Towards Universal Quantum Computation with Bosonic Qubits

Dr. Yvonne
A*STAR Quantum Technology

Abstract
The realisation of robust universal quantum computation with any platform ultimately requires both the coherent storage of quantum information and (at least) one entangling operation between individual elements. The use of multiphoton states encoded in superconducting microwave cavities as quantum memories is a promising route to preserve the coherence of quantum information against naturally-occurring errors. However, operations between such encoded qubits can be challenging due to the lack of intrinsic coupling between them. In this talk, I will discuss the recent experimental work on engineering a coherent and tunable bilinear coupling between two otherwise isolated microwave quantum memories in a three-dimensional circuit QED architecture. Building upon this coupling, we also demonstrate programmable interference between stationary quantum modes and realise robust entangling operations between two encoded qubits. Our results provide a crucial primitive necessary for universal quantum computation using bosonic modes.

Short Biography
Yvonne’s work focuses on developing the crucial primitives for universal quantum computation using superconducting circuits in a modular architecture. She received her B.A from the University of Oxford and her Ph.D from Yale University. During her graduate studies at Yale, Yvonne and her team developed the technique to realise a robust and programmable coupling between two otherwise isolated logical qubits encoded in superconducting microwave cavities[1]. She also led the experimental efforts that demonstrated, for the first time, a universal entangling gate between two logical qubits[2]. Since returning to Singapore, Yvonne is a member of the A*STAR quantum technology programme. She is working on developing a novel material platform and device architecture for hybrid quantum computing using solid-state systems.