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# PL2.1 - Keynote

## Ultrasonics with EUV and x-ray lasers

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### Abstract:

The invention of the optical laser in the 20th century greatly advanced the field of ultrasonics: lasers are now widely used for both generation and detection of ultrasound. The beginning of the 21st century witnessed remarkable progress in the development of bright and ultrafast short wavelength sources, including free electron lasers operating in the extreme ultraviolet (EUV) and x-ray ranges. In this talk, I will provide an overview of recent advances achieved by using EUV and x-ray lasers for the generation and detection of acoustic fields on the ultrafast time scale. Much of the discussion will be focused on the transient grating technique, in which two short laser pulses are crossed in the sample to launch acoustic waves at the wave vector defined by the periodicity of the optical interference pattern. This technique has recently been extended to the EUV and x-ray spectral ranges [1-4]. The main advantage of using short wavelengths is that the transient grating period defining the acoustic wavelength can be very short: measurements with periods down to 10 nm have already been demonstrated [4]. We will also discuss diffuse scattering of EUV and x-ray radiation by acoustic waves with nanoscale wavelengths [5, 6]. A surprising recent finding [6] is the observation of dynamic circular fringe patterns in the EUV scattering from metal and semiconductor samples following femtosecond laser excitation. These patterns originate from spatially random but temporally coherent surface acoustic waves with wavelengths down to 60 nm whose excitation is facilitated by miniscule surface roughness. Other advances in using EUV and x-ray radiation in ultrasonics will also be briefly reviewed.uantum technologies promise a change of paradigm for many fields of application, for example in communication systems, in high-performance computing and simulation of quantum systems, as well as in sensor technology. Current efforts in photonic quantum science target the implementation of practical devices and scalable systems, where the realization of quantum devices for real-word deployment and controlled quantum network structures is key for many applications.

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