1. Introduction

Eruption of 2011-03-08 ∼19:00UT observed by AIA, SWAP, MK4, and LASCO. Two-stage eruption, with previously studied two-stage flaring active region (secondary heating?) ().

2. Techniques

New CORIMP techniques for detecting and characterising CMEs in coronagraph data have been developed and applied to the *SOHO*/LASCO and *STEREO*/SECCHI datasets (Morgan *et al.* 2012; Byrne *et al.* 2012). But to connect CMEs to their source regions, data from disk imagers, such as *PROBA2*/SWAP and *SDO*/AIA, should be used in tandem with the coronagraph observations. However, difficulties arise due to the varying instrument specifications, e.g., image passbands, fields-of-view (FOVs), cadences, etc.

Therefore, to bridge the gap between the white-light images of the extended corona and the EUV observations of the solar disk and low corona, we propose to use the SWAP imager in conjunction with the MLSO/MK4 coronagraph to directly compare the observations of CMEs as they erupt through the overlapping FOVs, as shown in Figure 1. This will allow a direct correspondence of features in the EUV images with those in the white-light images, providing new insight into the connection of CMEs to the Sun during their initial phases of eruption and acceleration away from their source regions on the disk.

We shall extend the CORIMP techniques, first developed for coronagraphs, to enhance and characterise the detailed structure in the EUV images of SWAP and AIA. For example, an overlay of SWAP and AIA-171 images is shown in Figure 2 for an erupting prominence on 2012 April 16 at 17:43 UT. The left image shows the level-1 processed data. The right image shows the result of the multiscale filtering technique developed by Young & Gallagher 2008, applied in such a manner as to enhance the edges of the detected structure in the data. The complex nature of the erupting material is such that its signal may be multiplied across numerous scales, while the more linear background coronal features and small-scale noise fall away (as detailed in Byrne *et al.* 2012). This is demonstrated in Figure 3, where the original and multiscale enhanced SWAP images are polar-unwrapped about Sun-centre and the coronal heights of $1-1.7\,R_\odot$ are displayed. The comparison of an intensity slice at a height of $1.3\,R_\odot$ in each, reveals how the multiscale techniques best characterise the complex structure of the erupting prominence material and suppress the more linear background features. Such methods of image processing will be further enhanced with the application of a radial filter (as per the NRGF technique of Morgan *et al.* 2006 to be extended for use on the EUV images).

The CORIMP methods, which have been used to detect and characterise CMEs in coronagraphs, thus show excellent promise for revealing the structure of the eruptions in EUV images that precede, or underlie, the CMEs. It is a goal of this proposal to develop such techniques for applying to the SWAP images in combination with the MK4 images, to bridge the gap between disk and corona observations. This will allow us to quantify their early acceleration, along with their expansion and possible deflection from their source region locations, in a more comprehensive manner than has been previously possible. These unique datasets will therefore help to advance our knowledge of the forces that act during the initiation phase of CMEs. It

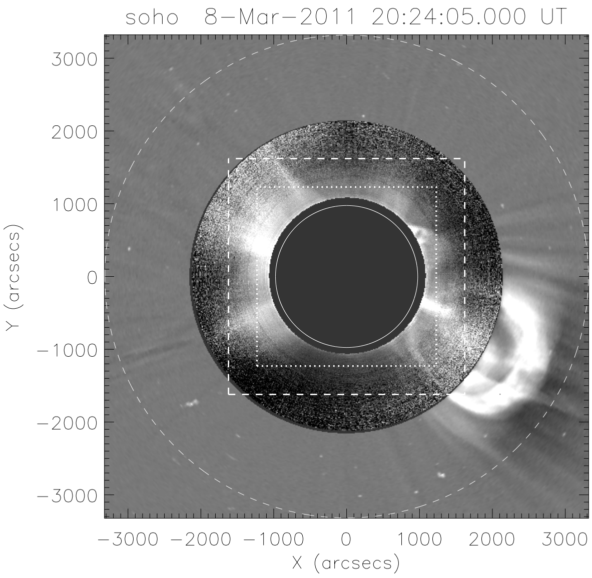

Fig. 1. *A LASCO/C2 image with an MLSO/MK4 image overlaid in the range 1.1 − 2.2 $R_\odot$, dated 2011 March 8 at 20:24 and 20:22 UT respectively. The C2 image has been processed via the CORIMP techniques of normalising radial graded filter (NRGF) and quiescent background subtraction. It has been trimmed to a half-width of 3.4 $R_\odot$, which is the upper limit of the PROBA2/SWAP FOV as indicated by the dashed circle. The SWAP FOV during nominal operations is indicated by the dashed box. The SDO/AIA FOV is indicated by the inner dotted box. The limb of the Sun behind the occulter is indicated by the solid white circle. A CME is observed off the south-west limb as a bright loop structure with some inner core material, as seen here in the Thomson-scattered white-light coronagraph images. It is clear how the SWAP and AIA images can be used to bridge CME observations to the low corona and solar disk, for studying the physics of their initiation phase.*

