P24

Soft x-ray emitting laser-produced plasmas: Advances in imaging, spectroscopy and simulation techniques

K. Mongey, R. Brady, B. Delaney, E. Sokell, F. O' Reilly

School of Physics, University College Dublin, Belfield, Dublin 4, Ireland
kevin.mongey@ucdconnect.ie

The development and deployment of laboratory-based soft x-ray light sources is a growing research activity - for some applications such as soft x-ray tomography[1], they offer an affordable and compact alternative to the current gold standard of soft x-ray production via synchrotron and Free Electron Laser facilities[2]. A common alternative method x-ray generation via creation of a laser-produced plasma (LPP)[3]. The subsequent x-ray emission generated can be tuned by appropriate choice of laser wavelength, energy, pulse duration and target material.

Presented here are recent developments in experimental characterisation and modelling of micrometer scale soft x-ray emitting LPPs, generated via the irradiation of select metallic targets using a tightly focused Nd:YAG 1064 nm 5 nanosecond laser. The motivation is to reveal the spatial and spectral behaviours of these tiny plasmas with the ultimate goal of increasing radiance for source optimisation. We present unique deconvolution techniques applied to pinhole images of generated soft x-ray emitting plasmas, from which the true size of the plasma can be inferred, which cannot be inferred directly from pinhole imaging due to diffractive blurring. We show the design and use of a compact and cost-effective soft x-ray spectrometer. We show that similar spectral information can be extracted from the spatial imaging of these plasmas. Finally, we present developments in the simulation of these small-scale, x-ray plasmas via the single–temperature, single–fluid hydrodynamics code with radiation transport, RALEF-2D[4], which shows promising results in the ability of predictive modelling techniques.

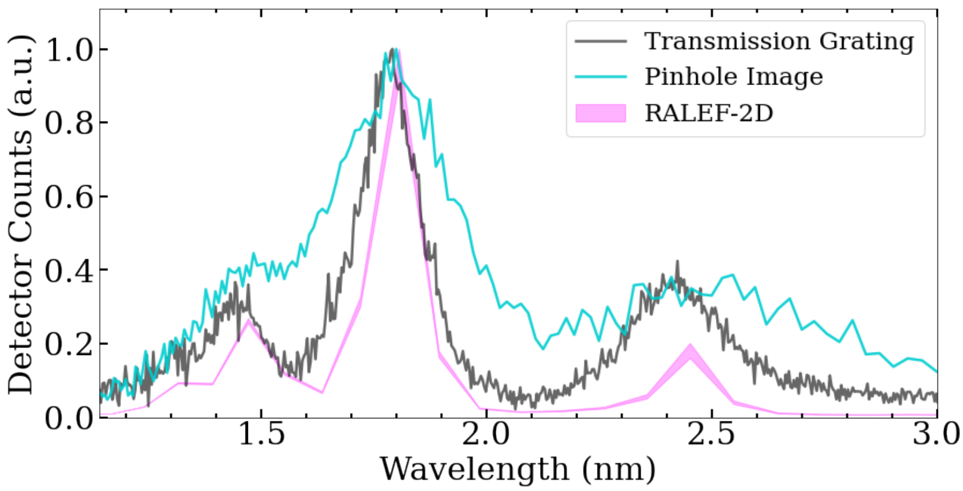

Figure 1: Soft x-ray spectrum of tin shown from the transmission grating spectrometer in black, pinhole image in blue and RALEF-2D in magenta.

This work is supported by Science Foundation Ireland (SFI), via the *Frontiers for the Future Programme* Award under grant 19/FFP/6795.

[1] K. Fahy, et al., Journal of Physics: Photonics, **3**, 031002 (2021).
[2] D. Bleiner, Spectrochimica Acta Part B: Atomic Spectroscopy, **181**, 105978 (2021).
[3] G. O'Sullivan, et al., Journal of Physics B **48**, 144025 (2015).
[4] M. M. Basko, J. Maruhn, and A. Tauschwitz, GSI Rep. **1**, 410 (2010).