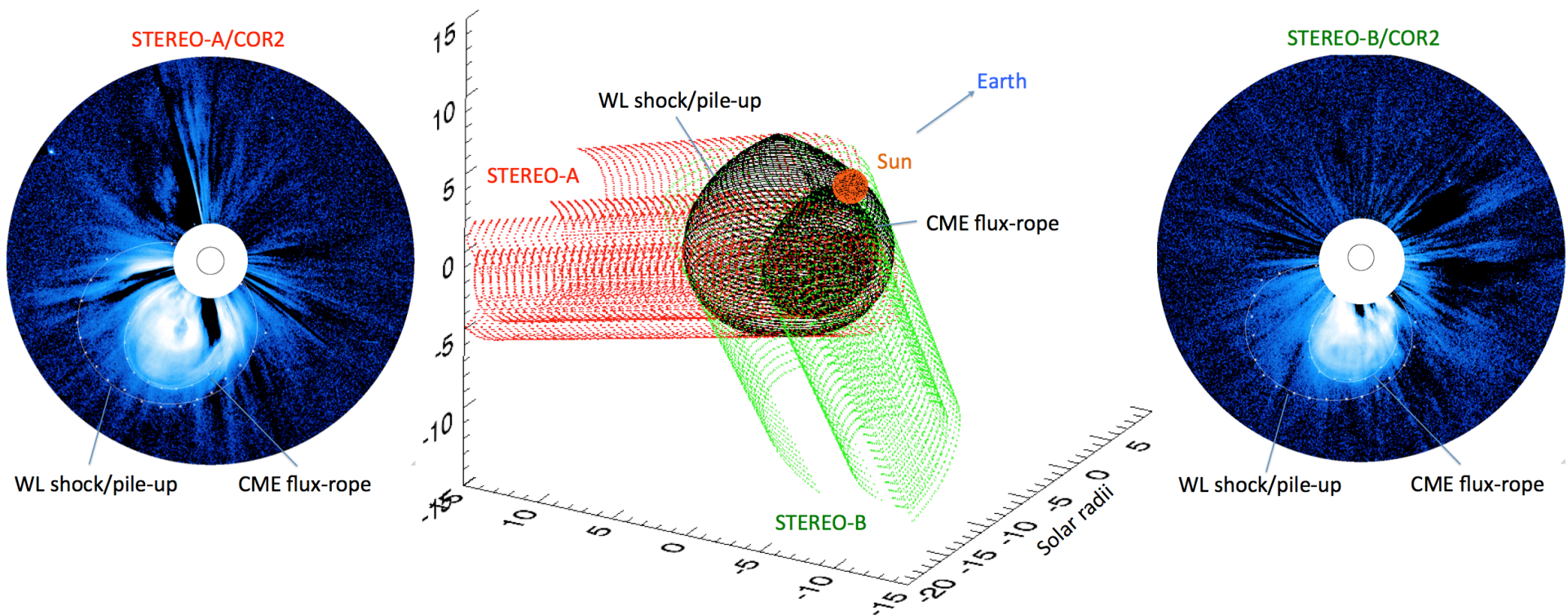


The New CORIMP CME Catalog & 3D Reconstructions

Jason P. Byrne¹, Shadia R. Habbal¹, Huw Morgan², Peter T. Gallagher³

¹Institute for Astronomy, University of Hawaii | ²Aberystwyth University, Wales | ³Trinity College Dublin, Ireland



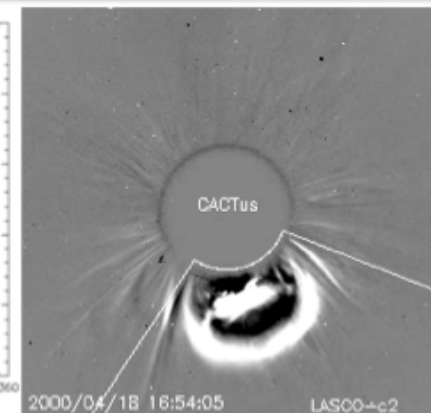
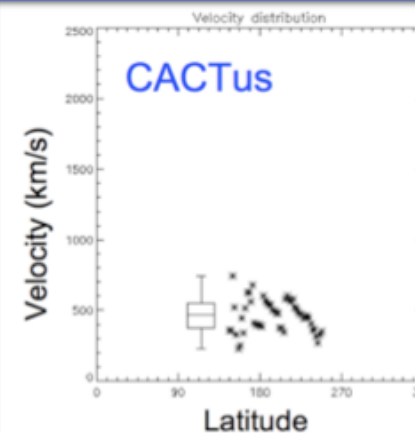
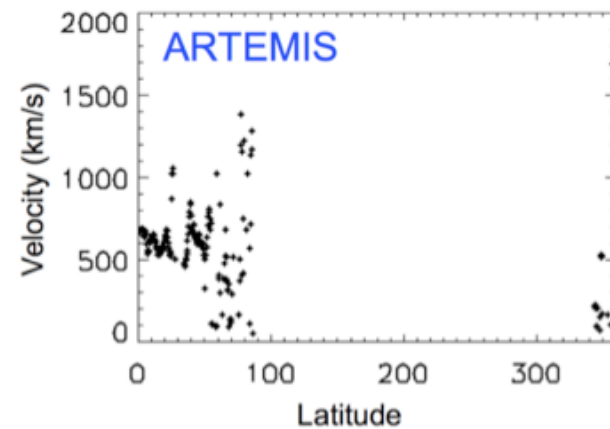
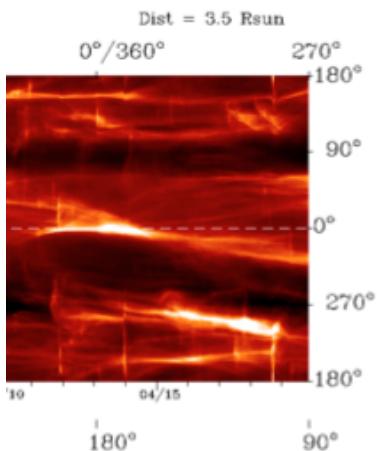
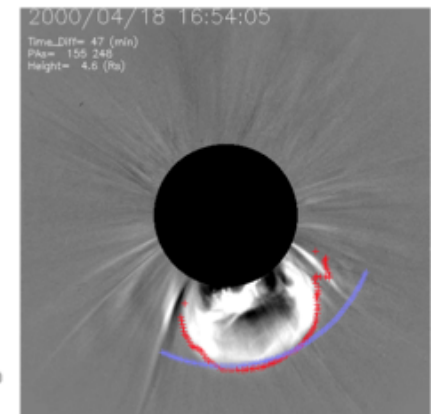
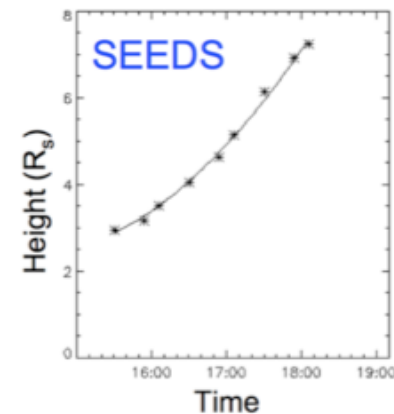
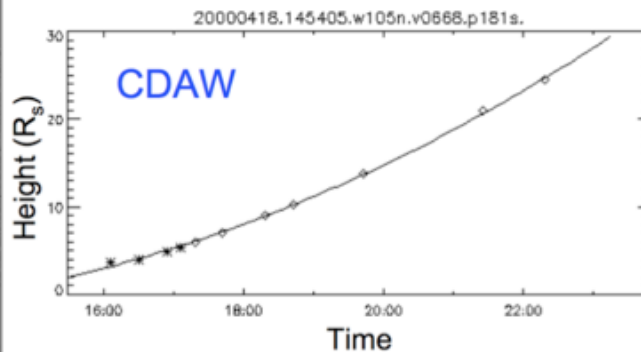
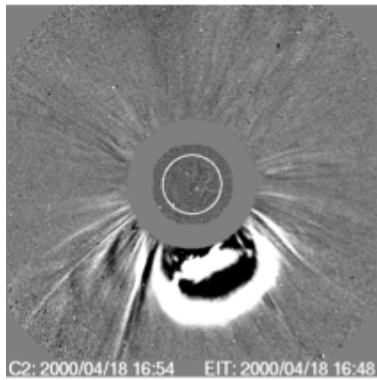
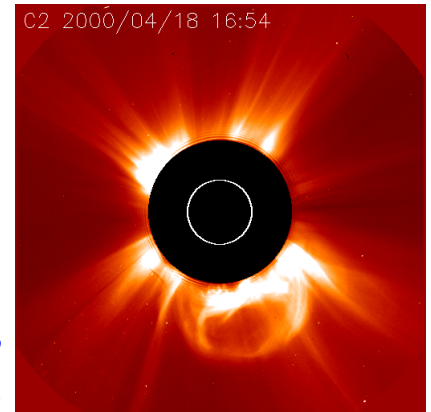
CME Catalog website: <http://alshamess.ifa.hawaii.edu/CORIMP>

