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Contributions of metastable states and non-Maxwellian EEDF to electron-impact ionization of tungsten ions

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Tungsten is being considered as a plasma-facing material in magnetically confined fusion devices, such as ITER. Electron collision ionization is a dominant atomic process in fusion plasma which determines the ionization balance of the non-local thermal equilibrium plasmas. Despite great effort have been pain the experimental measurements and theoretical calculations, however, the effect of long-lived excited states in low charged ionic stages need to be investigated[1]. Moreover, reliable EISI data are not available for many tungsten ions[2]. Last but not least, suprathermal electron influence and non-Maxwellian rate coefficients of high charged W ions remain unclear.

Therefore, we investigate the contributions of metastable states and non-Maxwellian EEDF to electron-impact ionization of tungsten ions, and aim to provied accurate electron-impact ionization rate coefficients of tungsten ions. Comparison between the previous experimental measurement results and present calculation show a prominent contribution of metastable states in low charged states such as W7+-W10+ ions[3-4]. Moreover, we performed calculations of detailed electron-impact single ionization cross sections for tungsten ions, spanning charge states W38+-W45+[5]. We demonstrate the influence of non-Maxwellian distribution on the rate coefficient of the W46+-W55+[6]. The data obtained are expected to be useful for modelling plasmas for fusion applications.

[1] 1st IAEA Technical Meeting on Tungsten and Hydrogen in Edge Plasmas meeting, https://amdis.iaea.org/meetings/tm-tungsten-hydrogen/
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Primary author: Dr LI, Bowen (Lanzhou University)

Presenter: Dr LI, Bowen (Lanzhou University)

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