エクストリームフォトニクスセミナー
Extreme Photonics Seminar

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Date： Dec. 15th(Wed), 2010, 15:00 ～ 17:00

Location： Cooperation Center, 5F Meeting Room, W524
(研究交流棟5階会議室 W524)

Title： Few-cycle, high-energy, CEP-stable optical parametric chirped pulse amplifiers and its applications to strong field physics

Speaker： 石井 順久 氏 (東京大学物性研究所, JST CREST)
Dr. Nobuhisa Ishii (University of Tokyo and JST CREST)

We talk about recent progresses on the development of infrared optical parametric chirped pulse amplifiers (OCPCA) and its application to researches in strong field physics.
Home-made few-cycle, high-energy, phase-stable OPCPA operated around 750 nm is applied to the strong field experiment: high-harmonic generation in the soft X-ray, spectrum of which reached the entrance of the water window because of its ultrashort pulse duration and high energy. The CEP dependence of harmonics peaks is observed in near cutoff region around 170 eV using helium as generation medium, corresponding well to the calculated results. This CEP dependent high harmonics is in the highest energy range ever observed. Further improvement of our OPCPA system will be able to produce an isolated attosecond pulses in the same energy range, which can have the shortest pulse duration.
We also mention about a proof-of-principle experiment on a novel parametric amplification scheme in the infrared, which is applicable toward a quasi-mono-cycle, high-energy, CEP-locked infrared OPCPA system. We tried two borate crystals, BBO and BIBO, in an infrared optical parametric amplifiers (OPA) pumped with Ti:sapphire laser. We obtained the octave amplification of infrared pulses spanning from 1100 to 2200 nm in a BIBO-based OPA system with an 800-nm pump. We also demonstrated that a BBO-based OPA using 800-nm pump pulses gives the gain bandwidth from 1200 to 2200 nm, which is less broad than BIBO, as in the case of former experiments. However, when we switched the pump wavelength to 760 nm, the spectrum of optical parametric fluorescence becomes broader especially in the short-wavelength range than an 800-nm pump. The octave-spanning amplified pulse obtained from a BIBO-based OPA preserved the carrier-envelope phase using an f-to-2f interferometer without additional spectral broadening, which is able to generate the SHG of the long-wavelength part and combine the SHG with the short-wavelength components.

Title： Non-thermodynamical-equilibrium photoionized plasma generated by laser-produced Planckian x-ray source

Speaker： 藤岡 慎介 氏 (大阪大学レーザーエネルギー学研究センター)
Dr. Shinsuke Fujioka (Institute of Laser Engineering, Osaka Univ.)

To derive physical properties from astronomical observations, x-ray astronomers rely on non-local-thermodynamical-equilibrium atomic physics in a cold ambient gas subject to an extreme radiation field, for which the mean radiation temperature is of the order of 1 keV. The distance of these objects and the inability to control or accurately ascertain the conditions that govern their behaviour makes it difficult to interpret the origin of the features in astronomical x-ray measurements. The novelty of the present experiment is the notion that laser-driven implosion can create a flash of brilliant Planckian x-rays those can be used to simulate x-rays from a astronomical compact object. A cold and rarefied silicon plasma, mimicking the stellar wind around the compact object, is generated in the vicinity of the core. The silicon plasma is photoionized by intense radiation from the core plasma, then x rays emitted from the plasma have characteristic spectra those are quite similar to astronomical x-ray spectra. We also found that photoionization drastically changes opacity spectrum in a soft x-ray range. This experimental observation is relevant to radiation transport modeling in a stellar interior.

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