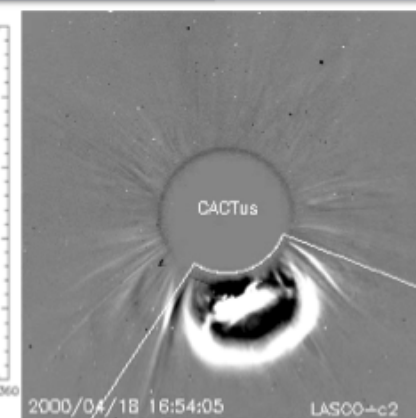
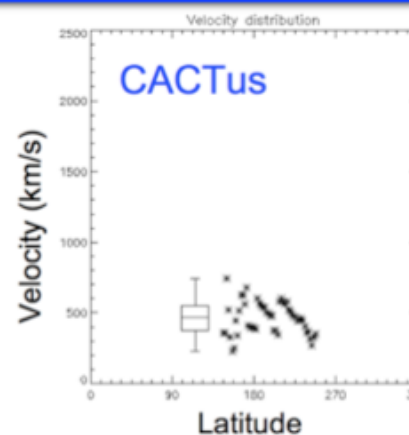
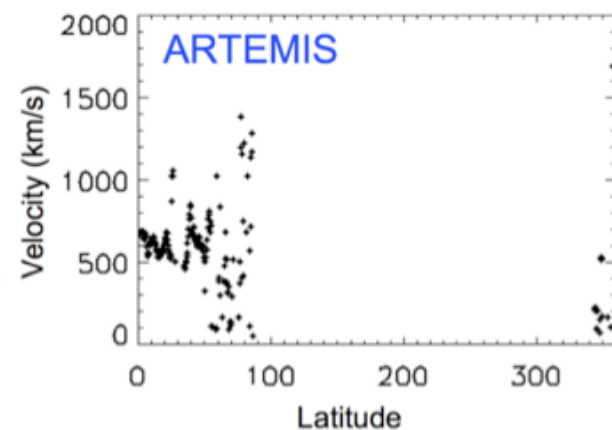
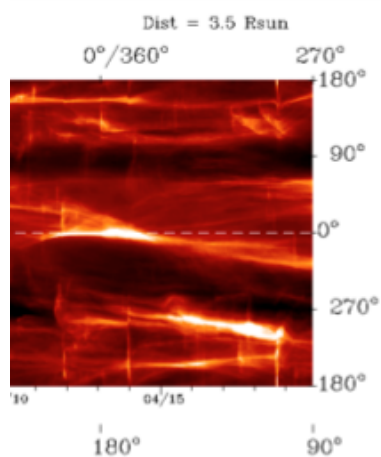
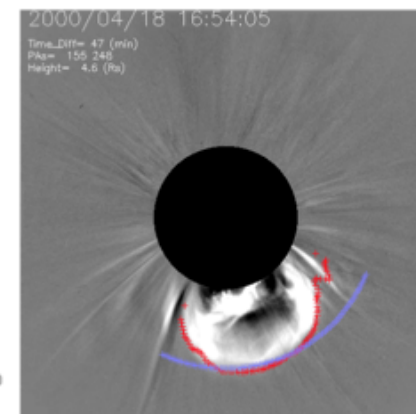
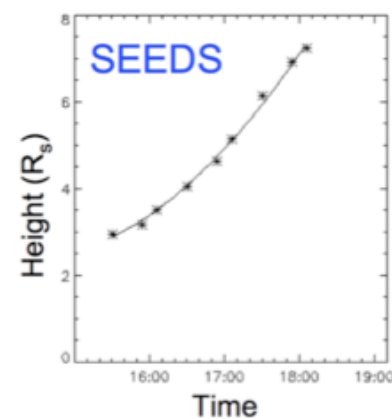
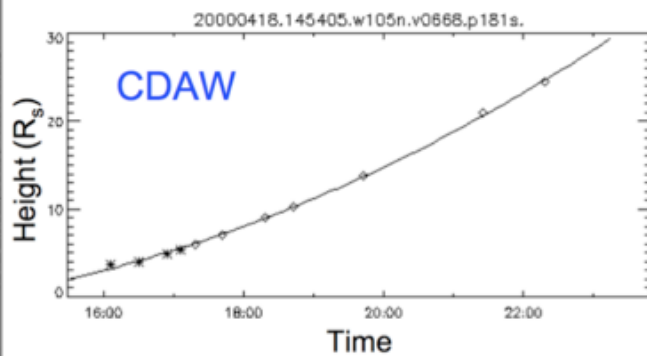
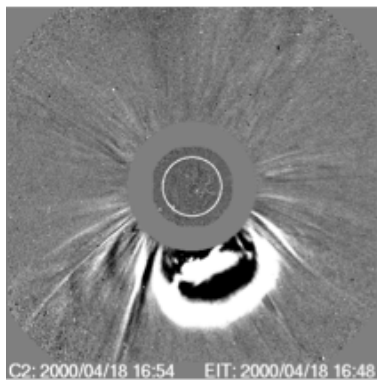


Motivation

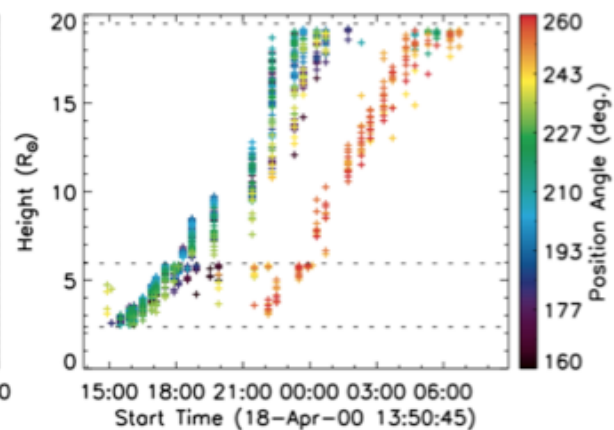
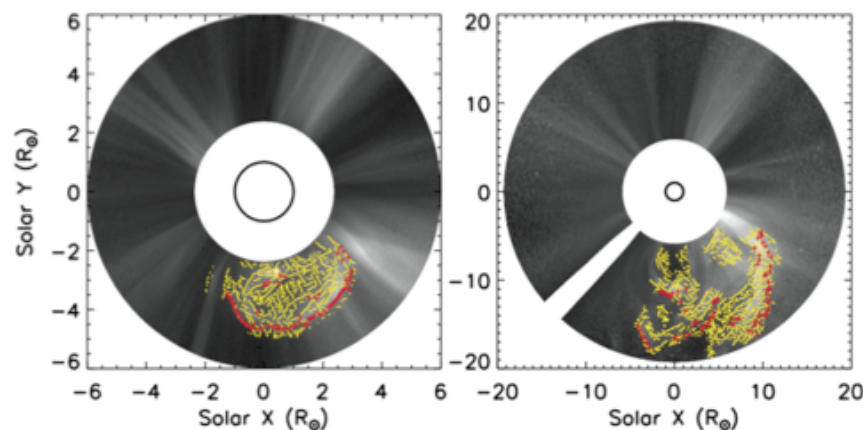
To build a robust automated CME detection and characterisation algorithm, that determines CME kinematics and morphology with a high degree of accuracy and reliability.

