**Quantum Computing and Simulations with Trapped Ions**

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ABSTRACT: Laser-cooled and trapped atomic ions are standards for quantum information science, acting as qubits with unsurpassed levels of quantum coherence while also allowing near-perfect measurement. When spin-dependent optical dipole forces are applied to an ion crystal, a long-range Ising interaction arises, forming the basis of a reconfigurable fully-connected quantum computer. Similar forces allow the simulation of quantum magnetism, and recent experiments have implemented tunable long-range interacting spin models with up to 25 trapped ion spins. Recently we have performed spectroscopic studies of excited states and quench dynamics, and studied many body non-thermalization processes in this system, from prethermalization to many body localization (MBL). Finally, by applying a periodically driven Floquet Hamiltonian tempered with a MBL Hamiltonian, we have observed features of a discrete time crystal.