

## One non-relativistic particle coupled to a photon field

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We investigate the ground state energy of a charged particle coupled to a photon field. First, we regard the self-energy of a “free” electron, which we describe by the Pauli-Fierz Hamiltonian. We show that, in the case of small values of the coupling constant  $\alpha$ , the leading order term is represented by  $8\pi\alpha(\Lambda - \ln[1 + \Lambda])$ .

Secondly, we treat the self-energy of a charged boson and provide a different proof for recovering the next to leading order term in  $\alpha$ , which has already been obtained in Hainzl-Vougalter-Vougalter.

Thirdly, we estimate from above the binding energy of a charged boson in the field of a nucleus. The first order radiative correction turns out to behave like  $\ln[1 + \Lambda]$  for large values of the ultraviolet-cutoff parameter  $\Lambda$ .