Quantum Simulators: from the Fermi Hubbard Model to Quantum Assisted NMR Inference

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I will discuss the recent progress of the optical lattice emulators of the Fermi Hubbard model. The new feature of these experiments is the availability of snapshots of many-body states with single particle resolution. I will review new insights from these experiments on the properties of doped Mott insulators, including the demonstration of magnetically mediated pairing. I will also present the idea of using quantum simulators to perform inference of NMR spectra for biological molecules. I will review the recent experimental realization of this algorithm on a quantum computer using trapped ions. Prospects for scaling this approach to solving practically relevant problems will be discussed.