Electron -phonon interaction and energy relaxation in InAs quantum dots

G. Bastard, R. Ferreira and O. Verzelen
Laboratoire de Physique de la Matière condensée ENS
24 rue Lhomond F75005 Paris (France)

The interaction between electrons and LO phonons in bulk semiconductors, quantum well and wire structures can be described by a weak coupling scheme. This means that the eigenstates of the interacting excitations are to a very good approximation weakly damped products of electron states by phonon states.
We shall present the results of far infrared magneto – optical experiments performed in InAs self assembled quantum dots which demonstrate that the weak coupling scheme is inapplicable to strongly confining dots and that the real elementary excitations in these structures are *polaron* states.
This finding has immediate consequences on the energy relaxation in quantum dots which can no longer be associated with the irreversible emission of LO phonons. Instead, the polaron relaxation is triggered by the anharmonicity of the vibrations which leads to a decay of the optical phonon part of the polaron. We shall present calculations of the thermalization time of polarons.
Finally, we shall discuss the polaron coupling in dot molecules as well as the consequence of polaron effects on interband transitions in single dots.