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Characterizing extreme laser intensities by ponderomotive acceleration of protons from rarefied hydroge[1] A. MAKSIMCHUK, University of Michigan, O. E. VAIS, Lebedev Physics Institute, Dukhov Research Institute of Automatics, Russia, A. G. R. THOMAS, K. KRUSHELNICK, University of Michigan, V. YU. BYCHENKOV, Lebedev Physics Institute, Dukhov Research Institute of Automatics, Russia — A new method to diagnose extreme laser intensities through measurement of angular and spectral distributions of protons directly accelerated by the laser beam focused into a rarefied gas is proposed. This work addresses a range of laser parameters with intensities from 10^{21} to 10^{24} Wcm^{-2}, pulse durations from 15 to 80 fs and focal spot diameters from 1λ to 4λ, where λ =0.8 μm is the laser wavelength. The Stratton-Chu diffraction integrals are used to describe focusing of a laser pulse with different spatio-temporal parameters and the test particle method with relativistic ponderomotive force is used to simulate laser-proton interactions. This approach has allowed us to construct analytical formulas estimating spectral and angular characteristics of the accelerated protons as a function of laser intensity. The proposed method is relaxed in terms of the experimental realization and can be used to accurately compare the results of different extreme intensity experiments with theoretical predictions and with each other. It can be, therefore, valuable for the commissioning of new laser facilities.

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Anatoly Maksimchuk
University of Michigan

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