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Weak Antilocalization and Spin-Orbit Coupling in InAlN/AlN/GaN Heterostructures H. CHENG, C. KURDAK, Department of Physics, University of Michigan, Ann Arbor, MI, 48109, J.H. LEACH, M. WU, H. MORKOC, Department of Electrical and Computer Engineering, Virginia Commonwealth University, Richmond VA, 23284 — Spin-orbit coupling is investigated by magnetotransport and weak antilocalization (WAL) measurements in $In_xAl_{1-x}N$/AlN/GaN heterostructures in the carrier density ranges extending from 1.22×10^{13} cm^{-2} to 1.41×10^{13} cm^{-2} and from 1.99×10^{13} cm^{-2} to 2.15×10^{13} cm^{-2}. By combining the data from AlGaN/AlN/GaN samples, we find that the spin-orbit field is not a constant at high carrier densities and the electron spin-splitting energies show a deviation from linear behavior with Fermi wavefactor. However, the spin-splitting energies extracted from WAL oscillations, even in this high carrier density regime, were found to be much smaller than the previous reports based on Shubnikov-de Haas (SdH) measurements. We will discuss how the nonuniformities in the carrier density can lead to beating features in SdH oscillations, which can then be misinterpreted as large spin-splitting energies. This finding may resolve the long-standing discrepancy between the WAL and SdH results.

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