Systematic Calculations of oscillator strengths of intermediatly ionised trans-iron elements for the spectral analysis of hot white dwarfs

S.Gamrath[1],

1. Physique Atomique et Astrophysique, Université de Mons, Belgium

A few years ago, in collaboration with the Institute for Astronomy and Astrophysics of the University of Tubingen, following the discovery of lines of trans-iron elements in the spectrum of the hot white dwarf RE0503289 [1], we began systematic calculations of transition probabilities and oscillator strengths in several heavy elements in their moderately ionization stages (see e.g. [2]). With those brand new theoretical data, extreme overabundances, due to radiative levitation, were highlighted in RE 0503-289 [3] for many elements. However, for that kind of spectral analysis of hot compact stars to be reliable, non-local thermodynamic equilibrium (NLTE) model-atmospheres have to be used. Contrary to LTE models, where occupation numbers of atomic levels are determined by Saha and Boltzmann equations, they have to be determined in detail, i.e. all radiative and collisional transitions between all levels have to be considered. In other words, for bound-bound transitions reliable radiative parameters are required, not only for lines that are identified in the observation but for the complete model atoms that are considered in the model-atmosphere calculations. At the conference we will present a global overview of those calculations and we will show brand new radiative decay rates for Bromium, Caesium and Silver ions. Those data were computed using the pseudo-relativistic Hartree Fock (HFR) method [4] taking core-polarization (CPOL) effects into account. The method used can therefore be called a HFR+CPOL approach [5,6]. For each ion, this method was combined with a semi-empirical procedure to optimize some radial integrals by fitting the calculated energy levels with available experimental data (often very rare in the litterature tough).

References

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