SOHO LASCO/C2
2000/04/18 16:54

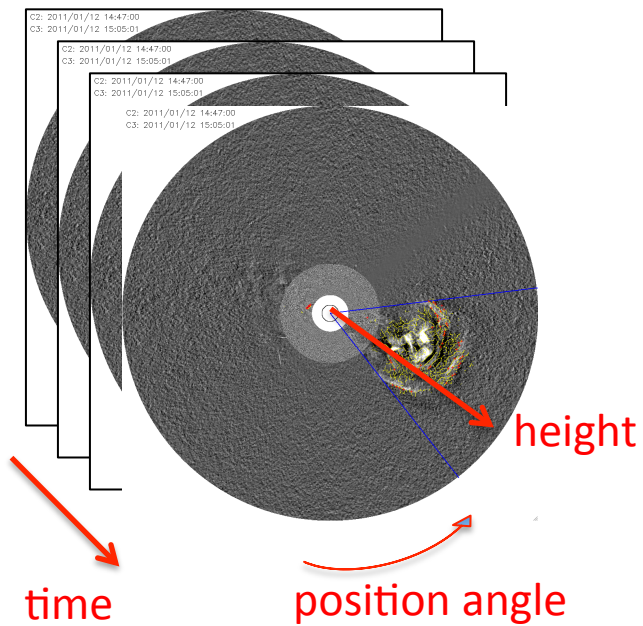




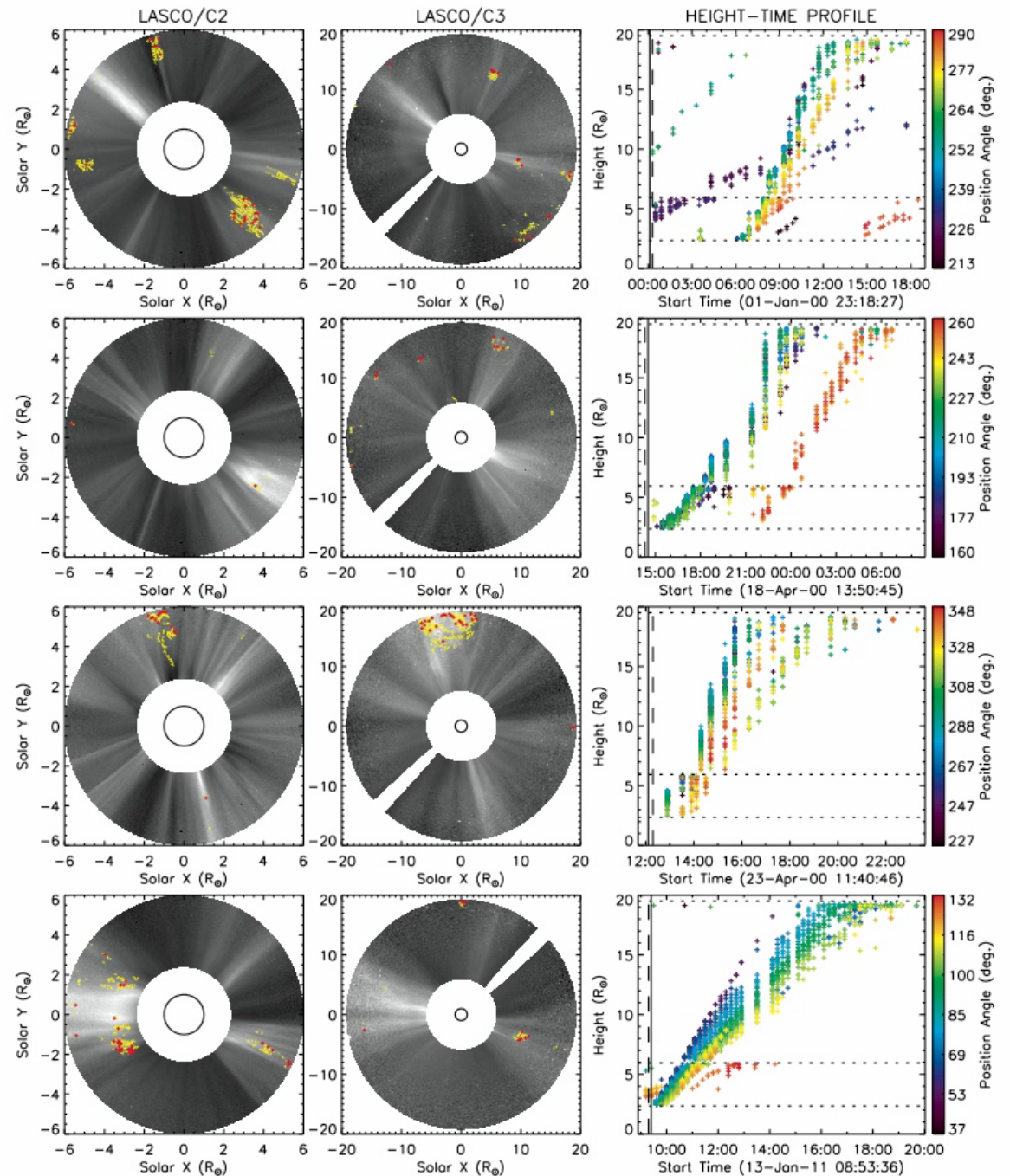
CORIMP



CME Detections

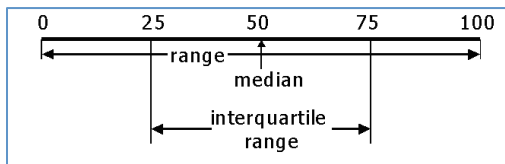
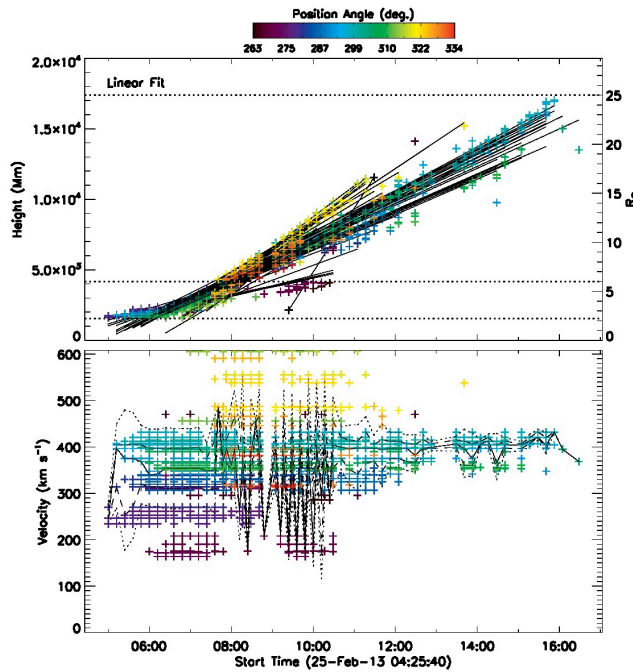


Morgan et al. *Astrophys. J.* (2012)
 Byrne et al. *Astrophys. J.* (2012)

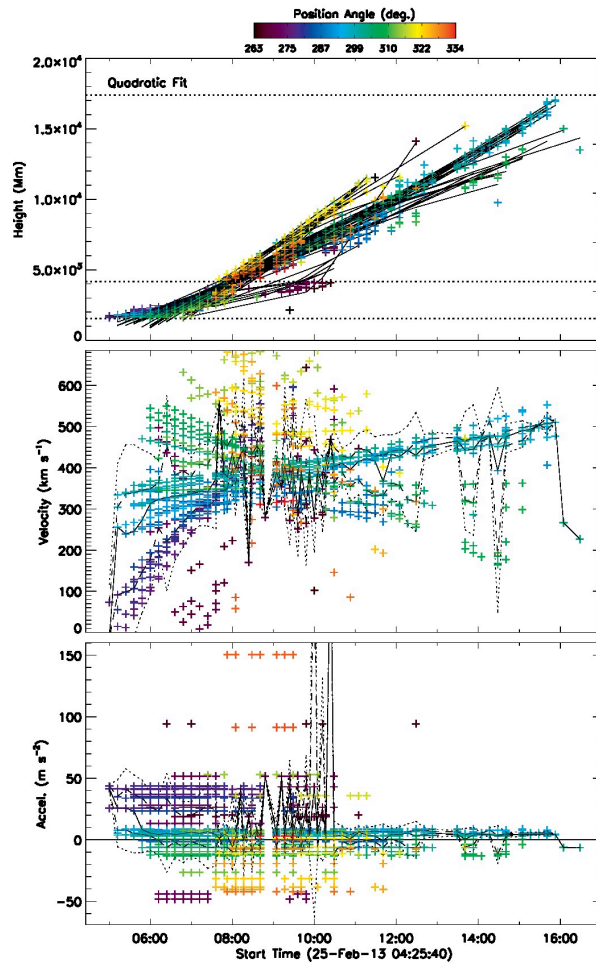


CME Kinematics

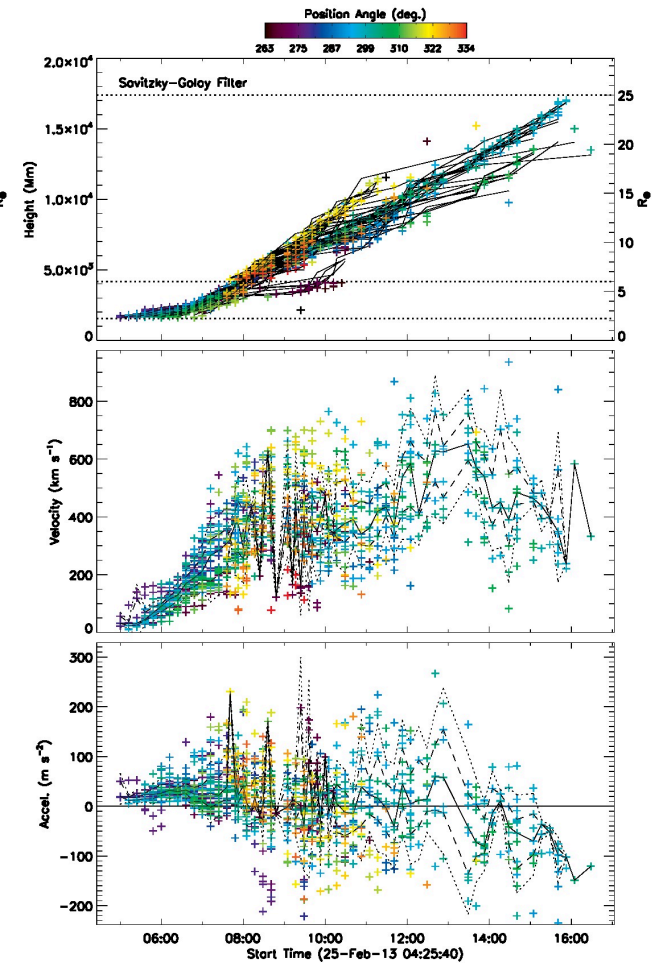
Linear fits



Quadratic fits



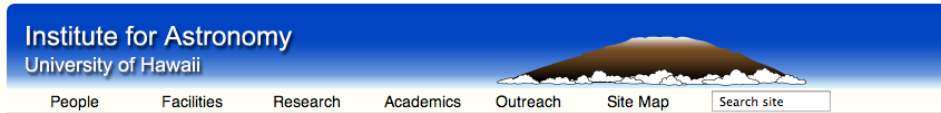
Savitzky-Golay filter



Byrne et al. *Astron. & Astrophys.* (2013)

CME Catalog

<http://alshamess.ifa.hawaii.edu/CORIMP>



CORIMP CME Catalog

SOHO / LASCO (under construction)

[Realtime CME detections \(latest available data\)](#)

[Weekly CME detections \(past 7 days\)](#)

Related Links
CDAW CME Catalog
CACTus CME Catalog
SEEDS CME Catalog
ARTEMIS CME Catalog
NRL CME List
COR1 CME List
Solar Monitor
SDO Feature Finding Team
Helioviewer



Year	Month											
2014	Jan	Feb	Mar	Apr	May*	Jun*	Jul*					
2013	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2012	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2011	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2010	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2009	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2008	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2007	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2006	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2005	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2004	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2003	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2002	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2001	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2000	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

*Italic detections populated from realtime data.
(Missing detections currently being processed.)

