Propogating Oscillations in Coronal Loops

Robert W. Walsh[1], Jane B. Noglik[1], Mike S. Marsh[2]

[1]University of Central Lancashire, Preston, UK
[2]NASA Goddard Space Flight Centre, Washington DC, US

Contact: jbnoglik@uclan.ac.uk, rwwalsh@uclan.ac.uk, mmarsh@uclan.ac.uk

AIM: To observe the connection between the oscillations at the solar surface and the oscillations in the corona down to the fine scale structure of the magnetised atmosphere combined observations using VIM, EUI and EUS is required.

Wave heating mechanisms are thought to play an important role in the heating of coronal loops. The resonant absorption of MHD waves in loop type cavities predicts narrow regions of significant energy deposition: phase mixing of Alfven waves predicts a strongly time dependent amplitude damping.

This study intends to take high resolution spectroscopic observations of coronal loops. Yielding high cadence/time dependent plasma diagnostics within the structures. This will allow the physical properties of the oscillations to be determined, and give a possible indication of which theoretical model is applicable for these 'waves'. Also, it may be possible that their dissipation profiles can be described and placed in the context of coronal heating.

The spatial resolution of Orbiter will be five times greater than TRACE and an order of magnitude greater than the best current spectrometer. Thus it may be possible to distinguish the spatial scale across atmospheric structures, viewing finer sub-resolution threads than ever before. With this increased spatial resolution it will be possible to determine whether the finer thread like structures are acting together "as a bundle" or if not, whether one is able to pick out the differing frequencies of the individual threads. Techniques of coronal seismology (to determine indirectly say, the magnetic field strength) would be employed.

EUS instrument requirements

1. Emission line requirements

We will need strong coronal, transition region and chromospheric lines. Therefore combining Band 5 and Band 7a seems appropriate. We need to be able to see the effect of the oscillation throughout the atmosphere and the variation of the oscillation with temperature.

2. Spectral resolution requirements

The best spectral resolution available is necessary; profiles need to be resolved for studying line widths.

3. Spatial coverage

It is unlikely that EUS will be able to cover an entire active region with "normal rastering". However, we can concentrate upon part of an active region. We would observe the base of specific loop structures to see the oscillations propagating up through the footpoints and also at the apex of loop structures to see how the oscillations are transmitted along the structures.

4. Time resolution (incl. count rates)

Given the increased spatial resolution, it would be our desire to push the temporal resolution to as high as is practically possible. Of the order of seconds would be preferred at the very least. To study the dynamic nature of the solar atmosphere the spectrometer needs to have a fast rastering capability (low rastering overheads).

5. Requirements for other instruments

Imaging capability for coronal and transition region temperatures is important for placing the spectroscopic images in context. An imager (EUI) is also important for observing the global changes in the active region (or area of an AR) over the observational period. Coincident magnetograms, from VIM, is a crucial component in understanding the magnetic skeleton through the atmosphere.

6. Other requirements

N/A

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

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

Dissipation of MHD waves is a significant factor when considering coronal heating and the structure and dynamics between the photosphere and the corona.

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

The dynamics of the oscillations propagating through the atmosphere requires the study of several spectral lines, allowing the energy flow along magnetic structures to be modelled from the photosphere to the corona.

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

N/A