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Magic wavelengths and other properties of Li for optical cooling and trapping[1] MARIANNA SAFRONOVA, University of Delaware, ULYANA SAFRONOVA, University of Nevada, Reno, CHARLES W. CLARK, JQI, NIST and the University of Maryland — Using first-principles calculations, we identify magic wavelengths λ for the $2s - 2p_{1/2}$, $2s - 2p_{3/2}$, $2s - 3p_{1/2}$, and $2s - 2p_{3/2}$ transitions in Li. The ns and np_j atomic levels have the same ac Stark shifts at the corresponding magic wavelength, which facilitates state-insensitive optical cooling and trapping. Possible differences between the positions of magic wavelengths in ^{6}Li and ^{7}Li are investigated. Our approach uses high-precision, relativistic all-order method in which all single, double, and partial triple excitations of the Dirac-Fock wave functions are included to all orders of perturbation theory. Recommended values are provided for a large number of Li electric-dipole matrix elements. Trends of dynamic polarizabilities of the ground and $2p_j$, $3s$, and $3p_j$ states are investigated. Uncertainties of all recommended values are estimated. Implications of our results for optical cooling and trapping of Li are discussed.

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