Soutenance de thèse

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Experimental study and numerical simulations of the spectral properties of XUV lasers pumped by collisional excitation

Improving the knowledge of the spectral and temporal properties of plasma-based XUV lasers is an important issue for the ongoing development of these sources towards significantly higher peak power. The spectral properties of the XUV laser line actually control several physical quantities that are important for applications, such as the minimum duration that can be achieved (Fourier-transform limit). The shortest duration experimentally achieved to-date is ~1 picosecond. The demonstrated technique of seeding XUV laser plasmas with a coherent femtosecond pulse of high-order harmonic radiation opens new and promising prospects to reduce the duration to a few 100 fs, provided that the gain bandwidth can be kept large enough.

Using a wavefront-division interferometer we have characterized three types of collisional XUV lasers, developed in three different laboratories: transient pumping in Ni-like Mo, capillary discharge pumping in Ne-like Ar and quasi-steady state pumping in Ne-like Zn. These XUV laser sources have distinct output properties, but also markedly different plasma parameters (density, temperature) in the amplification zone, hence different spectral properties are expected. Besides the accurate measurement of the temporal coherence of the laser in each case, from which the linewidth is inferred, we have studied the spectral behaviour when the laser is operated in the saturation regime and when it is seeded with high-order harmonic radiation. We have also investigated the temporal behaviour of the Ni-like Mo transient XUV laser, using an ultrafast X-ray streak camera. Our linewidth measurements are compared with detailed numerical calculations including relevant broadening mechanisms as well as radiative transfer effects. The shortest temporal coherence (ie the largest bandwidth) is measured for the quasi-steady state pumping XUV laser, which operates at the highest density and ionic temperature.

ATTENTION JOUR ET HEURE INHABITUELS

Jeudi 20 décembre 2012 à 14h

Bât 351 – 2ème étage (Bibliothèque)

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