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A Catalogue of Geometrically-Modelled Coronal Mass Ejections Observed by the STEREO Heliospheric Imagers

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Contents

- A description of the basic HI CME catalogue
- Modelling techniques used to estimate CME kinematic properties from HI observations
- Statistical properties from the new CME catalogue
- Stereoscopic modelling of CMEs observed by both spacecraft
- Summary

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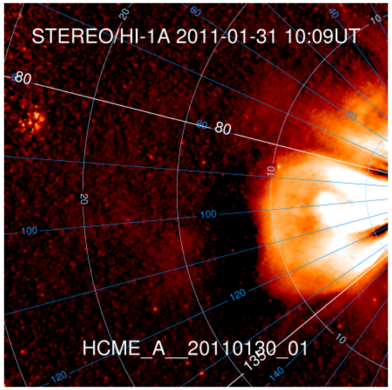
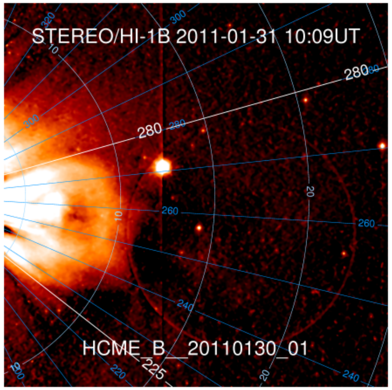
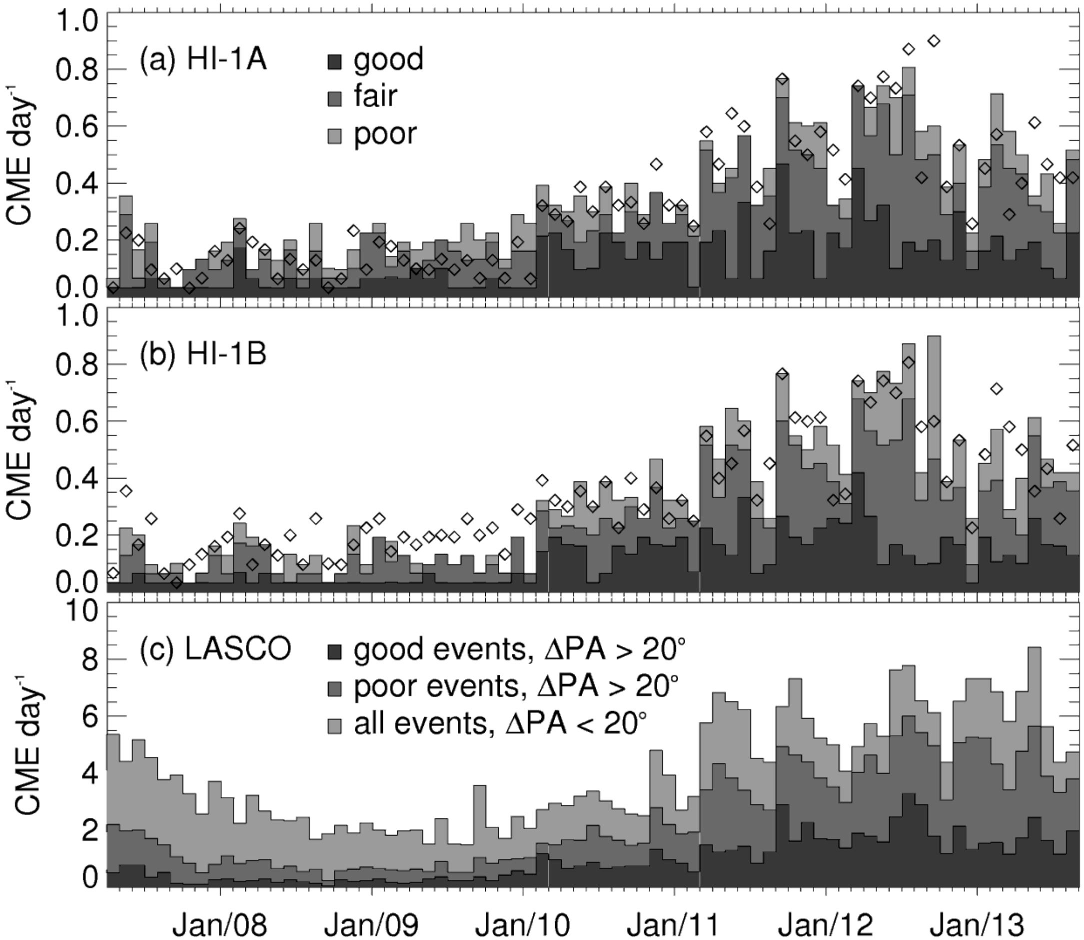
The HELCATS HI-Catalogue

