

Quantum degenerate atoms in an optical lattice

Tremendous progress has been achieved in the preparation of strongly correlated quantum systems using ultra-cold quantum gases in the past couple of years. Due to their exceptional degree of controllability, not present in typical condensed matter systems, cold atomic gases realize an "Experimental Quantum Simulator" in the sense initially proposed by Feynman to tackle the problem of strongly correlated quantum systems. Both in fermionic and bosonic quantum systems cold atomic gases have advanced the understanding of correlated matter. In particular when atoms are studied in the periodic potential of an optical lattice, access to various quantum many-body regimes including superfluids, Mott-insulators, and Luttinger liquids has been achieved. We will present recent experiments with fermions and mixtures of bosons and fermions in optical lattices.