The study of unconventional boundary driven mechanism for generating magnetic field

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Conventional mechanisms for generating long scale magnetic field in plasma either involve anisotropy in momentum distribution of plasma/beam flows or it involves evolution of seed magnetic fields i.e. Biermann Battery effect. Recent studies have shown an unconventional mechanism for the generation of magnetic fields which is associated with the finite boundary of the electron beam/laser pulse[1]. The long scale magnetic fields through this mechanism are found to get generated at very early times, i.e. much before the onset of any other well known instability. The signature of long scale magnetic fields at sub-ps time scales have also been found in experiments[2]. Using PIC simulations in OSIRIS4.0 framework we will present a detailed characterization of this unconventional mechanism. By choosing various beam profiles we show that the choice of abruptly sharp beam profile is not necessary for this mechanism to be operative. We also demonstrate that this mechanism proves efficient towards at leading a state where the magnetic field and kinetic energy are closer towards equipartition levels.

References

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