Prof. Aishwarya Kumar (he/him/his)

Contact Information

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Academic Positions

Assistant Professor **2024 to Present**
Department of Physics & Astronomy
Stony Brook University

Postdoctoral Scholar **2020 to 2023**
University of Chicago and Stanford University
Supervisors: Prof. Jonathan Simon and Prof. David Schuster

Coupling Rydberg atoms to superconducting resonators
High cooperativity, "smallwaist" cavity arrays

Education

The Pennsylvania State University, University Park, PA
Ph.D., Physics **2019**

- Thesis Topic: *Quantum computation with neutral atoms : Quantum gates and Maxwell's demon*

  High-fidelity site-selective gates in a 3D neutral atom array
  Atom sorting in a 3D atom array
  High fidelity state detection of atomic qubits

- Advisor: Prof. David S. Weiss

Indian Institute of Technology, Delhi, India
Bachelor of Technology, Engineering Physics
(minor in Computer Science) **2012**

Awards

Chicago Quantum Exchange Quantum Creators Prize **2022**

Student Awards — Pennsylvania State University
- Peter Eklund Award for Scientific Communication **2018**
- David C. Duncan Graduate Fellowship in Physics **2015**
- David H. Rank Memorial Prize in Physics **2013**
- Homer F. Braddock Fellowship **2012**

Student Awards — Indian Institute of Technology, Delhi
- Summer Undergraduate Research Award **2011**

Teaching Experience and Service

Supervisor and mentor to graduate and undergraduate students **2014 to present**
Teaching Assistant
PHYS 211 - General Mechanics **Fall 2012, 2013, and Spring 2014**
PHYS 212 - Electricity and Magnetism **Spring 2013**
Reviewer for Physical Review and Wiley Journals

Submitted/In Press Journal Publications

1. Shadmany, D.*, **Kumar, A***., Soper, A., Palm, L., Yin, C., Ando, H., Li, B., Taneja, L., Jaffe, M., Schuster, D. and Simon, J. Cavity QED in a High NA Resonator. *arXiv preprint : 2407.04784* (2024).

Refereed Journal Publications

1. Yin, C., Ando, H., Stone, M., Shadmany, D., Soper, A., Jaffe, M., **Kumar, A**. and Simon, J. A cavity loadlock apparatus for next-generation quantum optics experiments. *Review of Scientific Instruments*, 94(8) (2023).
2. **Kumar, A.***, Suleymanzade, A.*, Stone, M.*, Taneja, L., Anferov, A., Schuster, D.I. and Simon, J. Quantum-enabled millimetre wave to optical transduction using neutral atoms. *Nature*, 615(7953), 614-619 (2023).
3. Baum, C., Jaffe, M., Palm, L.,**Kumar, A.**, and Simon, J. Optical mode conversion via spatiotemporally modulated atomic susceptibility. *Optics Express*, 31(1), 528-535 (2023).
4. Mejia, F.*, **Kumar, A.***, Wu, T.Y., Du, P., and Weiss, D.S. State-selective EIT for quantum error correction in neutral atom quantum computers. *Physical Review A* 106(3), 032425 (2022).
5. Jaffe, M., Palm, L., Baum, C., Taneja, L., **Kumar, A.**, and Simon, J. Understanding and suppressing backscatter in optical resonators. *Optica* 9, 878-885 (2022).
6. Wu, T., **Kumar, A.**, Giraldo, F., and Weiss, D. S. Stern-Gerlach detection of neutral atom qubits in a state dependent optical lattice. *Nature Physics* 15, 538-542 (2019).
7. **Kumar, A.**, Wu, T., Giraldo, F., and Weiss, D. S. Sorting ultracold atoms in a three dimensional optical lattice in a realization of Maxwell's demon. *Nature* 561, 83-87 (2018).
8. Wang, Y., **Kumar, A.**, Wu, T., and Weiss, D. S. Single-qubit gates based on targeted phase shifts in a 3D neutral atom array. *Science* 352(6293), 1562-1565 (2016).
9. Wang, Y., Zhang, X., Corcovilos, T. A., **Kumar, A.** and Weiss, D. S. Coherent Addressing of Individual Neutral Atoms in a 3D Optical Lattice. *Phys. Rev. Lett.* 115, 043003 (2015).
10. Agrawal, A., Kejalakshmy, N., Uthman, M., Rahman, B. M. A. , **Kumar, A.**, and Grattan, K. T. V. Ultra low bending loss equiangular spiral photonic crystal fibers in the terahertz regime. *AIP Advances* 2, 022140 (2012).

