Linear Optical Quantum Information Processing in Silicon Nanophotonics

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It would be difficult to overestimate the level of attention being paid worldwide to quantum information processing, and anticipated advantages it may offer to a wide variety of pursuits in engineering, technology, and basic science. Futurists muse on the wondrous possibilities and theorists formulate actual algorithms for advanced computing not possible with classical computing machines, *if only* there were scalable quantum computers. Further, several groups have performed compelling experiments related to quantum teleportation and quantum key distribution – both essential pieces for quantum cryptography. Still, it is a very challenging hardware problem to design architectures that support, appropriately protect, route, and process qubits to function as universal logic gates. To date, most of the optical successes toward this goal have been in bulk media, which is not easily scalable to carry out the required degree quantum error correction. In this talk, I will discuss a couple of the proposals that my collaborators at the Air Force Research Laboratory, at the Rochester Institute of Technology, and I have made toward addressing the issue, among others, of scalability. Further, thanks to the inception of the AIM Photonics Initiative, I will talk briefly about experimental tests that we have started and others that we have planned for assessing in situ the effectiveness of the devices that we have analyzed theoretically.