Initial Results from Hinode

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The Hinode (Solar-B) satellite, the successor of Yohkoh (Solar-A), was successfully launched on 23 September 2006. Hinode is a Japan-US-UK joint project with contributions for downlink connections from ESA. The mission focuses on high resolution optical imaging with magnetography, coupled with X-ray imaging and XUV spectroscopy. The three primary instruments on Hinode are

(1) solar optical telescope/magnetograph (SOT),
(2) soft X-ray telescope (XRT), and
(3) extreme ultraviolet imaging spectrometer (EIS).

SOT is a 50cm-diameter telescope with a resolution of 0.2 arc sec, and for the first time we are able to study the emergence and evolution of magnetic fields in the finest scale ever observed. XRT is an upgrade of Yohkoh/SXT with higher spatial resolution (1 arc sec pixel size) and broader temperature response. EIS observes spectra of various ions in the transition region and in the corona. Through coordinated observations of the solar atmosphere using these instruments, it is expected that Hinode will bring major breakthrough to the study of many topics in solar and astrophysics. The most important topic among them would be the coronal heating mechanism.

The heating mechanism of the outer atmosphere of the sun and stars is one of the fundamental problems in astrophysics. It is generally agreed that the heating mechanism of the solar corona is ultimately related to the magnetic fields in the solar atmosphere. The models are broadly divided into two categories. In one class of models, waves are assumed to carry kinetic/magnetic energy to the corona and then dissipate there. Recently our knowledge on the waves in the corona has greatly advanced by observations from space and from the ground. Another class of models assumes that the corona is heated by an aggregate of small-scale, flare-like explosions. It is appealing in the latter model that a single, common mechanism may explain both flares and coronal heating. However, so far it is claimed that the number of small-scale events is not enough to provide the required energy input. Hinode is able to observe the driving motion on the photosphere and its response in the upper layers with an unprecedented resolving power, and will find vital clues in disentangling the problem of coronal heating mechanisms.