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CI-MBPT calculations of energies, transitions, and g factors of La II and La I IGOR SAVUKOV, Los Alamos National Laboratory — Lanthanide atoms and ions, including La II and La I, are important for astrophysical applications. La II and La I have large valence-core polarization correction and conventional configuration-interaction many-body perturbation theory, CI-MBPT, that includes valence-core correction in the second order is not sufficiently accurate. By introducing scaling factors for the second-order screening corrections, it is possible to improve accuracy for energies and transition probabilities. It is found that CI-MBPT with 10 such scaling factors, 7 of which can be estimated from a single-valence La III energies and the 3 remaining set to unity, or alternatively all 10 set to a single optimal value, after careful optimization, is able to reproduce La II energies and transition probabilities with quite high precision. La I energies are also well reproduced, although some La I transitions due to strong mixing are less accurate. In the talk, the La II and La I CI-MBPT calculations of energy levels, g-factors, transition probabilties and lifetimes will be presented and comparison with experiments and other theories will be given. Comparison showed that most CI-MBPT theoretical values agree well with experiments and the theory can be used to predict a large number of transitions. Such transitions can be used for applications in astrophysics and other fields. Also, the theoretical approach can be extended to other similar atoms and ions where valence-core interactions are large.

Igor Savukov
Los Alamos National Laboratory

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