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Theoretical Investigation of anomalous Intensity Ratio of Spectral Lines of at 18.03 and 18.79 nm of Ar^{13+} ion in ADITYA-U tokamak.

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Vacuum ultraviolet (VUV) spectroscopy on ADITYA-U tokamak is carried out to understand the impurity behaviour in the plasma. Argon impurity transport study in ADITYA-U tokamak has revealed the role of inward pinch in the core argon transport [1]. To carry out such study, the observed VUV lines from Ar^{13+} ions at 18.79 nm ($2s^2 2p\ ^2P_{3/2}$–$2s2p^2\ ^2P_{3/2}$) and Ar^{14+} ions at 22.11 nm ($2s^2\ ^1S_0$–$2s2p\ ^1P_1$) are utilized. However, it has been observed that the intensity of 18.79 nm line of Ar^{13+} ions is orders of magnitude greater than the resonance lines at 18.03 nm ($2s2p^2\ ^2P_{3/2}$ - $2s^2 2p\ ^2P_{1/2}$) and 18.34 nm ($2s2p^2\ ^2P_{1/2}$ - $2s^2 2p\ ^2P_{1/2}$). The similar feature has also been observed in few other tokamaks in the past [2-3]. However, no attempts have been made in the past to explain this anomaly. Present theoretical study aims to explain the anomaly associated with this feature as it is normally believed that the resonance lines having transition to ground state level $2s^2 2p\ ^2P_{1/2}$ are more stronger than the lines having transition to the lower level at excited state.

In this present work, the theoretical line intensity calculations of all the above three lines of Ar^{13+} ion have been carried out. Here, first the photon emission coefficients (PEC) are evaluated for all three lines using the collisional radiative model (CRM) of Atomic Data and Analysis Structure (ADAS) database. The experimental intensities of all three lines are matched with theoretical calculations to find out the processes responsible for higher intensity of 18.79 line as compared to 18.03 line. It has been found through the theoretical estimation that higher absorption oscillation strength of ($2s^2 2p\ ^2P_{3/2}$–$2s2p^2\ ^2P_{3/2}$) transition is the reason behind the observation of anomalous intensity ratio between 18.79 and 18.03 nm line.

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