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Science Objectives of the Solar-C(EUVST)

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Magnetic reconnection has been discussed as one of the important mechanisms for heating and bulk acceleration in astrophysical plasma, because the magnetic field energy can be rapidly released to the plasma during reconnection. One of the major aspects of magnetic reconnection is the rapid energy con- version of stored free magnetic energy to kinetic energy, thermal energy, non-thermal particle energy, and wave/turbulence energy. This energy conversion is fundamental and essential to the understanding of the dynamical behavior of plasma, not only in the solar atmosphere but also in Earth's magnetosphere, in the laboratory, or in other astronomical objects. One of the goals for studying magnetic reconnection is to understand how much energy is converted toward plasma and what happens afterward. To answer this question, it is essential to observe the entire energy conversion in magnetic reconnection on a large scale continuously. The solar atmosphere is an excellent space laboratory for magnetic reconnection because of the observability of its magnetic reconnection on a large scale.

One of the most famous phenomena associated with magnetic reconnection is the solar flare. Modern telescope observations have confirmed many typical features expected from the magnetic reconnection model. On 2006 the *Hinode* spacecraft was launched (Kosugi et al. 2007), and after first light *Hinode* has been revealing many new solar flare aspects. The recent observation of magnetic reconnection in solar corona confirms many phenomena related to the magnetic reconnection. On the other hand, there is not enough observational knowledge of the physical parameters in the reconnection region itself. The inflow into the reconnection region, the temperature of the plasma in the reconnection region, and the fast Alfvenic flows predicted by reconnection have not been quantitatively measured sufficiently. *Hinode* and/or the *Solar Dynamics Observatory* (*SDO*) may provide some answers if solar cycle 24 ever produces a solar maximum. However, it is important to discuss why most observations cannot detect the predicted flow or temperature in the reconnection region. One of the reasons why we cannot observe inside the magnetic reconnection region is its darkness. Generally, we can see the bright cusp-like structure during the solar flare, although the reconnection region, which might be located above the cusp-like structure, is faint. Recently, Imada et al. (2011) have pointed out that ionization cannot reach equilibrium in the magnetic reconnection region because of its fast flow and rapid heating. Actually, the timescale for ionization (~100 s) is comparable to the Alfven timescale (~100 s) in the magnetic reconnection region. The reconnection region might be much fainter than we expected in some cases. Therefore, it is important to consider the time-dependent ionization process when we interpret the observation of the magnetic reconnection region.

Now in the solar community are preparing to launch the new satellite. Solar-C(EUVST) (EUV High-Throughput Spectroscopic Telescope) is designed to answer how stellar plasma are created and evolve, and how the Sun influences the Earth and other planets in our solar system. The proposed mission is designed to comprehensively understand the energy and mass transfer from the solar surface to the solar corona and interplanetary space, and to investigate the elementary processes that take place universally in cosmic plasmas. The two primary science objectives for Solar-C_EUVST are : I) Understand how fundamental processes lead to the formation of the solar atmosphere and the solar wind, II) Understand how the solar atmosphere becomes unstable, releasing the energy that drives solar flares and eruptions. Solar-C_EUVST will, A) seamlessly observe all the temperature regimes of the solar atmosphere from the chromosphere to the corona at the same time, B) resolve elemental structures of the solar atmosphere with high spatial resolution and cadence to track their evolution, and C) obtain spectroscopic information on the dynamics of elementary processes taking place in the solar atmosphere. In this talk, we will first introduce the science targets of the Solar-C_EUVST, and then discuss in detail the topics related to the magnetic reconnection such as hot plasmas in magnetic reconnection region.

References

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