Physics > Atomic Physics

Magic-zero wavelengths of alkali-metal atoms and their applications

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Using first-principles calculations, we identify "magic-zero" optical wavelengths, \lambda_zero, for which the ground-state frequency-dependent polarizabilities of alkali-metal atoms vanish. Our approach uses high-precision, relativistic all-order methods in which all single, double, and partial triple excitations of the Dirac-Fock wave functions are included to all orders of perturbation theory. We discuss the use of magic-zero wavelengths for sympathetic cooling in two-species mixtures of alkalis with group-II and other elements of interest. Special cases in which these wavelengths coincide with strong resonance transitions in a target system are identified.

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