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Preparation and detection of magnetic quantum phases in optical superlattices ANA MARIA REY, ITAMP, Harvard -Smithsonian Center of Astrophysics, VLADIMIR GRITSEV, EUGENE DEMLER, MIKHAIL LUKIN, Physics Department, Harvard University — By loading spinor atoms in optical lattices it is now possible to simulate quantum spin models in controlled environments and to study quantum magnetism in strongly correlated systems. In this talk we describe a technique that allows one to prepare, detect and characterize magnetic quantum phases in ultra-cold spinor atoms loaded in optical superlattices. Our technique makes use of singlet-triplet quantum spin manipulation in double-well potentials in analogy to the recently demonstrated quantum control in semiconductor double quantum dots. We shall also discuss the many-body dynamics arising from coherent coupling between singlet-triplet pairs in adjacent double-wells. In particular by deriving an effective description for such many-body system we will discuss the generation of complex magnetic states by adiabatic and non-equilibrium dynamics.

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