misagh Ghezellou, **Sattwik D. Mishra**, Hiroshi Abe, Takeshi Ohshima, Jawad Ul-Hassan, Jelena Vučković
  Phys. Rev. X 13, 011005 (2023)

- [4H-silicon-carbide-on-insulator for integrated quantum and nonlinear photonics](#)
  Daniil M. Lukin[*], Constantin Dory[*], Melissa A. Guidry[*], Ki Youl Yang, **Sattwik D. Mishra**, Rahul Trivedi, Marina Radulaski, Shuo Sun, Dries Vercruysse, Geun Ho Ahn, Jelena Vučković
  Nature Photonics 14, 330 (2020)

RELEVANT COURSEWORK

- **Stanford University:** Machine Learning, Artificial Intelligence, Convex Optimization, Many-body Quantum Dynamics, Advanced Topics in Quantum Mechanics, Nanophotonics, Quantum Optics

- **I.I.T. Bombay:** Data Structures and Algorithms, Computer Networks, Computational Electromagnetics, Nonlinear Dynamical Systems

SELECTED AWARDS AND ACADEMIC ACHIEVEMENTS

- **Institute Academic Prize** (2015, 2017) for ranking **1st** in the Dept. of Electrical Engineering, I.I.T. Bombay

- Awarded AP grade (for **exceptional performance**) in Digital Communications, Microprocessors, Computer Programming, Differential Equations, Data Analysis, and Economics courses at I.I.T. Bombay

- **All India Rank 131** and **State Rank 1** in Joint Entrance Examination (JEE) 2014 (**out of 126,000** examinees)

ADDITIONAL EXPERIENCE

- **Teaching Assistant** for **Applied Quantum Mechanics II (EE223, Winter 2022)** with Prof. David Miller at Stanford University

- **Machine Learning (CS229, Fall 2020) course project** with Prof. Andrew Ng at Stanford University: [Learning preconditioners for electromagnetic simulations](#)
  - Implemented data-driven preconditioners learnt from electromagnetic simulation data to improve the conditioning of discretized Maxwell's equation and speed up iterative numerical solvers.