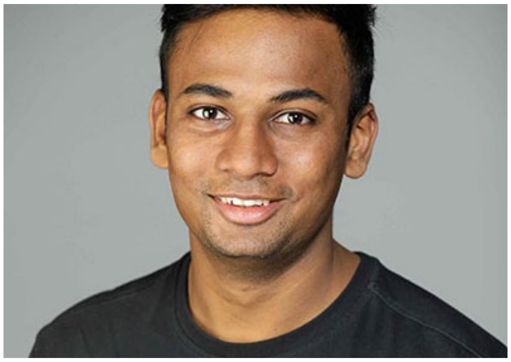
Building Quantum Networks with Quantum Electrooptics



Rishabh Sahu
Postdoctoral Scholar
Institute of Science and Technology Austria

Wednesday, February 28
10:30 AM • MSEE 112

Zoom https://purdue-edu.zoom.us/j/94734981352 ~ Meeting ID: 947 3498 1352

Abstract
In the last few decades, a myriad of physical systems such as photons, atoms, ions and spins have been explored for various different quantum technologies such as computation, communication and meteorology. Until now, no single physical system has been suitable for all the different quantum applications and, therefore, different systems are utilized in different spheres usually without any intercompatibility between them. A solution to this emerging chaos in the quantum landscape is to build hybrid quantum networks where various quantum systems with their unique advantages can be connected together to build a combined system able to perform better than the sum of its aggregates. The nodes in such a network would be connected using flying qubits - telecom wavelength optical photons - which would also allow these nodes to be separated by long distances. There has been some progress in this direction, particularly attempts to make trapped ions and solid state qubits compatible with optical photons. However, making microwave technologies such as superconducting qubits compatible with high energy optics is more challenging due to the large energy gap between the two. In this talk, I will present how quantum electro optics can be used to establish a quantum bridge between microwave and optical frequencies. Such a bridge would not only allow connection of superconducting quits over a long distance but also would be a key step in making future hybrid quantum networks a reality.

Bio
Rishabh completed his bachelor's and master's degree in Physics at the Indian Institute of Technology, Kanpur. His research mainly involved studying orbital angular momentum (OAM) of light, in particular, developing an "angular lens", that is analogous to an optical lens, which sorts light with different OAMs just like a normal lens sorts different planar waves. His master's thesis involved developing parallel C++ code which solves Maxwell's equations using the Finite Difference Time Domain (FDTD) method. Rishabh started graduate school at Institute of Science and Technology Austria (ISTA) in fall of 2018 and joined the Fink group in 2019. At ISTA, he worked on an electrooptic platform to bridge the gap between microwave and optical frequencies which is required to connect future microwave-based quantum computers such as superconducting qubits to a quantum network run at optical telecom frequency. He demonstrated high efficiency quantum transduction and deterministic entanglement between these frequencies and also direct dynamical backaction between the microwave and optical modes. Rishabh is now a postdoc at Fink group since June 2023 where he conducts further experiments with microwave-optical transducers and superconducting qubits.

Host Professor Pramey Upadhyaya, prameyup@purdue.edu, 765-494-5248

PURDUE UNIVERSITY | Elmore Family School of Electrical and Computer Engineering