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Carrier thermal escape in families of InAs/InP self-assembled quantum dots GUILLAUME GELINAS, ALI LANACER, RICHARD LEONELLI, Universite de Montreal, RQMP, REMO A. MASUT, Ecole Polytechnique de Montreal, RQMP, PHILIP J. POOLE, National Research Council of Canada — The temperature evolution of the photoluminescence spectra of single-layer InAs/InP (001) self-assembled quantum dots samples was measured from 10 K to 300 K. To understand the thermal quenching of their multimodal emission, we developed a coupled rate-equation model that includes the effect of carrier thermal escape from a quantum dot to the wetting layer and to the InP matrix, recapture and/or non-radiative recombination. Our model reproduces the temperature dependence with a single set of parameters. We find that the main escape mechanism of the carriers in the quantum dots is through thermal emission to the wetting layer. The activation energy for this process is found to be close to one-half the energy difference between wetting layer and a quantum dot family, as measured by photoluminescence excitation experiments. This indicates that electrons and holes exit the InAs quantum dots as correlated pairs.

Guillaume Gelinas
Universite de Montreal, RQMP

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