'Reversing the problem' clarifies molecular structure

December 23 2011

Optical techniques enable us to examine single molecules, but do we really understand what we are seeing? After all, the fuzziness caused by effects such as light interference makes these images very difficult to interpret. Researchers at the University of Twente's MESA+ Institute for Nanotechnology adopted a "reverse" approach to spectroscopy which cleaned up images by eliminating background noise. The researchers presented their findings in *Physical Review Letters*.

Rather than starting with the laser beam, the trick is to take the molecule you are studying as the starting point. This radical "reversal" led to a relatively simple modification of conventional CARS spectroscopy, which delivered better images. CARS was already a powerful technique which used lasers to visualize molecules for such purposes as food testing and medical imaging. One advantage is that no fluorescent labels are needed to make the molecules visible. However, background noise complicates the task of interpreting the resultant images. This new approach eliminates such noise completely, leaving only the "real" image. More information than ever before, such as accurate details of the substance's concentration, can be obtained using this technique. It is easier to detect the signature of the molecule in question.

The key to side-stepping the overwhelming complexity involved lay in Prof. Shaul Mukamel's exhortation to just "Look at the molecule!" (the professor, who holds a post at the University of California, collaborated on the present publication). So don't focus on the way that light interacts with the molecule, as this makes it very difficult - even impossible - to

"separate the wheat from the chaff" and reveal the real image. Instead, start by examining the energy levels inside the molecule. Previous work, based on Prof. Mukamel's exhortation, has mainly led to the development of new theories. The University of Twente researchers have now translated this theory into the new technique of Vibrational Molecular Interferometry, which will vastly expand the uses of CARS and other techniques.

This study was conducted in Prof. Jennifer Herek's Optical Sciences group. The research group is part of the MESA+ Institute for Nanotechnology of the University of Twente.

More information: The publication, entitled "Background-free nonlinear microspectroscopy with vibrational molecular interferometry", by Erik Garbacik, Jeroen Korterik, Cees Otto, Shaul Mukamel, Jennifer Herek and Herman Offerhaus, was published on 16 December, in the online edition of *Physical Review Letters*.

Provided by University of Twente

Citation: 'Reversing the problem' clarifies molecular structure (2011, December 23) retrieved 10 April 2024 from https://phys.org/news/2011-12-reversing-problem-molecular.html

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.