# PHOTO-CARRIER RADIOMETRY AND DEEP-LEVEL PHOTO-THERMAL SPECTROSCOPY: TWO NEW NON-CONTACT METHODOLOGIES FOR OPTO-ELECTRONIC MATERIAL AND DEVICE DIAGNOSTICS

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This talk will present two optoelectronic diagnostic methodologies for non-contact transport and energetic studies in semiconductors, introduced at the CADIFT within the past 5 years with much promise for both fundamental physical electronics studies and industrial semiconductor quality control technologies. Photo-Carrier Radiometry (PCR), is a form of spectrally gated modulated photoluminescence. I will give an overview of the physical principles and instrumentation of PCR and will discuss various applications to semiconductor diagnostics with particular focus placed on quantitative determination of electronic transport parameters, defect and contamination monitoring in silicon, two-beam cross modulation PCR, and ion implant dose monitoring and ultra-sensitive imaging.
Then I will introduce Deep-Level Photo-Thermal Spectroscopy (DLPTS), a purely optical non-contact methodology developed very recently for the defect-state characterization of semiconductors. DLPTS is a two laser-beam technique; it utilizes near infrared sub-band-gap absorption to monitor the thermal emission of traps after an optical filling pulse. The methodology encompassing the adiabatic theory and combined DLPTS time-scanned transients and temperature-scanned spectra, amounts to an analytical quantitative photo-thermal spectroscopy capable of non-contact all-optical probing of band-gap defect/impurity state energy distributions and capture cross-sections in direct-gap semiconductors, and SI-GaAs in particular. The

technique has been applied to vertical-gradient-freeze grown SI-GaAs wafers, and the very first results will be presented.