Abstract Submitted
for the MAR16 Meeting of
The American Physical Society

Probing surface recombination velocities in semiconductors using two-photon microscopy BENOIT GAURY, Maryland Nanocenter, University of Maryland, College Park. CNST, National Institute of Standards and Technology, PAUL HANEY, National Institute of Standards and Technology — We propose an analysis of the diffusion problem related to the two-photon time-resolved photoluminescence microscopy technique. We are considering a model of excess carrier diffusion in three dimensions, with recombination that is first order in carrier density (ie valid in low injection regime) and various boundary conditions that will apply to different use of the technique. First, we study a single planar boundary with enhanced recombination (parameterized with a recombination velocity). This planar boundary may represent the exposed sample surface, or any deep subsurface structure, such as a grain boundary or materials interface. Next, we assume the diffusion to be bounded by two parallel planes parameterized with different recombination velocities. This may apply to thin films where the diffusion length is higher than the sample thickness, or when the carrier generation volume axially spans the entire film. Finally, we investigate diffusion in a sphere where the spherical surface plays the role of a closed grain boundary. For all these cases we give analytical solutions for the three-dimensional diffusion problem for an excitation of arbitrary spatial or time dependence. We believe the solutions and scalings to be simple enough to enable convenient data fitting.

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Date submitted: 05 Nov 2015 Electronic form version 1.4