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X-ray phase contrast imaging applied to laser driven shocks

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X-ray phase contrast imaging (XPCI) is an imaging technique based on the phase-shift of an X-ray photon induced by the refractive index. In particular, the phase-shift is related to the real part of X-ray phase contrast imaging (XPCI) is an imaging technique based on the phase_shift of an X-ray photon induced by the refractive index. In particular, the phase-shift is related to the real part of the
refractive index, while the imaginary part is related to the absorption. A coherent X-ray source such as a synchrotron or X-ray free electron laser are the best choice for XPCI, however, it is possible to use broadband incoherent X-ray sources by limiting the source size and careful positioning of the experiment and detector. The interaction of high power laser with matter produces X-rays according to the intensity, energy and pulse duration. These sources can be used for XPCI. In this work we present the characterization and the application of XPCI using a laser-produced bremsstrahlung source to a shock. The X-ray source was created by irradiating a 5 μm diameter tungsten wire with a Nd:Glass laser pulse 0.5 ps long and energy of 25 J in first harmonic. This produces a strong bremsstrahlung radiation. We applied this source to XPCI static objects and a laser-driven shock-wave in a plastic target. In both cases the XPCI clearly indicates the presence of density interfaces with 5 μm spatial resolution. This proof-of-principle experiment shows how this technique can be a powerful tool for the study of warm and hot dense matter on large scale high-energy-density facilities.therefractive index, while the imaginary part is related to the absorption. A coherent X-ray source such as a synchrotron or X-ray free electron laser are the best choice for XPCI, however, it is possible to use broadband incoherent X-ray sources by limiting the source size and careful positioning of the experiment and detector. The interaction of high power laser with matter produces X-rays according to the intensity, energy and pulse duration. These sources can be used for XPCI. In this work we present the characterization and the application of XPCI using a laser-produced bremsstrahlung source to a shock. The X-ray source was created by irradiating a 5 μm diameter tungsten wire with a Nd:Glass laser pulse 0.5 ps long and energy of 25 J in first harmonic. This produces a strong bremsstrahlung radiation. We applied this source to XPCI static objects and a laser-driven shock-wave in a plastic target. In both cases the XPCI clearly indicates the presence of density interfaces
with 5 μm spatial resolution. This proof-of-principle experiment shows how this technique can be a powerful tool for the study of warm and hot dense matter on large scale high-energy-density facilities.

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