Service des Photons, Atomes et Molécules
SÉMINAIRE

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Jeudi 21 juin 11h00

CEA-Saclay ¡b¿¡font color ='red'¿SPAM¡/font¿¡/b¿ Bât 522, p 138

Characterization of ultra-short pulsed laser damage in dielectrics by interferometry and photoelectron spectroscopy experiments

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Optical energy deposition and relaxation in wide-band gap crystals (oxides and halides) was investigated aiming to determine processes in charge of laser breakdown induced by IR femto- and picosecond laser pulses. In situ monitoring of electron concentrations around the damage threshold was performed using ultra-fast interferometry, while their energy was estimated in photo-electron spectroscopy experiment. In both cases, the same spot on the surface was exposed to a couple of laser pulses with variable time delay (UV followed by IR after-exposure) to distinguish stages of conduction band populating and the following heating of free electrons with possibility of impact ionization. Breakdown threshold were measured in the same conditions. This way, the most complete, direct and detailed set of measurements was performed to characterize electron multiplication and laser damage in these materials.

In spite of the similar damage dependences and significant energy of free electrons (¿ 20-30 eV) observed in all the materials far below the damage threshold, impact ionization was only observed in those known to bind the free electrons within self-trapped exitons (SiO2, NaCl). Oxides of Al and Mg did not reveal multiplication of electrons in spite of their long lifetime in the conduction band, were their energy seemed to be directly transferred to heat via electron-phonon coupling. Variation of energy of the IR heating pulse allowed to show, that achieving of critical electron density, used as conventional criterion of optical damage, is not valid in the case of both groups of materials.
