



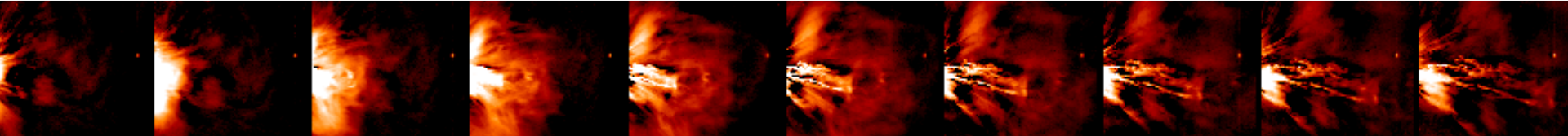
HELcats



EU FP7:
GA no: 606692

WP2: Producing a definitive catalogue of CMEs imaged by STEREO/HI – Introduction

Jackie Davies
STFC-RAL Space









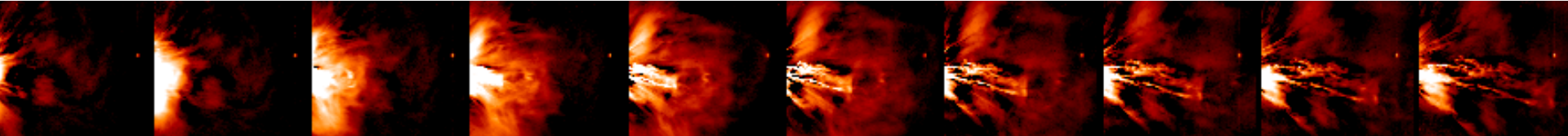
STEREO



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The scientific objectives of NASA's twin-spacecraft STEREO mission, launched in 2006, are to:

-  Understand the causes and mechanisms of CME initiation;
-  Characterize the propagation of CMEs through the heliosphere;
-  Discover the mechanisms and sites of energetic particle acceleration in the low corona and the interplanetary medium;
-  Improve the determination of the structure of the ambient solar wind.

