WHAT STARTS HERE CHANGES THE WORLD
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Physics

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Department of Physics News

8 March 2007:
University of Texas at Austin Physicists Slow and Control Supersonic Helium Beam

16 October 2006:
Holographic Snapshots of Laser wakefields

For more information on this news item, read the article from Nature Physics.

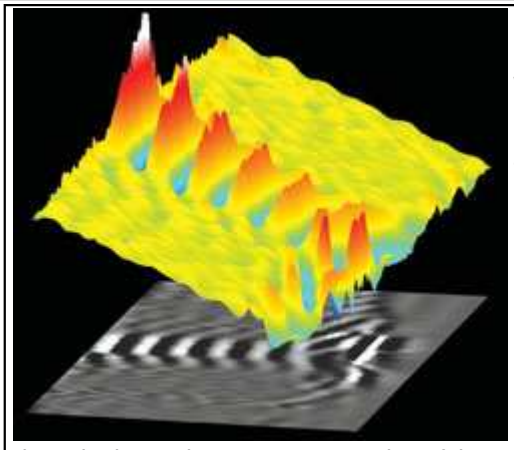

Image of a wakefield produced by a 30 TW laser pulse in plasma of density 2.7 x 10^{18} cm^{-3}.

The color image is a 3D reconstruction of the oscillations, and the grey scale is a 2D projection of the same data. These waves show curved wave-fronts, an important feature for generating and accelerating electrons that had been predicted, but never before seen.

UT Physics graduate student Nicholas Matlis (Ph.D. 2006), together with faculty advisor Mike Downer and a group at the University of Michigan, have photographed Langmuir waves racing through a plasma near the speed of light behind an intense laser driving pulse,[1] using a novel frequency-domain holographic strobe technique that Downer's group developed several years ago.[2] The so-called "laser wakefields" that Matlis et al. photographed form the

basis of tabletop plasma accelerators that were first proposed theoretically by former UT faculty member Toshi Tajima and the late John M. Dawson of UCLA in 1979.[3] With recent improvements, these accelerators can now produce nearly mono-energetic, GeV-range electron beams and femtosecond x-ray pulses, providing compact radiation sources for medicine, nuclear engineering, materials science and high-energy physics.[4-6] They work by surfing charged particles on electric fields exceeding 100 GeV m^{-1} (more than 1,000 times stronger than achievable in conventional accelerators) that are generated within the plasma waves that Matlis et al. photographed. The new "snapshots" capture the evolution of multiple wake periods, detect structure variations as laser-plasma parameters change, and resolve wave-front curvature, features never previously observed. UT physicist Serguei Kalmykov and faculty member Gennady Shvets, collaborators on the recent work, reproduced the main photographed features using computer simulations, yet each snapshot revealed unique details. These previously invisible features determine the charge, energy, energy spread and collimation of the accelerated beam. Because of the wave's microscopic size and luminal velocity, these critical structures had previously eluded direct single-shot observation, inhibiting progress in producing high-quality beams and in correlating beam properties with wake structure. The new technique reconstructs wake morphology in real-time, enabling rapid feedback and optimization, and promises to be an important step toward making compact accelerators a reality. Downer presented the results at the recent 48th Annual Meeting of the American Physical Society's Division of Plasma Physics in Philadelphia. The work was supported by the U. S. Department of Energy and the National Science Foundation. Further details are presented in a recent publication[1] in Nature Physics.

1. N. Matlis et al., "Snapshots of laser wakefields," Nature Physics 2, 749 (2006)
2. S. P. LeBlanc, E. W. Gaul, N. H. Matlis, A. Rundquist and M. C. Downer, "Single-shot measurement of temporal phase shifts by frequency-domain holography," Optics Letters 25, 764 (2000).
3. T. Tajima and J. M. Dawson, "Laser electron accelerator," Physical Review Letters 43, 267 (1979).
4. W. P. Leemans et al., "GeV electron beams from a centimetre-scale accelerator," Nature Physics 2, 696 (2006).
5. V. Malka et al., "Laser plasma accelerators: a new tool for science and for the society, Plasma Phys. Control. Fusion 47, 8481 (2005).
6. C. Joshi, "Plasma accelerators," Scientific American (February 2006), pages 41-47.

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5 October 2006:
Dear Colleagues,

Congratulations to Allan MacDonald, co-recipient of the 2007 Buckley Prize!

The American Physical Society has announced the winners of the Buckley Prize, the highest prize in condensed matter physics:

The APS 2007 Oliver E. Buckley Prize will be awarded to

* James P Eisenstein (Caltech),
* Steven M. Girvin (Yale University), and
* Allan H. MacDonald (University of Texas at Austin)

For their fundamental experimental and theoretical research on correlated many-electron states in low dimensional systems.

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21 September 2006:
New Superlens Reveals Hidden Nanostructures

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1 September 2006:
Dear Colleagues,

I am pleased to announce that this week the Department of Physics was named the recipient of the

2006 Everybody WINS Award

(WINS = Women in Natural Sciences)

The citation states: *"In recognition and appreciation of the department's commitment to best practices in the recruitment and/or retention of women and underrepresented minorities. These best practices enhance the culture and mission of the College of Natural Sciences and the University of Texas at Austin.."*

Thanks to all, and especially the recruitment committee, for making this possible.

Best regards,

John

John T. Markert
Departmetnt Chair, Physics

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4 April 2006:
MINOS collaboration releases new neutrino results

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4 January 2006:
Number squeezing of atoms achieved by Raizen

group

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29 September 2005:
Prof. Jim Chelikowsky has been awarded the 2006 David Adler Lectureship Award.

This award is sponsored by the Division of Materials Physics of The American Physical Society and by the friends of David Adler. The award was established to recognize an outstanding contributor to the field of materials physics, particularly one who is noted for the quality of his/her research, review articles, and lecturing.

The citation for this year's award to Jim reads: "For his creative and outstanding research in computational materials physics and for his effectiveness in communicating research results through lectures and publications."

The Adler Award will be presented to Jim at the APS March 2006 meeting in Baltimore, MD at a special ceremonial session.

Congratulations, Jim!