QED radiative corrections to electric dipole amplitudes in heavy atoms

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In the last years, increasing attention has been given to the role of quantum electrodynamic (QED) radiative corrections in high-precision studies of heavy many-electron atoms and ions. The ability to theoretically describe electric dipole (E1) transition matrix elements with high precision is important in a number of different areas, both fundamental and applied, including atomic parity violation studies, atomic polarizabilities, and atomic clocks. The account of QED corrections was critical in the interpretation of the atomic parity violation measurement in cesium [1].

We report on the first detailed study [2] of the interplay between QED and many-body effects in heavy atoms for E1 transition amplitudes. We use the radiative potential method and check its validity by comparing against the results of rigorous QED. We study the effects of core relaxation, polarization of the core by the E1 field, and valence-core correlations for the heavy alkali-metal atoms Rb, Cs, Fr, and alkali-metal-like ions Sr^+, Ba^+, and Ra^+. We identify several transitions in Cs for which the QED contribution exceeds the deviation between atomic theory and experiment; see also Ref. [3].

References

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