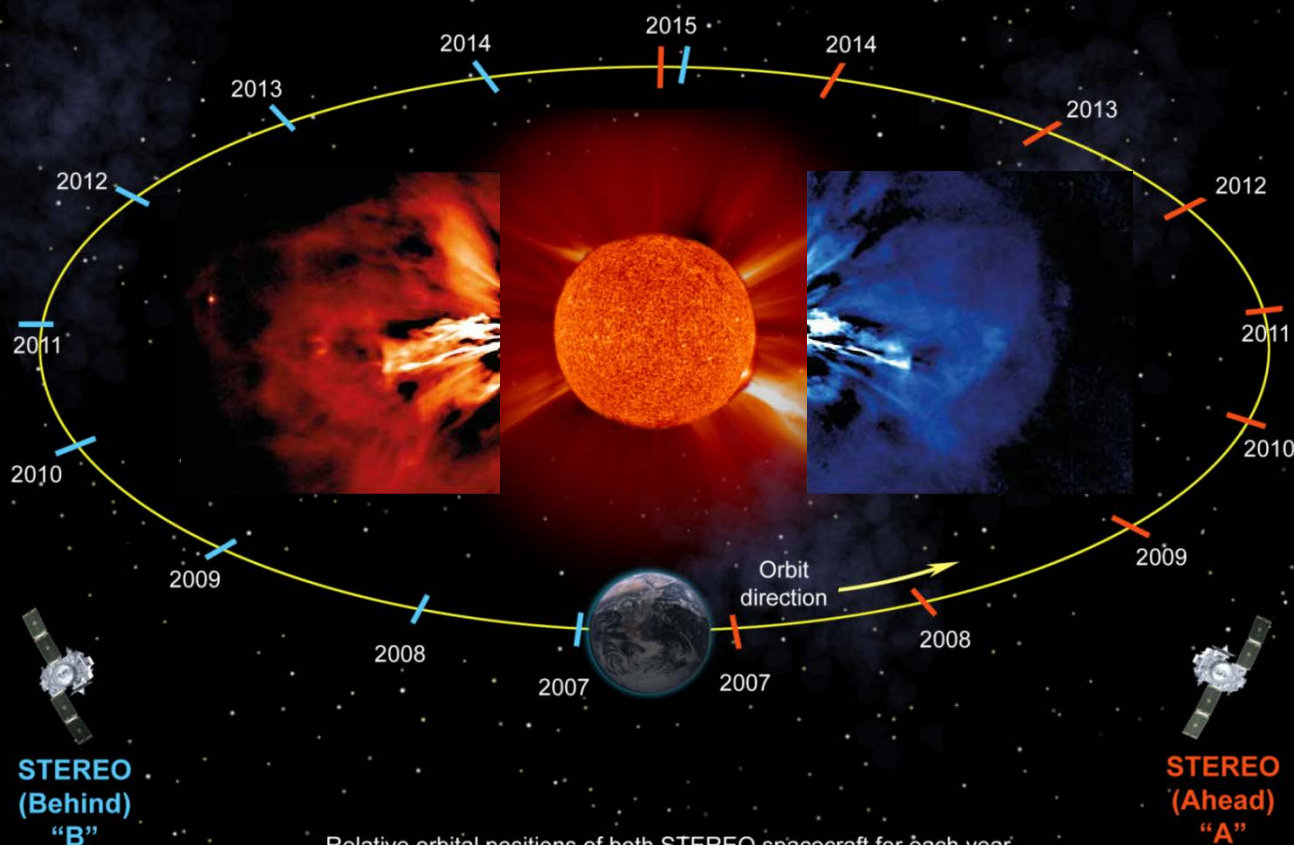




STEREO



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The twin-spacecraft NASA/STEREO mission was launched in October 2006.

The spacecraft are in near 1 AU heliocentric ecliptic orbits, each drifting relative to the Sun-Earth line by $\sim 22.5^\circ/\text{yr}$.

Relative orbital positions of both STEREO spacecraft for each year from June 2007 to June 2015 (Diagram not to scale)



STEREO



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After ~9 years, and having passed through superior conjunction:

ST-A is:

