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Development of the relativistic all-order method for the calculation of isotope shifts Z. ZUHRIANDA, University of Delaware, M.S. SAFRONOVA, University of Delaware and JQI — The comparison of the experimental and theoretical values of isotope shifts allows to determine the changes in the nuclear radius between two isotopes which are needed for many applications. Precision knowledge of isotope shifts is also needed for astrophysical search for the variation of the fine-structure constant. The specific mass shift (SMS) is extremely difficult to accurately calculate even for Na owing to large high-order correlation corrections. In fact, the calculations of the SMS constants in K and Rb carried out using two of the most accurate known methods for calculation of alkali properties were shown recently to disagree severely with each other and with experiment [Dzuba et al., PRA 72, 22503 (2005)]. In this work, we develop a relativistic all-order method for the evaluation of the specific mass shift by explicitly calculating SMS as the expectation value of corresponding one- and two-particle operators within the framework of all-order method. Combining this method with previously developed all-order method for the calculation of the field shift [Safronova et al., PRA 64, 052501 (2001)], we evaluate the isotope shifts in monovalent systems.

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