The relativistic and radiative corrections to the polarizability of hydrogen-like atoms

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The polarizability in atomic physics is important to determining the frequency standard [1], magic wavelengths and the tune-out wavelengths [2,3] of the atom in the optical lattice clock. It is also used to calculating the long-range interactions between atoms [4] in the cold atom research. However the higher order corrections are still researched inadequately [1,5]. In this work, starting from the relativistic polarizability of the Hydrogen-like atoms, we derive the operators of the nonrelativistic leading term and first order perturbation term: relativistic corrections and radiative corrections by applying Nonrelativistic Quantum Electrodynamic approach[6,7]. These correction are the dynamical parts, which dependent on the electric field frequency. The Bethe-logarithm-like correction is also obtained. This study can be helpful in our next step research about blackbody radiation contribution in atomic system, which is based on our previous study [8].

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