Studies of Laser-produced Multi-ionized Plasmas for Soft X-ray and EUV Light Sources using Collective Thomson Scattering

K. Tomita[1*], Y. Pan[1], A. Sunahara[2,3], and K. Nishihara[3]

[1]*Division of Quantum Science and Engineering, Hokkaido University, Sapporo 060-8628, Japan*
[3]*Center for Materials Under eXtreme Environment (CMUXE), School of Nuclear Engineering, Purdue University, IN 47907, United States of America*
[4]*Institute of Laser Engineering, Osaka University, Suita, 565-0871, Osaka, Japan*

Observations of electron and ion dynamics are essential to diagnose multi-ionized light source plasmas, which are characterized by interactions among atomic physics, radiation hydrodynamics, and plasma physics. However, it is highly challenging to observe local plasma parameters, such as electron temperature (T_e), electron density (n_e), and averaged ionic charge (Z) due to their short (<50 ns) lifetime and small (< 0.5 mm) scale. Under such background, we have measured time-resolved two-dimensional profiles of T_e, n_e, and Z of laser-produced multi-ionized plasmas using collective Thomson scattering technique. In this presentation, we will report two types of plasmas. First one is carbon plasmas produced with a solid-plain target and a Nd:YAG laser (wavelength of 1064 nm, 10 ns pulse width) as a driving laser. Second one is tin (Sn) plasmas produced with droplet-type target and a CO_2 laser (wavelength 10.6 μm, 20 ns pulse width) as a driving laser. For both cases, we measured T_e, n_e, and Z during the laser irradiation timing. For the carbon plasmas, the Thomson scattering results were compared with 2D hydro-dynamic simulations [1]. For the Sn plasmas, the Thomson scattering results were discussed with self-emission image of 13.5 nm (±1%) wavelength width (in-band EUV) and absolute values of in-band EUV measurements [2].

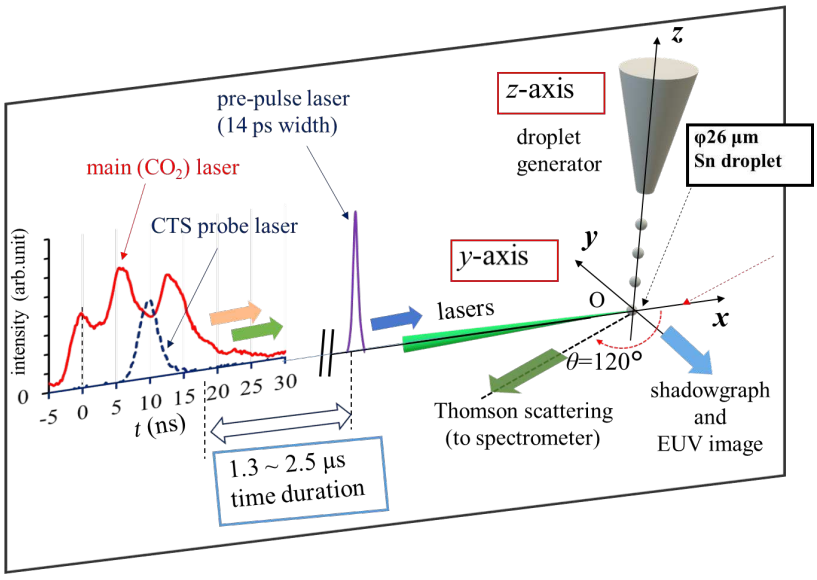

Figure 1. Schematics of collective Thomson scattering (CTS) setup for laser-produced Sn plasmas.

[1] Y. Pan, *et al.,* J. Phys. D: Appl. Phys. **56**, 025201 (2022).

[2] K. Tomita, *et al*., Sci. Rep. **13**, 1825 (2023).

*Presenting author: tomita.kentaro@eng.hokudai.ac.jp