Talks

1. **Invited**, 54th Winter Colloquium on the Physics of Quantum Electronics (2024), Snowbird, *Two new directions with neutral atom cavity QED*
2. **Invited**, New Laser Scientists Conference 2023, Tacoma, *Hybrid quantum science with neutral atoms in superconducting resonators*
3. **Invited**, Research Seminar, University of Cambridge, April 2023. *Hybrid quantum science with neutral atoms in superconducting resonators*

4. **Invited**, DNAP Annual Meeting, Tata Institute of Fundamental Research, April 2023. *Hybrid quantum science with neutral atoms in superconducting resonators*

5. **Invited** Research Seminar, Institute of Science and Technology Austria, March 2023. *Hybrid quantum science with neutral atoms in superconducting resonators*

6. **Invited**, AMO Seminar, Stony Brook University, March 2023. *Hybrid quantum science with neutral atoms in superconducting resonators*

7. **Invited**, APS March Meeting 2023, Las Vegas. *Cavity QED with Rydberg atoms in superconducting resonators*

8. **Invited**, AMO Seminar, University of Connecticut, March 2023. *Hybrid quantum science with neutral atoms in superconducting resonators*

9. **Invited**, Physics Department Special Seminar, Johns Hopkins University, Feb 2023. *Hybrid quantum science with neutral atoms in superconducting resonators*

10. **Invited**, CQP Special Seminar, New York University, Feb 2023. *Hybrid quantum science with neutral atoms in superconducting resonators*

11. **Invited**, Physics Department Seminar, University of Massachusetts Amherst, Feb 2023. *Hybrid quantum science with neutral atoms in superconducting resonators*

12. **Invited**, ECE Seminar, University of Massachusetts Amherst, Feb 2023. *Hybrid quantum science with neutral atoms in superconducting resonators*

13. **Invited**, LASSP & AEP Seminar, Cornell University, Feb 2023. *Hybrid quantum science with neutral atoms in superconducting resonators*

14. **Contributed**, APS DAMOP Meeting 2022, Orlando. *A hybrid system for interfacing mm-wave and optical photons*

15. **Invited**, HQAN research coordination talk, May 2022, Online. *Hybrid mm-wave cQED and quantum transduction*

16. **Invited Tutorial**, APS March Meeting 2022. *Quantum transduction with cold atoms*

17. **Selected** (as 1 of 14 out of 580 young scientists), Haroche and Wineland masterclass on "Control of Individual Quantum Systems", Lindau Nobel Laureate Meeting 2019, Lindau, Germany. *Quantum Gates and Maxwell's demon*

18. **Invited**, IQIM postdoctoral and graduate student seminar, Caltech, June 2019. *Quantum Gates and Maxwell's demon*

19. **Invited**, JFI special seminar, University of Chicago, June 2019. *Quantum Gates and Maxwell's demon*

20. **Invited**, Penn State Physics Department Colloquium, Peter Eklund Award, April 2019. *Quantum Gates and Maxwell's demon*

21. **Invited**, APS March Meeting 2018, Los Angeles. *Quantum Computing with Neutral Atoms: Quantum Gates and Maxwell's demon*

22. **Contributed**, APS DAMOP Meeting 2016, Providence. *Universal gates based on targeted phase shifts in a 3D neutral atom array*

23. **Contributed**, APS DAMOP Meeting 2015, Columbus. *Single qubit gates on neutral atoms in a 3d Optical lattice*