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Recent research for atomic data and collisional-radiative modeling

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Recent research activities for atomic data and collisional-radiative modeling in Korea Atomic Energy Research Institute, atomic data center are reported. Energy levels, radiative transition probabilities, and electron-impact excitation (EIE) and ionization (EII) for W I was calculated with multiconfiguration Dirac-Fock (MCDF) MD-FGME code (2024 version). Core-valance (CV) and core-core (CC) electron correlation were considered for configuration interaction of energy levels and the energy accuracies were improved. The radiative transition probabilities by the electron correlation are compared with other available, Hartree-Fock Relativistic (HFR) calculations and MCDF calculation by GRASP code as well as experimental NIST data. The radiative transition probabilities from the different calculations have very large discrepancies from each other and with the experimental data. The EII cross section was calculated Binary encounter Bethe (BEB) model and EIE cross section was obtained by scaled plane wave Born (PWB) approximation. The Maxwellian rate coefficients for EII and EIE are compared with other previous calculational results and discussed. These data are expected to be useful for collisional-radiative modeling for W I which is adopted for the spectroscopic determination of tungsten erosion rate in plasma surface interaction of fusion tokamak. We have also performed measurement and the analysis for the tungsten erosion rate in our plasma beam irradiation facility and are performing it in KSTAR tokamak.

As for collisional-radiative modeling (CRM) activity, we have performed CRM for Ar I and Ar II in low temperature and low density plasma. The effect of considered highly excited levels and the population kinetics processes to the CRM results are presented and discussed in detail with the used atomic data management.

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