Abstract Submitted
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Time-Resolved XUV Opacity Measurements of Warm Dense Aluminum[1] SAM VINKO[2], University of Oxford — The free-free opacity in plasmas is fundamental to our understanding of energy transport in stellar interiors and for inertial confinement fusion research. However, theoretical predictions in the challenging dense plasma regime are conflicting and there is a dearth of accurate experimental data to allow for direct model validation. Here we present time-resolved transmission measurements in solid-density Al heated by an XUV free-electron laser. We use a novel functional optimization approach to extract the temperature-dependent absorption coefficient directly from an oversampled pool of single-shot measurements, and find a pronounced enhancement of the opacity as the plasma is heated to temperatures of order the Fermi energy. Plasma heating and opacity-enhancement is observed on ultrafast time scales, within the duration of the femtosecond XUV pulse. We attribute further rises in the opacity on ps timescales to melt and the formation of warm-dense matter.

[1]Portions of this research were carried out at the FLASH facility.
[2]Vinko, Vozda, Andreasson, Bajt, Bielecki, Burian, Chalupsky, Ciricosta, Desjarlais, Fleckenstein, Hajdu, Hajkova, Hollebon, Juha, Kasim, McBride, Muehlig, Preston, Rackstraw, Roling, Toleikis, Wark and Zacharia, Phys. Rev. Lett. 124, 225002 (2020).

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