

New Regimes in Nuclear Resonance Excitation with X-Ray Lasers

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Synchrotron radiation had a profound impact on the applications of the Mössbauer effect in all natural sciences. The enormous brilliance of X-rays delivered by these sources enabled access to smallest amounts of materials under extreme conditions and allowed for studies with time resolution and polarization sensitivity that were virtually impossible in the lab. In this way it was even possible to transfer concepts of quantum optics into the regime of hard X-rays.

This science field gained a further momentum by the advent of x-ray lasers. These sources deliver radiation pulses with peak brightness values to enter qualitatively new regimes in the interaction of light and matter. In this talk I will present first results of recent experiments at the European X-ray free electron laser (EuXFEL) in which we explored nuclear resonant scattering under multiphoton excitation conditions with some surprising findings.

Moreover, I will discuss perspectives for incoherent diffractive imaging using nuclear resonance excitation at XFEL sources.