Abstract Submitted
for the MAR08 Meeting of
The American Physical Society

Absorption and photocurrent of semiconductor quantum wells: a multi-band NEGF study URS AEBERHARD, Paul Scherrer Institut — Interband photoexcitation of carriers in semiconductor quantum wells is exploited in various optoelectronic devices such as photodetectors or quantum well solar cells. For a quantitative prediction of the photocurrent, realistic models for the (sub)bandstructure as well as for the transport properties are required. In the present approach, the derivation of optical properties based on a multi-band empirical tight-binding Hamiltonian is combined with the non-equilibrium Green's function formulation of quantum transport. The photocurrent is calculated in presence of elastic and inelastic electron-phonon scattering from the self-consistent Born approximation of the self energy for carrier-light interaction, while the absorption is obtained from the transverse interband polarization function. Since the absorption as experimentally observed is governed by the excitonic contribution, the inclusion of this feature into the calculation of photocurrent and interband polarization via the respective many-body corrections is discussed.

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Date submitted: 26 Nov 2007 Electronic form version 1.4