Atomic and molecular data and collisional-radiative modeling for plasmas

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Our atomic data center in KAERI [1] has performed state-of-the art calculations for atomic data such as electron-impact excitation (EIE) /ionization (EIE), and dielectronic recombination (DR) of atomic ions for spectroscopic modeling on various astrophysical and laboratory plasmas. In this talk, the calculation methods are introduced and the usage of the data for the plasma modeling is presented.

In addition, we carried out collisional radiative modeling (CRM) for low temperature plasmas of Ar [2] and He [3] in capacitively-coupled plasma (CCP) and inductively-coupled plasma (ICP) devices. The CRM combined with an optical emission spectroscopy was adopted to measure the electron temperature and density of the plasmas, and the measured values were compared with a Langmuir probe measurement. The detailed CRM and the used atomic process data are explained.

Particular attention has been paid to developing a CRM for H and D plasma in our plasma beam irradiation facility based on the applied-field magnetoplasmadynamic thruster concept [4]. This CRM includes molecular processes as well as atomic processes. The density of the molecular ion H_3^+ (D_3^+) obtained by the CRM depends on the choice of the heavy particle collision ($H_2 + H_2^+ \rightarrow H_3^+ + H$) data significantly [5]. The sensitivity to the used data is reported.

References:
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