Abstract Submitted
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Precision calculation of blackbody radiation shifts for metrology at the 18$^{\mathbf{th}}$ decimal place MARIANNA SAFRONOVA, University of Delaware, MIKHAIL KOZLOV, PNPI, Gatchina, CHARLES W. CLARK, JQI, NIST and the University of Maryland — We developed a theoretical method within the framework of relativistic many-body theory to accurately treat correlation corrections in atoms with a few valence electrons. This method combines the all-order approach currently used in precision calculations of properties of monovalent atoms with the configuration-interaction approach that is applicable for many-electron systems. We have applied this method to accurately calculate the ground and excited state polarizabilities of divalent ions. The resulting polarizabilities are used to evaluate the blackbody radiation (BBR) shifts at 300K in the $ns^2 - nsnp\ ^3P_0$ clock transitions in Al^+, B^+, and In^+. Frequency-dependent corrections are also evaluated. We estimate that our calculation reduces the relative uncertainty due to BBR shift at 300K in Al^+ to 4×10^{-19}. We find the while the relative BBR shifts in B^+ and In^+ are larger than in Al^+, they are still anomalously small in comparison with BBR shifts in all other frequency standards. We estimate relative uncertainties due to BBR shifts in B^+ and In^+ to be at the 1×10^{-18} level.

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