Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

Strong enhancement of the luminescence decay time of isoelectronic centers in GaP:N at low temperatures PHILIPPE ST-JEAN, GABRIEL ETHIER-MAJCHER, ALARIC BERGERON, SEBASTIEN FRANCOEUR, Ecole Polytechnique de Montreal — Using time-resolved photoluminescence, the recombination dynamics of excitonic states bound to isoelectronic centers formed by either one or a pair of nitrogen atoms in GaP is investigated as a function of internuclear distance and temperature. Depending on their symmetry, centers formed by a pair of atoms exhibit several optical transitions that are, according to the excitonic state involved, either linearly polarized or unpolarized. At 4 K, for all nitrogen pairs studied, relatively long lifetimes approaching 1 μs are observed. Interestingly, these lifetimes vary considerably between excitonic states and ranges from 500 to 800 ns. This strong variation decreases with temperature, leading to similar lifetimes. Furthermore, as the temperature is increased to 30 K, all lifetimes decrease by about an order of magnitude, down to 60-90 ns, as previously reported. A thermodynamic model of the evolution of excitonic populations shows that a thermally activated process of about 2.5 meV characterizes this temperature behavior. This activation energy corresponds to an inter-level transfer between excitonic states. These findings enhance our understanding of the dynamics of carriers bound to isoelectronic centers, which are promising candidates for atomic-sized charge storing device.

Philippe St-Jean
Ecole Polytechnique de Montreal

Date submitted: 09 Nov 2012 Electronic form version 1.4