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Plasmon Resonances and Size-Quantization Effects in Doped Semiconductor Nanocrystals HUI ZHANG, Ohio Univ, VIKRAM KULKARNI, Rice Univ, EMIL PRODAN, Yeshiva Univ, PETER NORDLANDER, Rice Univ, ALEXANDER O. GOVOROV, Ohio Univ — Doped semiconductor nanocrystals represent a new type of quantum plasmonic material with optical resonances in the infrared spectral interval. These nanocrystals are fundamentally different from the metal nanoparticles because the electron density in a semiconductor can be tuned over a wide interval. Using the DFT-based time-dependent formalism, we computed the absorption spectra of doped quantum dots as a function of the number of carriers in a dot. The dynamic properties of doped quantum dots undergo an interesting transition from the size-quantization regime to the classical regime of plasmon oscillations. We demonstrate this quantum-to-classical transition for self-doped Copper Chalcogenides dots and for impurity-doped II-VI nanocrystals, and our simulations agree with the recent experiments well. The obtained results here can be used to predict and describe the optical properties of a broad class of semiconductor nanocrystals with quantum plasmonic resonances.

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