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Fermions and bosons in optical lattices

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We report on the preparation and study of fermionic and bosonic atoms in optical lattices. In a three-dimensional optical lattice the atoms realize a Hubbard model which is a fundamental model to describe the physics of strongly correlated condensed matter systems. The full phase diagram of the Hubbard model includes fascinating phases exhibiting strong correlations such as magnetic order, superconductivity and a Mott insulator. Mixtures of bosonic and fermionic atoms represent a fascinating extension of atomic lattice gases in which two systems of fundamentally different quantum statistics are interlinked. We study the mutual influence of fermions and bosons in optical lattice and investigate how the presence of the fermions modifies the coherence properties of the bosonic atoms.