Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

Coulomb correlation effects and density dependence of radiative recombination rates in polar AlGaN quantum wells GREG RUPPER, SERGEY RUDIN, U.S. Army Research Laboratory, FRANCESCO BERTAZZI, Politecnico di Torino, Torino, Italy, GREGORY GARRETT, MICHAEL WRABACK, U.S. Army Research Laboratory — AlGaN narrow quantum wells are important elements of deep-ultraviolet light emitting devices. The electron-hole radiative recombination rates are important characteristics of these nanostructures. In this work we evaluated their dependence on carrier density and lattice temperature and compared our theoretical results with the experimentally determined radiative lifetimes in the c-plane grown AlGaN quantum wells. The bands were determined in the k·p approximation for a strained c-plane wurtzite quantum well and polarization fields were included in the model. In order to account for Coulomb correlations at relatively high densities of photo-excited electron-hole plasma and arbitrary temperature, we employed real-time Green's function formalism with self-energies evaluated in the self-consistent T-matrix approximation. The luminescence spectrum was obtained from the susceptibility by summing over scattering in-plane directions and polarization states. The recombination coefficient was obtained from the integrated photoluminescence. The density dependence of the radiative recombination rate shows effects of strong screening of the polarization electric field at high photo-excitation density.

Greg Rupper
U.S. Army Research Laboratory

Date submitted: 02 Nov 2012 Electronic form version 1.4