3P-17

Cone-guided laser driven ion acceleration and electric and magnetic field measurements for fast-ignition laser fusion

イオン加熱レーザー核融合高速点火に向けた コーンガイドイオン加速の効率化と電場・磁場評価

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We investigate laser-driven energetic ions in the interaction of kilojoule multi-picosecond high intensity laser pulse with a cone target as a study for fast ignition of inertial fusion initiated by laser-driven ion beams. We show that electric and magnetic fields are induced inside the cone in the interaction, and measure the fields using proton deflectometry technique.

1. Introduction

Fast ignition by laser-driven ion beams has been proposed as an alternative to the standard electron fast ignition scheme. Ion-driven fast ignition (IFI) offers several advantages, such as generation of collimated beams, and high laser-to-ion conversion efficiency.

The IFI scheme assumes that the ion beams are generated from the foil target located inside the gold cone. In this study, we have investigated the laser-driven ions accelerated from the cone target. Besides, we have measured spatial and temporal profiles of electric and magnetic fields induced around the cone target using proton deflectometry technique.

2. Ion acceleration experiment

Ion acceleration experiments were performed using LFEX laser in Osaka University [1][2]. The laser pulse with ~1kJ in 2 ps was focused onto the CD (deuterated polystyrene) foil attached to the Au cone (cone target), and the CD foil for comparison.

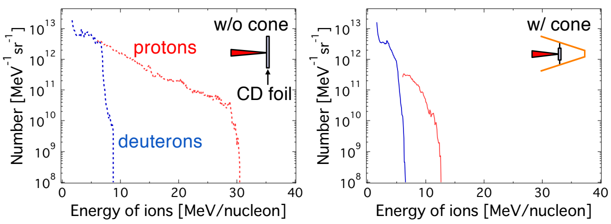

Fig.1 Energy spectra of laser accelerated ions from (left) CD foil, and (right) CD foil with cone

As shown in Figure 1, the number and energy of accelerated ions were decreased for the cone target. However, the protons greatly decreased in energy, while deuterons did not decrease so much. It is assumed that electric and magnetic fields were induced inside the cone and they bent the trajectory of ions.

3. Proton radiography experiment

In order to assess the electric and magnetic fields inside the cone mentioned above, we conducted experiments using proton deflectometry technique.

The proton radiography experiments were performed using LFEX laser. An intense laser pulse with ~350 J in 1.5 ps was focused onto the CD (deuterated polystyrene) foil attached to the Au cone. The proton beam was generated by another intense laser pulse, which had the energy of ~350 J in 1.5 ps, in the interaction with a 10-μm-thick Al foil. Two-dimensional spatial profile of the proton beam was recorded with a multilayered radiochromic film (RCF) with filters.

In the presentation, we report the result of the experiments in more detail.

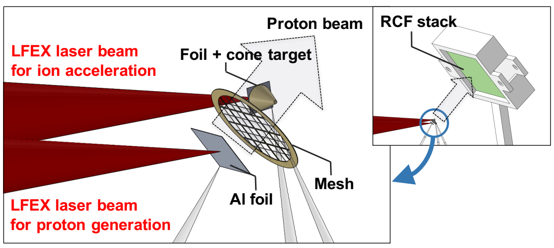

Fig.2 Proton radiography experiment

Acknowledgments

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Reference

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[2] Yogo, A. et al. Sci. Rep. **7**, 42451 (2017).