

F1A: Targeted Outcome to Capabilities to Implementation

Targeted Outcome: Phase 2005-2015, Opening the Frontier
Characterize magnetic reconnection at the Sun and the Earth

Required Understanding

What mechanisms lead to onset of reconnection?

What are the mechanisms and regions of particle acceleration within the reconnection geometry?

To elucidate the role of microphysics, meso-scales, global topology and cross-scale coupling in reconnection

What instabilities lead to global effects?

Where are the reconnection regions and what is their topology?

Enabling Capabilities & Measurements

Observations of solar wind conditions near 1 AU to provide information on drivers of geospace reconnection

High resolution imaging multiple wavelengths to measure dynamics of magnetic fields from photosphere through corona

In situ electron and ion temporal-scale particle distributions, and 3d fields from quasi-static to electron plasma frequency within reconnection regions on satellite clusters with variable spacing from few km to 100s km

New simulation techniques to incorporate microphysics into large-scale systems to enable modeling of complete reconnection process, including cross-scale coupling and large scale topology

Complementary missions to study precursors or results of reconnection

Implementation Phase 1: 2005-2015

Prime STP mission

MMS

To fully resolve microphysics and cross-scale coupling processes of reconnection using in-situ at the Earth's magnetosphere relevant to reconnection throughout cosmos

Explorer Candidates

Solar mission – To determine/study small-scale signatures of magnetic reconnection at the Sun

Other Agencies

L1 Monitor - to provide solar wind conditions

Auroral Imaging - to monitor substorm onsets and energy dissipation

Theory/Modeling

To apply insights obtained from in situ observations of geospace reconnection to large scale simulations to enable predictive capabilities at the Sun and Earth

THEMIS -substorm dynamics
Solar B -solar magnetic fields
STEREO-CMEs
RBSP-particle acceleration
SDO -solar magnetic variability and large scale, global magnetic structure leading to reconnection