# Magnetic Field Diffusion During the CME-Magnetosphere Interaction with Cluster Measurement on 6 November, 2001

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Intense geomagnetic storms are usually caused by the CME-magnetosphere interaction. Up to now there are only very few in situ measurements with respect to the details of interactions of interplanetary CME, ICME and magnetosphere. In this paper we report such a fortuitous observation made by Cluster four spacecraft. At 16:35 UT on Nov. 4, 2001 LASCO/SOHO observed an Earth-direction halo CME. The associated ICME caused an intense magnetic storm with Dst$<$-300 nT on Nov. 6-8, 2001. During the process of ICME-magnetosphere interaction since 01:54 UT on Nov. 6, the Cluster spacecraft located near in the near-tail dawn magnetopause ((-9.6, 15.0, 2.2)Re in GSM coordinates) more than five hours, meandering back and forth four times between the ICME and the magnetosphere. The constellation observed part process of the interaction between the ICME and the flank of magnetosphere.

During the magnetopause inbound crossings after 02:26 UT, the plasma temperature, hot ion density and fluxes of energetic ionsalways varied sharply; but the magnetic field varied continually and smoothly and almost kept the order of 100 nT. The primary analysis shows that the large magnetic field structures are generated by the reconnection between ICME and magnetosphere and move anti-sunward with the solar wind driving. It is very surprised that in this event, contrary to the usually magnetic frozen-in frame, the Cluster data shows that most part of the large magnetospheric magnetic field come from the ICME via magnetic diffusion in more than about half hours. We estimated the time scale of magnetic diffusion and the effective plasma conductivity based on the magnetic field differences of the Cluster four spacecraft. Usually the magnetosheath field is smaller than the magnetospheric field. But in this event the CME field is one order larger than the magnetospheric field. The magnetic diffusion is important because that the amplitude of the input magnetic energy from the ICME into the magnetosphere is unusually large, and it also gives some new clues on the primary physical process of CME-magnetosphere interaction.