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Abstract for an Invited Paper
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FINALIST: Dynamics of Strongly Interacting Quantum Many-Body Systems in Diamond[1]

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Recent advances in our ability to coherently manipulate many-body, quantum systems have enabled the exploration of dynamical phenomena in previously inaccessible regimes. In this talk, I will describe a number of investigations based on high-density ensembles of nitrogen-vacancy (NV) color centers in diamond. In our sample, the NVs are sufficiently dense such that dipolar interactions between their electronic spins dominate the system's dynamics. This naturally leads to the realization of a strongly interacting, disordered spin ensemble, which we utilize to explore a variety of exotic non-equilibrium quantum phenomena. In particular, I will describe our studies of both critically slow spin dynamics and our observation of discrete time crystalline order. Finally, I will present a new framework for controlling the dynamics of a generic spin ensemble using only global control fields; this framework allows one to quickly identify when a given many-body system can be used as a versatile analog simulator.

[1]This work was performed at Harvard University under the supervision of Prof. Mikhail D. Lukin.