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Spectral Description of Multi-Photon Processes in Quantized Many-Electron Systems Based on a Reduced-Density-Matrix Approach[1]
VERNE JACOBS, Naval Research Laboratory — The frequency-dependent transition rates for multi-photon processes in quantized many-electron systems are evaluated using a reduced-density-matrix approach. A fundamental foundation, based on quantum electrodynamics, is provided for systematic spectral simulations for electromagnetic interactions in quantized many-electron systems, including atomic, molecular, and solid-state systems. A perturbation expansion of the frequency-domain Liouville-space self-energy operator is employed in detailed evaluations of the spectral-line shapes. The self-energy contributions associated with environmental electron-photon and electron-phonon interactions are systematically taken into account. Detailed evaluations have been carried out for the spectral-line widths and shifts in the diagonal-resolvent, lowest order (Born), and short-memory-time (Markov) approximations.

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Verne Jacobs
Naval Research Laboratory

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