The coronal image processing (CORIMP) CME catalog is generated from the automatic detection and tracking of CMEs in images from the Solar & Heliospheric Observatory (SOHO) Large Angle & Spectrometric Coronagraph experiment (LASCO). The catalog utilises a normalising radial-graded filter (NRGF) that removes the steep gradient in coronal brightness. A deconvolution technique is used to remove the static background, separating dynamic and quiescent structures. A multiscale decomposition then results in a number of scales upon which the images can be automatically inspected for curvilinear features. Detection masks are generated to isolate CME structure, and a sequence of observations then reveal the changing CME kinematics and morphology.
(STEREO / SECCHI coming soon)

Note: A list of known bugs is compiled [here](#). Please contact us if you find another.

[A guide to using the catalog can be found here.](#)

Details available in the following publications (please cite these if using the catalog):

- Byrne, Morgan, Habbal & Gallagher, *ApJ* (2012)
- Morgan, Byrne & Habbal, *ApJ* (2012)

LASCO data currently; SECCHI imminent.

Realtime implementation.

Event list mirrors current catalogs: dividing data by Year & Month.

Catalog description

List of known bugs.

Relevant publications.

CME Catalog

Institute for Astronomy
University of Hawaii

People Facilities Research Academics Outreach Site Map Search site

CORIMP CME Catalog

SOHO / LASCO (under construction)

[Realtime CME detections \(latest available data\)](#)

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Year	Month											
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2001	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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Note: A list of known bugs is compiled [here](#). Please contact us if you find another.

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Details available in the following publications (please cite these if using the catalog):

- Byrne, Morgan, Habbal & Gallagher, *ApJ* (2012)
- Morgan, Byrne & Habbal, *ApJ* (2012)

Guide to using the catalog

The CORIMP catalog presents the results of the CME detections in a row/column format, as shown in the image below. The default catalog displays the kinematics derived using a Savitzky-Golay filter on the height-time data (see Byrne et al. 2013). The top links provide access to the kinematics derived from either quadratic fits or linear fits to the height-time profiles.

<< CORIMP			Savitsky-Golay filter			Quadratic fits		Linear fits			
Date yy/mm/dd	Time [UT]	Central PA [deg]	Angular Width [deg]	Median Speed [km/s]	Max Speed [km/s]	Median Accel. [m/s ²]	Max Accel. [m/s ²]	Min Accel. [m/s ²]	Mass [g]	Movie & Image Links	
2011/10/01	01:36:25	302	29 (36)	143	279	54	128	-87			C3 (dyn) (ims) C2 (dyn) (ims)
2011/10/01	03:42:07	246	47 (47)	262	466	14	57	-53			C3 (dyn) (ims) C2 (dyn) (ims)
2011/10/01	08:48:08	296	87 (87)	82	149	1	6	-5			C3 (dyn) (ims) C2 (dyn) (ims)
2011/10/01	10:54:07	235	132 (132)	175	508	6	36	-36			C3 (dyn) (ims) C2 (dyn) (ims)
2011/10/01	14:24:07	21	25 (26)	178	-	-	-	-			C3 (dyn) (ims) C2 (dyn) (ims)

The columns are divided as follows:

Date [yy/mm/dd]:	The date of first detection of the CME.
Time [UT]:	The time of first detection of the CME.
Central PA [deg]:	The central position angle of the detected CME, measured counter-clockwise from solar north.
Angular Width [deg]:	The angular width (and upper limit) of the detected CME.
Median Speed [km/s]:	The median of all 'upper quartile' values in the derived distribution of CME speed.
Max Speed [km/s]:	The value that is two median-absolute-deviations above the median of all 'upper fence' values in the derived distribution of CME speed.
Median Accel. [m/s ²]:	The median of all 'upper quartile' values in the derived distribution of CME acceleration.
Max Accel. [m/s ²]:	The value that is two median-absolute-deviations above the median of all 'upper fence' values in the derived distribution of CME acceleration.
Min Accel. [m/s ²]:	The value that is two median-absolute-deviations below the median of all 'upper fence' values in the derived distribution of CME acceleration.
Mass [g]:	The derived mass of the detected CME, at each corresponding position angle and totalled across its angular span.
Movie & Image Links	Links to the C2 and C3 movies & images, for both the processed original images and dynamic separated images.

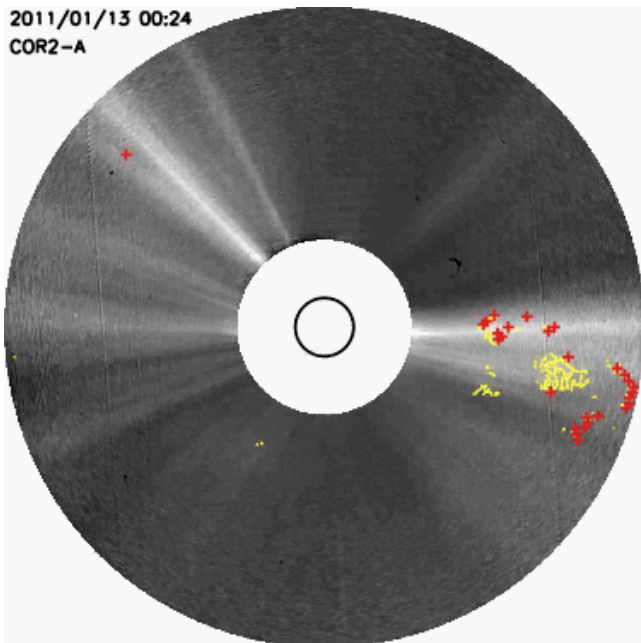
- Clicking on any particular 'Date' will bring up a movie of the event.
- Clicking on any particular 'Time' will show the text file containing the event information.
- Clicking on any of the derived CME parameters will bring up the kinematic plots, or the clicking the mass will show the mass plot.

The rows corresponding to each event are color-coded as follows:

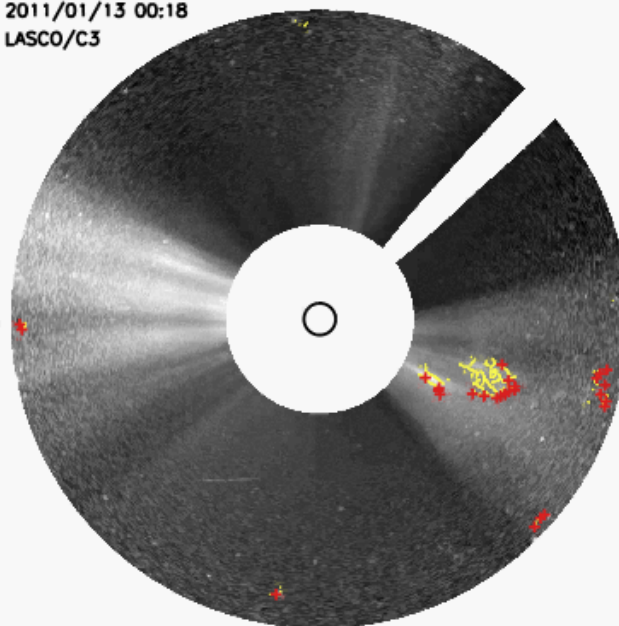
Red	Red events have a substantial number of detections that span greater than 90°.
Orange	Orange events have a substantial number of detections that span between 60° and 90°.
Yellow	Yellow events have a substantial number of detections that span between 30° and 60°.
White	White events do not have a substantial number of detections, regardless of their angular span.
Light-gray	Light-gray events do not have a substantial number of detections, and span less than 30°.
Dark-gray	Dark-gray events are the weakest detections, with potentially untrustworthy kinematics.

STEREO Observations

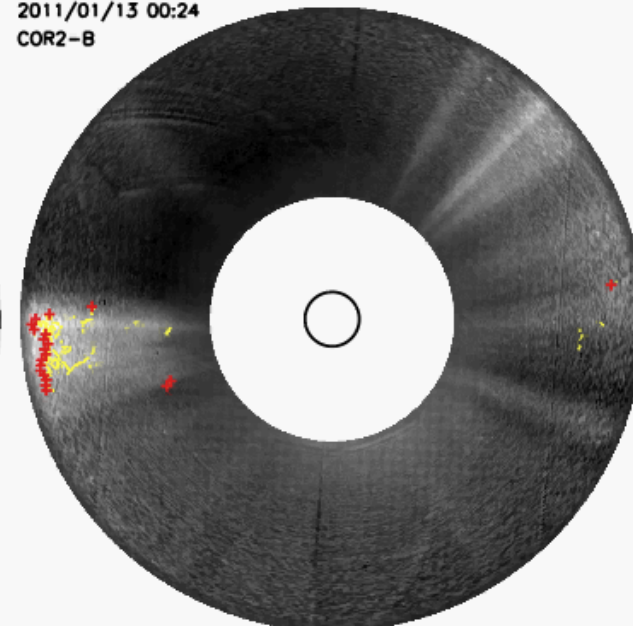
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COR2-A



