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Probing the K-edge of a laser heated aluminum plasma using X-rays from betatron oscillations in a laser wakefield accelerator with femtosecond resolution[1] KEEGAN BEHM, AMINA HUSSEIN, TONY ZHAO, University of Michigan, EDWARD HILL, Imperial College of London, ANATOLY MAKSIMCHUK, JOHN NEES, VICTOR YANOVSKY, University of Michigan, STUART MANGLES, Imperial College of London, KARL KRUSHELNICK, ALEXANDER THOMAS, University of Michigan, CENTER FOR ULTRAFAST OPTICAL SCIENCE TEAM, PLASMAS GROUP TEAM — Presented here are data from a two-beam pump-probe experiment. We used synchrotron-like X-rays created by betatron oscillations to probe a thin metal foil that is pumped by the secondary laser beam. The Hercules Ti:Sapphire laser facility was operated with a pulse duration of 34 fs and a power of 80 TW split. A 75-25 beam splitter was used to drive a laser wakefield accelerator and heat the secondary target. We observed opacity changes around the K-edge of thin aluminum foil as it was heated by an ultrafast pump laser. To understand how the opacity is changing with heating and expansion of the plasma, the delay between the two laser paths was adjusted on a femtosecond time scale from 50 to 400 fs. Experimental data for aluminum shows variation in opacity around the K-edge with changes in the probe delay. The transmitted synchrotron-like spectrum was measured using single photon counting on an X-ray CCD camera and was available on a shot-by-shot basis. The success of this work demonstrates a practical application for X-rays produced from betatron oscillations in a wakefield accelerator.

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