

Contribution submission to the conference Berlin 2015

Quantum electrodynamical time-dependent density functional theory on a lattice — ●MEHDI FARZANEHPOUR¹ and ILYA TOKATLY^{1,2} — ¹Nano-Bio Spectroscopy group and ETSF Scientific Development Centre, Departamento de Física de Materiales, Universidad del País Vasco UPV/EHU, E-20018 San Sebastian, Spain — ²IKERBASQUE, Basque Foundation for Science, E-48011 Bilbao, Spain

We present a rigorous formulation of the time-dependent density functional theory for interacting lattice electrons strongly coupled to cavity photons. We start with an example of one particle on a Hubbard dimer coupled to a single photonic mode, which is equivalent to the single mode spin-boson model or the quantum Rabi model. For this system we prove that the electron-photon wave function is a unique functional of the electronic density and the expectation value of the photonic coordinate, provided the initial state and the density satisfy a set of well defined conditions. Then we generalize the formalism to many interacting electrons on a lattice coupled to multiple photonic modes and prove the general mapping theorem. We also show that for a system evolving from the ground state of a lattice Hamiltonian any density with a continuous second time derivative is locally v-representable.

Part: TT
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