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Generation and exploration of the Spin-Orbit coupled Bose gas

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To generate an artificial gauge field with ultracold quantum gas becomes a very hot topic in last few years and will continue to be attractive for ultracold atomic and condensed matter physics in the coming future. Many interesting and important topics such as Fractional Quantum Hall effect, Spin-orbit coupling and Topological insulator are connected to this topic very closely. Here we present our recent experimental progress of the synthesized gauge potential and the spin-orbit coupled Bose-Einstein condensate (BEC) in optical dipole trap. Raman coupling technique and a bias magnetic field is applied to tune the structure of the gauge potential and spin-orbit coupling. Several fundamental properties of spin-orbit coupled BEC is experimentally studied including the properties of collective dipole oscillation, the stability of excited dressed state, the critical temperature of spin-orbit coupled Bose gas and the formation of magnetic order during evaporative cooling. These studies enrich the knowledge of this field and further explorations are also in planning.