The no-photon approximation in relativistic quantum chemistry

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The construction, from quantum field theory, of a relativistic n-electron Hamiltonian in a basis representation, appropriate for quantum chemisty, is discussed. Special attention is paid to the no-photon approximation, in which the electromagnetic interaction is not quantized, and which allows a very compact approach. A Fock space theory in normal order with respect to the fermion vacuum is presented. At this level the concept of vacuum Polarization arises [1]. We are on the way to understand why the very popular Dirac-Coulomb Hamiltonian is not acceptable, and how the Brown-Ravenhall disease can be cured.

[1] Kutzelnigg, W. *Chem. Phys.*, 395:16, 2012