Fastest waves ever photographed

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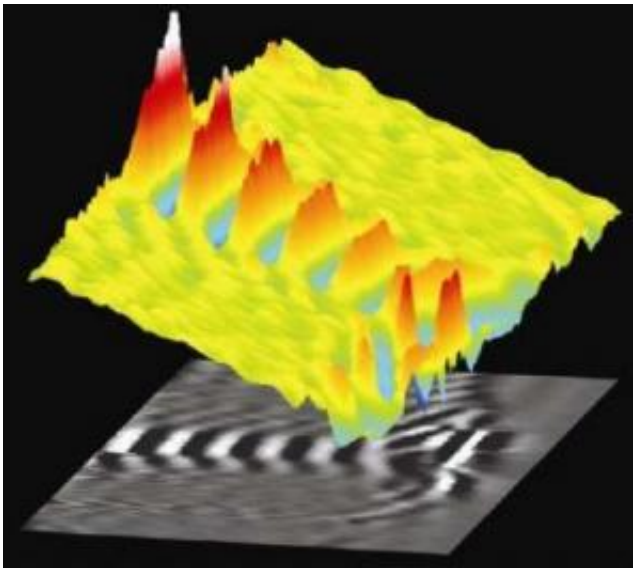

Images of a wakefield produced by a 30 TW laser pulse in plasma of density 2.7 x 10^18 cm^-3. The color image is a 3-D reconstruction of the oscillations, and the grey-scale is a 2D projection of the same data. These waves show curved wavefronts, an important feature for generating and accelerating electrons that has been predicted, but never before seen. Credit: Michael Downer, University of Texas at Austin, and Nicholas Matlis, University of Texas at Austin

Plasma physicists at the Universities of Texas and Michigan have photographed speedy plasma waves, known as Langmuir waves, for the first time using a specially designed holographic-strobe camera.

The waves are the fastest matter waves ever photographed, clocking in at about 99.997% of the speed of light. The waves are generated in the

wake of an ultra-intense laser pulse, and give rise to enormous electric fields, reaching voltages higher than 100 billion electron volts/meter (GeV/m).

The waves' electric fields can be used to accelerate electrons so strongly that they may lead to ultra-compact, tabletop versions of a high-energy particle accelerators that could be a thousand times smaller that devices which currently exists only in large-scale facilities, which are typically miles long.

Until now, a critical element necessary for understanding interaction between electrons and accelerating wakes has been missing: the ability to see the waves. The new photographic technique uses two additional laser pulses moving with the waves to image the wakefield ripples, enabling researchers to see them for the first time and revealing theoretically predicted but never-before-seen features. The ability to photograph these elusive, speedy waves promises to be an important step towards making compact accelerators a reality.

The record-setting images will be presented next week at the 48th Annual Meeting of the American Physical Society's Division of Plasma Physics, which runs October 30-November 3, 2006, in Philadelphia, Pennsylvania.

Source: American Physical Society