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Hot carrier dynamics in bulk GaN under short laser pulse excitation S. RUDIN, U.S. Army Research Laboratory, E. BELLOTTI, Boston University, G. A. GARRETT, M. WRABACK, U.S. Army Research Laboratory — In this work, we apply the semiconductor Bloch equation formalism to the study of the electron-hole dynamics in bulk GaN under short laser pulses excitation. Both coherent and non-coherent processes contribute to the dynamics on short time scales. The numerical solution of the equations of motion for the electron-hole plasma and the polarization is obtained by using a generalized Monte Carlo algorithm. This includes a direct solution of the coherent process and a stochastic description of the dephasing mechanisms. Screened carrier-carrier interaction and carrier-phonon interaction are considered in the dephasing processes. The model also includes the description of the interaction of the ultra-short laser pulse with the semiconductor media. The non-parabolic two-band analytical approximation was used in this work. The interaction of LO-phonons with electrons in GaN is much stronger than in GaAs, and the LO-phonon-electron scattering rate in GaN is almost one order higher than that in GaAs. The computed time dependent carrier densities were used to obtain time dependent luminescence at different probe wave-lengths for different excitation powers. The results were compared with the experimental results obtained by the subpicosecond time-resolved spectroscopy of UV luminescence.

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