Structure and Dynamics of Transient Brightenings and their Relation to Magnetic Field Geometry

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Scientific Justification

Active region coronae are composed of discrete isolated loops, each defined by closed magnetic field lines. These loops, visible in UV and X-rays, are created by some localized heating mechanism (Rosner *et al.* 1978). Recently, Yohkoh SXT observations with high temporal resolution have revealed that at least some of these loops brighten suddenly, and stay bright for periods of minutes (Shimizu *et al.* 1992). These "transient brightening" (TB) events may be related to microflares (Gary *et al.* 1995), and could account for a significant fraction of the energy deposited in an active region.

We propose to study active region loops and TBs using SUMER spectroheliograms in NV and FeXII, CDS spectroheliograms in MgX, EIT images in FeXII and FeXV, and ground based vector magnetograms from the University of Hawaii's Mees Solar Observatory. Several TBs should be visible within a single $2' \times 2'$ FOV. Because of their relatively short lifetime, these maps must be made relatively quickly.

The high sensitivity and spatial resolution of SUMER, CDS and EIT will provide unprecedented detail in the study of TB's. Simultaneous imaging in lines at transition region and coronal temperatures will permit the study of the loop's structure, dynamics and energy budget. For instance, the intensity of the NV line, formed in the transition region, can in some cases be used as a pressure diagnostic for the base of a loop (Hawley and Fisher 1992). Doppler shifts of both coronal and transition region lines provide information on how and where energy is being deposited. Our goal will be to use this information to study the energetics and dynamics of TBs.

It is also important to understand why TBs occur along specific isolated magnetic field lines. We plan to coordinate the SUMER, CDS, and EIT observations with the Imaging Vector Magnetograph (IVM) at the University of Hawaii, which creates vector magnetograms of an active region. The magnetic field should provide the key to understanding the energy source for TB's, if that source is coronal. We are particularly interested in magnetic features known as *separator field lines* (Gorbachev and Somov 1988; Longcope 1996) which play a crucial role in theories of reconnection. If TB's are caused by reconnection they should be located at or near separator field lines.

References

Gary, D., Hartl, M., and Shimizu, T. (1995). *Transactions, AGU 1995 Fall Meeting* **76**(46), SH41B.

Gorbachev, V. and Somov, B. (1988). *Solar Phys.* **117**, 77.

Hawley, S. L. and Fisher, G. H. (1992). *ApJ Supp* **78**, 565.

Longcope, D. W. (1996). *Solar Phys.* . submitted.

Rosner, R., Tucker, W. H., and Vaiana, G. S. (1978). *ApJ* **220**, 643.

Shimizu, T., Tsuneta, S., Acton, L. W., Lemen, J. R., and Uchida, Y. (1992). *Proc. Astron. Soc. Japan* **44**, L147.

SUMER Observation Sequence

Initial pointing	A Small Bipolar Active region
Slit	$1 \times 120\,\mathrm{arcsec}^2$
Scan Area	$122 \times 120\,\mathrm{arcsec}^2$
Step Size	0.78 arcsec (full step)
Resulting Number of Scan Locations	160
Dwell Time	2.5 sec
Duration of Scan	421 sec
Line Selection	N V (1242.804Å)
	Fe XII (1242.01Å)
Spectral Binning	$50 \rightarrow 25$
Estimated Reduction Factor	
• Selection	$1 \times 25 \times 120\,px$
• Compression	Quasilog
• Reduction	$\rightarrow 25 \times 120 \times 8$ bits/scan

CDS Observation Sequence

Initial pointing	A Small Bipolar Active region
Slit	$2 \times 120\,\mathrm{arcsec}^2$
Scan Area	$122 \times 120\,\mathrm{arcsec}^2$
Resulting Number of Scan Locations	61
Dwell Time	5 sec
Duration of Scan	474 sec
Line Selection	MgX (609.79Å)
	MgX (624.94Å)
Spectral Binning	20 px (no binning)
Compression	Truncate to 12 bits

EIT Observation Sequence

Initial pointing	A Small Bipolar Active region
Partial Frame Images	FeXII (195Å)
	FeXV (284Å)
Timing	195Å– several images per minute
	284Å– one image every 10 minutes