Rahul Trivedi,
Max Planck Institute of Quantum Optics
Email: rahul.trivedi@mpq.mpg.de

EDUCATION

Dec 2020	PhD Electrical Engineering,	Stanford University.
Dec 2020	MS Electrical Engineering,	Stanford University.
May 2016	BTech Electrical Engineering,	Indian Institute of Technology Delhi,

ACADEMIC APPOINTMENTS

Sept 2022 – : Assistant Professor (Tenure Track), Electrical and Computer Engineering, University of Washington, Seattle.

Oct 2022 – : Adjunct Assistant Professor, Physics, University of Washington, Seattle.

Jan 2021 – Aug 2022: Postdoctoral fellow, Max Planck Institute of Quantum Optics, Max Planck Harvard Research Center for Quantum Optics.

Sept 2016 – Dec 2020: Graduate researcher and teaching assistant, Stanford University.

RESEARCH INTERESTS

Broad definition: Developing theoretical methods for analysis and design of quantum systems for quantum information technologies.
Specific Interests: Theory of open quantum systems, simulatability of open quantum systems, simulatability phase transitions in open quantum systems, quantum control and application in quantum optics, algorithms for noisy intermediate scale quantum computers.

AWARDS AND SCHOLARSHIP

2023: NSF IMOD seed grant for "Quantum-enhanced spectroscopy with solid-state light sources".
2022: Quantum Innovator for Science and Engineering, Institute for Quantum Computing and University of Waterloo.
2021: Postdoctoral fellowship from Max Planck Harvard research center for quantum optics.
2020: Runner up for Ken Hass Outstanding student paper award at APS March Meeting.
2019: Quantum Innovator for Science and Engineering, Institute for Quantum Computing and University of Waterloo.
2019: Stanford Electrical Engineering Teaching fellowship.
2019: Centennial Teaching Assistant award.
2016: Thomas and Sarah Kailath Stanford Graduate fellowship.
2016: Silver Medal at Indian Institute of Technology Delhi for Department Rank 1 (Electrical Engineering).
2016: Bambewala award for best undergraduate thesis at Indian Institute of Technology Delhi.
2014: OP Jindal Engineering and Management Fellowship.
2013: Aditya Birla Scholarship.
2012: Gold medal at the 42nd International Physics Olympiad, Estonia.
2012: Gold medal at the 13th Asian Physics Olympiad, India.

PUBLICATIONS

Citations (as of 11/2023) > 1800, h-index = 18.
Equal contribution indicated by *

Preprints

1. A. Saxena, E. Abbasgholinejad, A. Majumdar, **R. Trivedi**, "Boundary scattering tomography of the Bose Hubbard model on general graphs," arXiv:2310.14191 (2023).
2. S. D. Mishra, M. Frias, **R. Trivedi**, "Classically computing performance bounds on depolarized quantum circuits," arXiv:2306.16360 (2023).
3. **R. Trivedi***, A. Franco Rubio*, J. Ignacio Cirac, "Quantum advantage and stability to errors in analogue quantum simulators," arXiv:2212.04924 (2022).
4. **R. Trivedi**, "Description and complexity of non-Markovian open quantum dynamics," arXiv:2204.0963 (2022).
5. **R. Trivedi**, "Gradient descent globally solves average-case non-resonant physical design problems," arXiv:2111.02978 (2021).

Published (in press)

