Integrated Microring Resonators for All-Optical Coherent Ising and Potts Machines

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Silicon nitride integrated photonics is a promising platform for both quantum technologies and energy-efficient optical computing. In this talk, I will present our recent results on the development of integrated photonic devices based on high-Q silicon nitride microresonators.

First, I will discuss the generation of squeezed states of light using nonlinear parametric processes in integrated microresonators. Such devices provide a compact route toward quantum sensing, quantum communications, and continuous-variable quantum computing.

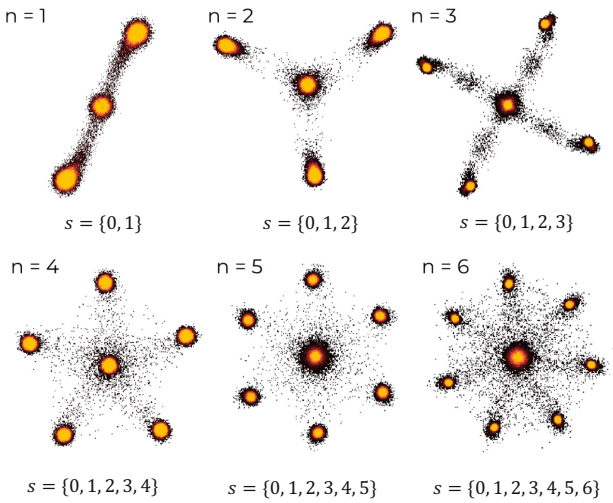

Figure 1:

I will then present our work on coherent optical computing architectures based on networks of coupled nonlinear photonic oscillators, including integrated coherent Ising and Potts machines. The first generation of phase-multistable optical states in a microring resonator (see Fig. 1) opens the way for observing the generation of high-order Schrödinger's cat states.

These results demonstrate the potential of silicon nitride photonics as a unified platform for quantum state engineering and photonic information processing, enabling the development of next-generation quantum and optical computing systems.