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Progress on Radiative Transition Probabilities in Neutral Cerium

J.J. CURRY, NIST, Gaithersburg, USA — Cerium is a rare-earth atom that is currently used in energy-efficient metal-halide lamps because of its rich visible emission spectrum. More than 20,000 lines have been observed and classified for neutral cerium in the wavelength range of 340 nm to 1 μm (Bill Martin, unpublished). We recently derived more than 500 absolute transition probabilities from existing experimental data (J. Phys. D: Appl. Phys. 2009). Lawler and Den Hartog at the University of Wisconsin have made measurements that are expected to produce a few thousand transition probabilities. These advances, however, leave the data situation far short of what is needed to simulate an accurate global emission spectrum in numerical models of metal-halide lamps containing cerium. One possibility for closing this gap is through atomic structure calculations. Although it may be difficult for calculations to match the accuracy of measurements for any given transition, the global spectral distribution produced with calculated transition probabilities may still be satisfactory. For such a large number of lines, calculations may be the only realistic way to produce a reasonably complete set of data. We will discuss our recent atomic structure calculations of neutral cerium with the Cowan code based on a parametric fit of calculated energy level values to experimental values.

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