VUV-FEL radiation at 100 nm: Radiation properties and first experimental results

The TESLA test facility collaboration

The vacuum-ultraviolet free-electron laser at the TESLA test facility (TTF) has reached saturation in a wavelength range around 100 nm. Several methods of characterisation have been employed to analyse the radiation properties of the self-amplified spontaneous emission. A pulse duration of 30 to 100 fs and peak brilliance of 2 x 10^{28} phts/(s•mm^2•mrad^2•0.1%) were determined. First experiments have employed the FEL radiation in investigations of damage of optical material and in investigation of interaction of FEL radiation with cluster beams.

The route towards 0.1 nm FEL radiation at DESY

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DESY at present extends the existing TESLA test facility in order to provide short-wavelength FEL radiation for first user-experiments in the wavelength range 40 to 6 nm. Using a single undulator a beam distribution system will serve five to six experiments. User-operation of TTF is scheduled to resume in 2004. The proposal for an x-ray free-electron laser laboratory for 0.1 to 6 nm wavelength (200 eV - 14 keV) is evaluated at present and could start operation around 2010. The FEL radiation will be transverse coherent, have a duration of ~ 100 fs and reach a peak brilliance of 10^{33} phts/(s•mm^2•mrad^2•0.1%) with 10^{12}-10^{13} photons per pulse. Five SASE undulators and five undulators for spontaneous radiation will serve up to 30 experimental stations. Flexible modes of operation and dedicated instrumentation will allow to operate several user-experiments at the same time.