Abstract Submitted
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Collective modes in two- and three-dimensional electron systems with Rashba spin-orbit coupling[1] SAURABH MAITI, University of Florida, Gainesville and National High Magnetic Field Lab, Tallahasse, VLADIMIR ZYUZIN, DMITRII MASLOV, University of Florida, Gainesville — In addition to charge plasmons, a 2D electron system with Rashba-type spin-orbit coupling (SOC) also supports three collective modes in the spin sector: the chiral-spin modes. We study the dispersions of the charge and spin modes and their coupling to each other within a generalized RPA for arbitrarily strong SOC, and both in 2D and 3D systems. We find that the charge plasmons are coupled to only one of the three chiral-spin modes. In 3D, the chiral-spin modes are strongly damped by particle-hole excitations and disappear for weak electron-electron interaction. Landau damping of the chiral-spin modes in 3D is directly related to the fact that, in contrast to 2D, there is no gap for particle-hole excitations between spin-split subbands. The gapless continuum is also responsible for Landau damping of the charge plasmon in 3D - a qualitatively new feature of the SOC system. The in-plane transverse chiral-spin mode shows up as dispersing peak in the optical conductivity at finite wave number which can can be measured in the presence of diffraction grating. We also discuss possible experimental manifestations of chiral-spin modes in semiconductor quantum wells such InGaAs/AlGaAs and 3D giant Rashba materials of the BiTeI family.

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