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Third-order relativistic many-body calculations of energies, transition rates, hyperfine constants, and black-body radiation shift in ^{171}Yb$^+$

ULYANA SAFRONOVA, University of Nevada, Reno, MARIANNA SAFRONOVA, University of Delaware — Relativistic many-body perturbation theory is applied to study properties of singly ionized ytterbium, Yb$^+$. Specifically, energies of the [Xe]$4f^{14}ns_{1/2}$, [Xe]$4f^{14}np_j$, and [Xe]$4f^{14}nd_j$ (n $\leq$9) are calculated through third order. Reduced matrix elements, oscillator strengths, and transition rates are determined for electric-dipole transitions including the 6s, 7s, 8s, 6p, 7p, 5d and 6d states. Lifetime values are determined for the 6p states. Electric-dipole ($6s_{1/2}$ $-np_j$, n = 6–12) matrix elements are calculated to obtain the ground state E1 polarisabilitie. The hyperfine A-values are determined for the low-lying levels up to n = 7 of ^{171}Yb II. The quadratic Stark effect on hyperfine structure levels of ^{171}Yb II ground state is investigated. The calculated shift for the (F = 1, M =0) $\leftrightarrow$ (F = 0, M =0) transition is -0.1796 Hz/(kV/cm)^2, in agreement with previous theoretical result -0.171$\pm$0.009. These calculations provide a theoretical benchmark for comparison with experiment and theory.

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