Abstract Submitted
for the MAR06 Meeting of
The American Physical Society

Optical Imaging for the Determination of Minority Carrier Transport[1] DAVID LUBER, Naval Postgraduate School, FRANK BRADLEY, NANCY HAEGEL — A scanning electron microscope technique is used, in combination with an optical imaging system, to measure minority carrier diffusion length in a heavily doped GaAs double heterostructure. Both diffusion and drift of charge are imaged. A diffusion length of $\sim$ 3.2 - 4 μm is measured, corresponding to a minority carrier mobility of 950-1480 cm^2/Vs in p-type material, doped $\sim$ 5 x 10^{18} cm^{-3}, in good agreement with theoretical predictions. Drift and diffusion behavior are also studied in more heavily doped regimes where plasmon scattering is expected to play a significant role. Measurements will be presented as a function of doping level, local electric field and sample temperature. We explore the limitations on determination of the diffusion length due to effects such as the finite nature of the excitation volume and photon recycling near the point of generation and compare approaches for extracting key material parameters. The technique offers a flexible approach to direct measurement of various transport properties and is applicable to a range of luminescent materials and multilayer devices. Examples from high resolution mapping of non-uniform electric field distributions will also be presented.

[1]This work has been supported by NSF Grants DMR-02033997 and DMR-0526330.

David Luber
Naval Postgraduate School

Date submitted: 30 Nov 2005 Electronic form version 1.4