Contributions of the 4f-core-excited states in determination of atomic properties in the Promethium Isoelectronic Sequence

PETER BEIERSDORFER, Lawrence Livermore National Lab., U.I. SAFRONOVA, A.S. SAFRONOVA, University of Nevada, Reno — The atomic properties of Pm-like ions were comprehensively studied using relativistic atomic codes with the main emphasis on W ion. Excitation energies of the 4f^{14}nl (with nl = 5s, 6s, 5p, 6p, 5d, 6d, and 5f) states in Pm-like ions with nuclear charge Z ranging from 74 to 100 are evaluated within the framework of relativistic many-body theory (RMBPT). First- and second-order Coulomb energies and first- and second-order Breit corrections to the energies are calculated. The important question of what is the ground state in Pm-like ions was answered. Properties of the 4f-core-excited states are evaluated using the multiconfiguration relativistic Hebrew University Lawrence Livermore Atomic Code (HULLAC code) and the Hartree-Fock-Relativistic method (COWAN code). Our large scale calculations includes the following set of configurations: 4f^{14}5s, 4f^{14}5p, 4f^{13}5s^2, 4f^{13}5p^2, 4f^{13}5s5p, 4f^{12}5s^25p, 4f^{12}5s5p^2, and 4f^{12}5p^3. Excitation energies, transition rates, and lifetimes in Pm-like tungsten are evaluated with additional inclusion of the 4f^{11}5s^25p^2, 4f^{11}5s5p^3, 4f^{10}5s^25p^3, and 4f^{10}5s5p^4 configurations. Wavelengths of the 5s – 5p transitions are obtained by the COWAN, HULLAC, and RMBPT codes.

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