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Quantum dimer models emerging in ultracold Mott insulating Bose gases with a large spin 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 propose using an optical Feshbach resonance to engineer spin dependent interactions between bosonic atoms. We show that in the limit of weak lattice tunneling and weak interaction for spin singlets, this system maps to a rich quantum dimer model. For the parameters in our proposal, we find several interesting phases in different lattice geometries: columnar phase on a square lattice, $\sqrt{12} \times \sqrt{12}$ phase on a triangular lattice, and a theoretically unknown phase on a cubic lattice. We give protocols to measure 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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