Abstract Submitted
for the MAR07 Meeting of
The American Physical Society

Optical Transport Imaging for the Measurement of Electric Field and Minority Carrier Diffusion Length N.M. HAEGEL, P. ANDRIKOPOULOS, T.J. MILLS, Physics Dept. Naval Postgraduate School — An optical imaging technique is used to determine electric field and minority carrier diffusion length in planar heterostructures. We combine an optical microscope inside an SEM and image the spatial distribution of luminescence due to diffusion and drift from point source excitation. By comparing peak luminescence intensity with and without applied field, a quantitative measure of electric field value is obtained, while the transport image illustrates the field direction. Drift behavior has been imaged in a dimensionally confined region in a p type AlGaAs/GaAs double heterostructure where electron motion transitions from quasi 1D to 2D. Comparison to finite element modeling confirms the approach and demonstrates the sensitivity of the technique to local material and field variations. The technique can also be used for a 2 point measure of contact resistance. In the absence of applied field, the luminescence distribution provides a measure of minority carrier diffusion length, in a contact-free manner from a single image. This is demonstrated for a range of minority carrier diffusion lengths from $\sim$ 1.5 to 60 μm in III-V materials. The technique provides direct access to minority carrier mobility for studies of anisotropy, field dependence and domain behavior. We acknowledge support from NSF DMR-0203397 and DMR-0526330.

Nancy Haegel
Naval Postgraduate School

Date submitted: 02 Dec 2006 Electronic form version 1.4