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Explorations in nuclear photonics with X-ray lasers

Tuesday, October 7, 2025 11:00 AM (30 minutes)

Accelerator-driven X-ray sources 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 possible, for example, to transfer concepts of quantum optics into the regime of hard X-rays [1]. With the advent of ever brighter sources, especially X-ray lasers, this research field continues to expand and flourish. In this presentation I will describe new regimes of nuclear photonics in the low-energy (Mössbauer) regime around a few 10 keV, ranging from anomalies in coherent nuclear forward scattering to the excitation of nuclear clock isomers like Scandium-45 [2].

[1] Ralf Röhlsberger et al., Nature 482, 199 (2012)
[2] Yuri Shvyd'ko, Ralf Röhlsberger, Olga Kocharovskaya, Jörg Evers et al., Nature 622, 472 (2023)

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