Laser-Driven Low-beta Magnetic Reconnection

Jiayong Zhong
Department of Astronomy, Beijing Normal University, Beijing100875, China

Magnetic reconnection is at the core of many dynamic phenomena in the universe, including solar flares, geomagnetic substorms, and tokamak disruptions. Magnetic field lines may break and reconnect rapidly when twisted and sheared, converting magnetic energy into heat and kinetic energy. We report here a group of low beta magnetic reconnection experiments with a millimeter plasma device, which can deliver around 100T magnetic fields with SGII and SGII-U intense lasers, respectively. With optic, X-ray and proton backlights we identify the magnetic separatrices, diffusion regions, and plasma flows associated with reconnection and show they are in rough agreement with established reconnection theory. The electron energy spectrum is also measured at the outflow direction, which shows a typical power law and the spectral index is much flatter than those of laser driven magnetic reconnection in high beta plasmas.

References

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