Contains the basic observational properties of CMEs observed during the science phase of the STEREO mission (April 2007 - September 2014)



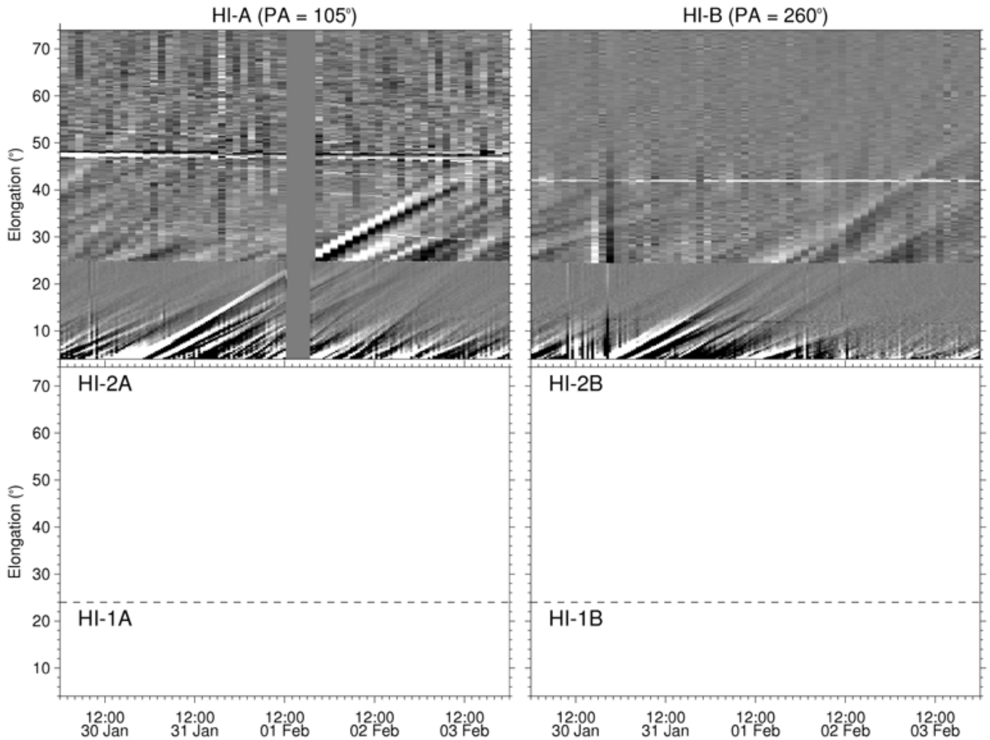




http://www.helcats-fp7.eu/catalogues/wp2_cat.html

CME Tracking

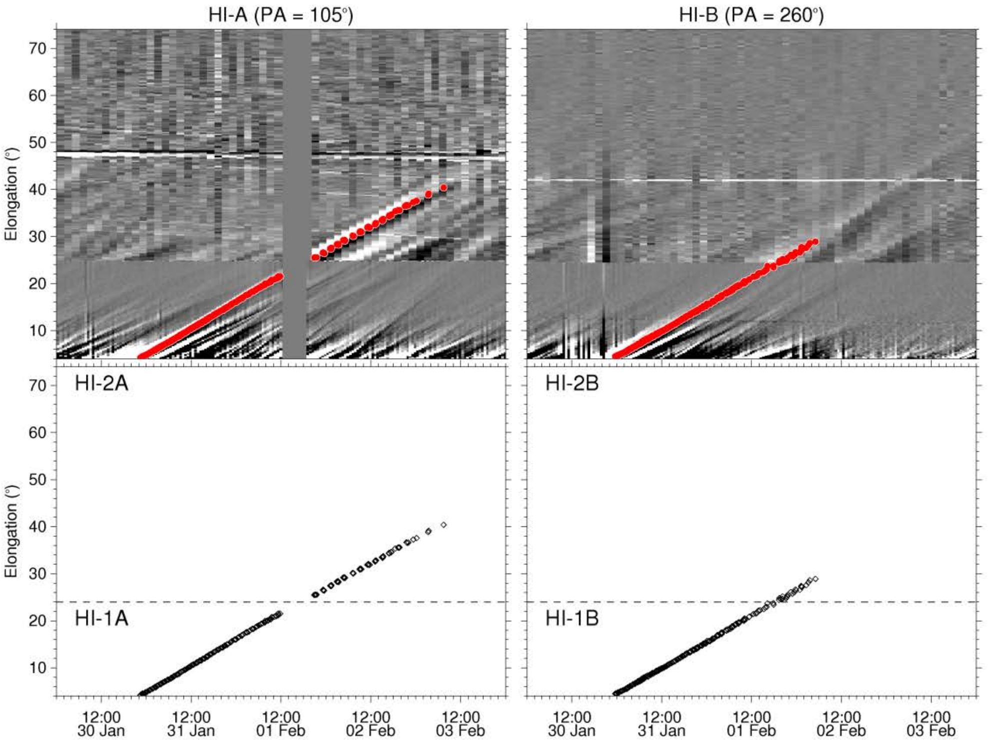
- CMEs are identified in time/elongation plot



