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Felicidades al nuevo graduado de doctorado del ICFO

El Dr. Ying-Hao Chien se ha doctorado con una tesis titulada "Revealing Ultrafast Dynamics in Hexagonal Boron Nitride with Attosecond X-ray Absorption Fine-structure Spectroscopyï¿½

January 27, 2026

Felicitamos al Dr. Ying-Hao Chien que ha defendido su tesis esta manana en el auditorio del ICFO.
El Dr. Chien obtuvo su Master en Fisica por la University of Wyoming en Estados Unidos, antes de unirse al grupo de investigacion de Attoscience and Ultrafast Optics dirigido por el profesor ICREA en ICFO Dr. Jens Biegert. Su tesis titulada "Revealing Ultrafast Dynamics in Hexagonal Boron Nitride with Attosecond X-ray Absorption Fine-structure Spectroscopy" ha sido supervisada por el Prof. Dr. Jens Biegert.

RESUMEN:
Since the invention of the integrated circuit (IC) in the 1950s, modern civilization has been built upon its foundation. As ICs continue to scale down and operate at higher speeds, managing heat dissipation and energy transfer process is critical to overcoming performance limitations and enabling the development of next-generation ICs. In classical models, electrons and phonons are treated as independent systems to simplify calculations. This approximation successfully describes electronic band structures, charge transport, and optical responses in many materials under equilibrium conditions. However, it neglects the critical role of electron-phonon coupling, a fundamental many-body interaction that governs non-equilibrium energy exchange between electronic and lattice degrees of freedom. Recent advances in attosecond X-ray absorption fine structure (atto-XAFS) spectroscopy offer an unprecedented opportunity to observe electron-phonon coupling dynamics with both attosecond temporal and element-specific resolution. Hexagonal boron nitride (hBN), a widely studied prototypical material with diverse applications, still presents unresolved questions regarding its ultrafast dynamics. In this work, we investigate the coupled electron and phonon dynamics in bulk hBN using atto-XAFS. By employing different excitation conditions and exploiting different temporal resolutions, we disentangle the respective contributions of electrons and phonons to the transient response, demonstrating the unique capability of atto-XAFS to probe many-body dynamics in real-time. To enable further studies

of novel materials, we upgraded our titanium-doped sapphire (Ti:sapphire) chirped pulse amplification (CPA) laser system, integrated a new commercial TOPAS optical parametric amplifier, designed a novel microfluidics gas target combined with a piezo pulse valve system aimed at reducing helium consumption for high harmonic generation (HHG), implemented a cryogenic sample mount for temperature-dependent measurements, and replaced the diffraction grating in the soft X-ray spectrograph with high diffraction efficiency and high resolving power reflection zone plates. We demonstrate the enhanced performance of the upgraded system for future advanced atto-XAFS experiments.

Tribunal de Tesis:

Prof. Dr. Heinrich Schwoerer, Max Planck Institute for the Structure and Dynamics of Matter

Prof. Dr. David Artigas Garcia, ICFO

Prof. Dr. Themistoklis Sidiropoulos, Friedrich-Schiller-Universitat Jena

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Tribunal de Tesis