Breakthrough measurement of light affecting individual atoms

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Tyndall National Institute and its collaborators are unravelling how atoms vibrate and change when hit with intense bursts of light. The ground-breaking work has been recognised through publication of a paper in *Nature Physics*.

The collaborative research, led at the Tyndall National Institute by Prof. Stephen Fahy, is currently using x-ray lasers to investigate how natural vibrations of molecules and solids are excited by intense bursts of light. The x-ray laser generates pulses so short that they can capture a snapshot of the moving atoms in less than a billionth of a billionth of a second, which enables researchers to better understand how individual atoms are affected when light is absorbed.

While current studies focus on movement of atoms in germanium, this is the first time that researchers have been able to look at any material in such detail. As the research progresses, it has the potential to revolutionise the speed and capacity of data transfer through optical fibres on the internet and even unlock how atom-level photosynthesis works, with the possibility for it to be replicated to increase energy storage capacity.

Explaining the significance of their research, Prof. Fahy, Materials Theory Group, Tyndall National Institute said: "Understanding and controlling how light alters the forces between atoms is central to our understanding of photo-chemistry and underpins many areas of energy science, such as photocatalysis. Tyndall and its collaborators are one of

only a few groups worldwide with the ability to measure and calculate such atomic motion and we are delighted to have our work recognised by Nature."

The research paper was co-authored by researchers from SLAC National Research Laboratory, Stanford University, University of Michigan, Oxford University, ETH Zurich, Lund University and the University of Duisburg-Essen under the direction of Prof. David Reis, Stanford University Department of Applied Physics, who was also resident in Tyndall from April to June this year under the SFI Walton Visiting Fellow programme.

More information: M. Trigo, M. Fuchs, J. Chen, M. P. Jiang, M. Cammarata, S. Fahy, D. M. Fritz, K. Gaffney, S. Ghimire, A. Higginbotham, S. L. Johnson, M. E. Kozina, J. Larsson, H. Lemke, A. M. Lindenberg, G. Ndabashimiye, F. Quirin, K. Sokolowski-Tinten, C. Uher, G. Wang, J. S. Wark, D. Zhu, D. A. Reis.*Nature Physics* 9, 790–794 (2013) DOI: 10.1038/nphys2788 Received 14 March 2013 Accepted 11 September 2013 Published online 27 October 2013

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