

MAGNETIC RECONNECTION IN SPACE AND LABORATORY PLASMAS AND ITS IMPLICATION IN TOKAMAK PLASMA CONFINEMENT

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Abstract

Magnetic reconnection is the topological restructuring of magnetic field lines in high temperature plasmas. The aim of this paper will be to describe the fundamental physics of magnetic reconnection and discuss the various MHD models to describe magnetic reconnection. Magnetic reconnection as observed in both space plasmas and laboratory plasmas results in significant changes in kinetic and thermal properties of the plasma. This inherently deteriorates the ability to confine plasma in the laboratory. The second part of this paper will describe the fundamentals of sawtooth instabilities triggering magnetic reconnection in tokamak plasma devices. Due to the undesirable effects of magnetic reconnection in laboratory plasmas, several techniques have been developed to control sawtooth instabilities. The efficacy of these techniques to include current drive schemes and ion population control will be discussed.

1 Reconnection Defined

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1.1 What is Reconnection

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1.2 Where Does Reconnection Occur

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1.3 Why is Reconnection Bad