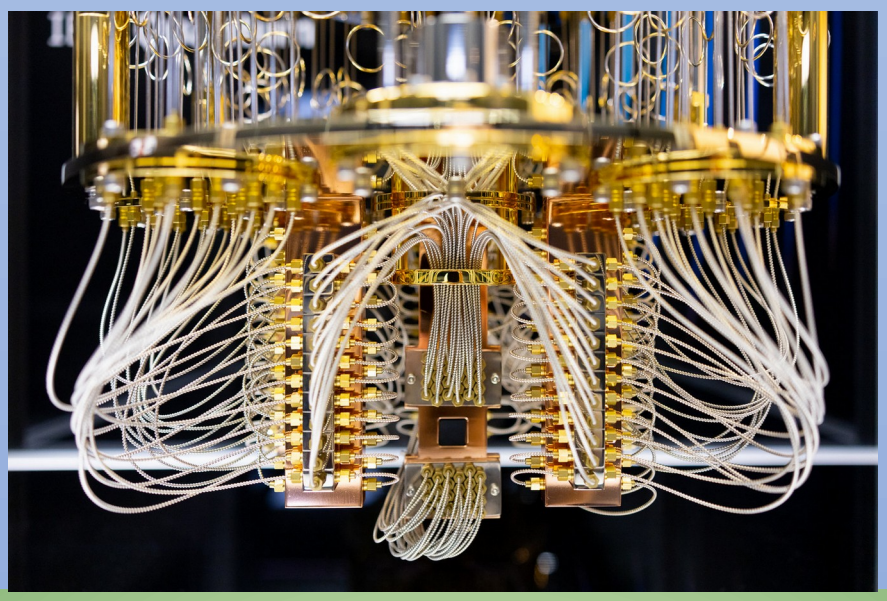
A Joint Infosys Condensed Matter - ASET Colloquium

What can I do with a quantum computer today?

Dr. Abhinav Kandala

IBM T.J Watson Research Center, New York



Dr. Abhinav Kandala is an experimental physicist and a Principal Research Scientist at the IBM T. J. Watson Research Center, New York. Here, he currently leads the Quantum Capabilities and Demonstrations team, building the tools for executing large quantum circuits and exploring beyond-classical quantum computation. His work at IBM has spanned the control and coherence of superconducting qubits, multi-qubit characterization, deployment and applications of quantum computers. His most significant contributions have been towards exploring whether useful information can be obtained from near-term quantum processors. In 2023, he led the "quantum utility" experiment. Abhinav received his B. Tech in Engineering Physics from IIT Bombay in 2008 and received his PhD in Physics from the Pennsylvania State University in 2015. He was recognized by MIT Tech Review as one of 35 innovators under 35 in 2019, and by IIT Bombay with a Young Alumni Achiever award in 2024.

Quantum computers can offer dramatic speed-ups over their classical counterparts for certain problems. However, noise remains the biggest impediment to realizing the full potential of quantum computing. While the solution to this challenge has been known for almost 30 years with the theory of quantum error correction, a large scale realization of fault tolerance is still pending. What can one hope to do then, with existing noisy processors? Superconducting quantum processors now exist with over 1000 qubits, at a scale that is well beyond direct, brute-force classical simulation. In this talk, I will present methods to learn and manipulate noise in these devices to obtain noise-free computations. These methods, dubbed "error mitigation", do not require the large qubit overheads of quantum error correction, and are immediately accessible to current devices. I will then present experiments that demonstrate the accurate execution of quantum circuits at a scale that is only accessible with classical approximate methods. I shall argue that these experiments present the first evidence that useful information can be obtained from current quantum computers even before the advent of fault tolerance.

Time:June 7, 2024 at 4 pm **Venue: TIFR Colaba, Room AG66**

YouTube link https://youtu.be/IsaI3WR3_4Q

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