**Ab-initio dynamics of electrons and nuclei in solids**

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We consider the nonadiabatic electron-nuclear coupling by treating nuclei as classical particles. This approach can extend the definition of the Born effect charge to the dynamical regime. Finally, we propose a fully quantum mechanical treatment for small-amplitude nuclear motions in solids. By applying Wick’s theorem to the square of the Fröhlich Hamiltonian, we derive a set of two coupled Bogoliubov equations of electrons and phonons to describe band gap renormalization and superconductivity in solids.