1. A. Saxena, A. Manna, **R. Trivedi**, A. Majumdar, "Realizing tight-binding Hamiltonians using site-controlled coupled cavity arrays," Nature Communications 14 (1), 5260 (2023).
2. V. Villafane, B. Scaparra, M. Rieger, S. Appel, **R. Trivedi et al**, "Three-photon excitation of InGaN quantum dots," Physical Review Letters 130 (8), 083602 (2023).
3. **R. Trivedi**, J. I. Cirac, "Transitions in computational complexity of continuous-time local open-quantum dynamics," Physical Review Letters 129 (26), 260405 (2022).
4. G. Gonzalez*, **R. Trivedi***, J. I. Cirac, "Error propagation in NISQ devices for solving classical optimization problems," Physical Review X Quantum 3, 040326 (2022).
5. D. Malz, **R. Trivedi**, J. I. Cirac, "Large-*N* limit of spontaneous superradiance," Physical Review A 106(1), 013716 (2022).
6. A. D. White*, **R. Trivedi***, K. Narayanan, J. Vuckovic, "Superradiance in dynamically modulated Tavis-Cumming model with spectral disorder," ACS photonics 9(7), 2467-2472 (2022).
7. G. H. Ahn, K. Y. Yang, **R. Trivedi**, A. D. White, L. Su, J. Skarda, J. Vuckovic, "Augmenting On-Chip Microresonator through Photonic Inverse Design," ACS photonics 9(6), 1875-1881 (2022).
8. J. Skarda*, **R. Trivedi***, L. Su*, D. Ahmad-Stein, H. Kwon, S. Han, S. Fan, J. Vuckovic, "Simulation of large-area metasurfaces with a distributed transition matrix method," NPJ computational materials 8, 78 (2022).
9. **R. Trivedi**, K. Fischer, S. Fan, J. Vuckovic, "Few-particle scattering from localized systems in spatially structured bosonic baths," Quantum 6, 691 (2022).
10. **R. Trivedi**, D. Malz, J. I. Cirac, "Convergence guarantees for discrete mode approximations to non-Markovian quantum baths," Physical Review Letters 127, 250404 (2021).
11. M. A. Guidry, D. M. Lukin, K. Y. Yang, **R. Trivedi**, J. Vuckovic, "Quantum optics of Kerr frequency combs," Nature Photonics 16(1), 52-28 (2021).
12. G. Gonzalez*, **R. Trivedi***, J. I Cirac, "Quantum algorithms for powering stable Hermitian matrices," Physical Review A 103, 062420 (2021).
13. S. D. Mishra*, **R. Trivedi***, A. Safavi-Naeini, J. Vuckovic, "Quantum control for inhomogeneous broadening compensation in single photon transducers," Physical Review Applied 16 (4), 044025 (2021).
14. **R. Trivedi**, D. Malz, S. Fan, J. Vuckovic, "Optimal two-photon excitation of bound states in non-Markovian waveguide QED." Physical Review A 104 (1), 013705 (2021).
15. **R. Trivedi**, A. D. White, S. Fan, J. Vuckovic, "Analytic and geometric properties of scattering from periodically modulated quantum optical systems." Physical Review A 102 (3), 033707 (2020).
16. **R. Trivedi**, G. Angeris, L. Su, S. Boyd, S. Fan, J. Vuckovic, "Bounds for scattering from absorptionless electromagnetic structures." Physical Review Applied 14 (1), 014205 (2020).
17. D. M. Lukin, A. D. White, **R. Trivedi**, M. A. Guidry et al, "Spectrally reconfigurable quantum emitters enabled by optimized fast modulation." NPJ Quantum information 6, 80 (2020).
18. E. Scholl, L. Schweickert, L. Hanschke, K. D. Zeuner, F. Sbresny, T. Lettner, **R. Trivedi** et al, "The crux of using cascaded emission of a 3-level quantum system to generate indistinguishable photons." Physical Review Letters 125 (23) 233605 (2020).

