DEVELOPMENT OF THE FARADAY ROTATION DIAGNOSTIC AT THE WAVELENGTH OF 266 NM

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A Faraday rotation diagnostic at the wavelength of 532 nm was used for the investigation of magnetic fields in wire arrays at the 1-MA Zebra generator [1]. Magnetic fields were observed in the precursor of cylindrical wire arrays, imploding plasma, and stagnated Z-pinches. Unfortunately, 1-MA stagnating pinch is opaque at the wavelength of 532 nm and the Faraday Effect can be observed only on the boundaries of the Z-pinch with strong plasma gradients. To calculate the magnetic field with the Faraday rotation angle a measurement of the electron plasma density is needed. Interferometry can be applied to the trailing mass but the body of the pinch is not transparent. For these reasons a structure of the magnetic field in the Z-pinch cannot be studied with regular laser probing at 532 nm. Laser probing at the wavelength of 266 nm provides a better opportunity for an investigation of the Z-pinch. Bremsstrahlung absorption and refraction from plasma gradients are significantly lower at 266 nm compared to 532 nm. Interferometry at 266 nm can derive an electron plasma density of $>5\cdot10^{19}$ cm^{-3}. Faraday rotation is lower at the wavelength of 266 nm but a rotation angle of 7-10º is still expected with typical parameters of the Z-pinch plasma in the Zebra generator. The issue of this diagnostic is the weak Faraday signal which needs to be separation from UV self-radiation of the 1-MA Z-pinch. The Faraday rotation channel at the wavelength of 266 nm was designed and tested for the Zebra facility. The optical scheme of the polarimeter includes a Faraday channel, shadowgraphy, and air-wedge shearing interferometer. The results from testing the polarimeter are presented. A detailed investigation of magnetic fields and current distribution in the Z-pinch will help to better understand the mechanisms of plasma heating and x-ray generation.

1. V. V. Ivanov, G. S. Sarkisov, P. J. Laca et al., IEEE Trans. Plasma Sci. 34, 2247 (2006).

Work was supported by the DOE/NNSA under UNR grant DE-FC52-06NA27616.