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S-matrix calculations of energy levels of alkalilike ions[1]
JONATHAN SAPIRSTEIN, University of Notre Dame, K.T. CHENG, Lawrence Livermore National Laboratory — A recent S-matrix based QED calculation of energy levels of the lithium isoelectronic sequence is extended to the general case of a valence electron outside an arbitrary filled core. Formulas are presented that allow calculation of the energy levels of valence $ns, np_{1/2}$, $np_{3/2}$, $nd_{3/2}$, and $nd_{5/2}$ states. Emphasis is placed on modifications of the lithiumlike formulas required because more than one core state is present, and a discussion of an unusual feature of the two-photon exchange contribution involving autoiononizing states is given. The method is illustrated with a calculation of energy levels of the sodium isoelectronic sequence, with results for $3s_{1/2}$, $3p_{1/2}$, and $3p_{3/2}$ energies tabulated for the range $Z = 20 - 100$. A detailed breakdown of the calculation is given for $Z = 74$. Comparison with experiment and other calculations is given, and prospects for extension of the method to ions with more complex electronic structure discussed.

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