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Investigating Many-body Physics with Ultracold Molecules in Optical Lattices MICHAEL WALL, LINCOLN CARR, Colorado School of Mines — Ultracold polar molecules, with their large internal Hilbert space and significant electric dipole moments, offer exciting prospects for the production of novel many-body effects when placed in an optical lattice. In this talk we present a new lattice Hamiltonian, the *Molecular Hubbard Hamiltonian* (MHH), which is a natural Hamiltonian for the study of many-body effects using experimental setups that can be performed in the immediate future with established techniques in ultracold molecular quantum gases. We will explain the Hamiltonian, its physical motivation, and the significant differences with typical Hubbard-like models realized with ultracold atomic gases. We will then show results from entangled quantum dynamics simulations demonstrating that the Hamiltonian exhibits emergent time scales over which spatial entanglement grows, crystalline order appears, and oscillations between rotational states self-damp into an asymptotic superposition.

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