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# Observational study of the solar activity toward the research of the space environment for life

Kiyoshi Ichimoto[1*]

[1]Kwasan and Hida Observatories, Kyoto Uni

The solar plasma is highly magnetized and reveals various types of active phenomena that govern the interplanetary space environment. The sunspots, which are the most distinguished manifestation of the solar magnetic field, form active regions to produce eruptive phenomena causing vital disturbances in the interplanetary space. Sunspots are also associated above them with hot and dense corona that emits strong X-ray and UV radiations to give a significant influence on highest atmosphere of the earth. The presence of the hot solar corona and solar wind, and especially their temporal fluctuation, affect the geospace conditions in dramatic way. In explosive events like flares, high energy particles are ejected into the interplanetary space and occasionally they cause a significant impact on artificial satellites and astronauts. Thus the sun affects our environment and human life through electromagnetic radiations, high energy particles and plasma flows. Understanding the basic mechanism of sun's activity and prediction of their occurrence with a wide range of time scale; from seconds to billion years, are the key subject of the space weather study.
After the successful launch in 2006, Hinode has revealed a new dynamic view of the Solar atmosphere; the sun is filled with small scale transient magnetic fields, waves, ubiquitous magnetic reconnections and tiny plasma ejections into the corona. These observations strongly suggest the importance of the dynamics of the chromospheres, ie., the interface region between photosphere and corona, for the presence of outer solar atmosphere and creation of the active phenomena causing the impact on interplanetary space.
Taking into account the current situation of the solar study, we suggest the next direction of the observational study of the sun toward the research of the space environment for life as twofold; one is a microscopic approach in which we make precise diagnostics of small scale phenomena in chromosphere to identify and understand the physical nature of the elementary plasma processes. The other is a macroscopic approach in which we observe the entire sun over the full time coverage to capture any explosive events taking place on the sun and to make very precise measurement of the global solar magnetic field and flows to understand the property of the solar dynamo. Both approaches are highly complementary with the Hinode. To this end, we plan to build a high precession polarimeter with image stabilizing system on the Domeless Solar Telescope (DST) to study the elementary plasma processes, and equip high precession wide field magneto-Dopplergram on the SMART telescope to study the global feature of the solar magnetism at the Hida Observatory. We will also coordinate the world-wide network (CHAIN) for observing explosive events in H-alpha with full spatial and time coverage to establish a basic dataset for the space weather study. Research and development for the future solar mission, the Solar-C, is another task of the solar research subgroup.

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