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Collisional-radiative modeling of the tungsten spectrum from the EBIT and EAST tokamak

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The atomic structure, transition properties, kinetic processes, and emission spectra of tungsten ions are extremely important for diagnosing edge and impurity plasmas in the next-generation magnetic confined fusion reactors (such as ITER). For diagnostics, the accurate atomic data, such as the energy level, radiative transition rate, electron collisional excitation cross section, etc., and appropriate plasma model are required. Most of the atomic spectrum of the highly charged tungsten ions is measured from the electron beam ion trap (EBIT) and the fusion reactor such as JET, EAST Tokamak. These spectra need to be analyzed with the aid of the theoretical calculation on the atomic data and the collisional-radiative (CR) model.
The wavelength and transition rate of the 5p – 5s transition of W^{13+} – W^{15+} ions have been calculated by the relativistic configuration interaction method with the implementation of the flexible atomic code (FAC). And reasonable CR model has been constructed to simulate these spectra observed in EBIT. The results are in reasonable agreement with the available experimental and theoretical data. The confusion on the assignment of the ionization stage to the spectrum is pointed out in the present work.
The wavelength and transition rates of W^{43+} – W^{45+} ions in the 40 – 140 Å region have also been investigated to analyze the experimental spectrum from the EAST Tokamak. The result makes a reasonable agreement with the available experimental and theoretical data. The synthetic spectrum from the CR model agreed with the experimental spectrum. Some strong emission lines of the W^{43+} – W^{45+} ions are identified and assigned in the present work. Finally, according to the dependence of the intensity ratio on the electron temperature, some transition pairs are proposed as the diagnosis lines.

References

1. R. Janev, Contemp. Phys., 46, 121 (2005)
2. M. F. Gu, Can. J. Phys., 86, 675 (2008)
3. X.B. Ding et. al., Phys. Rev. A, 101, 042509 (2020)
4. X.B. Ding et. al., Phys. Lett. A, 420, 127758 (2021)
5. Y. L. Liu et. al., Phys. Lett. A, 454, 128500 (2022)

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