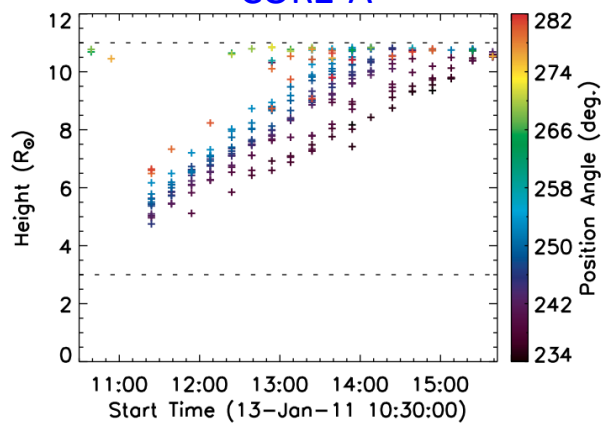
2011/01/13 00:18
LASCO/C3



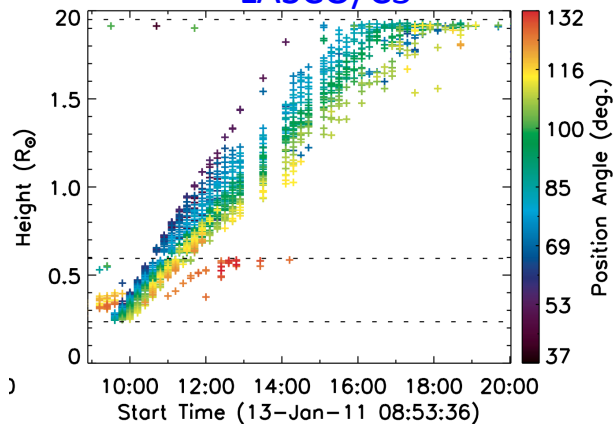
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COR2-B



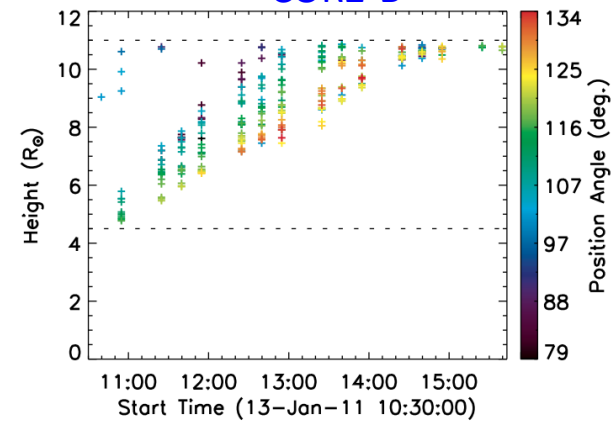
COR2-A



LASCO/C3



COR2-B

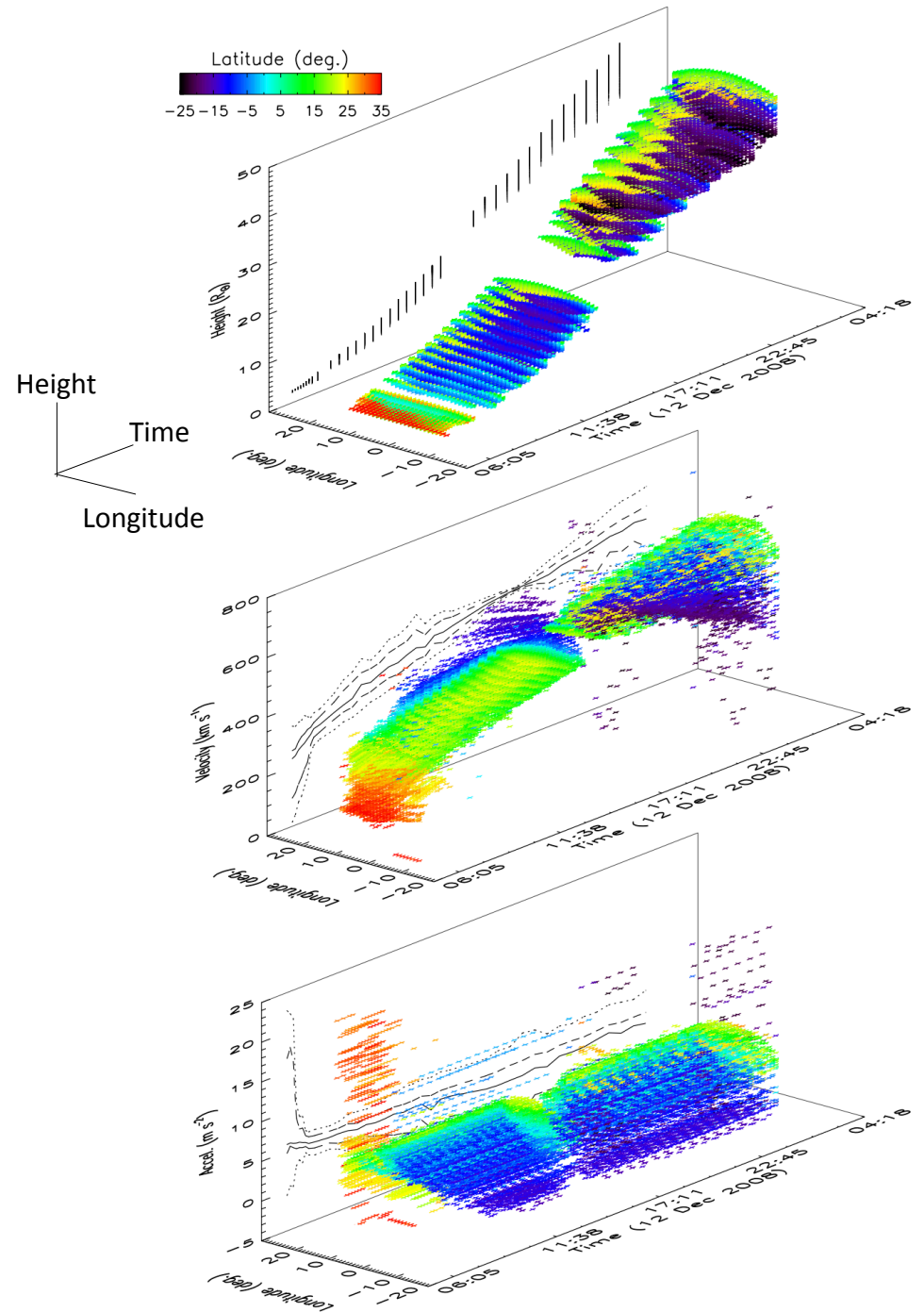
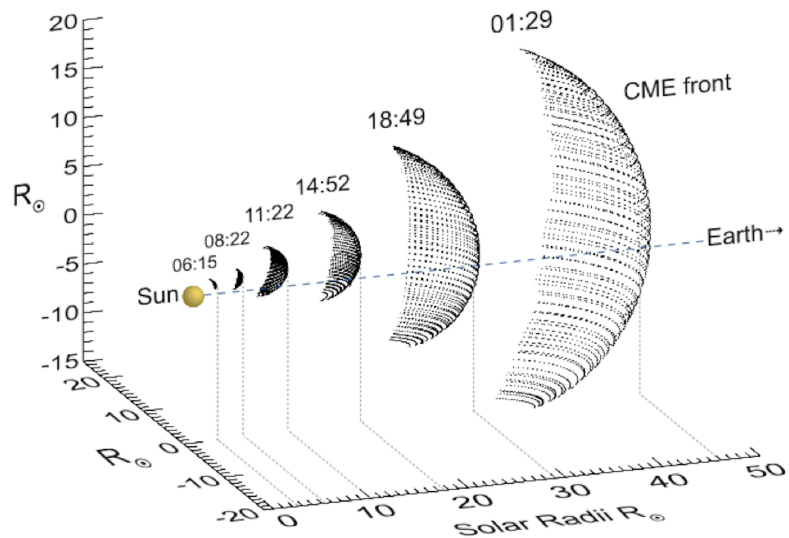
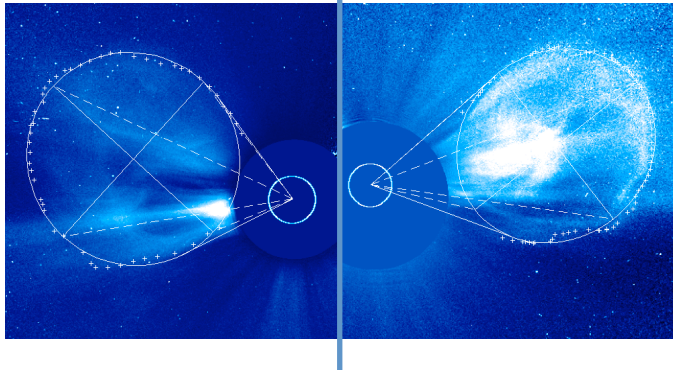


Byrne et al. *Astrophys. J.* (2012)

