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Zoom meeting D ：11/4 PM2 (15:45-18:15)
16:00〜16:15

2 つのパルスを用いた高効率な航跡場加速による GeV プロトン生成

#諫山 翔伍 [1)], 蔵満 康浩 [2)], 福田 祐仁 [3)], 陳 仕宏 [4)], 陳 漢偉 [4)], 耀澧 劉 [4)]
[(1 九大総理工,(2 阪大・工・電気,(3 量研関西,(4 台湾国立中央大学

Highly efficient laser wakefiled acceleration to generate GeV energy proton by using dual-laser pulses

#SHOGO ISAYAMA[1)],Yasuhiro Kuramitsu[2)],Yuji Fukuda[3)],Shih-Hung Chen[4)],Han-Wei Chen[4)],Liu Yao-Li[4)]
[(1IGSES,(2GSE, Osaka Univ.,(3QST,(4NCU

The laser-plasma interaction can generate high acceleration fields, which exceeds those of the conventional accelerators by orders of magnitude. Due to this excellent feature of large acceleration gradient, laser-driven proton acceleration possesses high potential to realize the compact high energy proton sources for various applications, including modern cancer therapies [1]. In space plasma, the model of astrophysical wake acceleration, which is driven by the strong Alfvenic pulses emitted by the magneto-rotational instability in the accretion disk, has been proposed to explain ultra-high energy cosmic rays above 10^{18} eV energy of proton and nucleus [2-4]. It has also been found that wakefield acceleration of particles occurs in a relativistic perpendicular shock, where the precursor waves are excited due to the synchrotron maser instability in the shock front, and the wakefields are generated by the ponderomotive force of the precursor waves [5,6]. In laser produced plasma, numerical attempts to produce GeV proton beams have been made [7-11] for the future experiment to investigate underlying generation process of such high energetic particles.

We propose an efficient hybrid acceleration scheme to generate relativistic (˜GeV) protons with using dual-pulses and solid density (SD) and near critical density (NCD) foils in tandem [12]. The acceleration mechanism is the two-stage acceleration process of radiation pressure acceleration (RPA) and laser wakefield acceleration (LWFA), where the injection of relativistic ions into wakefield is controlled by the parameters of the dual pulses. The energetic protons, which are accelerated by the first laser pulse in the first RPA stage, are injected into the NCD plasma. In the second stage, protons are trapped in front of the second laser pulse and accelerated by the laser induced wakefield. Since the second pulse reaches the NCD plasma through the hole of the SD target made by the first pulse, all amount of second pulse energy is used for the second LWFA, resulting in more efficient acceleration compared to the hybrid RPA-LWFA with a single-pulse, where a large amount of pulse energy is reflected by the SD target, resulting in the reduction of the energy used for the LWFA.

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