Consiglio Nazionale delle Ricerche

Istituto per i Processi Chimico-Fisici Area della Ricerca di Pisa

Mercoledì 6 Agosto 2008

ore 11:00

nell'Auletta Seminari IPCF

il Prof. Pietro Mulser

TQE: Theoretical Quantum Electronics
Technical University, Darmstadt, Germany
terrà un seminario su

The physics of collisionless absorption, collisional absorption in strong laser fields and the relativistic increase of the critical density for fast ignition

ABSTRACT - The problem of collisionless absorption of ultrashort laser pulses is solved after a 20 year effort. It is shown that in perfect analogy to linear resonance absorption of ns pulses, anharmonic resonance is responsible for the energy conversion of fs pulses and long, ps pulses in steep density gradients. In the nonlinear regime the plasma eigenfrequency undergoes a downshift until it resonates with the laser frequency. First the fast electrons in the MeV range are generated; they, in turn, generate plasmons which by Landau damping and similar collisionless processes heat less energetic electrons by cascading. Anharmonic resonance is able to explain all essential aspects of collisionless absorption: instantaneous generation of energetic electron jets, absorption up to 80 %, and the difference between linear and circular polarization on fast electron generation. The dielectric model of collisional absorption is presented and its advantages and shortcomings are discussed. Then it is compared with the ballistic model and the underlying physics as well as the origin of the various asymptotic formulas for the Coulomb logarithm are outlined. For the relativistic increase of the critical density quasineutrality of the plasma plays the decisive role. As the problem is highly nonlinear at present only a numerical approach is feasible. Thus, the increase of the critical density is determined from PIC calculations and a simple analytical formula is extracted. Resulting constraints on laser fluxes for fast ignition are discussed.

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