Alternative spectroscopic analysis of a photoionized plasma experiment

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Abstract

The study of photoionized plasmas -such as accretion disks in X-ray binaries or in active galactic nuclei- relies on a complex interpretation of their spectrum. Such interpretation is based on a large number of hypothesis which have not been sufficiently tested or validated in the corresponding ranges of temperature and density. Therefore we are now seeking to reproduce in laboratory plasmas representative of these astrophysical systems.
In 2017, an experiment of photoionized Si plasma -benefiting from numerous diagnostics- was carried out at the Sandia laboratories. From the plasma parameters provided by the diagnostics, none of the tested atomic kinetic codes could reproduce the main structures of the experimental spectrum. This result namely called into question the recombination rates computation.
I will present a new analysis of this transmission spectrum using a spectroscopic diagnostic tool developed to interpret the photoionized plasmas produced at the LULI facility. The restitution of the recorded spectra is here carried out by post-processing data computed by a 1D hydrodynamic-radiative simulation (ESTHER) coupled with a NLTE atomic kinetic code (SAPHyR). I will show that the transmission spectrum resulting from this procedure is now in good agreement with the experimental data.

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