

Beyond the Coulomb Interaction: Why the Relativistic Description of Photons and Matter Matters

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Most functionals used in density functional theory are based on the Coulomb interaction. This approximation to the more fundamental interaction found in quantum electrodynamics (QED) may be inadequate for matter under extreme conditions. I'll discuss what is missing and how to account for some relativistic effects using expansions in powers of $1/c$. By analogy with electron-phonon coupled superconductivity, I'll also show how a fully relativistic mean-field version of QED can be derived.

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