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Investigation of opacity effects on optically thick lines for diagnosing plasma conditions in buried layer targets for x-ray opacity studies

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K-shell x-ray emission spectroscopy is a standard tool used to diagnose the plasma conditions created in high-energy-density physics experiments such as short-pulse heated buried microdot targets. In the simplest approach, the emissivity-weighted average temperature of the plasma can be extracted by fitting an emission spectrum to a single temperature condition. Recent work has shown that temperature distributions resulting from spatial gradients and the time evolution of the sample can be extracted from time-integrated x-ray spectra [1], however the intensity of the optically thick emission lines needed to be modified to fit the experimental spectra. In this work, we explore the effects of various treatments of optically thick emission lines in the analysis of buried layer microdot targets including escape factors and full radiation transport calculations. In doing so, we aim to identify the origin of the multipliers required to fit such experimental spectra and improve the characterization of the plasma conditions in the buried layer targets used for x-ray opacity studies.

Reference

1. M. J. MacDonald et al., *Rev. Sci. Instrum.* **93**, 093517 (2022).

Acknowledgements

This work was performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under Contract No. DE-AC52-07NA27344.

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