

Electrical detection of Rashba and Dresselhaus parameters in a quantum well layer

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The absolute values of Rashba and Dresselhaus parameters are separately observed in an InAs quantum well channel via an electrical method [1]. The InAs active layer is inserted by $\text{In}_{0.52}\text{Al}_{0.48}\text{As}/\text{In}_{0.53}\text{Ga}_{0.47}\text{As}$ double cladding layers to confine the carriers. The Rashba field is always perpendicular to the wavevector direction but the Dresselhaus field depends on the crystal orientation. The vector sum of two fields is as a function of wavevector direction. Thus, the Rashba and Dresselhaus spin-orbit interaction parameters can be separately extracted by observing the Shubnikov-de Haas oscillations for the various crystal directions. The gate dependence of measurement shows that the Rashba effect is only controllable term whereas the Dresselhaus term is constant with gate electric field.

References:

[1] Y. H. Park et al., Appl. Phys. Lett. 103, 252407 (2013).