Two-color synchronized atomic inner-shell X-ray laser

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Abstract

The introduction of X-ray free-electron laser (XFEL) has made possible studies of nonlinear interactions of X-ray with matters. An example of such appealing ideas is applying nonlinear spectroscopy techniques in the X-ray regime. XFEL, however, is incapable of studying such effects as X-ray stimulated coherent Raman spectroscopy or four-wave mixing since ultrashort, temporally coherent and synchronized two-color X-ray source are required. Progress in generating desired X-ray laser is recently made by N. Rohringer *et al.* at Linac Coherent Light Source of the SLAC National Accelerator Laboratory. XFEL pulses of 960eV is targeted at neon gas of $\sim$500 torr to spot sizes and 1-2-μm in radius. About 1.8% of the core-ionized neon atoms undergo a spontaneously decay, emitting 849eV photons. Both the transmitted XFEL X-ray and atomic X-ray radiation have pulses of photon of the order of $10^9 \sim 10^{10}$ and ultrashort duration of 40 fs and 5 fs, respectively. The enhanced wavelength ability and monochromaticity and temporal coherence compared with XFEL opens a new path to the study of high-resolution spectroscopy and nonlinear X-ray.

References:

1. N. Rohringer et al. Nature 481, 488491 (2012).