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Magnetoplasmon excitations in Rashba spintronic quantum wires: Maxons, rotons, and negative-B dispersion MANVIR KUSHWAHA, University of Puebla, Puebla, Mexico — We report on the theoretical investigation of plasmon excitations in a quasi-two-dimensional electron gas in the presence of a harmonic potential, a perpendicular magnetic field, and the spin-orbit interaction (SOI) induced by the Rashba effect. The resultant system is a Q1D quantum wire with free propagation in the y direction and magnetoelectric quantization along the x. The problem involves three length scales: $l_0 = \sqrt{\hbar/m^*\omega_0}$, $l_c = \sqrt{\hbar/m^*\omega_c}$, and $l_\alpha = \hbar^2/(2m^*\alpha)$, which characterize the relative strengths in the interplay of confinement, the magnetic field, and the Rashba SOI. The resulting Schrödinger-like equations are two coupled equations, which cannot be solved in an explicit form. However, invoking the limits of a strong magnetic field, $l_c \ll l_0$, and $k_y l_0 \ll 1$ allow us to solve this set of coupled equations exactly. We then derive and discuss the dispersion relations for collective excitations within the framework of Bohm-Pines' RPA. The intrasubband and intersubband magnetoplasmons in a Q1DEG are characterized, respectively, by the negative-B dispersion and the magnetoroton excitation. Here we scrutinize the effect of the Rashba SOI on these characteristics in depth. We observe that the SOI modifies drastically the behavior of both magnetoplasmons in the long wavelength limit and may render them relatively more susceptible to the Landau damping in the short wavelength limit.

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