NWS11-2011-000016

Abstract for an Invited Paper
for the NWS11 Meeting of
the American Physical Society

New Frontiers in Optical Science: Terahertz Spectroscopy ot Two Dimensional Systems

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Terahertz (THz) radiation is electromagnetic radiation whose frequency lies between the microwave and infrared regions of the spectrum. Naturally occurring THz radiation fills up the space of everyday life providing warmth, yet this part of the spectrum remains the least explored region mainly due to the technical difficulties. The technological gap, however, has been rapidly diminishing for the last two decades. The new and exciting frontier of the THz science and technology has encroached on many different disciplines producing a broad range of applications such as medical imaging, sensing of biochemical agents, and ultra-high speed communication. Furthermore, the unique and advanced techniques of the THz spectroscopy have been proved to be a powerful tool to investigate the material properties inaccessible until recently. For example, THz waves strongly interact with electrons and holes in two dimensional systems, in which their dynamics are governed mainly by many-body Coulomb interactions. I will present our experimental studies demonstrating remarkable quantum effects in semiconductor nanostructures and exotic charge carrier dynamics in graphene.