

4 - 21 Experimental Characterization of the Electron Beam Focusing Effect Induced by Plasma Current in Opposite Directions*

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In order to observe the oblique two-stream instability (OTSI) phenomenon, the experiment is currently underway at the High Energy Electron Radiography (HEER) platform at the Institute of Modern Physics (IMP), Chinese Academy of Sciences by employing a gas-discharge plasma target with two 7.8 cm-long collinear quartz tubes. Such a long target is conducive to the observation of OTSI. And the simulation based on experimental parameters has been completed^[1]. We first use a low-charge electron beam to diagnose the applicability of the platform and study the transport process of the beam. The beam is first accelerated by the accelerating tube up to 50 MeV and then passes through the gas-discharge plasma target, with the current up to 1.5 kA flowing in opposite directions in either of the two tubes. In such plasma current configuration, the electron beam is defocused in the first tube and focused in the second one. With symmetric plasma currents, the asymmetric focusing effects are however induced on the beam transport process and the beam radius is reduced by a factor of 2.6 compared to that without the plasma, as shown in Fig. 1.

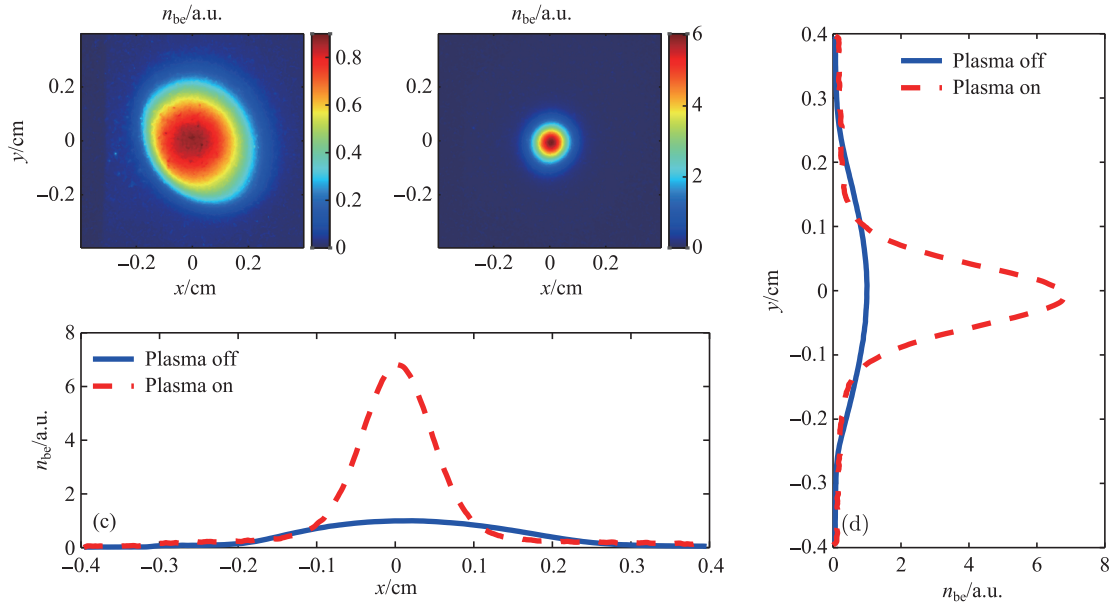


Fig. 1 (color online) The beam spot measured on the first screen downstream of the plasma target with the discharge turned off ($\sigma_r = 1.25$ mm, (a)). When turned on, it is $I_{pe} \approx 1$ kA at $5.7 \mu\text{s}$ delay ($\sigma_r = 478.6 \mu\text{m}$, (b)). The horizontal (c) and vertical (d) bunch envelopes report the transverse projections of (a) and (b). The beam energy is 50 MeV.

Reference

- [1] H. L. Li, Z. H. Hu, Q. T. Zhao, et al., Phys. Plasma, 29(2022)052101.

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