Contribution ID: **67** Type: **Oral**

Extreme ultraviolet spectra and collisional-radiative model for mid-charged tungsten ions

Tuesday, 28 November 2023 12:15 (30 minutes)

Tungsten used as a plasma-facing material for divertor in fusion devices is sputtered and transported into plasmas. The tungsten behaviors in divertor, edge, and core plasmas should be examined by spectroscopic methods, and the spectroscopic models and atomic data for a wide charge state range of tungsten ions are required to analyze tungsten spectra. Many studies have been done on tungsten ions experimentally and theoretically. Extreme ultraviolet (EUV) spectra of tungsten ions have been examined by comparison of measured spectra in fusion devices and electron beam ion traps (e.g. [1,2]) and calculated spectra by collisional-radiative (CR) models (e.g.[3,4]). Wide peaked spectral feature, so-called the unresolved transition array (UTA) at 4.5-7nm wavelength region is found in plasma with electron temperature ~1keV and is known as numerous overlapped 4d-4f and 4p-4d transitions of tungsten ions. Many little-wide peaks at 2-4 nm are produced mainly by 4g-5f and 4g-6f transitions of Wq+ with q=22-30. These peaks are useful for estimating the charge state distribution and behaviors of these ions in plasmas [4,5]. For ions with q<22, no peaks are found in the 2-4 nm region, and we need to find some spectral peaks for ions with q<22.

We extend our study to EUV spectra at 10-30 nm where n=5-5 transitions of mid-charged tungsten ions are found. We have performed plasma experiments to measure tungsten spectra by pellet injection into Large Helical Device plasmas for this wavelength region. We also try to extend our CR model for tungsten ions down to q=20. Details of the comparison will be presented at the conference.

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Session Classification: CR