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Calculations of atomic transition probabilities in Hf VI using a multiplatform approach

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Hafnium ($Z = 72$) is an element that could be employed in plasma-facing materials in Tokamaks [1,2] and is also produced in neutron-induced transmutation of tungsten ($Z = 74$) and tungsten-alloys that will compose the divertors in these fusion reactors [3]. As a consequence, their sputtering may generate ionic impurities of all possible charge states in the deuterium-tritium plasma that could contribute to radiation losses in controlled nuclear fusion devices. The radiative properties of these ions have therefore potential important applications in this field.

To our knowledge, few studies have been dedicated to the Hf VI spectrum. In 2012, Ryabtsev *et al.* [4] classified the Hf VI $4f^{13}5s^25p^6 - 4f^{13}5s^25p^56s$ transitions in spectra recorded in the ultraviolet (UV) range $145 - 350$ Å using a low-inductive vacuum spark source and a grazing-incidence vacuum spectrograph. A few years later, they analysed the UV spectra recorded by two high-resolution vacuum spectrographs, one in the region $190 - 350$ Å using the Institute of Spectroscopy Troisk grating and the other in the spectral range $300 - 500$ Å using the Meudon Observatory grating [5]. They classified 189 Hf VI lines as transitions from the excited even-parity configurations $4f^{12}5s^25p^65d$, $4f^{12}5s^25p^66d$, $4f^{13}5s^25p^55d$, $4f^{13}5s^25p^56s$, $4f^{14}5s^25p^45d$, $4f^{14}5s^25p^46s$ and $4f^{14}5s5p^6$ to the two low-lying odd-parity configurations $4f^{13}5s^25p^6$ and $4f^{14}5s^25p^5$, and found 142 even-parity fine-structure levels.

Following our previous work on erbium-like Lu IV, Hf V and Ta VI [6], a multiplatform approach has been adopted to determine the transitions probabilities of electric dipole (E1) transitions in Hf VI and evaluate their accuracy. It consisted in using the semi-empirical Hartree–Fock with relativistic corrections method (HFR) [7] and the *ab initio* multiconfiguration Dirac–Hartree–Fock with subsequent relativistic configuration interaction method (MCDHF–RCI) [8]. The radiative parameters have been calculated for the 312 E1 transitions between all the experimental energy levels as published in 2014 by Ryabtsev *et al.* [5]. Their Ritz wavelengths span the UV range from 180 Å to 1170 Å. Results will be presented in details during this conference.

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