QPhysics
AT QUEENS COLLEGE

Colloquium Notice

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Quantum Engineering of Electron Processes for Advanced Sensing and Energy Conversion

This presentation focuses on charge/energy transfer modeling starting from nanoscale quantum phenomena and continuously broadening to macroscale, where these quantum effects can be observed and utilized. Methods of quantum field theory and a quantum transport equation based on the Keldysh-Feynman diagrammatic technique are employed to describe quantum phenomena in the electron-phonon energy exchange [1] and transport phenomena [2,3]. The sophisticated analytical methods used at the nanoscale may be sewed with the numerical Monte-Carlo simulations at larger scales [4]. This approach is used for investigating the charge/energy transfer in nano-materials and for modeling of superconductor and semiconductor nanodevices. I will discuss the design and optimization of next-generation ultra-sensitive detectors, quantum nanocalorimeters, THz mixers, and IR single-photon counters [5]. I will also consider a quantum dot solar cell and its optimization that leads to enhanced harvesting and very efficient photovoltaic conversion of IR energy [6].

1. Y.-L. Zhong, A. Sergeev et al., Phys. Rev. Lett. 104, 206803 (2010).
2. M. Bell, A. Sergeev, et al., Phys. Rev. Lett. 104, 046805 (2010).
3. A. Sergeev, M. Reizer, and V. Mitin, Phys. Rev. Lett. 106, 139701 (2011); Europhys. Letters 92, 27003 (2010).
4. V. Mitin, A. Sergeev, L-H. Chien, and N. Vagidov, Large-Scale Scientific Computing, Springer, p. 403, 2010.
5. B.S. Karasik, A. Sergeev, and D. Prober, "Nanobolometers for THz photon detection," IEEE Trans. on Terahertz Science & Technology, 1 (Inaugural Issue), 97 (2011).
6. K.A. Sablon, J.W. Little, V. Mitin, A. Sergeev, N. Vagidov, and K. Reinhardt, Nano Letters 11, 2311 (2011).

Monday
October 31, 2011
Starts at 12:15 PM
Coffee at 12:00 PM
Physics Conference Room, SB B326