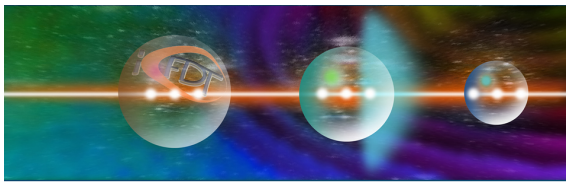

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Identification and Analysis of New Tungsten X-ray Spectra on EAST based on a medium-energy electron beam ion trap

Monday, 21 October 2024 18:05 (1 hour)

New X-ray spectra of tungsten have been observed using the X-ray Crystal Spectrometer (XCS) on the Experimental Advanced Superconducting Tokamak (EAST). The wavelength of these new x-ray spectra ranges from 3.895 Å to 3.986 Å. It is tentatively determined that the unidentified spectra measured by X-ray crystal spectrometer in EAST are emitted from W43+, W44+ and W45+ [1]. However, there is no sufficient evidence for the identification of these lines. To validate the spectral lines, this study adopted the Flexible Atomic Code (FAC) to calculate the atomic parameters such as the energy level, transition energy, spontaneous emission transition probability, and the electron collisional excitation cross section of W43+-W45+ ions. The simulated results were further validated using the Medium-Energy Electron Beam Ion Trap (EBIT) spectroscopy research platform, which can provide an electron beam currents reaching 20 mA and electron energies ranging from 80 eV to 30 keV [2]. The results are in reasonable agreement with the available experimental and theoretical data. These newly identified spectral lines are validated and crucial for measuring ion and electron temperatures, high-Z impurities, and rotation velocities in current tokamaks and future fusion experimental reactors.

[1] Lin Z C , Zhang H M , Wang F D ,et al. Preliminary observation of tungsten-impurity suppression using on-axis ECRH by X-ray crystal spectroscopy in EAST[J], Phys. Plasmas. 30 (2023), 032505.
[2] B. Bin, B. Lyu, et al. A compact electron beam ion trap in support of high-temperature plasma diagnostics based on conduction-cooled superconducting coils[J], Rev. Sci. Instrum. 92 (2021) 063512.

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