HL 50: Invited Talk Schmult

Time: Friday 10:15–11:00 Location: H15

Invited Talk HL 50.1 Fri 10:15 H15

Quantum Transport in High Mobility GaN/AlGaN 2DEGs and Nanostructures — •Stefan Schmult[1], Alexander Punnoose[1], Michael J. Manfra[1], Hungtao Chou[2], David Goldhaber-Gordon[2], and Richard J. Molnar[3] — [1]Bell Labs, Alcatel-Lucent, Murray Hill, NJ, USA — [2]Stanford University, Stanford, CA, USA — [3]MIT Lincoln Lab, Lexington, MA, USA

We report on the transport properties of high mobility GaN/AlGaN two-dimensional electron gases (2DEGs) grown by molecular beam epitaxy. Using an insulated gate Hall bar structure, the electron density is continuously tuned from $2\times10^{12}\mathrm{cm}^{-2}$ down to $2\times10^{11}\mathrm{cm}^{-2}$. At T=0.3K, the 2DEG displays a maximum mobility of $1.67\times10^{5}\mathrm{cm}^{2}/\mathrm{Vs}$ at a sheet density of $9.1\times10^{11}\mathrm{cm}^{-2}$. Detailed analysis of the dependence of mobility on 2D density allows us to isolate the primary scattering mechanisms at low carrier density and low temperatures. A detailed study of the weak localization and antilocalization corrections to the classical conductivity identifies that the spin-orbit coupling is of Bychkov-Rashba type. We estimate the values of the coupling constant and the spin relaxation time and find that spin-orbit scattering is not negligible as one might expect for a wide-bandgap material. Recently we have realized electron transport through quantum point contacts (QPCs) and quantum dots (QDs) in GaN/AlGaN nanostructures. True one-dimensional conduction channels in QPCs show well quantized plateaus, which spin-split in high perpendicular magnetic field. The transconductance of a QD depends on its size and exhibits Coulomb oscillations, representing resonant transport through the dot.