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# Theoretical Study of Electronic Structure of Erbium (Er), Fermium (Fm), and Nobelium (No)

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**Abstract :** Recently developed versions of the configuration method for open shells, configuration interaction with perturbation theory (CIPT), and configuration interaction with many-body perturbation theory (CI+MBPT) techniques are used to study the electronic structure of Er, Fm, and No atoms. Excitation energies of odd states connected to the even ground state by electric dipole transitions, the corresponding transition rates, isotope shift, hyperfine structure, ionization potentials, and static scalar polarizabilities are calculated. The way of extracting parameters of nuclear charge distribution beyond nuclear root mean square (RMS) radius, e.g., a parameter of quadrupole deformation β, is demonstrated. In nuclei with spin > 1/2, parameter β is extracted from the quadrupole hyperfine structure. With zero nuclear spin or spin 1/2, it is impossible since quadrupole zero, so a different method was developed. The measurements of at least two atomic transitions are needed to disentangle the contributions of the changes in deformation and nuclear RMS radius into field isotopic shift. This is important for testing nuclear theory and for searching for the hypothetical island of stability. Fm and No are heavy elements approaching the superheavy region, for which the experimental data are very poor, only seven lines for the Fm element and one line for the No element. Since Er and Fm have similar electronic structures, calculations for Er serve as a guide to the accuracy of the calculations. Twenty-eight new levels of Fm atom are reported.

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