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Plasmon-exciton excitations and coulomb blocking in nanojunctions

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Abstract

Intersite dipolar energy-transfer interaction influences on electron transport through molecular wires in nanojunctions. Such interactions can compensate Coulomb repulsions (CR) for particular relationships between their values. This effect of exciton compensation of Coulomb blocking can be observed by varying the exciton coupling that can be achieved by controlling the plasmonic response of metallic contacts. Exploiting their tunability feature, wavelength specific designs for optimal energy transfer can be realized. We have applied the pseudoparticle non equilibrium Green function formalism to the study of coupling between plasmons and excitons in nonequilibrium molecular nanojunctions. The formalism treats on-site CR, inter-site exciton and plasmon-exciton couplings exactly, and is shown to be especially convenient for exploration of plasmonic absorption spectrum of nanopolaritonic systems with combined electron and energy transfers. We demonstrate the sensitivity of the exciton-plasmon Fano resonance to junction bias, CR and inter-site exciton coupling. We evaluate the local field and exciton coupling enhancement, along with the energy transfer to metal, using the dressed interaction and FDTD calculations near plasmonic nanostructures. Our study opens a way to deal with nanopolaritonic systems in nonequilibrium molecular devices.

Biography

Boris Fainberg received his Ph.D. (1977) from the State Optical Institute named for S.I.Vavilov (St.-Petersburg, Russia). In 1991 he moved to the School of Chemistry at Tel-Aviv University where he is a visiting professor beginning 2000. In 1998 he joined the staff of the Holon Institute of Technology (Israel) where he works as a professor of chemical physics. He published more than 115 papers in reputed journals. He was a visiting professor at Institute of Atomic and Molecular Science, Taipei; Institute of Physics and Chemistry of Materials, Strasbourg; Humboldt University of Berlin; University of Augsburg; Northwestern University, Evanston, IL.