Magnetic reconnection in a semi-collisional regime.

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Magnetic reconnection is a phenomenon which is of great interest to many researchers because of both its application to astrophysical situations and potential effects within hohlraum geometries. Laser-solid interactions allow a reconnection region to be generated in between laser spots, as previously investigated by several different laser experiments [1, 2, 3]. However, experimental verification of the mechanisms within the interaction region has remained elusive. This experiment produces a semi-collisional environment in which the importance of anisotropic pressure effects in mediating the reconnection process is demonstrated.

The Orion laser facility was used to perform a two, long-pulse beam experiment, with probing of the reconnection region using both protons and an optical probe. Field strengths can be extracted from results and with the support of modelling and analytical techniques the evolution and redistribution of the fields can be observed. Novel targets were used to allow for easier probing in multiple directions, allowing for a more detailed 3D projection to be built up of the interaction. Simulations were performed using IMPACTA [4, 5] and shown to support the experiment, demonstrating anisotropic pressure effects dominating the reconnection region field dynamics. Other diagnostics such as gated X-ray spectrometers and imagers were also fielded on the experiment, yielding temperature measurements of plasma conditions within the regions of interest.

References

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