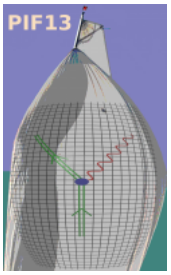

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Probing of QED vacuum with superstrong laser field

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The development of laser technologies promises very rapid growth of laser intensities in close future already. Two exawatt class facilities (ELI and XCELS, Russia) in Europe are already in the planning stage. Realization of these projects will make available a laser of intensity ~10^26 W/cm^2 or even higher. Therefore discussion of nonlinear optical effects in vacuum are becoming urgent for experimentalists and are currently gaining much attention. We show that, in spite of the fact that the respective field strength is still essentially less than E_S=m^2c^3/eħ=1.32•10^16V/cm, the nonlinear vacuum effects will be accessible for observation at ELI and XCELS facilities. The most promissory for observation is the effect of pair creation by laser pulse in vacuum. It is shown that at intensities \gtrsim 5•10^25 W/cm^2 creation even of a single pair is accompanied by development of an avalanchelike QED cascade. There exists an important distinctive feature of the laser-induced cascades, as compared with the air showers arising due to primary cosmic ray entering the atmosphere. In our case the laser field plays not only the role of a target (similar to a nucleus in the case of air showers). It is responsible also for acceleration of slow particles. It is shown that the effect of pair creation imposes a natural limit for attainable laser intensity. Apparently, the field strength ~ E_S is not accessible for pair creating electromagnetic field at all.

Primary author: Prof. NAROZHNY, Nikolay (National Research Nuclear University MEPhI)

Co-author: Dr FEDOTOV, Alexander (National Research Nuclear University MEPhI)

Presenter: Prof. NAROZHNY, Nikolay (National Research Nuclear University MEPhI)

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