

Further Development of Coupled HF-MPL/ TRPL/Drift Diffusion on III-V materials and other materials

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III-V semi-conductors are recognized as high-performance materials for the fabrication of (opto)electronics devices such as avalanche photodiodes, light emitting diodes, lasers and photovoltaic cells working under concentration. For this reason, the knowledge of the different recombination paths in material single layers or full devices is crucial when elaborating a fabrication process. Methods of choice are transient characterizations such as TR-PL or impedance spectroscopies.

We have developed an HF-MPL setup able to work up to 100MHz and tested It successfully on InP samples, where TRPL can also be measured. On a variety of III-V samples, we could show that we are able to determinate carrier lifetime and to detect SRH traps centers situated at the surface on such samples, giving an estimation of the traps capture cross sections [1] thanks to the simultaneous use of TRPL and HF MPL. The association of both methods enabled an accurate determination of the recombination phenomena in a very large range of time scales

Several new experiments are currently performed on GaAs, CIGS, and perovskites. The results will be presented and discussed.

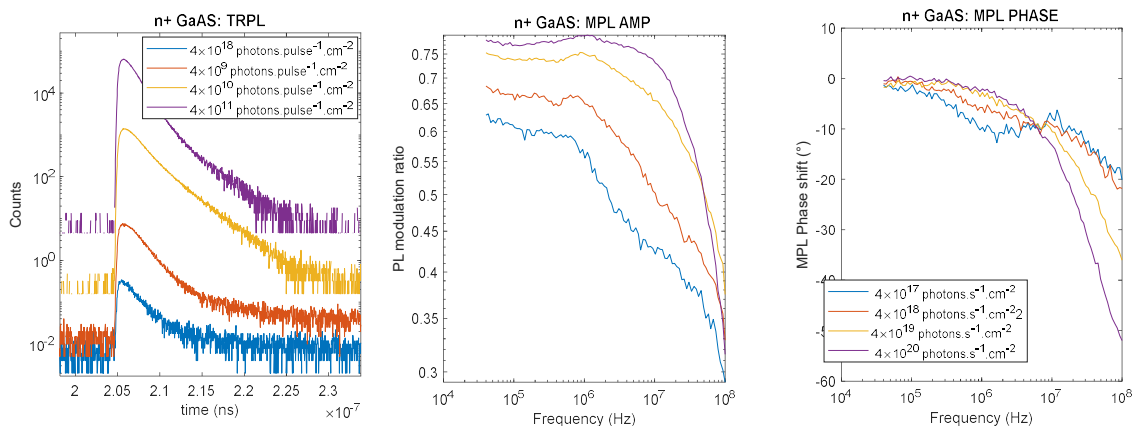


Figure 1, n+ GaAs sample TRPL decays at flux 2×10^8 photons/pulse/cm² times 1, 15, 200, 2x103. MPL phase and amplitudes at 4×10^{17} photons/cm²/s times 1 (blue), 10 (red), 10² (yellow) 10³ (purple).

[1] Wei Zhao, Cendra Rakotoarimanana, Anne Marie Goncalves, Arnaud Etcheberry, Mathieu Frégnaux, Laurent Lombez, Baptiste Bérenguier and Jean-François Guillemoles , “Surface recombination mechanism in InP with and without phosphazene monolayer probed by combined time-resolved photoluminescence and high frequency-domain photoluminescence technique”, submitted...