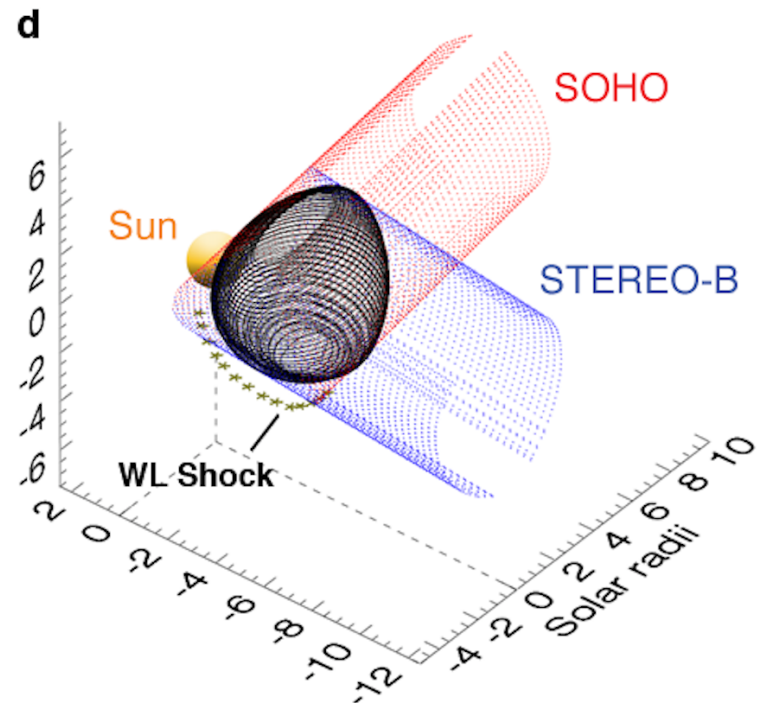
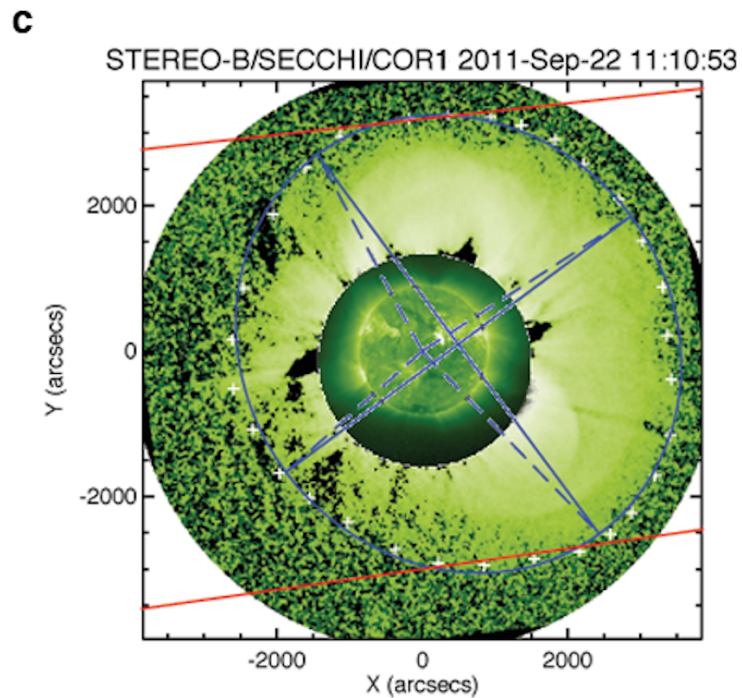
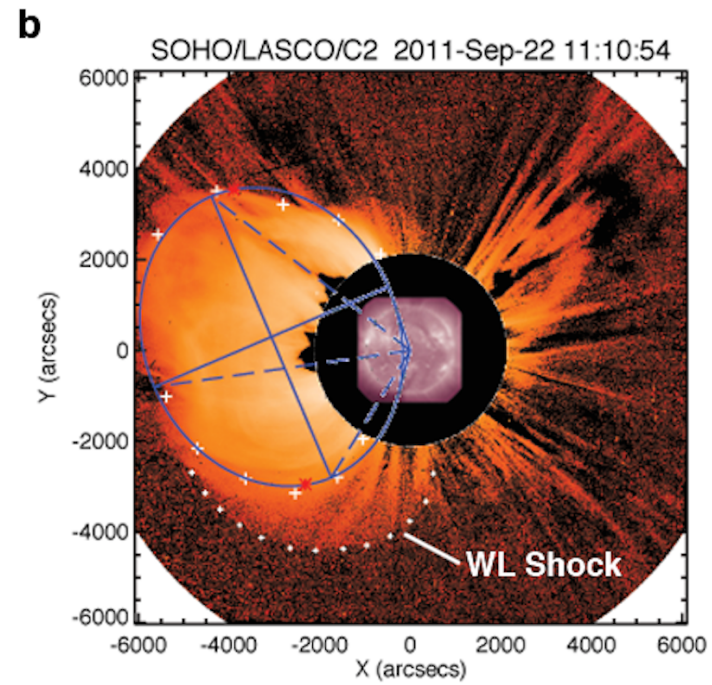
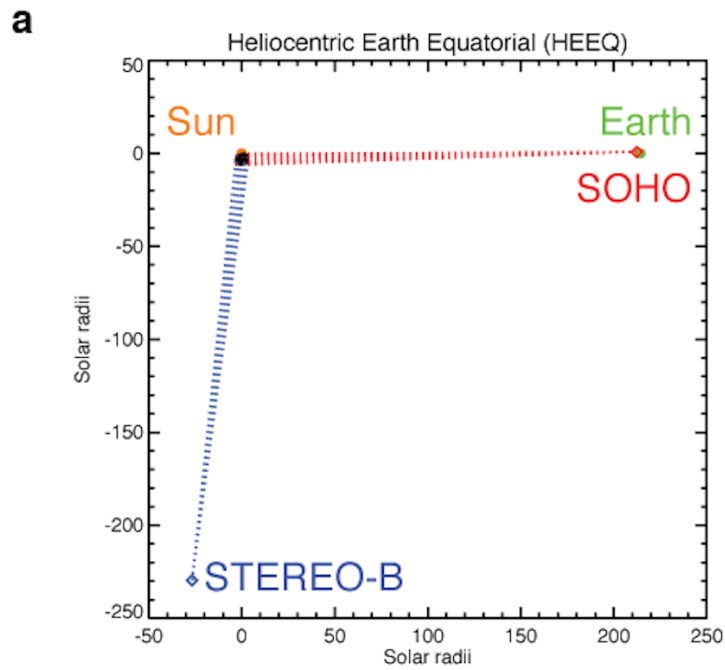
STEREO Observations

COR2-A

COR2-B



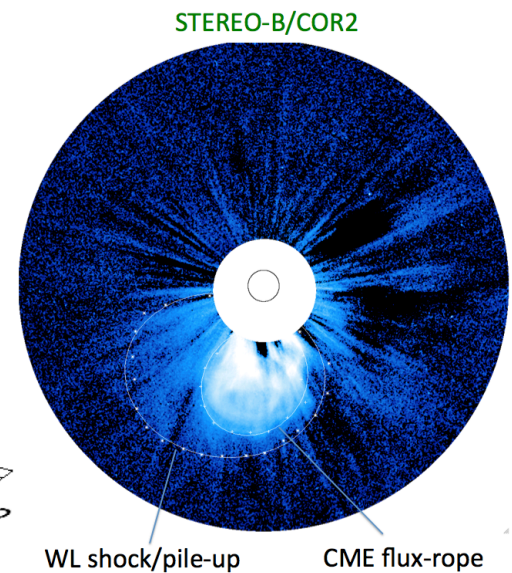
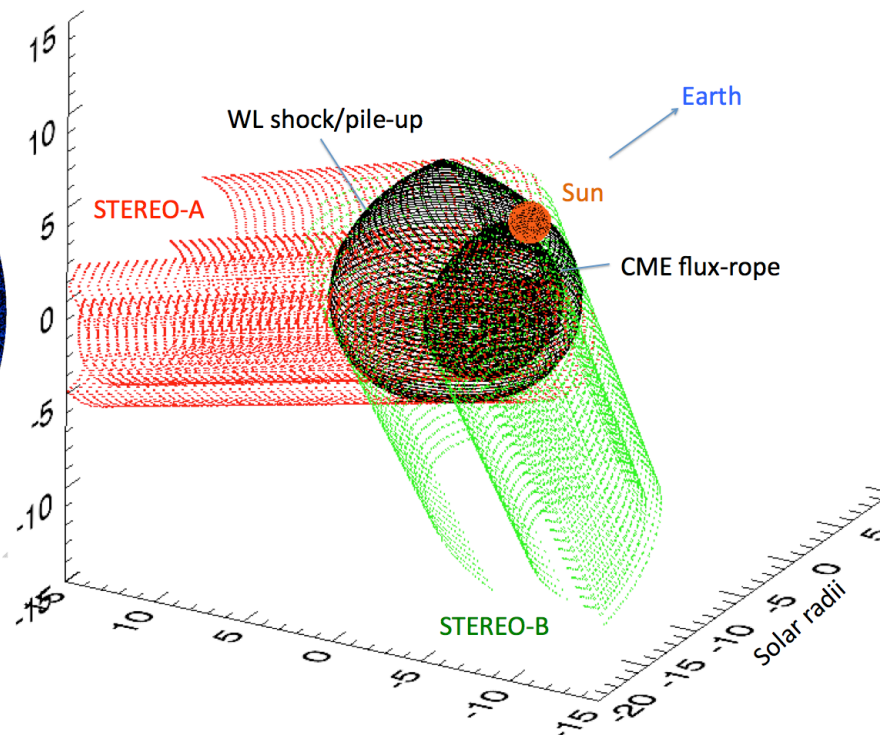
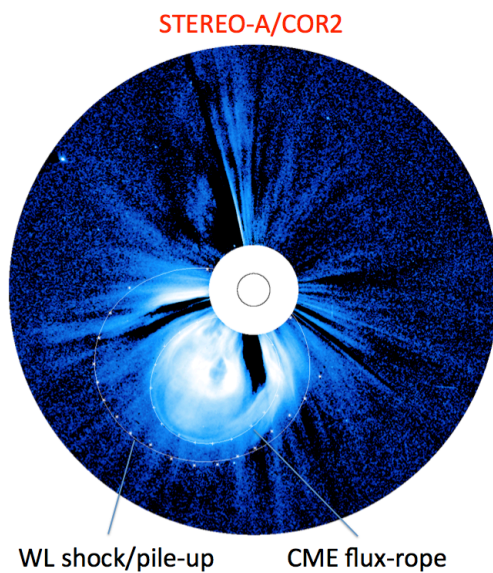
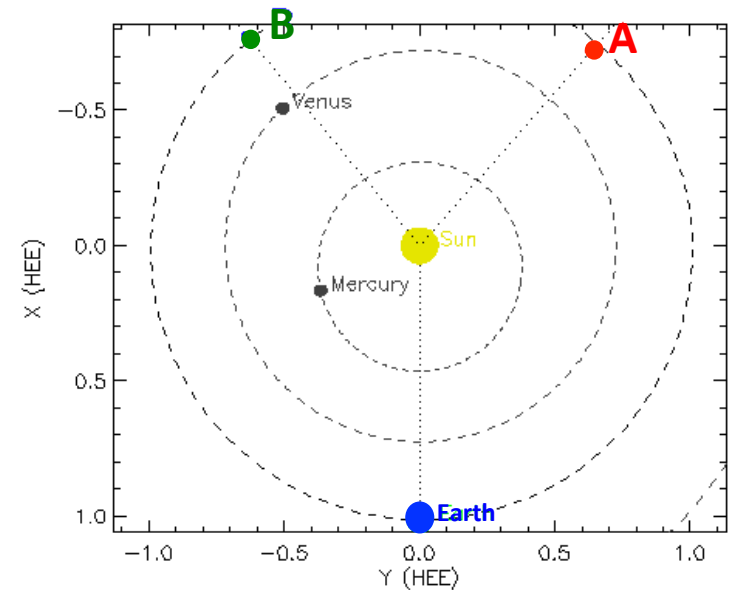
Byrne et al., *Nature Commun.* (2010)



