



## **Large-scale Quantum Photonic Processors: Photonics for AI and AI for Photonics**

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Photons play a central role in many areas of quantum information science, either as qubit themselves or to mediate interactions between long-lived matter based qubits. Techniques for (1) high-fidelity generation, (2) precise manipulation and (3) ultra-efficient detection of quantum states of light are therefore a prerequisite for virtually all quantum technologies. A quantum photonics processor is the union of these three core technologies into a single system, and, bolstered by advances in integrated photonics, promises to be a versatile platform for quantum information science. In this talk we present recent progress towards large-scale quantum photonic processors, leveraging the platform of silicon photonics. We demonstrate how quantum photonic processors can accelerate both quantum and classical machine learning, and how optimization techniques can enhance large-scale quantum control.