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Solid-density plasma expansion in intense ultra-short laser irradiation measured on nanometer scale and in real time[1] T KLUGE, J METZKES, A PELKA, A LASO GARCIA, I PRENCIPE, M BUSSMANN, K ZEIL, T SCHOENHERR, N HARTLEY, HZDR, Dresden, Germany, C GUTT, University Siegen, Germany, E GALTIER, I NAM, HJ LEE, EE MCBRIDE, S GLENZER, SLAC, U HUEBNER, Leibniz-Institute of Photonic Technology, Jena, Germany, C ROEDEL, Friedrich-Schiller-University, Jena, germany, M NAKATSUTSUMI, European XFEL, Schenefeld, Germany, M ROEDEL, M REHWALD, M GARTEN, M ZACHARIAS, U SCHRAMM, T.E. COWAN, HZDR, Dresden, Germany and TU-Dresden, Germany — Small Angle X-ray Scattering (SAXS) is discussed to allow unprecedented direct measurements limited only by the probe X-ray wavelength and duration. Here we present the first direct in-situ measurement of intense short-pulse laser - solid interaction that allows nanometer and high temporal resolution at the same time. A 120 fs laser pulse with energy 1 J was focused on a silicon membrane. The density was probed with an X-ray beam of 49 fs duration by SAXS. Despite prepulses, we can exclude premature bulk expansion. The plasma expansion is triggered only shortly before the main pulse, when an expansion of 10 nm within less than 200 fs was measured. Analysis of scattering patterns allows the first direct verification of numerical simulations.

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