CME Tracking

- CMEs are identified in time/elongation plot

- Tracks are manually identified



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CME Tracking

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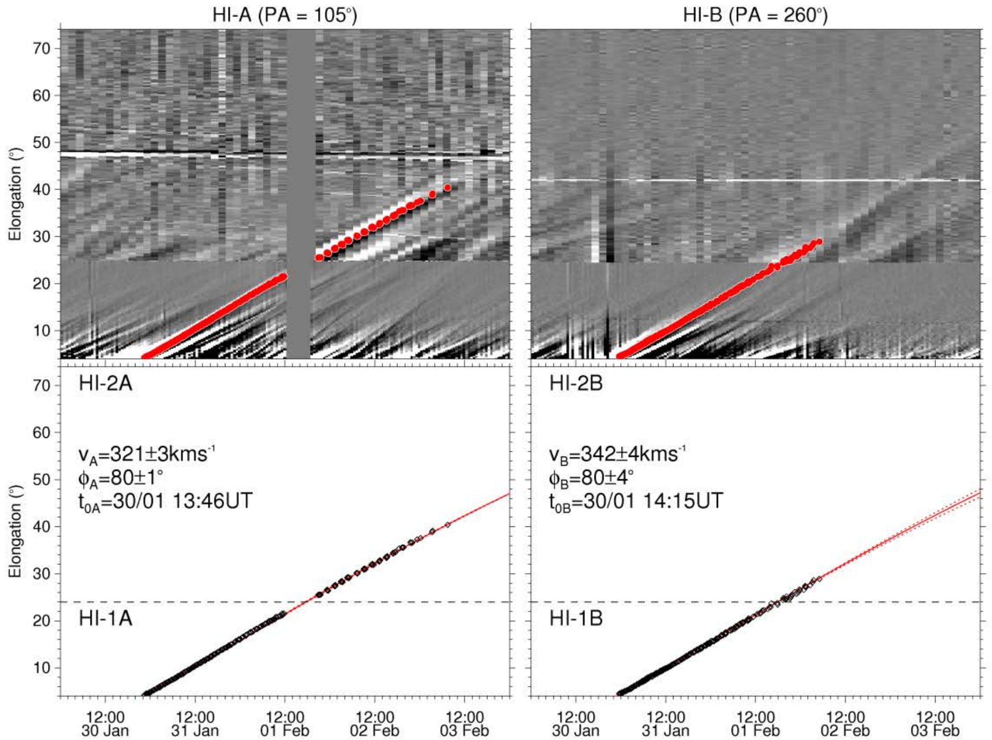

- Kinematic properties are determined based on assumptions of CME morphology (Davies et al. 2012)

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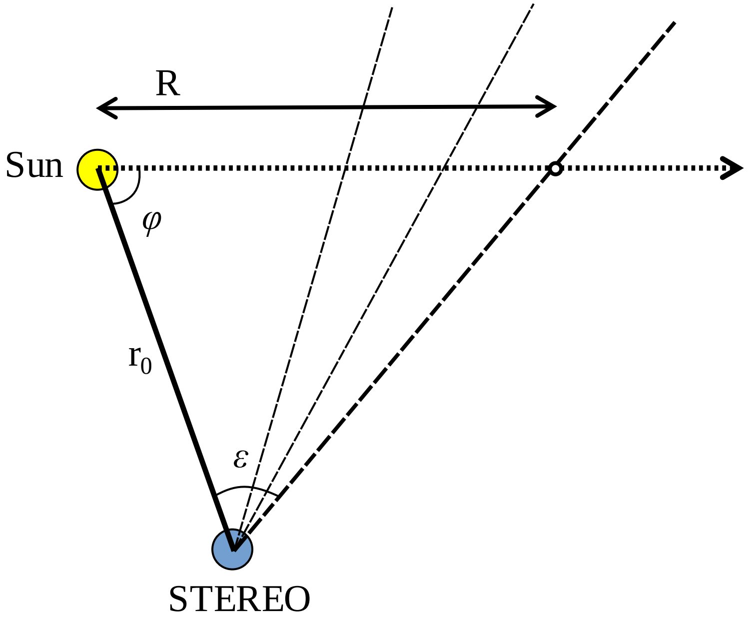
1st Model: Fixed-phi