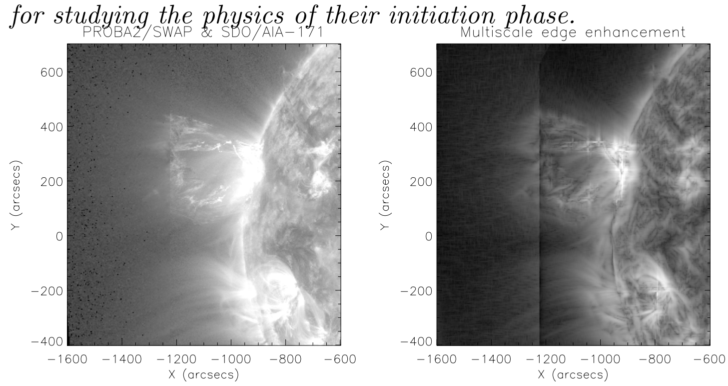

Fig. 2. *Combined PROBA2/SWAP and SDO/AIA-171 image of an erupting prominence observed on 2012 April 16 at 17:43 UT.* Left: *The level-1 data, with the AIA image extending to approximately 1.3 $R_\odot$ and SWAP continuing out to ∼ 1.7 $R_\odot$.* Right: *The result of a multiscale edge enhancement technique: the intensity showing the relative strengths of the detected edges along the structures in the image. A substantial amount of detail is revealed within the erupting prominence material and across the solar disk and corona.*

is intended that this work be published in a peer-reviewed journal, and the developed codes made publicly available through the CORIMP branch of the SSW tree.

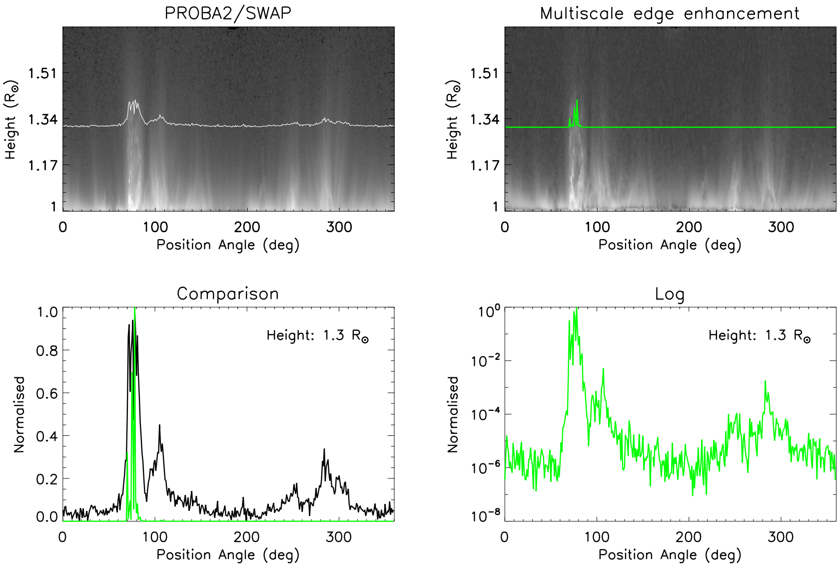

Fig. 3. *The top two panels show polar-unwrapped images of the solar corona across the PROBA2/SWAP FOV on 2012 April 16 at 17:43 UT; left being the level-1 data, right being the enhanced data. Across each image, at a constant height of 1.3 $R_\odot$, an intensity slice is plotted (of arbitrary normalised units) to demonstrate how the background coronal structure is suppressed by the multiscale techniques, to highlight only the complex structure of the prominence. The bottom left plot shows a direct comparison of the two intensity slices, where the prominence is located between $70-90°$. The bottom right plot shows a log scale of the normalised intensity slice across the enhanced image to demonstrate that the rest of the coronal structure is still present, just strongly suppressed relative to the prominence material.*

2.1. Height-Time Profiles

3. CORIMP Detections

4. Conclusions

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References

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