

## **ICTS Seminar**

Title : Random access quantum information processing using multimode circuit quantum electrodynamics

Speaker : Srivatsan Chakram, University of Chicago, USA

Date : Monday, December 18, 2017

Time : 11:30 AM

Venue : Emmy Noether Seminar Room, ICTS Campus, Bangalore

**Abstract :** Qubit connectivity is an important property of a quantum processor, with an ideal processor having random access -- the ability of arbitrary qubit pairs to interact directly. We describe the implementation of a random access superconducting quantum information processor, demonstrating universal operations on a nine-bit quantum memory, with a single superconducting transmon qubit serving as the central processor. The quantum memory uses the eigenmodes of a linear array of coupled superconducting resonators. The memory qubits are superpositions of vacuum and single-photon states, controlled by a single superconducting transmon coupled to the edge of the array. We show that single transmon charge control, and flux-driven sideband interactions with the cavity modes are sufficient for universal quantum control of the entire multimode manifold. We demonstrate universal gate operations between arbitrary pairs of modes, as well as efficient schemes for generating multi-photon entangled states. The fast and flexible control, achieved with efficient use of cryogenic resources and control electronics, in a scalable architecture compatible with state-of-the-art quantum memories in the form of high-Q 3D microwave cavities, is promising for quantum computation and simulation.