

Femtosecond laser-driven collisional soft x-ray lasers

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Using ultrashort laser pulses to collisionally pump soft x-ray transitions has been demonstrated since 1995, opening the path to compact and high repetition rate soft x-ray laser sources. In this scheme the ion stage is produced by optical-field ionization and is controlled by the laser intensity while the energy distribution of the resulting electrons is controlled by varying the polarization of the pumping laser. Linearly polarized lasers generate relatively cold free electrons which are suitable for recombination-type soft x-ray lasers. On the other hand, the interaction of circularly polarized lasers with a gas medium produces higher energy electrons which can be used to form a population inversion in the extreme ultraviolet range by collisional processes. In this presentation we will present 20 years of research on this type of source from the first saturated amplification in 2002 to most recent achievements on high spatial quality femtosecond soft x-ray laser sources.