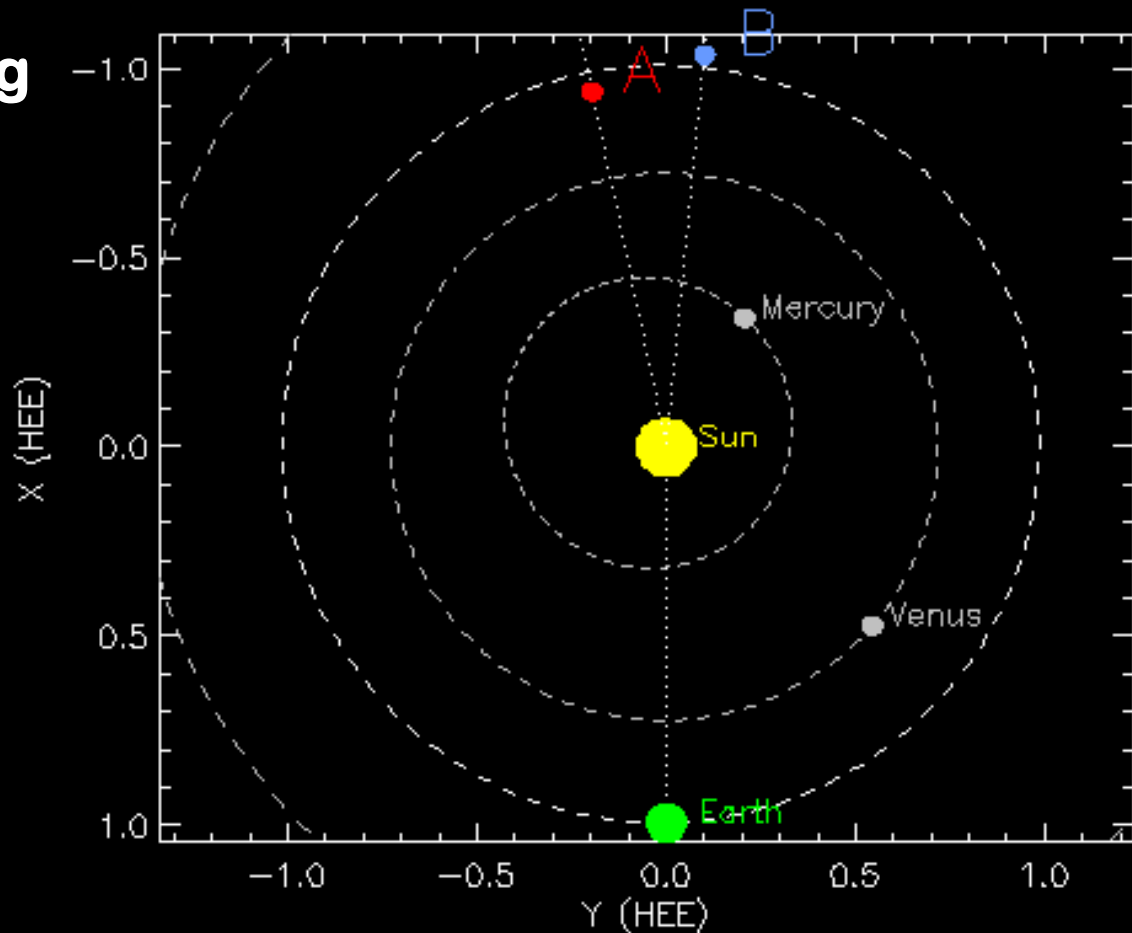
HEE longitude: 168.3°

HEE latitude: -0.0°

ST-B is:

HEE longitude: 174.4°


HEE latitude: -0.3°





STEREO




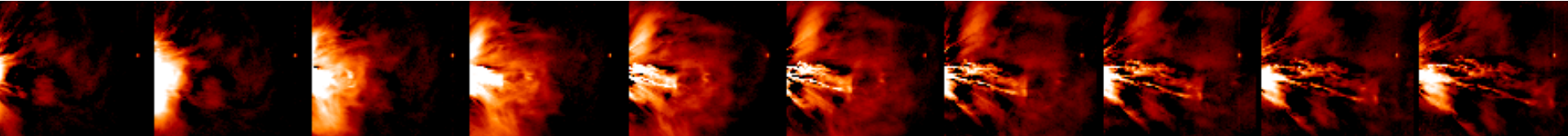
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 The small Sun-spacecraft-Earth angles on approach to superior conjunction led to potentially damaging overheating of the STEREO HGAs.

 As a compromise between spacecraft health protection and data return, a strategy for “reduced operations” either side of conjunction was developed based on HGA off-pointing.

 Unfortunately, during a test of reduced operations prior to entering conjunction, contact with ST-B was lost (attempts to re-establish contact are due to resume soon).

 ST-A emerged safely from superior conjunction, with spacecraft and all instruments (including HI) operating nominally. While currently still in a period of reduced operations, nominal operations will resume shortly.





