Hinode/SOHO Observational Plan

Title1:

Checking the possible drives of solar wind origin in the coronal hole

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Short title: Drives of SW in CH
List of instruments and spacecraft:
XRT/HINODE, SOT/HINODE, EIS/HINODE, SUMER/SOHO

Science Objective:

Tu et al. (2005, Science, 308, 519) suggested a scenario of solar wind origin in the coronal funnel with energy and mass being delivered through underlying magnetic reconnection between open magnetic funnel and closed magnetic loops. The data analysis in (Tu et al., 2005) is restricted to 25 Mm, at which height Ne VIII emits, due to lacking observations of the coronal above 25 Mm. Thus, it is still unclear whether or not the outflow in the transition region maintains moving upward in the corona. It is needed to reveal the flow information in the corona above the upper transition region. One important scientific objective of EIS is analyzing flow field in the corona through spectroscopic scanning. SUMER and EIS together provide us an excellent opportunity to obtain a complete physical picture of solar wind origin from the chromosphere to the corona.

In Tu et al (2005), the drive supporting the solar wind outflow is assumed to come from the supergranular convection on the photosphere. However, the detailed supergranular convection around the strong Ne VIII blue-shifts (the proxy of solar wind outflow) has not been presented. The supergranular convection causes the motion of magnetic elements on the photosphere, which can be derived from temporal variation of magnetograms. Therefore, SOT is required to measure the photospheric magnetogram with a high spatial resolution and high cadence for the purpose of derivation of the supergranular convection around the strong Ne VIII blue-shifts and reconstruction of magnetic field structure. Another possible alternative drive of the solar wind is supposed to be the p-mode oscillations with period ranged in [150, 350] s, which may produce low-frequency Alfvenic wave propagating upward [De Pontieu et al., 2007, Science, 318, 1574]. Nevertheless, it is unclear whether the strong p-mode oscillations are connected with the strong Ne VIII blue-shifts, which is an important implication of correlation between the solar wind origin and p-mode oscillations. Therefore, we need SOT to observe the photospheric Dopplergram with a high spatial resolution and high cadence in order to check the connection between the strong p-mode oscillation and the strong blue-shift of transition emission lines.

Target:

The instruments are operated to pointed at a low- or mid- latitude CH with an area of about 250”x300”. The imaging or scanning lasts for about 3 hours and 30 minutes.

Request to instruments:

Request to SUMER:

Slit: 300”x1”
X=250”; 1” steps
Exposure time: 50 sec
Duration: 210 min
Spectral window: 756~800 Å (970 spectral-pixels), which contains various distinguishable lines formed over a wide range of temperatures, e.g. O II (3.2x10^4, 796.66 Å), O IV (1.6x10^5 K, 787.72 Å, 790.11/790.19 Å), O V (2.5x10^5 K, 758.68 Å, 760.43 Å, 761.99 Å), N III (7.9x10^4 K, 763.33 Å, 764.36 Å), N IV (1.3x10^5 K, 765.15 Å), Ne VIII (6.3x10^5 K, 770.42 Å, 780.30 Å), and S V (1.6x10^5 K, 786.47 Å). The recording of each line is assigned with at least 70 spectral-pixels.

Request to EIS:
Slit: 512”x1”
Scan: 250”; 1” steps
Exposure time: 50 sec
Duration: 210 min
Line list: COMSCI_LL_QS1, which contains strong coronal lines, e.g. Fe X (1.0x10^6 K, 184.41 Å), Fe XI (1.3x10^6 K, 188.23 Å), Fe XII (1.3x10^6 K, 195.12 Å), Fe XIII (1.6x10^6 K, 202.04 Å, 203.83 Å).

Request to SOT:
High resolution Dopplergram, magnetogram and intensity
Spatial resolution: 0.08”/pixel
FOV: 328”x164”
Cadence: 0.5 minute

Request to XRT:
Routine observation in the time range selected for the purpose of identifying a proper low- or mid-latitude coronal hole on the solar disk;