19. D. M. Lukin, C. Dory, M. A. Guidry, K.Y. Yang, S. D. Mishra, **R. Trivedi**, M. Radulaski, S. Sun, D. Vercruysse, G. H. Ahn, J. Vuckovic, "4H-silicon-carbide-on-insulator for integrated quantum and nonlinear optics." Nature Photonics 14 (5), 330-334 (2020).
20. N. V. Sapra, K. Y. Yang, D. Vercruysse, K. J. Leedle, D. S. Black, R. J. England, L. Su, **R. Trivedi**, Y. Miao, O. Solgaard, R. L. Byer, J. Vuckovic, "On-chip integrated laser-driven particle accelerator," Science 376 (6473), 79-83 (2020).
21. **R. Trivedi**, L. Su, J. Lu, M. F. Schubert, J. Vuckovic, "Data-driven acceleration of photonic simulations," Scientific reports 9 (1), 1-7 (2020).
22. **R. Trivedi***, K. Fischer*, S. D. Mishra, J. Vuckovic, "Point-coupling Hamiltonian for frequency-independent linear optical devices," Physical Review A 100 (4), 043827 (2019).
23. D. Vercruysse, N. V. Sapra, L. Su, **R. Trivedi**, J. Vuckovic, "Analytical level set fabrication constraints for inverse design," Scientific Reports 9 (1), 1-7 (2019).
24. **R. Trivedi**, M. Radulaski, K. Fischer, S. Fan, J. Vuckovic, "Photon blockade in weakly driven cavity quantum electrodynamic systems with many emitters." Physical Review Letters 122 (24), 243602 (2019).
25. L. Hanschke, K. Fischer, S. Appel, D. M. Lukin, J. Wierzbowski, S. Sun, **R. Trivedi**, J. Vuckovic, J. J. Finley, K. Muller, "Quantum dot single-photon sources with ultra-low multi-photon probability," NPJ Quantum information 4 (1), 1-6 (2018).
26. K. Fischer, **R. Trivedi**, D. M. Lukin, "Particle emission from open-quantum systems," Physical Review A 98 (2), 023853 (2018).
27. K. Fischer, S. Sun, D. M. Lukin, Y. Kelaita, **R. Trivedi**, J. Vuckovic, "Pulsed coherent drive in the Jaynes-Cummings model," Physical Review A (2), 021802 (2018).
28. **R. Trivedi**, K. Fischer, S. Xu, S. Fan, J.Vuckovic, "Few-photon scattering and emission from low-dimensional systems." Physical Review B 98, Issue 14, 144112 (2018).
29. K. Fischer, **R. Trivedi**, V. Ramesh, I. Siddiqui, J. Vuckovic, "Scattering into one-dimensional waveguides from a coherently driven quantum optical system." Quantum 2, 69 (2018).
30. L. Su, **R. Trivedi**, N. V. Sapra, A. Piggott, D. Vercruysse, J. Vuckovic, "Fully-automated optimization of grating couplers," Optics Express 26 (4), 4023-4034 (2018).
31. A. Thomas, **R. Trivedi**, A. Dhawan, "Plane-wave scattering from a plasmonic nanowire array spacer-separated from a plasmonic film," Materials Research Express 3 (6), 065004 (2016).
32. **R. Trivedi**, U. Khankhoje, A. Majumdar, "Cavity-enhanced second-order nonlinear photonic logic circuits," Physical Review Applied 5 (5), 054001 (2016).
33. A. Zhan, S. Colburn, **R. Trivedi**, T. Fryett, C. Dodson, A. Majumdar, "Low-contrast dielectric metasurface optics," ACS photonics 3(2), 209-214 (2016).
34. **R. Trivedi**, Y. Sharma, A. Dhawan, "Plane-wave scattering from a plasmonic nanowire-file system with the inclusion of non-local effects," Optics Express 23 (20), 26064-26079 (2015).
35. **R. Trivedi**, U. Khankhoje, "A perturbative solution to plane-wave scattering from a rough dielectric cylinder," IEEE transactions on antennas and propagation 63 (9), 4069-4080 (2015).
36. **R. Trivedi**, A. Thomas, A. Dhawan, "Full-wave electromagnetic analysis of a plasmonic nanoparticle separated from a plasmonic film by a thin spacer layer," Optics Express 22 (17), 19970-19989 (2014).