Carley et al., *Nature Phys.* (2013)

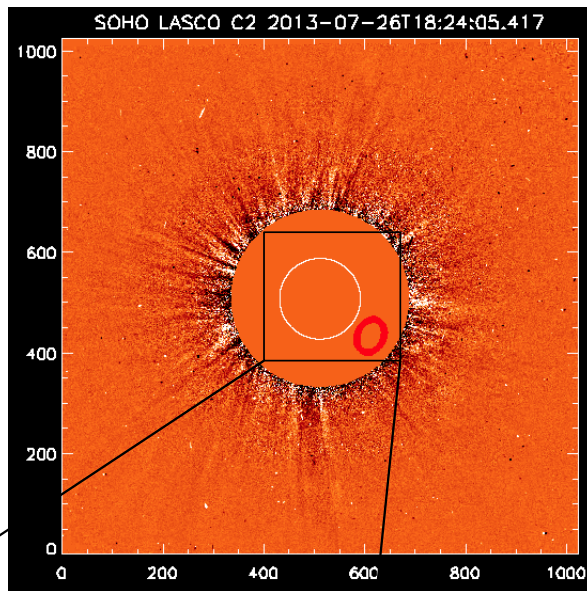
STEREO Observations

- Far-side of the sun
- Example: 7 June 2013 (~quadrature)
- CME with white-light shock/pile-up
- 3D reconstruction: elliptical tie-pointing

