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Collective Modes of Spin-Orbit Coupled Condensate ZHU CHEN, HUI ZHAI, Institute for Advanced Study, Tsinghua University — Collective modes of Spin-orbit coupled Bose-Einstein condensate in harmonic potential are studied systematically. The NIST type spin-orbit coupling is considered mainly due to its experimental realization. The dipole oscillation frequency turns out to be related to the oscillation magnitude, which is the reflection of the the violation of kohn's theorem. Analytical results are obtained in small amplitude limit, which are consistent with the effective mass theory. Breath modes and surface modes are also obtained, which are shown to be coupled with the center of mass motion. Mode resonance among them is observed. Furthermore, a special case is considered when center of mass motion in real space induces tunneling in momentum space. A simplified two-mode model is proposed to explain qualitatively such oscillation plus tunneling process. At last, the most general form of spin-orbit coupling is studied, and results in small amplitude limit are also obtained.

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