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Probing Many-Body Physics in an Optical Lattice Clock

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My graduate research has focused on experiments with atomic clocks. Advances in atomic, molecular, and optical (AMO) physics push the frontiers of atomic clock research and offer exciting research opportunities. At the same time, atomic clocks now provide us with sensitive measurement tools, accurate navigation through the Global Positioning System (GPS), and are vital for many internet based applications. The base unit of time, the second, is now derived from a microwave transition frequency in cesium. However, the systematic uncertainty of the most advanced clocks based on optical transitions now surpass those of the cesium atomic standards. These transition frequencies are effected by environmental perturbations which include, for example, the local electric and magnetic field environment. For the case of optical lattice atomic clocks, multiple atoms are confined together within a standing wave of light and the atom-atom and atom-light interactions both need to be considered. My PhD research focuses on studies of these interactions. These studies not only help to understand the systematic shifts these clocks experience but also allow the simulation of many-body Hamiltonians and dipolar interactions and are therefore pushing the frontiers of AMO physics.

[1]Harry Lustig Award Session