Rashba effect in wurtzite n-GaN:Si

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Spin-orbit effects attract a renewed attention in the context of novel effects expected in hybrid structures involving semiconductors, metals, ferromagnets, and superconductors. On the other hand GaN and related alloys are expected to play a major role in the realization of spin-related functionalities based on semiconductors.

Here, we report on experimental studies of weak localization and antilocalization magnetoresistance in epitaxial layers of wurtzite (wz) n-GaN:Si. The Si-doped GaN layers have been grown in an horizontal tube metalorganic vapor phase epitaxy reactor and deposited on a c-plane sapphire substrate.

Millikelvin magnetotransport studies are carried out down to 40mK. The dependency of the conductivity on magnetic field and temperature is interpreted in terms of theories that take into account disorder-induced quantum interference of one-electron and many-electron self-crossing trajectories. The Rashba parameter $\alpha_R = (4.5 \pm 1)$ meVÅ is determined [1], and it is shown that in the previous studies of electrons adjacent to GaN/(Al,Ga)N interfaces, bulk inversion asymmetry was dominant over structural inversion asymmetry. The comparison of experimental and theoretical values of α_R across a series of wurtzite semiconductors is presented as a test of current relativistic *ab initio* computation schemes. It is found that electron-electron scattering with small energy transfer accounts for low temperature decoherence in these systems.

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[1] W. Stefanowicz, R. Adhikari, T. Andrearczyk, B. Faina, M. Sawicki, J.A. Majewski, T. Dietl, A. Bonanni, "Experimental determination of Rashba spin-orbit coupling in wurtzite n-GaN:Si", arXiv:1402.6843 (2014)