BOOKS, REVIEW ARTICLES AND BOOK CHAPTERS

1. J. Vuckovic and **R. Trivedi**, "Physics and applications of optical cavities," American Institute of Physics Publishing (Under preparation, 2020).
2. **R. Trivedi**, D. M. Lukin and J. Vuckovic, "Quantum optics and non-classical light generation," in Proceedings of international physics school of Enrico Fermi, Course 204 on Nanoscale Quantum Optics, Varenna. Edited by Mario Agio et al, Italian Physical Society in partnership with IOS Press, Amsterdam (2020).
3. J. Skarda, G. H. Ahn, **R. Trivedi**, T. Wu. S. Mitra, J. Vuckovic, "Inverse design of optical interconnects," in Silicon photonics for high performance computing and beyond edited by Mahdi Nikdast, CRC Press/Taylor & Francis Group (2020).
4. **R. Trivedi**, K. A. Fischer, J. Vuckovic, K. Muller, "Generation of non-classical light using semiconductor quantum dots," Advanced Quantum Technologies 3 (1), 1900007 (2020).

PRESENTATIONS

1. **R. Trivedi**, "Simulating many-body physics with noisy quantum devices," Lorentz center workshop *Bridging the gap between classical and quantum simulation* (2024) [*Invited*].
2. **R. Trivedi**, "Quantum Simulation of many-body physics with accuracy guarantees," APS March meeting (2024) [*Invited*].
3. **R. Trivedi**, "Collective phenomena in quantum optics - tomography and metrological applications," IEEE Photonics Conference (2023) [*Invited*].
4. **R. Trivedi**, "Simulating many-body physics with noisy quantum devices," International workshop on general purpose quantum computing and quantum information theory, Institute of Theoretical Physics (ITP), Chinese Academy of Sciences (2023).
5. **R. Trivedi**, A. Franco Rubio, J. Ignacio Cirac "Accuracy guarantees for quantum simulators," Quantum 2.0 conference (2023).
6. A. Saxena, E. Abbasgholinejad, A. Majumdar, **R. Trivedi**, "Boundary Scattering tomography of quantum photonic lattices," Quantum 2.0 conference (2023).
7. **R. Trivedi**, "Advantages and limitations of noisy quantum simulators," Bernoulli Center workshop on *Quantum-classical quantum simulations*, EPFL (2023) [*Invited*].
8. **R. Trivedi**, "Computational bounds on depolarized quantum circuits," Amazon Braket (2023) [*Invited*].
9. **R. Trivedi**, "Quantum simulation of many-body physics in the near-term," Purdue AMO-QIS seminar (2023) [*Invited*].
10. **R. Trivedi**, "Errors in near-term quantum hardware," UC Davis AMO-QIS seminar (2022) [*Invited*].
11. **R. Trivedi**, "Errors in near-term quantum hardware: models and algorithms," Columbia AMO-QIS seminar (2022) [*Invited*].
12. **R. Trivedi**, "Impact of errors on near-term quantum hardware," IQC and U. Waterloo Quantum Innovators in Science and Engineering Workshop (2022) [*Invited*].
13. **R. Trivedi**, "Non-Markovian open quantum systems: Theoretical description and simulatability," UW Physics ABC seminar, Stanford QFarm seminar (2022) [*Invited*].
14. **R. Trivedi**, "Dynamics of many-body open quantum systems: Theoretical description, simulatability and technological implications," UW ECE colloquium (2022) [*Invited*].
15. **R. Trivedi**, "Global Optimality of Photonic Inverse Design," Metamaterial Congress (2021) [*Invited*].
16. **R. Trivedi**, "Simulation methods for non-Markovian quantum optics," Second workshop on waveguide QED (2021) [*Invited*].
17. **R. Trivedi,** G. Angeris, L. Su, S. Fan and J. Vuckovic, "Fundamental limits on the performance of electromagnetic devices," APS March Meeting (2020). [*Runner up for Ken Hass Outstanding student paper award*].
18. **R. Trivedi** and J. Vuckovic, "Inverse-design of large area metasurfaces," OSA Incubator Workshop (2020) [*Invited*].
19. **R. Trivedi** and J. Vuckovic, "Inverse-design of large-scale practical photonic circuits," Physics of Quantum Electronics (2020).
20. **R. Trivedi**, "Scattering theory in quantum optics," IQC and U. Waterloo Quantum Innovators in Science and Engineering Workshop (2019) [*Invited*].
21. **R. Trivedi**, M. Radulaski, K. Fischer, S. Fan and J. Vuckovic, "Photon blockade in weakly-driven cavity QED systems with many emitters," APS March Meeting (2019).
22. **R. Trivedi**, K. Fischer, S. Xu. S. Fan. J. Vuckovic, "Few-photon scattering and emission in low-dimensional systems," APS March Meeting (2018).
23. **R. Trivedi** and U. Khankhoje, "Polarization response of a cloud of rough cylinder," International conference on electromagnetics in advanced applications (2016).
24. **R. Trivedi** and U. Khankhoje, "A perturbative solution to plane-wave scattering from a rough dielectric cylinder," Progress in electromagnetics research symposium (2015).

