Title: Silicon photonics research: from datacenters to quantum computing

Abstract: After over 15 years of research in silicon photonics at IBM, application areas are shifting from classical data communication tasks to new research directions in a variety of fields. I will provide a perspective on one slice of this research transition into the area of quantum computing by discussing the current state of our classical silicon photonics platform and the motivations for a new effort to transduce optical and microwave photon states.
Shared publicly within the context of the IBM Quantum Experience, IBM's quantum computing effort has focused on developing the superconducting circuit qubit platform. As the capabilities of such quantum computers rapidly improve, the question of how to provide a suitable interface has become an important research topic. Housed in the low temperature environment of a dilution refrigerator, the thermal population of microwave photon states prohibits the direct input and output of quantum states to an ambient environment from such a system. Optical photons at telecommunication wavelengths provide a robust, technically mature platform for quantum state transmission, but do not natively interact with the superconducting qubits in a desirable manner. To solve this problem, the optical photon must be reversibly transduced to a microwave photon. I will spend the majority of the seminar discussing the details of this transduction problem and the application use cases. Our engineering analysis of this problem has surprisingly led us back to the group-IV material platform to leverage our silicon photonic experience after brief forays into more traditional electro-optic materials such as $LiNbO_3$.