Abstract Submitted
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Molecular dynamics simulations of ablation and spallation of gold irradiated by femtosecond laser[1] BRIAN DEMASKE, VASILY ZHAKHOVSKY, University of South Florida, NAIL INOGAMOV, Landau Institute for Theoretical Physics, Russia, IVAN OLEYNIK, University of South Florida — The dynamics of material response to irradiation of thin gold foils by a femtosecond laser pulse is examined by molecular dynamics simulations. The major physical phenomena include ablation - the removal of material from irradiated surface and spallation - the ejection of a thin layer of material from the rear of the film. In order to reproduce the physical processes that occur under experimental conditions, we simulated 1 μm thick foils containing up to 170,000,000 atoms. Such thick foils are also needed to prevent the ablation and spallation zones from overlapping. In this presentation, we discuss the major physics of laser ablation and spallation observed in MD simulations: heating of a narrow region beneath the surface of the foil, its transformation to a metastable stress-confined state, and the rapid decomposition of this state into a strong rarefaction and compression wave. At some critical absorbed laser fluence, the rarefaction wave results in nucleation and growth of voids leading to ablation of the frontal surface. At higher absorbed fluences, the compression wave causes rear-side spallation of crystalline gold. Quantitative data such as the absorbed fluence thresholds, crater depths, and cavitation strength of gold are obtained from simulation and compared to experimental data.

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