

**MULTIPOLAR THEORY OF BLACK-BODY RADIATION SHIFT OF ATOMIC  
ENERGY LEVELS AND ITS IMPLICATIONS FOR OPTICAL LATTICE  
CLOCKS**

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Black-body radiation (BBR) shifts of  $^3P_0-^1S_0$  clock transition in divalent atoms Mg, Ca, Sr, and Yb are evaluated. The dominant electric-dipole contributions are computed using accurate relativistic many-body techniques of atomic structure. At room temperatures, the resulting uncertainties in the E1 BBR shifts are large and substantially affect the projected  $10^{-18}$  fractional accuracy of the optical-lattice-based clocks. A peculiarity of these clocks is that the characteristic BBR wavelength is comparable to the  $^3P$  fine-structure intervals. To evaluate relevant M1 and E2 contributions, a theory of multipolar BBR shifts is developed. The resulting corrections, although presently masked by the uncertainties in the E1 contribution, are required at the  $10^{-18}$  accuracy goal.