$$v(t - t_0) = \frac{r_0 \sin(\varepsilon(t))}{\sin(\varepsilon(t) + \varphi)}$$

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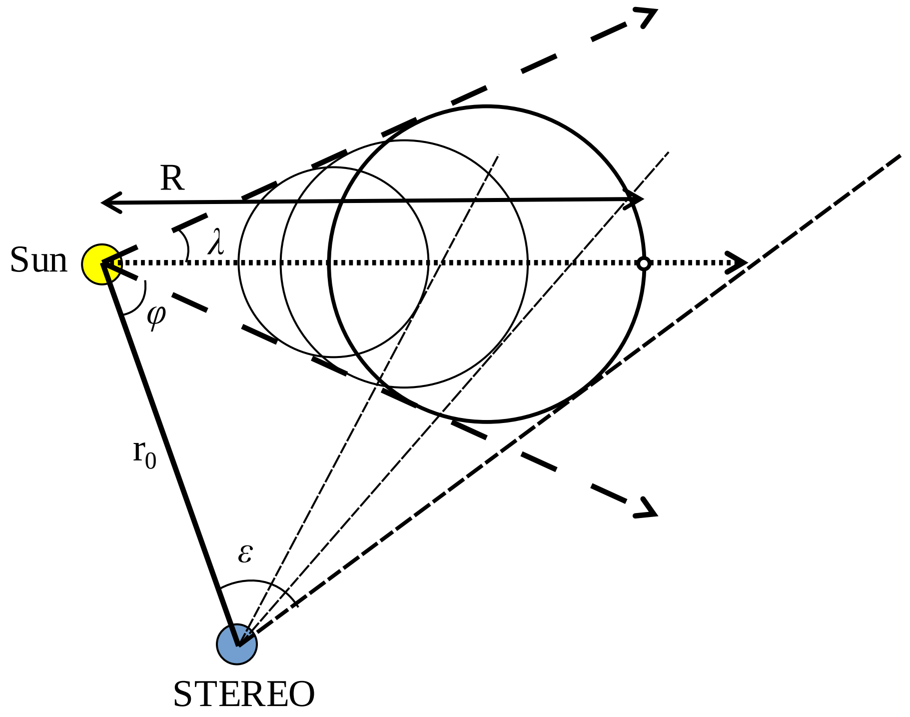
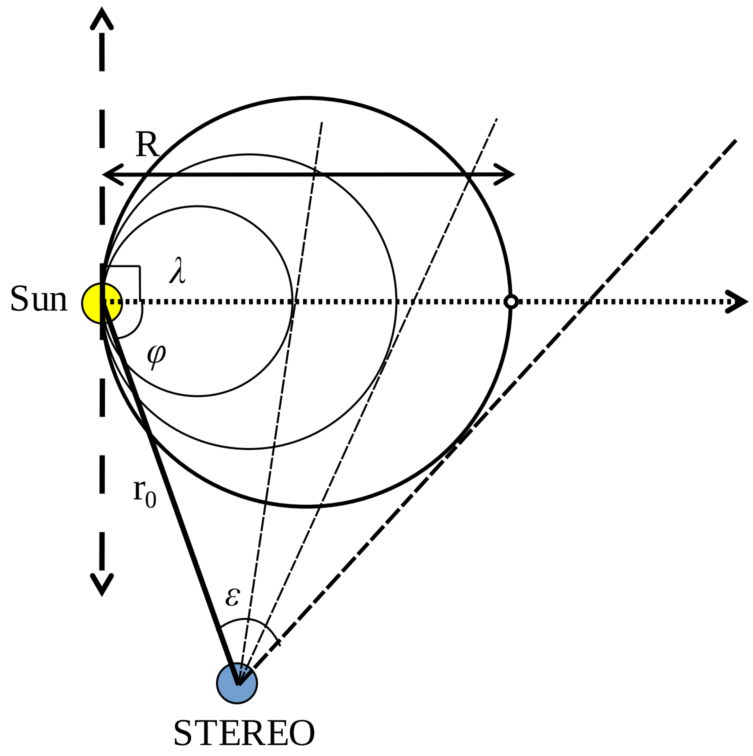
2^{nd} Model: Self-Similar Expansion



$$v(t - t_0) = \frac{3r_0 \sin(\varepsilon(t))}{2\sin(\varepsilon(t) + \varphi) + \frac{1}{2}}$$

