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Energy Relaxation in the Bloch-Gruneisen Regime Probed by Weak Antilocalization (WAL) Measurements in GaN Heterostructures HAILING CHENG, CAGLIYAN KURDAK, Physics Department, University of Michigan, NECMI BIYIKLI, JINQIAO XIE, HADIS MORKOC, Department of Electrical Engineering, Virginia Commonwealth University — Electron-phonon (e-p) interaction was investigated in wurtzite $Al_{0.15}Ga_{0.85}N/AlN/GaN$ and $Al_{0.83}In_{0.17}N/AlN/GaN$ heterostructures with polarization induced two dimensional electron gases in the Bloch-Gruneisen regime. WAL and Shubnikov-de Haas measurements were performed on gated Hall bar structures at temperatures down to 0.3 K. With gate voltage, we cover a carrier density range from $3.41\times10^{12}cm^{-2}$ to $4.92\times10^{12}cm^{-2}$. Moreover, we used the WAL as a thermometer to measure the electron temperature T_e as a function of the bias current. We find the power dissipated per electron P_e is proportional to T_e^4 due to piezoelectric acoustic phonon emission by hot electrons. We calculated P_e as a function of T_e without using any adjustable parameters for both static and dynamic screening cases of piezoelectric e-p coupling. In the temperature range of this experiment the static screening case is expected to be applicable; however, our data are in better agreement with the dynamic screening case.

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