International research project leads to a breakthrough in terahertz spectroscopy

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Although terahertz spectroscopy has great potential, especially for environmental monitoring and security screening applications, it previously could not be used effectively to study nanocrystals or molecules at extremely low concentrations. An international team led by Professor Luca Razzari at the INRS Énergie Matériaux Télécommunications Research Centre has found a solution to this problem by increasing the technique's sensitivity using metallic nanostructures, as explained in an article published in *Nano Letters* in January 2015.

Terahertz rays (T-rays) have special properties that are very useful in identifying complex molecules and nanomaterials. However, the very long wavelength associated with this kind of radiation significantly hinders its interaction with nano-objects such as nanoparticles, nanorods, and nanotubes, or large molecules of biological interest. To overcome this limitation, the researchers used nanoantennas to reinforce terahertz spectroscopy, building on an existing strategy that has been successfully employed for other applications such as surface-enhanced Raman spectroscopy (SERS).

The researchers demonstrated that it is possible to retrieve the spectroscopic signature of a single layer of semi-conductor nanocrystals and increase their absorption by more than a million times when they are placed in the antennas' nanocavities. The unique method they developed to squeeze terahertz light into nanovolumes opens up new research perspectives in nanophotonics and broadens the field of applications in

both spectroscopy and nonlinear optics.

More information: These research findings were published in *Nano Letters* (January 2015): 'Squeezing Terahertz Light into Nanovolumes: Nanoantenna Enhanced Terahertz Spectroscopy (NETS) of Semiconductor Quantum Dots' DOI: 10.1021/nl503705w

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