Abstract

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"The Ground State Energy of Heavy Atoms"

We begin with a review of the mathematical description of heavy atoms, i.e., of atoms with large atomic number Z: The Hamiltonian was suggested in physics on the basis of an approximation of quantum electro-dynamics and takes relativistic effects into account which is essential since the innermost electrons move very fast. It is the so called no-pair-operator in the Furry picture.

We show that to leading order (large Z and fixed quotient of Z and velocity of light) the lowest spectral point (ground state energy) is – as for the non-relativistic Schrodinger operator – is $-c_1 Z^{7/3}$ (Lieb and Simon 1977) . This is corrected $c_2 Z^2$ (Scott correction). Contrary to the leading term, this term differs from the non-relativistic case and yields quantitative reasonable results when compared with measured values.