PATENTS

1. Sattwik Deb Mishra, Rahul Trivedi, Amir H. Safavi-Naeini, and Jelena Vuckovic, "Optimized quantum transduction," filed November 2020 (Stanford disclosure S20-514).
2. Rahul Trivedi, Logan Su, Jelena Vuckovic, "Fast and Accurate Large-Scale Optimization of Metasurfaces", filed January 2020 (Stanford disclosure S18-558).

3. Logan Su, Alex Piggott, Dries Vercruysse, Rahul Trivedi, Neil Sapra, Jelena Vuckovic, "Title: Fully-automated design of grating couplers," filed January 2018 (Stanford Disclosure S18- 019).
4. Jesse Lu, Jan. Petykiewitz, Alex Piggott, Logan Su, Dries Vercruysse, Neil Sapra, Jinhie Skarda, Rahul Trivedi, Geun Ho Ahn, Jelena Vuckovic, "SPINS: Stanford Photonics Inverse Design Software," filed January 2018 (Stanford Disclosure S18-012).

TEACHING

Principal instructor/Co-instructor for graduate level classes on

- (Quantum and Classical) Stochastic calculus at the University of Washington, Seattle – 2023.
- Quantum Optics (EE528) at the University of Washington, Seattle – 2023.
- Circuit Theory (EE233) at the University of Washington, Seattle – 2023.
- Probability and Stochastic Processes (EE505) at the University of Washington, Seattle - 2022.
- Optical micro and nanocavities (EE340) at Stanford University – 2019, 2020.

Teaching assistant/Supporting instructor for electrical engineering/applied physics courses

- Quantum information science and Technology (Theory) at Technische Universität München – 2021.
- Optical micro and nanocavities (EE340), Stanford University – 2018, 2020.
- Applied Quantum Mechanics (EE222/223), Stanford University – 2017-2019.
- Analog Circuit Design, Indian Institute of Technology Delhi – 2015.
- Engineering Electromagnetics, Indian Institute of Technology Delhi – 2014, 2015.

STUDENTS ADVISED

- Jordi Montana Lopez (PhD student, 2023 – Current).
- Erfan Abbasgholinejad (PhD student, 2022 – Current).
- Abhi Saxena (PhD student co-advised with Arka Majumdar, 2022 – 2023).
- Vikram Kashyap (pre-graduate researcher co-advised with Sara Mouradian, 2023 – Current).

SCIENTIFIC REVIEWER

Reviewed articles for Nature Physics, Science Advances, Physical Review Letters, Quantum Journal, Physical Review A, Physical Review Applied, Optica, Optics Express, Optics Letters, ACS Photonics.

INDUSTRY EXPERIENCE

May 2018 – Sept 2018: Research Intern at Google X, Mountain View.
May 2015 – July 2015: Analog Design Intern at Texas Instruments, Bangalore.
May 2014 – July 2014: Research intern at NSF ASSIST Nanosystems Center, Raleigh.