Interferogram analysis of X-pinch plasmas using lens-pair configuration and synthetic dark-field Schlieren image

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The wire core region of X-pinch plasmas has very high electron densities even comparable to solid density within a few millimeter scales [1]. Although a Mach-Zehnder interferometer imaging system is developed to diagnose the two-dimensional line-integrated electron density of X-pinch plasmas, Its analysis is quite challenging because of the stiff electron density gradient. There are mainly two factors that make interferometer analysis difficult. One is significant refraction losses and the other is complex fringe patterns may lead to misjudgment of fringe numbering. To obtain electron density information in such high electron density gradient regions, lens-pair configuration is adopted to increase the acceptance angle of the imaging systems. Synthetic dark-field Schlieren images are qualitatively compared to simultaneously taken actual dark-field Schlieren images to detect misjudgment of fringe numbering. We present the experimental results of lens-pair configuration and a method to generate synthetic dark-field Schlieren images from interferograms. The practicality and limitations of lens-pair configuration and synthetic dark-field Schlieren comparison are also discussed.

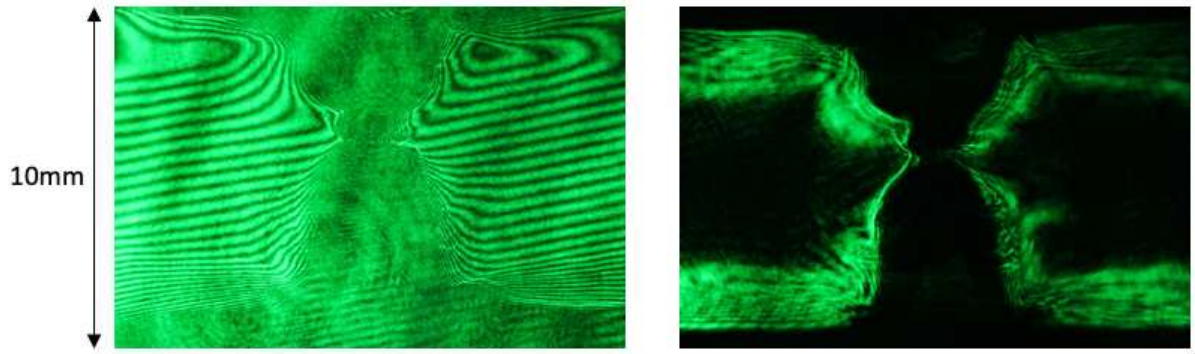

Figure 1. An example of simultaneously taken Interferogram (left) and dark-field Schlieren image (right) of the 25 um Cu from an X-pinch plasma.

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[1] Pikuz, S. A., Shelkovenko, T. A., & Hammer, D. A. (2015). X-pinch. part i. Plasma physics reports, 41, 291-342.

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