# The Interplay of Rashba Spin-Orbit Interaction and Landau Level Broadening on a Two-Dimensional Electron Gas Under a Tilted Magnetic Field

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A two-dimensional electron gas in a tilted magnetic field with Rashba spin-orbit interaction was studied. Assuming that opposite spin states of adjacent Landau levels have equal probability, an analytic solution was obtained. The eigenvalues show that tilting the magnetic field lifts the degeneracies brought about by the crossings of energy levels that are normally present in the perpendicular-magnetic-field case. The absence of the crossings resulted to the suppression of the beats in Shubnikov-de Haas oscillations.
The Landau level broadening is attributed to disorder while the Rashba spin-orbit interaction (RSOI) is accredited to the asymmetry of the heterostructure where the two-dimensional electron gas is found. Increased Landau level broadening smears the oscillations in the density of states. In contrast, stronger RSOI amplifies them since it is a source of spin-splitting at zero or weak magnetic fields. On the other hand, both the broadening and the RSOI shift the chemical potential to higher values. The similarity in effects can be explained by recognizing that the asymmetry of the heterostructure is in itself a form of structural disorder.