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# *Programmable Quantum Simulations with Laser-cooled Trapped Ions*

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**Zoom Link**

Host: Mahdi Hosseini

Trapped ions are among the most advanced technology platforms for quantum information processing. When laser-cooled close to absolute zero temperature, atomic ions form a Coulomb crystal with micron-scale spacings in a radio-frequency ion trap. Qubit or spin-1/2 levels, encoded in hyperfine energy states of each ion, can be initialized, manipulated, and detected optically with high precision. Laser fields can also couple the qubit states of arbitrary pairs of ions through (virtual) excitation of collective phonon modes, creating programmable quantum logic operations and spin Hamiltonians.

In this talk, I will describe programmable trapped-ion quantum spin simulators and explain how techniques from holographic optical engineering to machine learning can be combined to harness the power of these simulators.

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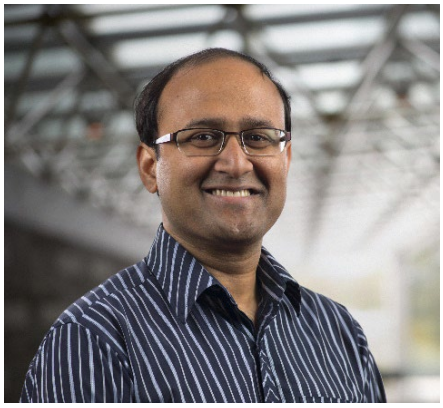

Dr. Rajibul Islam's research interests are in quantum information processing, in particular quantum simulation. His research team at the Institute for Quantum Computing (IQC) at University of Waterloo, Canada is building quantum simulators with laser-cooled trapped ions to simulate models of interacting quantum many-particle systems. Dr. Islam received his early physics education from Jadavpur University and TIFR, India, before getting his PhD in physics from University of Maryland, College Park. He worked at the Harvard-MIT Center for Ultracold Atoms as a postdoctoral fellow before joining University of Waterloo. Dr. Islam received a distinguished PhD dissertation award from U Maryland and an Early Researcher Award from the Government of Ontario, Canada.

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