Abstract Submitted
for the MAR08 Meeting of
The American Physical Society

Ab initio method for the electron-phonon scattering times in semiconducting nanostructures NATHALIE VAST, JELENA SJAKSTE, Ecole Polytechnique, Laboratoire des Solides Irradies, CEA-DSM-DRECAM, CNRS, 91128 Palaiseau, France, VALERIY TYUTEREV, Tomsk State Pedagogical University, Tomsk, Russia — The interaction of excited electrons with phonons plays a central role for electronic and transport properties at the nanoscale. It is the dominant process limiting the excitation lifetime at medium excitation energies. Despite its importance, a reliable approach within ab initio methods for phonon interaction with excited carriers was still lacking. We present in this work our fully ab initio approach to calculate the electron-phonon scattering times for collisions of carriers in the conduction band with short-wavelength phonons. We apply it to the deexcitation of hot electrons in GaAs [1,2], and to the lifetime of the direct exciton in GaP and GaAs [2,3], all in excellent agreement with experiments. Finally, we discuss the effect of nanostructuring on the electron-phonon coupling constants in GaAs/AlAs superlattices.

[1] J. Sjakste, N. Vast, V. Tyuterev, 2007, accepted in Phys. Rev. Lett.
[2] J. Sjakste, V. Tyuterev, N. Vast, Appl. Phys. A 86 (2007) 301.
[3] J. Sjakste, V. Tyuterev, N. Vast, Phys. Rev. B 74, 235216 (2006).

Jelena Sjakste
Ecole Polytechnique, Laboratoire des Solides Irradies,
CEA-DSM-DRECAM, CNRS, 91128 Palaiseau, France

Date submitted: 10 Jan 2008 Electronic form version 1.4