

# An in-depth correlation study of the ground term transition in Ag-like tungsten and its isoelectronic neighbours

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Tungsten, because of its excellent thermo-mechanical properties and its very low erosion under various physical and chemical conditions, is considered as a strong candidate for the plasma facing material for future fusion devices. But as a heavy element, it exhibits very high radiation power, so a small fraction of W atoms in a fusion plasma could lead to dramatic effects on the plasma temperature and thereby degrade the plasma performance.

We present an experimental and theoretical study of the  ${}^2F_{5/2} - {}^2F_{7/2}$  fine structure energy in Ag-like W ( $W^{27+}$ ). The experimental energy was obtained through measuring the wavelength of the  ${}^2F_{5/2} - {}^2F_{7/2}$  M1 transition using the Shanghai permanent magnet EBIT. The theoretical value was obtained using the GRASP2K [1] set of computer codes and included a comprehensive correlation study, including core valence correlation of all core sub-shells and an estimate of core-core correlation in all shells. The experimental M1 wavelength was measured as  $3377.4 \pm 0.26 \text{ \AA}$  ( $3378.4 \text{ \AA}$ , vacuum wavelength). We performed two different calculations resulting in  $3378.0$  and  $3381.8 \text{ \AA}$ , which is in excellent agreement with the experiment. This shows the importance of fully understanding the electron correlation effects to predict the energy of the fine structure even in this, for tungsten, relatively simple case.

The presence of tungsten ions in a fusion plasma will also form other atomic species. We have therefore extended the analysis of the ground term transition in Ag-like tungsten to include some of its closest isoelectronic neighbours.

## REFERENCES

1. P. Jönsson, G. Gaigalas, J. Bieroń, C. Froese Fischer and I.P. Grant, *Comput. Phys. Commun.* to be submitted (2012).