STEREO/HI



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Timeline of reduced operations/superior conjunction & impact on STEREO/HI image cadence and resolution

S/C	HI Event	Date
ST-A	Switch to 1 st side lobe	20 Aug 2014
ST-B	Loss of contact	1 Oct 2014
ST-A	Switch to 2 nd side lobe	5 Jan 2015
ST-A	Enter superior conjunction	20 Mar 2015
ST-A	Exit superior conjunction (2 nd side lobe)	11 Jul 2015
ST-A	Switch to 1 st side lobe	16 Aug 2015
ST-A	Switch to main lobe	16 Nov 2015
ST-B	Resume recovery efforts (1 st side lobe)	30 Nov 2015

STEREO/HI reduced operations Nominal image return per day

1st side lobe:

2 HI-1 images: 512 x 512

1 HI-2 image: 512 x 512

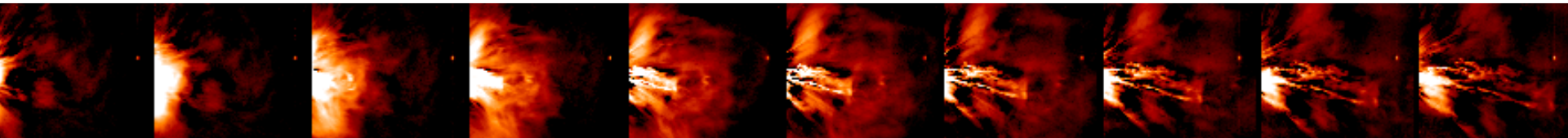
Lossless compression

2nd side lobe:

1 HI-1 image: 256 x 256

1 HI-2 image: 256 x 256

Lossless compression










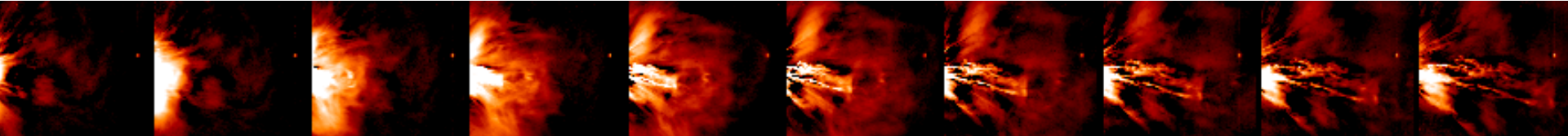
STEREO/HI



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-  A definitive in-flight photometric calibration/flat fielding of HI-2, using stellar sources, has recently been implemented (Tappin et al. SP, 2015).
-  A modification of the methodology used by Bewsher et al. (SP, 2010) for HI-1 was needed due to high density of stars and large/asymmetric HI-2 PSF.
-  As for HI-1 (Bewsher et al. SP, 2012), this work demonstrates the excellent photometric stability of HI-2 (compared to other white-light imagers).
-  Tappin et al. (SP, submitted) revisit the HI-1 photometric calibration over a more extended period (incl. examining effect of gyroless operations).
-  Different levels of (calibrated/uncalibrated) STEREO/HI imagery, in a variety of units, are available from the UK Solar System Data Centre (UKSSDC)*

*Can be accessed via: <http://www.stereo.rl.ac.uk>





STEREO/HI



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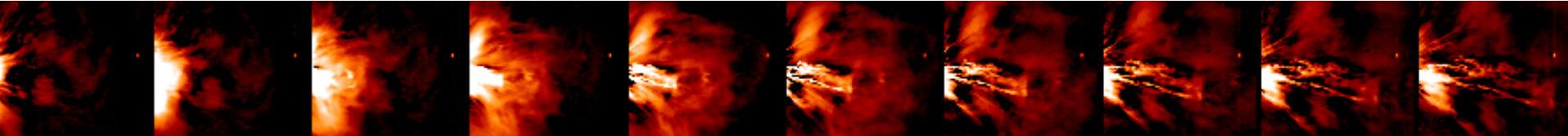
STEREO is in a NASA mission extension phase (currently approved to 2016);



The most recent (2013) NASA senior review rated the overall scientific merit for the proposed extended STEREO mission as excellent. Its value to the heliophysics system observatory was ranked as compelling;



STEREO is included in the 5-year plan with planned figures to the start of US FY 2015, and nominal figures to FY 2018 with an invitation to submit to the 2015 review. The mission is formally extended to September 2016.





