

# CM/AMO Seminar

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**“Trapped-ion qubits: a paradigm for coherent control in infinite-dimensional quantum systems”**

**Time: Tuesday, April 7, 4PM**

**Location: 335 West Hall**

**Abstract:** Theories of quantum control have, until recently, made the assumption that the Hilbert space of a quantum system can be truncated to finite-dimensions. Controllability in an infinite-dimensional quantum system is hard to prove with conventional methods, and infinite-dimensional systems provide unique challenges in designing control fields.

In this talk, I will discuss the control of a popular system for quantum computing – the trapped-ion qubit. This system, modeled by a spin-half particle coupled to a quantized harmonic oscillator, is an example for a surprisingly rich variety of control problems. I will show how this infinite-dimensional quantum system can be examined via the lens of the Finite Controllability Theorem, two-color STIRAP, bichromatic control of a truncated system, etc.

These results could be important for developing quantum control protocols, particularly in similar quantum computing systems such as electrons in Penning traps. This work expands the scope of quantum control research to beyond that of finite-dimensional quantum systems.

This research was carried out in collaboration with Dr. Tony Bloch (University of Michigan) and Dr. Roger Brockett (Harvard University).