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Engineering quantum dimer models via large-spin Mott insulating ultracold bosons[1] BHUVANESH SUNDAR, Cornell University, TODD RUTKOWSKI, MICHAEL LAWLER, Binghamton University, ERICH MUELLER, Cornell University — We propose an experimental protocol to produce quantum dimer models using ultracold bosonic atoms with a large hyperfine spin confined in a deep optical lattice. We explain how an optical Feshbach resonance can control the strength of interactions in different spin channels, leading to a limit where the low-energy Hilbert space is defined by non-overlapping short-range dimers. Solving this model in different lattice geometries yields the columnar phase on a square lattice and the $\sqrt{12} \times \sqrt{12}$ phase on a triangular lattice. The ground state is unknown on a cubic lattice. We give protocols to measure dimer-dimer correlations in the ground state using photoassociation and quantum gas microscopy. Experimentally implementing our proposal would allow us to explore models that have a long history in condensed matter physics, and experimentally resolve theoretically unknown phase diagrams in three-dimensional lattices.

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