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Magnetoplasmon excitations in Rashba spintronic quantum wires: Maxons, rotons, and negative energy dispersion M.S. KUSHWAHA, University of Puebla — We investigate the plasmon excitations in a quasi-one-dimensional electron gas (Q1DEG) in the presence of a perpendicular magnetic field (B) and spin-orbit interaction (SOI) induced by the Rashba effect. The problem involves three length scales: $\ell_0 = \sqrt{\hbar/m^*\omega_0}$, $\ell_c = \sqrt{\hbar/m^*\omega_c}$, and $\ell_s = \hbar^2/(2m^*\alpha)$ associated with, respectively, the confining potential, the magnetic field, and the Rashba SOI. The resulting Schrodinger-like equations satisfied by the wave function $\phi_{\uparrow\downarrow}$ are two coupled equations, which cannot be solved in an explicit analytical form. However, the limit of a strong magnetic field ($\ell_c \ll \ell_0$) and $k\ell_0 \ll 1$ helps solve this set of coupled equations exactly. We derive and discuss the dispersion relations for charge-density excitations within the framework of Bohm-Pines' RPA. The intrasubband and intersabband magnetoplasmons (MPs)in a Q1DEG are characterized by, respectively, the negative energy dispersion with increasing B and the magnetoroton excitations . Here we scrutinize the effect of the SOI on these characteristics in depth. We observe that the SOI modifies drastically the behavior of both the intrasubband and intersubband MPs in the LW limit and renders them relatively more prone to the Landau damping in the SW limit. We discuss the dependence of the MPs energy on the propagation vector, the magnetic field, the 1D charge-density, and the Rashba parameter characterizing the SOI.

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