Seminar

Institutul de Fizică Atomică

PULSE and IMPULSE of ELI *(Extreme Light Infrastructure)*

VII: COUPLING of (ULTRA-) RELATIVISTIC ATOMIC NUCLEI with PHOTONS

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The coupling of photons with (ultra-) relativistic atomic nuclei is presented in two particular circumstances: very high electromagnetic fields and very short photon pulses. We consider a typical situation where the (bare) nuclei (fully stripped of electrons) are accelerated to energies ~1TeV per nucleon (according to the state of the art at LHC, for instance) and photon sources like petawatt lasers ~1eV-radiation (envisaged by ELI-NP project, for instance), or free-electron laser ~10keV-radiation, or synchrotron sources, etc. In these circumstances the nuclear scale energy can be attained, with very high field intensities. In particular, we analyze the nuclear transitions induced by the radiation, including both one- and two-photon proceses, as well as the polarization-driven transitions which may lead to giant dipole resonances. The nuclear (electrical) polarization concept is introduced. It is shown that the perturbation theory for photo-nuclear reactions is applicable, although the field intensity is high, since the corresponding interaction energy is low and the interaction time (pulse duration) is short. It is also shown that the description of the giant nuclear dipole resonance requires the dynamics of the nuclear electrical polarization degrees of freedom.

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