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Anomalously small BBR shift in Tl^+ frequency standard[1] Z. ZUHRIANDA, MARIANNA SAFRONOVA, University of Delaware, MIKHAIL KOZLOV, Petersburg Nuclear Physics Institute — The operation of atomic clocks is generally carried out at room temperature, whereas the definition of the second refers to the clock transition in an atom at absolute zero. This implies that the clock transition frequency should be corrected in practice for the effect of finite temperature of which the leading contributor is the blackbody radiation (BBR) shift. In the present work, we have used configuration interaction + coupled-cluster method to evaluate polarizabilities of the $6s^2\ ^1S_0$ and $6s6p\ ^3P_0$ states of Tl^+; $\alpha_0(^1S_0) = 19.5$ a.u. and $\alpha_0(^3P_0) = 21.4$ a.u.. We find dynamic correction to the BBR shift to be negligible. The resulting BBR shift at 300 K is $\Delta\nu_{\mathrm{BBR}} = -0.0166(17)$ Hz. This result demonstrates that near cancelation of the $^1S_0$ and $^3P_0$ state polarizabilities in monovalent B^+, Al^+, In^+ ions of group 13 [Safronova *et al.*, PRL 107, 143006 (2011)] continues for much heavier Tl^+, leading to anomalously small BBR shift for this system. The corresponding relative BBR shift at 300 K is $|\Delta\nu_{\mathrm{BBR}}/\nu_0| = 1.1(1) \times 10^{-17}$. This calculation demonstrates that the BBR contribution to the fractional frequency uncertainty of the Tl^+ frequency standard at 300 K is 1×10^{-18}.

[1]NSF and RFBR

Marianna Safronova
University of Delaware

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