Researchers demonstrate attosecond temporal resolution in combination with atomic selectivity

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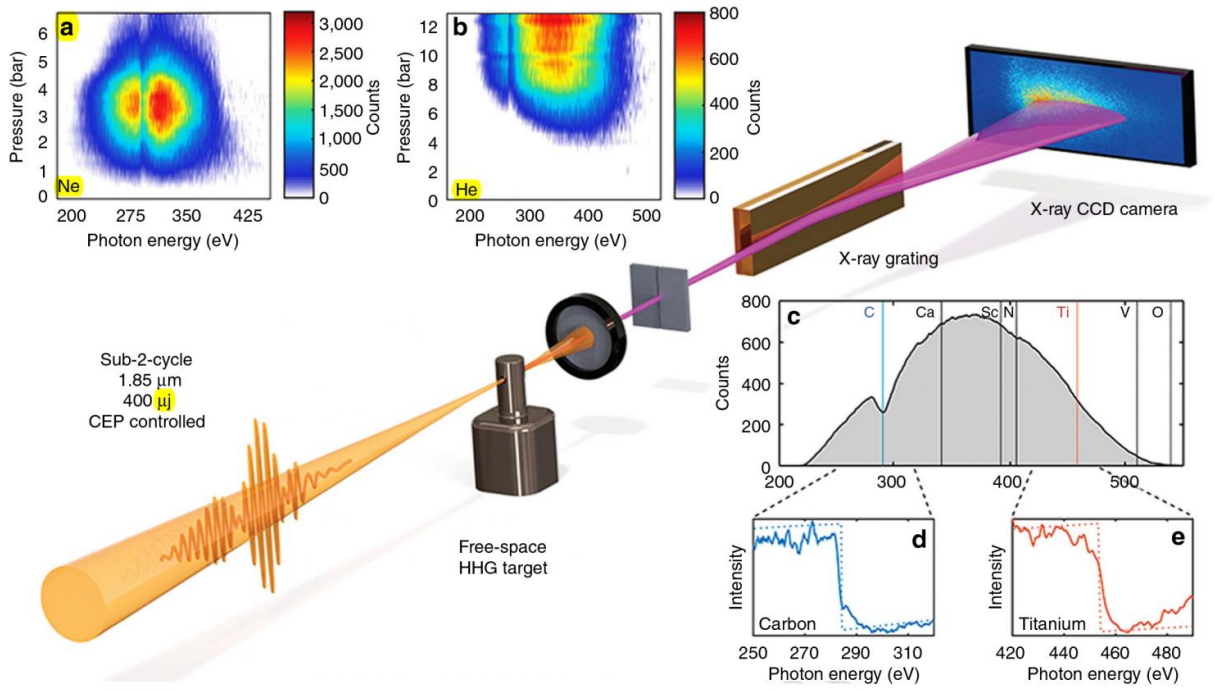

Experimental setup showing pressure dependence and spectral coverage. Credit: ICFO

Attosecond light pulses in the extreme ultraviolet have drawn a great deal of attention due to their ability to interrogate electronic dynamics in real time. Nevertheless, to follow charge dynamics and excitations in

materials, element selectivity is a prerequisite, which demands such pulses in the soft X-ray region, above 200 eV, to simultaneously cover several fundamental absorption edges of the constituents of the materials.

In a recent study published in *Nature Communications*, ICFO researchers S. M. Teichmann, F. Silva, S. L. Cousin and M. Hemmer from the Attoscience and Ultrafast Optics Group, led by ICREA Professor at ICFO Jens Biegert, have achieved isolated attosecond pulses covering the carbon, nitrogen and oxygen absorption edges simultaneously in the soft X-ray water window. This study provides site-specific probes for observing electron correlation and many-body effects of core-excited atoms or electron transfer in photo- and electro-chemical processes of organic solar cells and molecular electronics. The wavelength of 2 nm and their penetration depth permit coherent transmissive, reflective and ptychographic diffractive imaging to resolve structural dynamics of biomolecules at high resolution and fast timescales.

The work bridges the gap between ultra-fast time resolution and element specific probing, with applications that include elucidating the dynamics of the building blocks of biological life, organic semiconductors, light harvesting devices, and even molecular electronics.

More information: S. M. Teichmann et al, 0.5-keV Soft X-ray attosecond continua, *Nature Communications* (2016). DOI: 10.1038/ncomms11493

Provided by ICFO

https://phys.org/news/2016-05-attosecond-temporal-resolution-combination-atomic.html