4f and 5p inner-shell excitations of W-W^{3+} ions

M. G. Su, X. N. Cao, and C. Z. Dong

Key Laboratory of Atomic and Molecular Physics & Functional Materials of Gansu Province，College of Physics and Electronic Engineering, Northwest Normal University, Lanzhou, 730070, China

Tungsten should be an important diagnostic for the presence of heavy atomic species in the ITER plasma [1]. Understanding the influence of W on ITER plasma requires detailed knowledge about atomic structures and processes of tungsten atoms in all stages of ionization. In past years, the researches on the spectra of low ion stages of tungsten were much fewer than those of intermediate and highly ionized stages of tungsten, in spite of their importance at the edge region of ITER plasma. Since Haensel et al [2] firstly reported the photoaborption spectrum in the EUV energy region of the 5d transition metal W, Costello et al[3] and A Müller et al[4] also reported on dual laser plasma (DLP) experiments with atomic tungsten and on photoionization experiments with W^{q+} ions in charge states up to q = 5, respectively.

Here, with the purpose of theoretical simulation on the 4f and 5p inner-shell excitations of W-W^{3+} ions, calculations were performed with the Cowan RCN, RCN2 and RCG suite of Hartree-Fock with configuration interaction codes. Figure 1 shows the comparison between experiments and theoretical contributions of 4f and 5p inner-shell excitations of W-W^{3+} ions. It is clearly seen that two broad and strong resonances in the experimental spectra have been theoretically identified mainly from 5p-5d resonance. The 4f-5d,6d and 5p-6d transitions also have a small contribution to each spectrum, which are superimposed on the 5p-5d transition arrays. In this figure, two strong and broad absorption features from the 5p-5d resonance of W-W^{3+} ions are obviously observed. The distinct separation of the 5p excitations into two groups of dominant resonances can appear as a result of the spin-orbit splitting of the 5p hole.

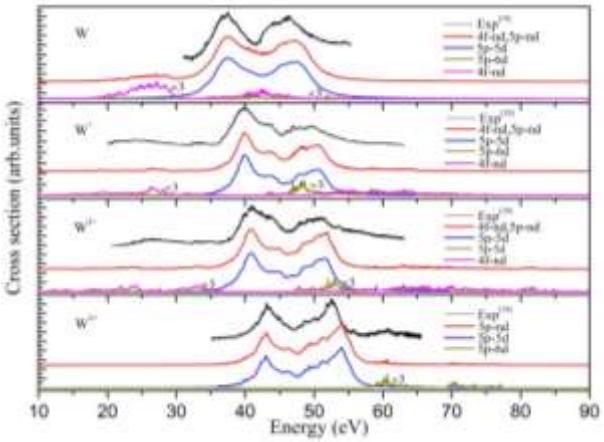

Figure 1. Comparison between experimental measurements and theoretical contributions of 4f and 5p inner-shell excitations of W-W^{3+} ions.

References

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[3] J T Costello *et al* 1991 *J. Phys. B* 24 5063
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