QuanTalks

IISc Quantum Technologies Initiative (IQTI)
Seminar Series

Title: A ring resonator-based coupler for enhanced connectivity in superconducting multi-qubit networks

Speaker: Prof. R. Vijayaraghavan

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Abstract: Qubit coherence and gate fidelity are typically considered the two most important metrics for characterizing a quantum processor. An equally important metric is inter-qubit connectivity as it minimizes gate count and allows implementing algorithms efficiently with reduced error. However, inter-qubit connectivity in superconducting processors tends to be limited to nearest neighbor due to practical constraints in the physical realization. In this talk, I will introduce a novel superconducting architecture that uses a ring resonator as a multi-path coupling element with the qubits uniformly distributed throughout its circumference. This enables long range connectivity between qubits while maintaining physical separation between them, leading to negligible qubit cross-talk. Our planar design provides significant enhancement in connectivity over state-of-the-art superconducting processors without any additional fabrication complexity. I will discuss the basic theory of the ring resonator-based coupler and present experimental results from a device capable of supporting up to twelve qubits where each qubit can be connected to nine other qubits [1]. Our concept is scalable, adaptable to other platforms and has the potential to significantly accelerate progress in quantum computing, annealing, simulations and error correction.

Reference: [1] Hazra et al., Phys. Rev. Applied 16, 024018 (2021)

Biography: Dr. Vijayaraghavan completed his Bachelors degree in Physics from St. Stephen's College, Delhi University in 1999. He spent two more years at the University of Cambridge pursuing a BA in Natural Sciences before starting a PhD at Yale University in 2001. At Yale, he developed a new measurement technique for superconducting quantum bits. He continued work on improving quantum measurements during his postdoctoral work at the University of California, Berkeley which led to the first observation of quantum jumps and the first demonstration of quantum feedback in a solid-state quantum system. Since December 2012, Vijay has been the Principal Investigator at the Quantum Measurement and Control Laboratory at TIFR where the main goal is to develop superior quantum processors and develop techniques to stabilize quantum states against decoherence. Some key highlights of this group's work include development of a broadband ultralow noise amplifier for quantum measurements and a novel multi-qubit processor design. He is currently leading several projects to build small scale quantum processors with funding from DAE, DRDO, TCS and DST.

Date & Time

Wednesday, 13th October 2021

8:30 PM IST

Meeting Link

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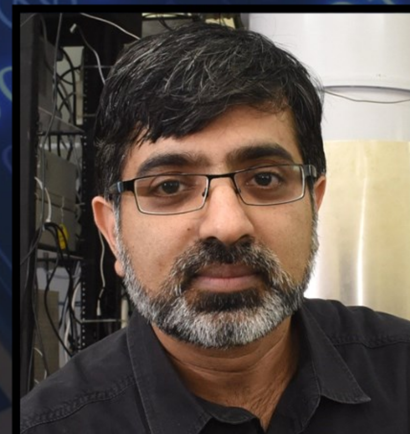

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