



Contribution ID: 33

Type: Talk (remote)

Development of laser wakefield acceleration driven by few-TW pulses in a sub-mm, dense nitrogen gas target

Wednesday, 12 April 2023 14:20 (20 minutes)

Laser wakefield acceleration (LWFA) driven by few-TW laser pulses in a thin, dense nitrogen gas target represents a favorable approach for stably generating 10-MeV-scale electron beams with satisfactory beam properties. With a high plasma density $> 10^{19} \text{ cm}^{-3}$, the self-focusing effect and the self-modulation instability developed on the pump pulse consequently cause a strong laser intensity to drive nonlinear plasma waves for acceleration, while the free-running ionization-induced injection from the ionization of nitrogen N^{5+} and N^{6+} ions can substantially enhance the energy and charge stabilities of output electron beams. To explore the performance of few-TW LWFA, we created sub-mm nitrogen gas cell and gas jet for interacting with 800-nm, 40-fs laser pulses having a moderate peak power of 1 TW; whereby, electron beams with primary energies scaling up to 10 MeV and a high charge in excess of 50 pC can be routinely generated when an appropriate atom/plasma density in the target and an optimal focal position of the pump pulse were assigned. The output beams showed a typical beam divergence $< 40 \text{ mrad}$ and the pointing fluctuation of them were estimated to be $\sim 15 \text{ mrad}$, accordingly. This scheme exhibits a high potential for generating 10-20 MeV electron beams with an on-target pulse energy less than 50 mJ, from which a high average beam current up to tens of nA can be realized in future development of high-repetition-rate LWFA driven by kilohertz-class laser systems.

Speaker's Title

Prof.

Speaker's Gender

Man

Speaker's Preferred name (if any)

Ming-Wei Lin

Speaker's Pronouns

He/Him

Speaker's Name

Ming-Wei Lin

Primary author: Prof. LIN, Ming-Wei (Institute of Nuclear Engineering and Science, National Tsing Hua University)

Co-authors: Mr LAI, Po-Wei (Institute of Nuclear Engineering and Science, National Tsing Hua University); Mr TRAN, Danh Khoa (Institute of Nuclear Engineering and Science, National Tsing Hua University); Prof. CHOU, Shao-Wei (Department of Physics, National Central University); Prof. CHU, Hsu-Hsin (Department of Physics, National Central University); Prof. CHEN, Shin-Hung (Department of Physics, National Central University); Prof. WANG, Jyhpyng (Institute of Atomic and Molecular Science, Academia Sinica)

Presenter: Prof. LIN, Ming-Wei (Institute of Nuclear Engineering and Science, National Tsing Hua University)

Session Classification: Room 2 (Conferece Room)

Track Classification: WG4: Innovative accelerator techniques