NLTE-12, Benford's Law for Atomic Databases and All That

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This talk will cover two topics. First, an overview of the 12th non-LTE Code Comparison Workshop that was held in Valladolid, Spain (Oct 2023) will be presented. This meeting was attended by more than 20 researchers who submitted case calculations with 14 different collisional-radiative (CR) codes. The proposed cases included (i) CR and photoionization kinetics and the L-shell emission of Fe for typical astrophysical conditions, (ii) CR kinetics and K-shell emission of Kr in dense plasmas of NIF imploded capsule experiments, and (iii) ionization balance and spectra of Au in hot laser-produced plasmas. We will present comparisons of the submitted data, main conclusions of the meeting, and future plans.

The second part of the talk (in collaboration with J.-C. Pain) will address applications of Benford's law to atomic spectra and opacity databases [1]. This intriguing, and yet not fully understood, law of anomalous numbers states that the significant digits of data follow a logarithmic distribution favoring the smallest values. We will discuss the compliance with this law of the atomic databases focusing on (i) line energies, oscillator strengths, and Einstein coefficients from the NIST Atomic Spectra Database [2] and (ii) radiative opacities from the NIST-LANL Lanthanide Actinide Opacity Database [3].

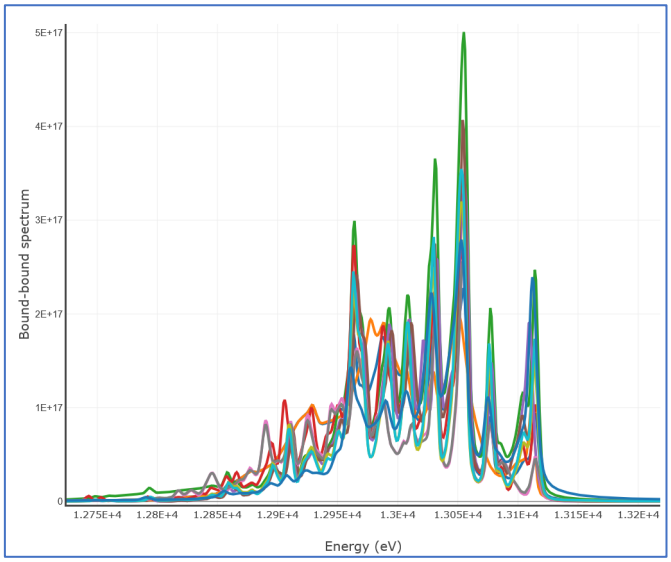

Figure 1. NLTE-12: Comparison of the bound-bound Kr spectra at 2000 eV and 3×10^{24} cm^{-3}.

References

[1] J.-C. Pain and Yu. Ralchenko, *J. Quant. Spectr. Rad. Transf.* **322**, 109010 (2024).

[2] URL https://www.nist.gov/pml/atomic-spectra-database.

[3] URL https://nlte.nist.gov/OPAC/.

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