2. Coronal bright points in quiet Sun and coronal hole

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Short title: BPs in QS and CH

List of instruments and spacecraft:

TRACE, XRT/HINODE, SOT/HINODE, EIS/HINODE, SUMER/SOHO, MDI/SOHO

Science case:

The energization of BPs is considered to result from the interaction between two magnetic fragments with opposite polarities, which can lead to magnetic reconnection and local heating of the plasma (e.g. Priest et al. 1994, ApJ, 427, 459; Axford et al. 1999, Space Science Reviews, 87, 25; Von Rekowski et al. 2006, A&A, 366, 125), or the energy is to be supplied by the heating in current sheets induced by photospheric motions (Büchner et al. 2004, ESA SP-575, p. 23).

The density diagnostics, mass flow and possible wave signatures in bright point regions, which are very important to understand the origin and acceleration of solar wind as well as coronal heating, have not been well investigated. Habbal et al. (1990, ApJ, 352, 333) compared the observational properties of BPs in a coronal hole with those in a quiet Sun region and concluded they behave similarly. However, the images they used have a low spatial resolution of 5”. They also found the intensities of BPs show variability with no regular periodicity, while Ugarte-Urra et al. (2004, A&A, 418, 313) found that oscillatory behaviour was present in two bright points observed in a coronal hole. Ugarte-Urra et al. (2005, A&A, 439, 351) measured the electron densities for six BPs observed in a quiet Sun region by using the method of line ratio diagnostics and suggested that BP plasma has similarities to active region plasma. Madjarska et al. (2003, A&A, 398, 775) found the Doppler shift in a bright point region is in the range of −10 to 10 km/s and shows no relation to explosive events. Xia et al. (2003, A&A, 399, L5) found BPs in a coronal hole correspond to no or small blue shift of Ne VIII.

In this study, we aim at investigating the properties of BPs in coronal hole as well as in quiet Sun at high temporal and spatial resolutions. Simultaneous observations of SOHO, HINODE and TRACE are suggested. TRACE will observe a coronal hole and a quiet-Sun region. Images of Fe XII and Fe IX can help us to identify BPs and tiny coronal loops consisting of every bright point. The data of C IV and continuum will be used to study the chromospheric counterparts. They can also record possible oscillation signatures. The evolution of the underlying magnetic fluxes should also be studied by using high-rate MDI magnetograms and vector magnetograms of SOT/SP. High temporal-resolution XRT images will record microflares related with BPs and can also be used to study the X-ray counterparts of EUV BPs. By using the filter-ratio method, the images of XRT can also help us estimate the physical properties of the plasma. SUMER and EIS can scan the two regions by using several lines with different formation temperatures, in order to derive the velocity field and electron densities of BPs at different heights above the photosphere. The spectroscopic observation can also help us to study the relationship between BPs and explosive events.

Observational details:

(1) Target: a coronal hole (equatorial hole or polar hole but the former is better) and a quiet Sun

region near the center of solar disk. The observation time for each of the targets should be no less than 24 hours for TRACE, XRT, and MDI observations, allowing us to record at least one BP from their birth to death. During this period, SUMER and EIS can scan the two regions. For SUMER, the size of each scanning region should be about 300” × 300”. For EIS, a reduced size is acceptable.

We suggest this observation be included in the joint observation of SOHO/HINODE this April. The observation date can be after 16th of April.

(2) TRACE: in order of decreasing priority

195 A time series at high S/N

173 A time series at high S/N

1550 A time series at high S/N

1700 A time series at high S/N

1216 A time series at high S/N

(3) XRT/HINODE:

Time series of Full-Sun images taken with the Ti-poly filter and thin-Al-mesh filter

(4) SOT/HINODE:

Broad-band imager: time series of 430.5 nm G-band and Ca II H images

Vector magnetograph: long time series if possible

(5) EIS/HINODE:

Set window heights as 304”, exposure (delay) time as 45 s(1 ms). Use the 2” slit to scan the same regions (reduced areas are acceptable, e.g. if the number of pointing positions is set as 80, then the size of the scanned area is about 160”×304”) by using the following lines:

He II (256.32A), width=40 pixels, Total Counts for Exposure (per pixel)=360

Fe XII (195.12A), width=40 pixels, Total Counts for Exposure (per pixel)=3000

Ca XVII (192.82A), width=40 pixels, Total Counts for Exposure (per pixel)=400

Fe XII (186.88A), width=40 pixels, Total Counts for Exposure (per pixel)=175

Fe X (184.54A), width=40pixels, Total Counts for Exposure (per pixel)=500

Fe X (257.26A), width=40pixels, Total Counts for Exposure (per pixel)=325

Fe XIII (202.04A), width=40 pixels, Total Counts for Exposure (per pixel)=500

Fe XIII (203.83A), width=40 pixels, Total Counts for Exposure (per pixel)=50

Fe XIV (274.20A), width=40 pixels, Total Counts for Exposure (per pixel)=60

Fe XIV (264.78A), width=40 pixels, Total Counts for Exposure (per pixel)=60

Fe XV (284.16A), width=40 pixels, Total Counts for Exposure (per pixel)=25

Si X (258.37A), width=40 pixels, Total Counts for Exposure (per pixel)=175

Si X (261.04A), width=40 pixels, Total Counts for Exposure (per pixel)=125

Mg VI (270.40A), width=40 pixels, Total Counts for Exposure (per pixel)=25

Si VII (275.35A), width=40 pixels, Total Counts for Exposure (per pixel)=125

(6) SUMER/SOHO

Scan the same regions by slit 2, the increasing step size is set as 1”. Exposure time is set as 45 seconds. One scan of a region with the size of 300” × 300” needs about 4 hours. The following lines are included:

Si VII (1445.76 A, 1440.49 A)

O IV (1399.77 A, 1401.16 A)

S X (1213.00 A, 1196.26 A)

Si III (1301.15 A, 1296.73 A)
O V (758.68 A, 761.13 A)
Mg IX (694.00 A, 706.06 A)
Ne VIII (770.4 A)
O II (834.4 A)
(7) MDI/SOHO
Time series of magnetograms (1 min cadence)