MATTER AND TECHNOLOGIES

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Parameter reconstruction for a Small-Angle X-Ray Scattering technique using Deep Learning

With Small Angle X-Ray Scattering (SAXS), the dynamics of laser-induced plasmas are being examined. However, the X-Ray detectors only capture the intensity of the scattered waves while additional phase information would be required to restore the density distribution of the object of interest immediately. SAXS is used here with a grating-shaped target which melts down during laser irradiation. This target including the melting influence can be described by a model based on three parameters. The task to deduce the object from the scatter image is then reduced to finding the three parameters which describe the object. In order to overcome disadvantages of conventionally used iterative phase retrieval algorithms, we follow a Deep Learning approach. Test data for neural networks are generated synthetically using the three-parameter model and the fact that the scatter image scales with the squared absolute value of the Fourier transform of the object image. We present results showing the principle applicability of neural networks for this application and evaluate the achieved results.

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