HELcats WP2:

Producing a definitive catalogue
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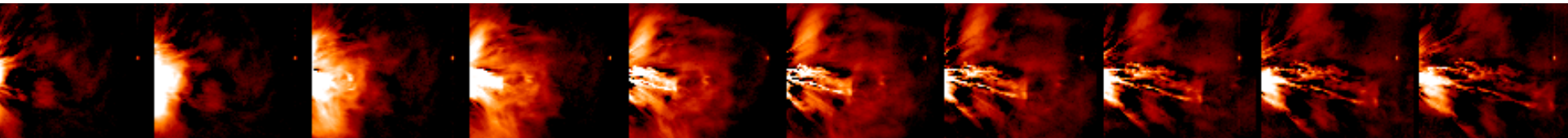
Type of Activity: RTD

Lead: Jackie Davies (STFC; 1)

Participants: STFC (1); UGOE (4); ROB (5)

Duration: Month 1 – 36

This WP provides the foundation for this project, namely the production of a catalogue of CMEs in the heliosphere produced from manual inspection of STEREO/HI data; use of automated techniques are also being investigated. Comparisons with coronal CME catalogues is also be made.





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WP2 Task 1 – STFC:

 Manual cataloguing of STEREO/HI CMEs

WP2 Task 2 – ROB:

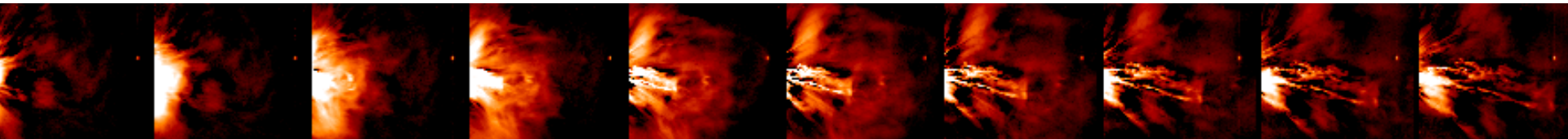
 Automatic cataloguing of STEREO/HI CMEs

WP2 Task 3 – UGOE, STFC, ROB:

 Comparison of CME catalogues

WP2 Task 4 – STFC:

 Scientific management





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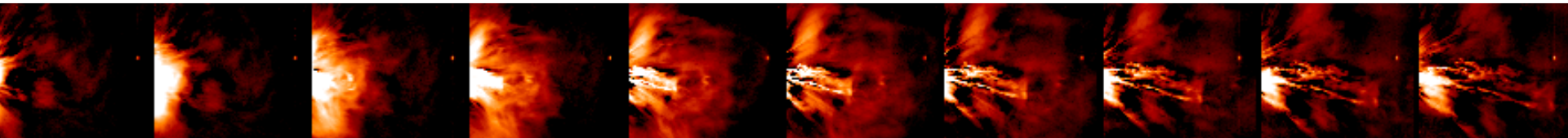


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List of deliverables

Deliverable Number ⁶¹	Deliverable Title	Lead beneficiary number	Estimated indicative person-months	Nature ⁶²	Dissemination level ⁶³	Delivery date ⁶⁴
D2.1	Catalogue of observational parameters of HI-1 manually-identified CMEs	1	13.50	Other	PU	36
D2.2	Report on the feasibility of automatic identification of CMEs in HI-1 data	5	14.00	Report	PP	12
D2.3	Report on the inter-comparison of the manual and automated CME catalogues	1	12.00	Report	PP	18
D2.4	Report in which the manual and automated HI CME catalogues are compared to pre-existing coronagraph CME catalogues	1	8.00	Report	PP	24
D2.5	Scientific management of HELcats	1	4.00	Other	PP	36
			Total			
				51.50		

Description of deliverables





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The following three talks will detail
progress in WP2, tasks 1, 2, and 3,
respectively.

