EUV/X-ray Bright points

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It is suggested that small-scale events in the quiet Sun such as EUV/X-ray bright points, microflares, nanoflares etc. can provide almost all the heat needed to maintain the coronal temperatures (Parnell & Jupp 2000, ApJ, 529, 554, Parnell & Galsgaard 2004, A&A, 428, 595). EUV/X-ray Bright Points (BPs) are small-scale loop like structures of enhanced emission seen in EUV and X-ray images of the Sun distributed all over the solar disk (for details see PhD Thesis 2004, Ugarte-Urra). They are connecting photospheric bipolar magnetic features with 2/3 of them associated with cancellation of pre-existing magnetic features. Von Rekovski, Priest & Parnell (2006, A&A 366, 125 & 369, 43) recently presented two-dimensional MHD simulations of cancelling magnetic features and associated X-ray BP. The magnetic reconnection was found to produce Ohmic heating required for the X-ray BP.

BPs, however, are seen simultaneously in all temperatures from the chromosphere to the corona suggesting a complex structure of several loops at different temperatures (Habbal et al. 1990, ApJ, 352, 333). Ugarte-Urra (PhD Thesis 2004) also showed CDS lightcurves of BPs covering a wide range of temperatures suggesting a complex and dynamic picture. Madjarska et al. (2003, A&A, 603,57) found Doppler velocities from -10 to 10 km/s predominantly red-shifted combined with 6 min velocity oscillations with amplitude 3-6 km/s (SUMER, S VI 933 Å). How are these oscillations related to the idea that BP's are reconnecting events? In order to test theoretical models; spatial (<1″), temporal (10 sec) and spectral (SUMER spectral capabilities) high-resolution spectroscopic observations are needed to derive plasma parameters such as temperature, density, velocities etc. at all levels in the solar atmosphere starting from the chromosphere up to the corona. In this context, the relation to the underlying magnetic field is extremely important and a very accurate co-alignment with VIM observations is mandatory. All this will provide the necessary information on the structure and evolution of these features and where and how the energy deposition takes place.

EUS instrument requirements

1. **Emission line requirements**

The spectral band 7b (1163 – 1265 Å) will provide a few strong transition region lines such as C III 1175 Å, N V 1238 Å and 1242 Å together with O V 629 Å and the coronal line M X 625 Å in second order. Rasters in the continuum here will provide excellent co-alignment with EUI, VIM and ground based data. If this band is registered together with spectral band 7a (970 – 1040 Å) we can have a pair of strong density sensitive lines such as C III 977 Å and C III 1175 Å.

2. **Spectral resolution requirements**

The profiles need to be resolved in order to study line widths and shifts.

3. Spatial coverage

The features have a size from 10" to 60" at 1 AU, a coverage of at least 3 times their maximum size i.e. 200" at 1 AU in rastering and sit-and-stare mode.

4. Time resolution (incl. count rates) 10 sec

5. Requirements for other instruments

Simultaneous imaging at similar temperatures and spatial and temporal resolution is essential, plus magnetograms.

Relation to Solar Orbiter science goals

Indicate how your science fits in with the four Orbiter science goals. Simply type "N/A" if it's not applicable to a science goal.

1. Determine the properties, dynamics and interactions of plasma, fields and particles in the near-Sun heliosphere

N/A

1. Investigate the links between the solar surface, corona and inner heliosphere

N/A

2. Explore, at all latitudes, the energetics, dynamics and fine-scale structure of the Sun's magnetized atmosphere

Loops of all scales are the main structural unit of the solar atmosphere. Their study provides information on the magnetic fields which are responsible for their generation and dynamics and can help us understand physical process such as magnetic reconnection, waves generation and propagation etc.

3. Probe the solar dynamo by observing the Sun's high-latitude field, flows and seismic waves

N/A