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High-precision calculation of La^- atomic properties for anion laser cooling MARIANNA SAFRONOVA, University of Delaware, ULYANA SAFRONOVA, University of Nevada, Reno, SERGEY PORSEV, University of Delaware — Anion laser cooling holds the potential to allow the production of ultracold ensembles of any negatively charged species. The negative ion of lanthanum, La^-, was proposed as the best candidate for laser cooling of any atomic anion [1]. A very exciting application of La^- laser cooling includes cooling of antiprotons for antihydrogen formation and subsequent tests of CPT invariance and weak equivalence principle [2]. A calculation of anion properties is a very difficult task, with complicated electronic structure of lanthanides presenting additional major problems. In this work, we present novel theoretical treatment of La^-. Affinity, energy levels, E1 matrix elements, transition rates, branching ratios, lifetimes, and hyperfine constants are calculated using high-precision CI+all-order method. Calculated theoretical transition energies are in agreement with measured values to 0.2% - 2%, signifying drastic improvement of theoretical accuracy for negative ions. Recommended values of transition rates and branching ratios of importance to the realization of laser cooling with of La^- are presented and critically evaluated for their accuracy. [1] S. M. O'Malley and D. R. Beck, PRA 81, 032503 (2010). [2] A. Kellerbauer and J. Walz, N. J. Phys. 8, 45 (2006).

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