SFB1242

SFB 1242 Nichtgleichgewichtsdynamik kondensierter Materie in der Zeitdomäne

UNIVERSITÄT DUISBURG ESSEN

Open-Minded

07.07.2020 / 10 Uhr c.t.

Ultrafast extreme-ultraviolet emission and excitations in solids

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The generation of extreme ultraviolet and soft-X-ray pulses by high-harmonic generation (HHG) is the workhorse of attosecond science [1] and enables the observation of ultrafast electronic and nuclear dynamics in molecules and solids [2]. Importantly, the introduction of extreme-ultraviolet lithography into the high-volume manufacturing of integrated circuits now created the first industrial applications of high-harmonic sources [3,4], and even attosecond spectroscopic techniques to investigate processes in solids are becoming implemented in industry [5]. Thus, both fundamental science and industrial applications now require more robust and brighter HHG sources, as well as a better understanding of the interaction of XUV photons with semiconductor wafers and thin films.

In this talk I will discuss experiments both for improving HHG sources, as well as their application to study ultrafast processes in solids. The recently discovered extreme-ultraviolet emission from solids opens an avenue to more compact HHG sources, and is a new method to study solids in high fields. I will discuss new experiments to boost the efficiency of XUV emission from solids through resonant enhancement in multi-color HHG, and ways to tailor the emission properties by engineering the surface of the materials. Extreme ultraviolet and soft-X-ray pulses provide an ideal way to monitor valence dynamics in transient reflectivity experiments. I will discuss previous experiments in germanium [6] that enable the simultaneous monitoring of valence and conduction band dynamics in real semiconductor wafers. Furthermore, I will introduce extreme-ultraviolet excited visible luminescence spectroscopy, which allows monitoring ultrafast XUV induced processes in thin films on picosecond to nanosecond time scales.

[1] P.M. Kraus, H.J. Wörner, Angew. Chem. Int. Ed. **57**, 5228-52472 (2018).
[2] P.M. Kraus, M. Zurch, S.K. Cushing, D.M. Neumark, S.R. Leone, Nat. Rev. Chem. **2**, 144-144 (2018).
[3] S. Roscam Abbing, F. Campi, F.S. Sajjadian, N. Lin, P. Smorenburg, P.M. Kraus, Phys. Rev. Appl. **13**, 054029 (2020).
[4] https://www.laserfocusworld.com/lasers-sources/article/14169549/highharmonic-generation-sources-enable-extreme-ultraviole lensless-imaging
[5] https://www.imec-int.com/en/articles/imec-to-install-high-na-euv-imaging-and-attosecond-analytical-lab-to-probe-lithography-down-to-8nm-pitch
[6] C.J. Kaplan, P.M. Kraus, A.D. Ross, M. Zürch, S.K. Cushing, et al., Phys. Rev. B **97**, 205202 (2018).

Für diese Zeit steht eine Kinderbetreuung nach vorheriger Anmeldung zur Verfügung.

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