High resolution solar physics with Solar-B

Saku Tsuneta[1]

[1] NAOJ

Solar Optical Telescope (SOT) aboard Solar-B satellite provides us with continuous (24hrs), high cadence, diffraction-limited (0.2”) stable images with fully-calibrated high polarimetric sensitivity. With SOT, we are able to reach (or be closer to) the Promised Land of solar magneto-hydrodynamics, where elemental magnetic fields, higher convective flows, higher electric-currents, sharp distribution of magnetic and non-magnetic atmospheres, various forms of MHD waves interplay each other. For instance, the Yohkoh and TRACE images show spatially-exclusive hot and cool quasi-steady loops. With groundbased telescopes, we found clear difference in magnetic filling factor, which was aerial fraction of magnetic atmosphere, between hot and cool loops (Katsukawa and Tsuneta, 2004). With Solar-B, introduction of the filling factor is no longer needed, and is replaced with observations on real interactions of flow and fields, the result of which would be coronal heating. Parker proposed that coronal heating is due to reconnection of magnetic fields entangled by photospheric motion. Whether this concept is true or not will be observationally answered by the long-term stable Lagrangian tracking of individual magnetic elements (and G-band bright points) from its creation through disappearance.

Demography of magnetic elements with different origins such as diffused fields and ephemeral fields would be interesting. Direct detection of various MHD waves from the high time-resolution polarimetric signals is within our reach, and high-frequency MHD waves, if any, may be useful for coronal heating. There are indeed many issues related to emergence and disappearance of sunspots: What is the role of convective collapse (Parker) and flows for the formation of pores and sunspots? Leighton-type diffusion may start with detached spine fields of penumbra in a form of isolated co-polarity MMFs. What is the role of initial inflow and subsequent outflow in the moat region (region around sunspots) for the formation and disintegration of sunspots? What is the sub-surface magnetic and flow configuration leading to flux emergence and eventual disintegration? What makes such a spectacular flute structure of penumbra? Solar-B will be launched on August, 2006. Current status of the mission preparation is excellent due to hard work of the international Solar-B team including NASA and UK PPARC over 5 years. I will also briefly introduce the onboard instruments, and report mission status with emphasis on SOT.