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Quasiparticle Representation of Coherent Nonlinear Optical Signals of Multiexcitons BENJAMIN FINGERHUT, KOCHISE BENNET, OLEKSIY ROSLYAK, SHAUL MUKAMEL, University of California, Irvine — Elementary excitations of many-Fermion systems can be described within the quasiparticle approach which is widely used in the calculation of transport and optical properties of metals, semiconductors, molecular aggregates and strongly correlated quantum materials. The excitations are then viewed as independent harmonic oscillators where the many-body interactions between the oscillators are mapped into anharmonicities. We present a Green's function approach based on coboson algebra for calculating nonlinear optical signals and apply it onwards the study of two and three exciton states. The method only requires the diagonalization of the single exciton manifold and avoids equations of motion of multi-exciton manifolds. Using coboson algebra many body effects are recast in terms of tetradic exciton-exciton interactions: Coulomb scattering and Pauli exchange. The physical space of Fermions is recovered by singular-value decomposition of the over-complete coboson basis set. The approach is used to calculate third and fifth order quantum coherence optical signals that directly probe correlations in two- and three exciton states and their projections on the two and single exciton manifold.

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