Laboratory studies of magnetic reconnection: How can they be applied to CT research?

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Magnetic reconnection is a fundamental process in nature in which magnetic field lines change their topology in plasma and convert magnetic energy to particles by acceleration and heating [1]. It is one of the most fundamental processes at work in laboratory and astrophysical plasmas. For local aspects, we have recently reported our results on the energy conversion and partitioning in a laboratory reconnection layer [2]. A systematic study of the quantitative inventory of converted energy within a reconnection layer is presented with a well-defined, variable boundary. This study concludes that about 50% of the inflowing magnetic energy is converted to particle energy, 2/3 of which is transferred to ions and 1/3 to electrons. A question arises, whether there is a fundamental principle in the energy partitioning in a proto-typical reconnection layer. This talk presents our physics analysis of the energy conversion processes in the magnetic reconnection layer of two-fluid physics regime. The flows of electrons at the reconnection layer lead to a formation of strong electrostatic field in the reconnection plane causing ion acceleration and resultant ion heating. Based on the two-fluid features, a quantitative analytical model of energy partitioning will be presented. In this talk, we focus on a few laboratory experiments recently carried out regarding both local and global aspects of magnetic reconnection and discuss how the results should be applied to CT research.

[1] M. Yamada, R. Kulsrud, and H. Ji, Rev. Mod. Phy. **82**, 603 (2010).
[2] M. Yamada et al. Nat. Commn. **5**, 4474 (2014)