

# Analysis of the free ion spectrum of Er<sup>3+</sup> (Er IV)

**Anis CHIKH**

LPCQ, Université Mouloud Mammeri Tizi-Ouzou et LERMA, Observatoire de Paris-Meudon

The analysis of the vacuum spark emission spectrum of moderately ionized lanthanides has been part of the research project of our collaborating team involving Jean-François Wyart. One of our recent works was the analysis of the Er IV spectrum, which began in 2015 with high-resolution vacuum ultraviolet (VUV) spectra recorded between 700Å and 2460Å using the 10.7m spectrograph at the Paris-Meudon Observatory. A first analysis [1] allowed the identification of 582 spectral lines as transitions between 120 energy levels belonging to the configurations 4f<sup>11</sup>, 4f<sup>10</sup>5d, 4f<sup>10</sup>6s and 4f<sup>10</sup>6p. This analysis was extended in 2021 [2] with the identification of 168 additional new levels and 1022 newly identified spectral lines. Energy values have been optimized by a least-squares procedure based on the increased number of measured wavelengths, resulting in a reduction of their uncertainties and consequently, in more accurate Ritz wavelengths of transitions. Parametric calculations have been performed using the Cowan codes, in which radial integrals are parameters fitted by least squares minimization of the differences calculated - experimental energies. The mean errors of the fits were respectively 51 cm<sup>-1</sup> for 65 odd levels (4f<sup>11</sup>+4f<sup>10</sup>6p) with 9 free parameters, and 53 cm<sup>-1</sup> for 223 even levels (4f<sup>10</sup>5d+4f<sup>10</sup>6s) with 17 free parameters. The increased number of experimentally known levels led to better defined parameters and improved prediction of unknown levels and transition probabilities.

## References

- [1] A Meftah, S Ait Mammar, J-F Wyart, W-U L Tchang-Brillet, N Champion, C Blaess, D Deghiche and O Lamrous, *J. Phys. B: At. Mol. Opt. Phys.* 49 (2016) 165002 (19pp)
- [2] A. Chikh, D. Deghiche, A. Meftah, W.-Ü L. Tchang-Brillet, J.-F. Wyart, C. Balança, N. Champion, C. Blaess, *JQSRT* 272, 107796 (2021)