PPPS 2019



Contribution ID: 1026

Type: Poster

4P64 - Zeeman Spectroscope Studies in Ar Gas Puff Z-Pinches on 1-MA COBRA*

Thursday 27 June 2019 16:00 (1h 30m)

The Zeeman splitting of visible spectral lines is measured to infer the magnetic field and current profiles in gas puff z-pinches. In high current (>1MA) z-pinches, the plasmas are highly ionized and most of the emitted photos are in XUV or x-ray region. It is difficult to apply the Zeeman splitting spectroscopy there because there are not many detectable visible lines. We have identified several spectral lines for the Zeeman splitting measurements in Ar gas puff z-pinches. These are 5174 and 5193Å from Ar VIII 4d-4f transition, 5801.3 and 5812.0Å lines from C IV 3s-3p transitions, and 5696.6 and 5722.7Å line from Al III 4s-4p transitions. Using a triple-nozzle gas puff z-pinch on COBRA, we observed Zeeman splitting of the Ar VIII and C IV lines about 15 ns before the pinch time. Gas puff z-pinches imploding onto an Al wire will be also investigated. Using the Zeeman spectroscopy, the radial current distribution between the wire and gas puff can be inferred. In the experiments, the emitted light from the plasma is focused on to arrays of optical fibers. Each fiber views a different chord in the plasma. The emission vs. chord light is disbursed by a 0.75M imaging spectrometer and the spectra are recorded by an ICCD camera. The spatially resolved doublet line-profiles of Ar, C or Al are captured for each shot. A de-convolute model for the spectrum is used to deduce the Zeeman shifts and the current in the plasma.

Using suitable polarization optics, the spectrum of the right σ + and left σ - circularly polarized Zeeman components are separately recorded and the π component are removed. At a field of 10T, Zeeman splitting between the red and blue shifted spectral features is about 5Å, while the instrument resolution is <0.5Å. Details of the experiments will be presented.

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Session Classification: Poster - Charged Particle Beams and Accelerators and High Energy Density Plasmas and Applications

Track Classification: 4.6 Fast Z Pinches