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Generation of relativistic electronsand gammas in interaction of relativistic laser pulses with plasma of near critical density.

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Experiments on the direct laser acceleration of electrons in long scale plasma of near critical density were carried out at the PHELIX laser facility at GSI, Darmstadt. Low density polymer foam layers of 300-450 um thickness and combination of foams with um up to mm-thin plane metallic foils were used as targets. Analysis of the electron energy distribution by application of the foam layers showed a 10-fold increase of the electron "temperature" from Thot =1-1.5 MeV, measured for the case of the interaction of 1019 W/cm2 laser pulse with a planar foil, up to 12 MeV for the case when the relativistic laser pulsed propagated through pre-ionized by a ns-pulse foam layer. Increase of the electron "temperature" was accompanied by a strong increase of the amount of relativistic electrons and well defined directionality of the electron beam. Using a combination of the foam layers with high Z convertors at the 1019 W/cm2 laser intensity, we measured up to 100-fold increase of the yield of the gamma-driven nuclear reactions Au (gamma, 3n) Au with a x-ray energy threshold beyond 23 MeV compared to the laser shots directly on to convertor foil at 1021 W/cm2 intensity.

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