Emission line spectra of the 2s-2p transitions of S VIII-S XIII in the extreme ultraviolet region 160-300 Å

Safdar Ali[*1], **Hiroyuki Kato**[*], **Nobuyuki Nakamura**[*2]

[*] Institute for Laser Science, The University of Electro-Communications, Tokyo 182 8585, Japan

Synopsis The extreme ultraviolet spectra of S VIII-S XIII have been measured using compact electron beam ion trap in the wavelength range of 160-300 Å. We have identified several lines by observing electron energy dependence between 365 and 680 eV and with the support of collisional radiative modeling data obtained with the FAC code. The measured wavelengths are found in good agreement with the calculated and previous reported results.

Most of our knowledge of high-temperature astrophysical plasma is based on the information collected by means of spectroscopy. One of the most important parameters that we acquire through spectroscopy is wavelength, which is a prerequisite for extracting the information contained in the spectra collected with space based observatories [1]. The accurate wavelengths, is thus required for modeling astrophysical spectra and to get plasma parameters such as densities, temperatures, elemental abundances, emission measures, etc. The extreme ultraviolet (EUV) region (regarded here as 160-300 Å), is in particular rich with the emission lines important for modeling solar atmosphere plasmas.

Sulfur is the 10^{th} most abundant element in the solar atmosphere with a photospheric abundance of 2.14×10^{-5} that of hydrogen [2, 3]. This abundance is sufficiently high to produce spectral lines from different charge states of sulfur and in particularly from S VIII-S XIII in the wavelengths region 160-300 Å. Several of the emission lines from these ions provide density diagnostics for solar flares and active regions [4].

In the present work, we report laboratory observations for the emission of EUV radiation from highly charged S VIII-SXIII in the wavelength range of 160-300 Å. The measurement was performed with a compact electron beam ion trap called CoBIT [5]. Sulfur ions were produced by injecting SF_6 into the center of the trap via a gas injection system. Different charge states of sulfur were produced by changing the electron beam energy between 365 and 680 eV. Spectra were recorded with a flat-field grazing-incidence spectrometer [6] with a groove number of 1200 mm^{-1} (Hitachi 001-0660) in a slitless configuration.

A typical spectrum of S XI acquired at electron beam energy of 530 eV is shown in Fig. 1a, while in Fig. 1b we plotted CR model spectra obtained using FAC code at an electron density of 10^{10} cm^{-3} and beam energy of 530 eV. Tentative identifications are given for several lines corresponding to 2s-2p transitions in S XI ions (indicated with arrows). The identification is based on the comparison with calculated spectra and beam energy dependence, since lines corresponding to different charge states show different energy dependence. The preliminary analysis shows the identification of total 32 lines from S VIII-S XIII. Several identified lines, in particularly from S X, XI and XII are useful for the density diagnostics of solar plasmas.

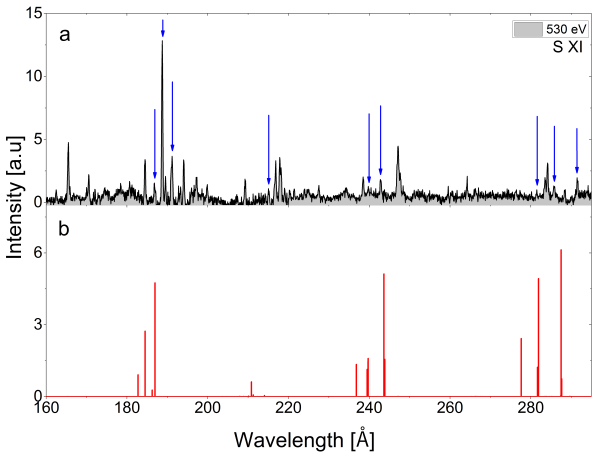

Figure 1. (a) Experimental and (b) CR model spectra from the 2s-2p transitions of S XI

References

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[1]E-mail: safdaruetian@gmail.com

[2]E-mail: n_nakamura@ils.uec.ac.jp