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Spin separation in cyclotron motion in anisotropic 2D systems T. MINAGAWA, Y. LYANDA-GELLER, Purdue University — Spin-orbit coupling in the two dimensional systems can lead to spatial separation of spins of charge carriers that experience cyclotron motion in an external magnetic field. In the experiment by Rokhinson et al, this effect was observed in p-GaAs grown along [113] direction. Such system, due to cubic anisotropy of the underlying GaAs crystal, possesses several remarkable properties. In particular, we investigate spin-orbit interactions of 2D holes quantized along [113] and demonstrate that the dominant contribution to spin-orbit coupling arises from the linear in the electron momentum terms. This is in contrast to hole system quantized along [001], in which the intrinsic spin-orbit interaction is cubic in the hole momentum. The linear in momentum terms in [113] system originate from both bulk GaAs cubic in momentum coupling and from asymmetry of the quantum well confining the 2D hole gas. We have analytically and numerically studied the spin separation of two-dimensional holes quantized along [113] direction and found strengths of spin-orbit coupling maximazing or eliminating the spatial separation of spins. We have also computed spin relaxation times for [113] 2D holes. We demonstrate that for spin-orbit interactions giving no spatial separation, the spin relaxation rate vanish. The same effect occurs in anisotropic electron systems, c.f., in the presence of both Rashba and Dresselhaus linear in momentum spin-orbit couplings.

Y. Lyanda-Geller
Purdue University

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