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Blackbody-radiation shifts in optical frequency standards with trapped ions DANSHA JIANG, BINDIYA ARORA, MARIANNA SAFRONOVA, University of Delaware, CHARLES W. CLARK, Joint Quantum Institute, National Institute of Standards and Technology and University of Maryland — The SI unit of time, the second, is defined in terms of the microwave transition frequency between the two hyperfine levels of the ground state of ^{133}Cs. Recent advancements in experimental techniques such as laser frequency stabilization, atomic cooling and trapping, etc. have made possible the realization of the second to a precision that is six decades higher than that of the existing standard, by use of optical *v.s.* microwave transitions. At optical frequencies, the transition levels are members of different electronic configurations, and one of the largest contributors to the uncertainty budget is the blackbody radiation (BBR) frequency shift. We report BBR shifts of the $\mathrm{Ca}^{+}4s-3d_{5/2}$ and $\mathrm{Sr}^{+}5s-4d_{5/2}$ clock transitions as calculated by the relativistic all-order method, in which all single and double excitations of the Dirac-Fock wave function are included to all orders of perturbation theory. Additional calculations are conducted for the dominant contributions in order to evaluate some omitted high-order corrections and estimate the uncertainty of our final values. Our results for these shifts are an order of magnitude more accurate than previous estimates and are of sufficient accuracy at the present stage of development of trapped-ion optical frequency standards.

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