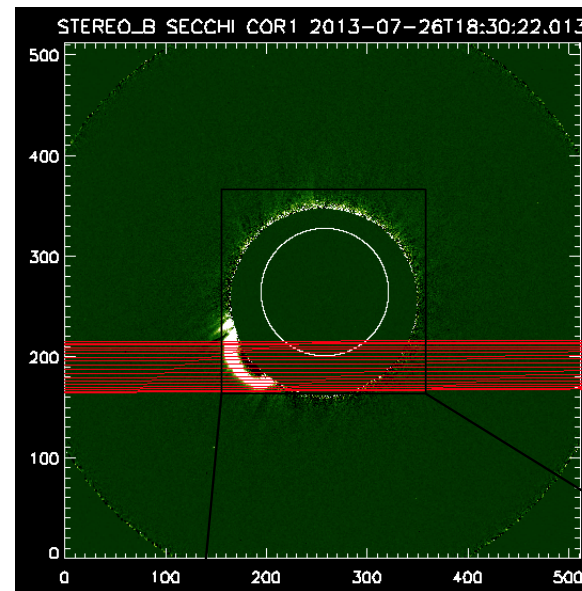


Combined Observations

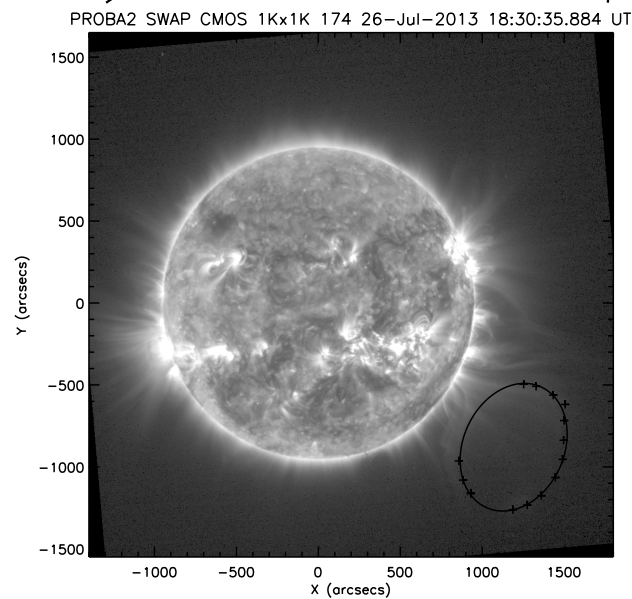
LASCO/C2



COR1-B

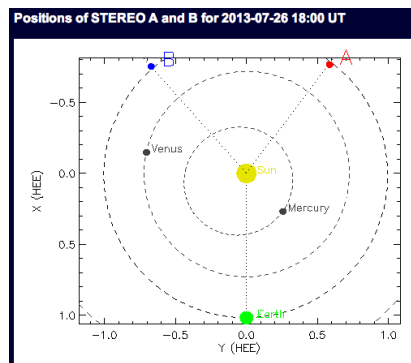


PROBA2/SWAP

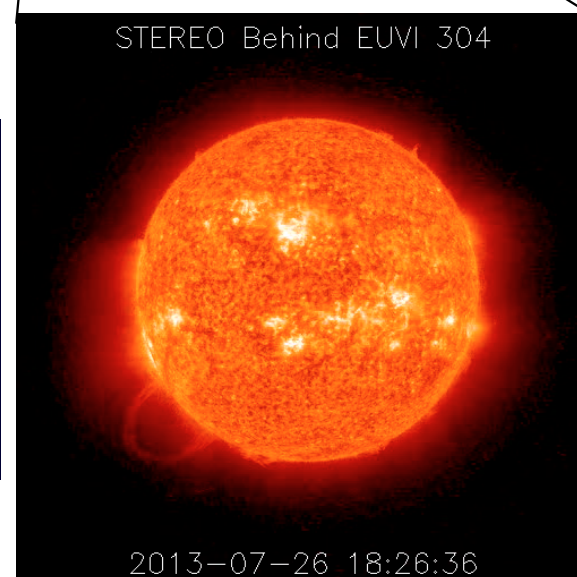


EUVI-B

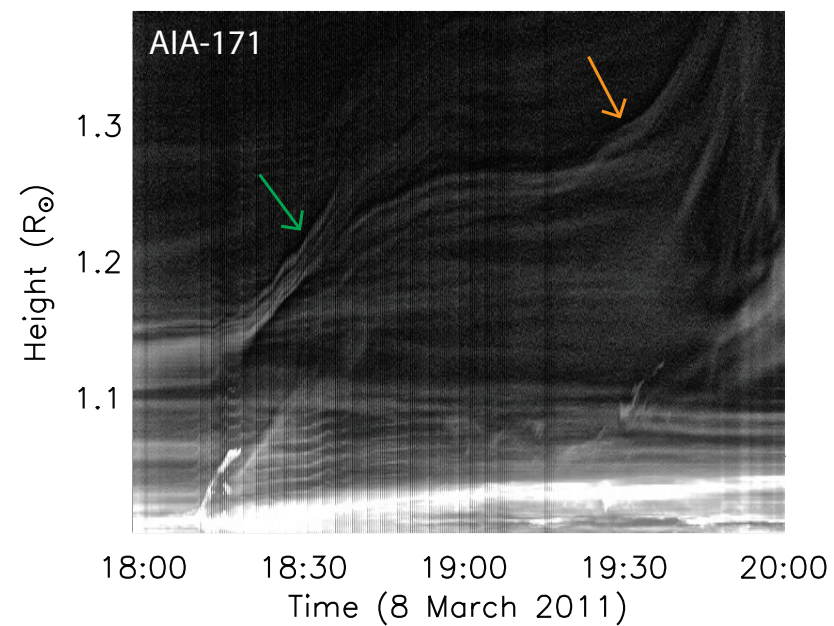
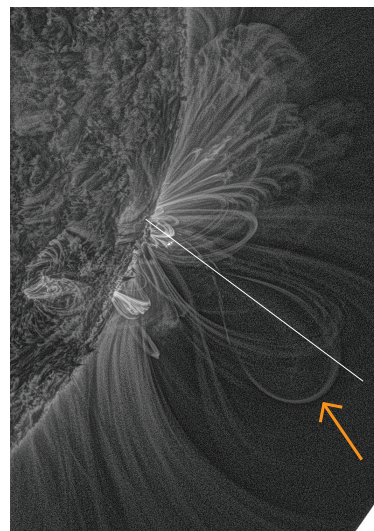
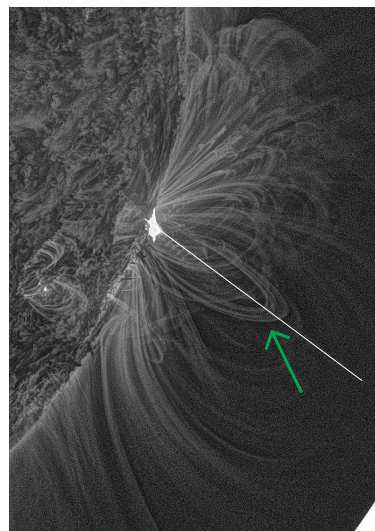
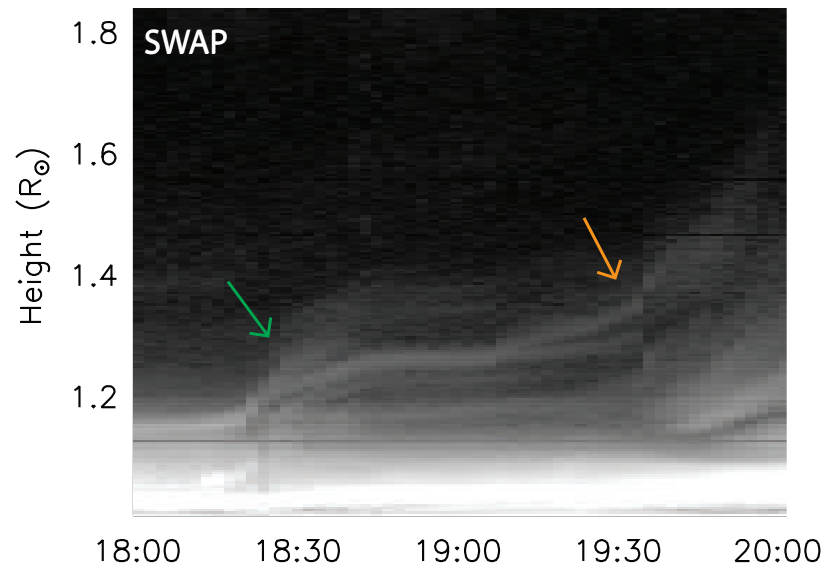
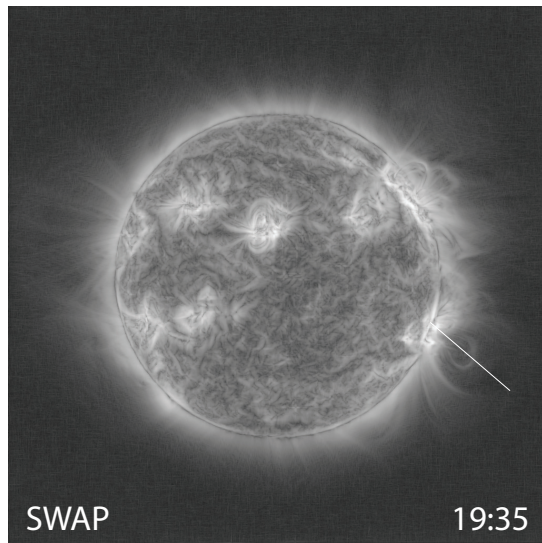
2013-07-26



STEREO Behind EUVI 304

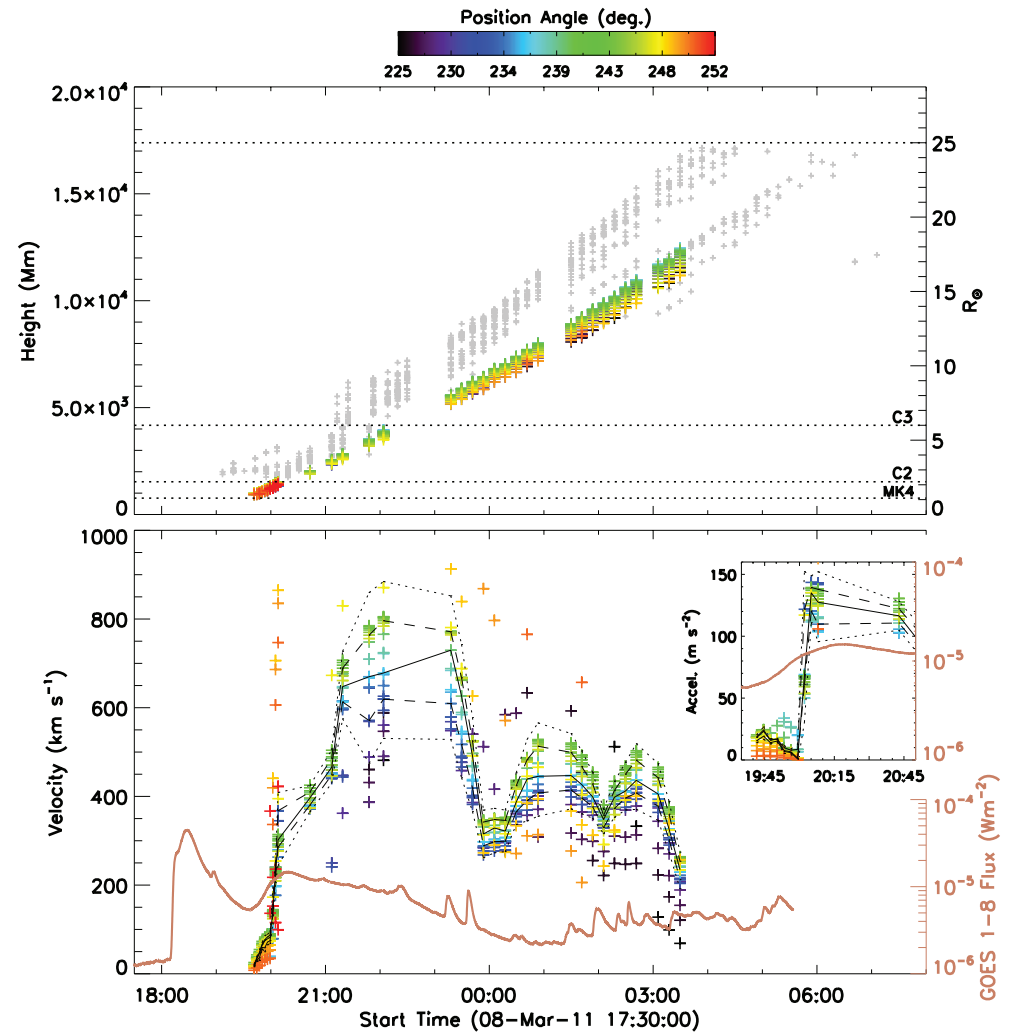
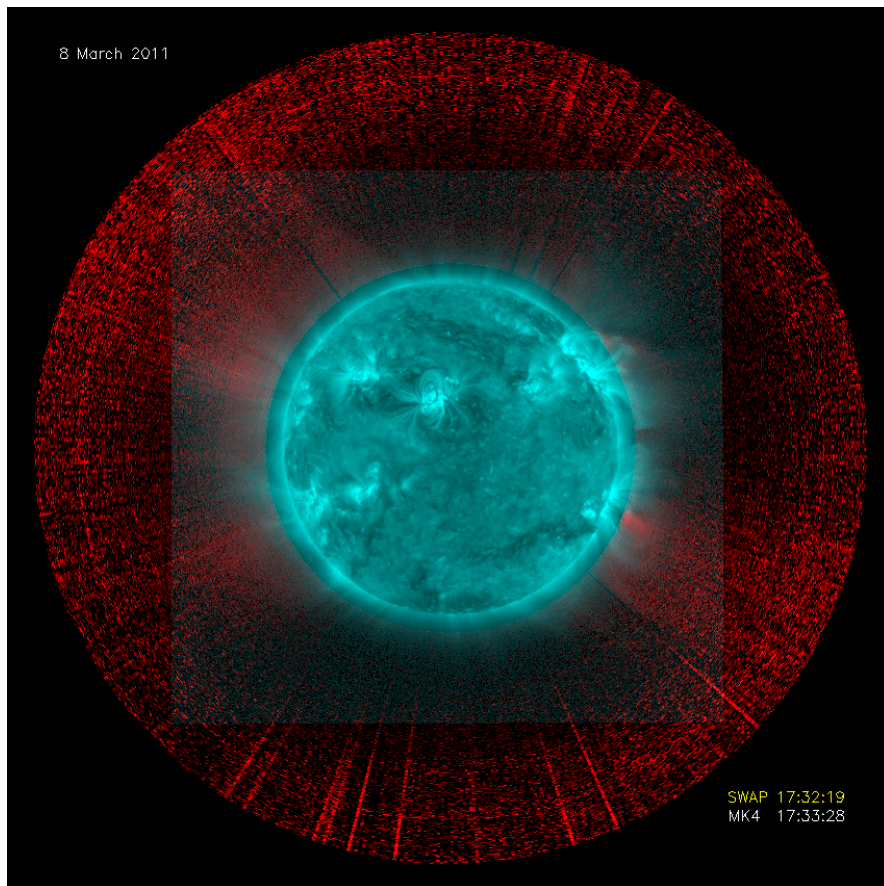


Combined Observations



Byrne et al., *Solar Physics* (2014; in press)

Combined Observations



Byrne et al., *Solar Physics* (2014; in press)

Ongoing & Future Work

- CORIMP catalogue & realtime detections
Database of high-fidelity CME measurements & statistics.
<http://alshamess.ifa.hawaii.edu/CORIMP>
- Investigate true CME kinematics & morphology
Across the entire STEREO mission dataset.
- Overlap with other instrument observations
Ranging from the Heliospheric Imagers down to K-cor.

