Laser driven coherent x-ray sources

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The generation of ultrashort laser pulses opened a new area of time-resolved spectroscopy. Subsequently the wavelength range has been extended by nonlinear techniques. A very successful approach for table-top coherent x-ray sources is high harmonic generation (HHG) producing spatially coherent sub-femtosecond XUV pulses. The rather low conversion efficiency of HHG can be increased by quasi-phase-matching schemes and/or parametric amplification of HH radiation. Using more energetic laser pulses, electrons can be accelerated up to relativistic velocities in a few mm long noble gas jet. Under optimized conditions, the electrons start to oscillate transversally and emit spatially coherent betatron radiation in the few keV range. The broad spectrum is ideally suited for studying transient states of matter with time-resolved x-ray absorption spectroscopy.