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Magnetoplasmon excitations in a quasi-two-dimensional Rashba spintronic systems: Oscillations, resonances, and energy gaps MANVIR S. KUSHWAHA, Institute of Physics, University of Puebla, Mexico — We report on the theoretical investigation of plasmon excitations in a quasi-two-dimensional electron gas (Q2DEG) in the presence of a perpendicular magnetic field and spin-orbit (SO) interaction induced by the Rashba effect. We derive and discuss the dispersion relations for charge-density excitations within the framework of Bohm-Pines' random-phase approximation (RPA). The magnetoplasmons in a 2DEG are known to be characterized by two important properties: (i) the oscillatory behavior of the dispersion curves in the short wavelength limit (SWL), and (ii) the resonance splitting at the frequency $\omega = n\omega_c$ in the long wavelength limit (LWL); n (≥ 2) being an integer and ω_c the cyclotron frequency. Here we study the effect of the Rashba spin-orbit interactions (SOI) on these characteristics in depth. We observe that the SOI modifies drastically both the oscillatory behavior in the SWL and yields multiple resonance splittings [at $\omega = (n \pm x_0)\omega_c$] in the LWL. Such resonance splittings make the spintronic systems potential candidates for quantum-well-based new devices as spin filters. We discuss the dependence of the magnetoplasmon energy on the propagation vector, the magnetic field, the 2D charge-density, and the Rashba parameter characterizing the SOI.

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