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New findings on laser electron acceleration and enhanced multi MeV high intense γ-ray generation at moderate laser intensities

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We report on new findings in laser electron acceleration and high intense bremsstrahlung generation in the multi MeV energy range at moderate laser intensities. The new findings demonstrate the feasibility in terms of applications in the research field of nuclear photonics.

In recent laser matter interaction experiments at PHELIX facility (GSI, Darmstadt) using special foam targets, irradiated at moderate laser intensities of only 10^{19} W/cm^2, we have observed reproducible an enhancement in the production of particles and high intense bremsstrahlung photons concerning number and energy. Electrons with >10 times increasing of the averaged kinetic energy (temperature) and protons with an enhanced Intensity are observed compared to the observations in the same experimental campaign using foil targets irradiated with higher laser intensities of more than 10^{21} W/cm^2. Furthermore, using polymer foam targets combined with different thick metal foils we investigated nuclear reactions in several Isotopes of different elements induced by protons as well as bremsstrahlung photons. For example, multi gamma induced photon-neutron disintegration reactions in gold and tantalum within an energy range of 8 MeV up to more than 30 MeV were observed with a 100 times higher reaction yield and a smaller angular spread at 10^{19} W/cm^2 compared to experiments with conventional targets at intensities of 10^{21} W/cm^2.

The new findings shown the capable feasibility in the realization of laser assisted nuclear physics experiments concerning the investigation of proton and photon induced fission reactions as well as time resolved experiments and nuclear structure physics up to nuclear astrophysics experiments. Therefore, the presented results are promising for applications in the research field of nuclear photonics using high-power pulsed laser systems in the TW range at moderate laser intensities.

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