3rd Model: Harmonic Mean



$$v(t - t_0) = \frac{2r_0 \sin(\varepsilon(t))}{\sin(\varepsilon(t) + \varphi) + 1}$$

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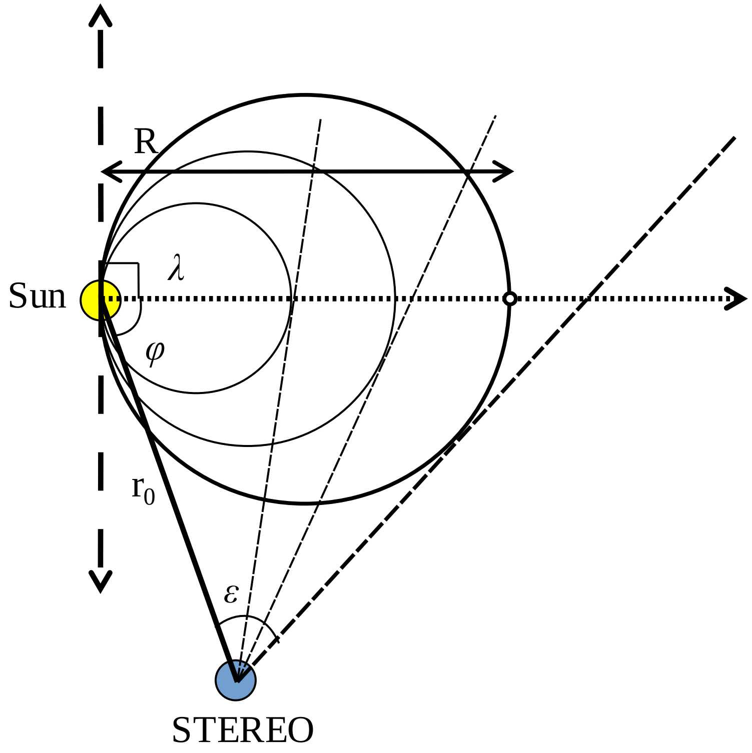
3rd Model: Harmonic Mean



$$v(t - t_0) = \frac{2r_0 \sin(\varepsilon(t))}{\sin(\varepsilon(t) + \varphi) + 1}$$

$$v(t - t_0) = \frac{r_0 \sin(\varepsilon(t))(1 + \sin(\lambda))}{\sin(\varepsilon(t) + \varphi) + \sin(\lambda)}$$

$\lambda = 0°$; fixed−phi
$\lambda = 30°$; self−similar expansion
$\lambda = 90°$; harmonic mean

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Catalogue of CME Kinematic Properties

- **Catalogue is complete for 1353 CMEs (Apr '07 - Sep '14)**

SSE launch date range | SSE speed: **50 to 3600 kms-1** | SSE HEEQ Lon: **-180 to 180 degrees** | SSE HEEQ Lat: **-45 to 45 degrees**

From 2007-01-01 to 2015-01-01

Show 10 entries | Search: | Show / hide columns

ID	SC	Quality	PA-fit	SSE speed [kms-1]	SSE Phi [deg]	SSE HEEQ Long [deg]	SSE HEEQ Lat [deg]	SSE Carr Long [deg]	SSE Launch [UTC]
HCME_A__20110122_01	A	fair	70	331	73	15	17	357	2011-01-21 18:47
HCME_A__20110124_01	A	good	95	379	72	13	-6	323	2011-01-24 03:39
HCME_A__20110125_01	A	good	60	[illegible]	[illegible]	31	23	323	[illegible]
HCME_A__20110130_01	A	good	105	321	81	3	-15	229	2011-01-30 13:46
HCME_A__20110214_01	A	fair	100	[illegible]	[illegible]	13	-10	54	[illegible]
HCME_A__20110214_02	A	good	90	417	70	16	0	42	2011-02-14 18:26
HCME_A__20110216_01	A	fair	[illegible]	750	144	-60	19	306	2011-02-16 04:25
HCME_A__20110217_01	A	fair	50	515	34	59	19	56	2011-02-16 23:26
HCME_A__20110225_01	A	fair	55	463	75	15	33	263	2011-02-25 06:46
HCME_A__20110226_01	A	fair	70	388	47	41	13	281	2011-02-25 20:17

Showing 231 to 240 of 1,315 entries (filtered from 1,330 total entries)

Select | Save | Print | Previous 1 .. 23 24 25 .. 132 Next

speed **direction** **launch time**

http://www.helcats-fp7.eu/catalogues/wp3_cat.html

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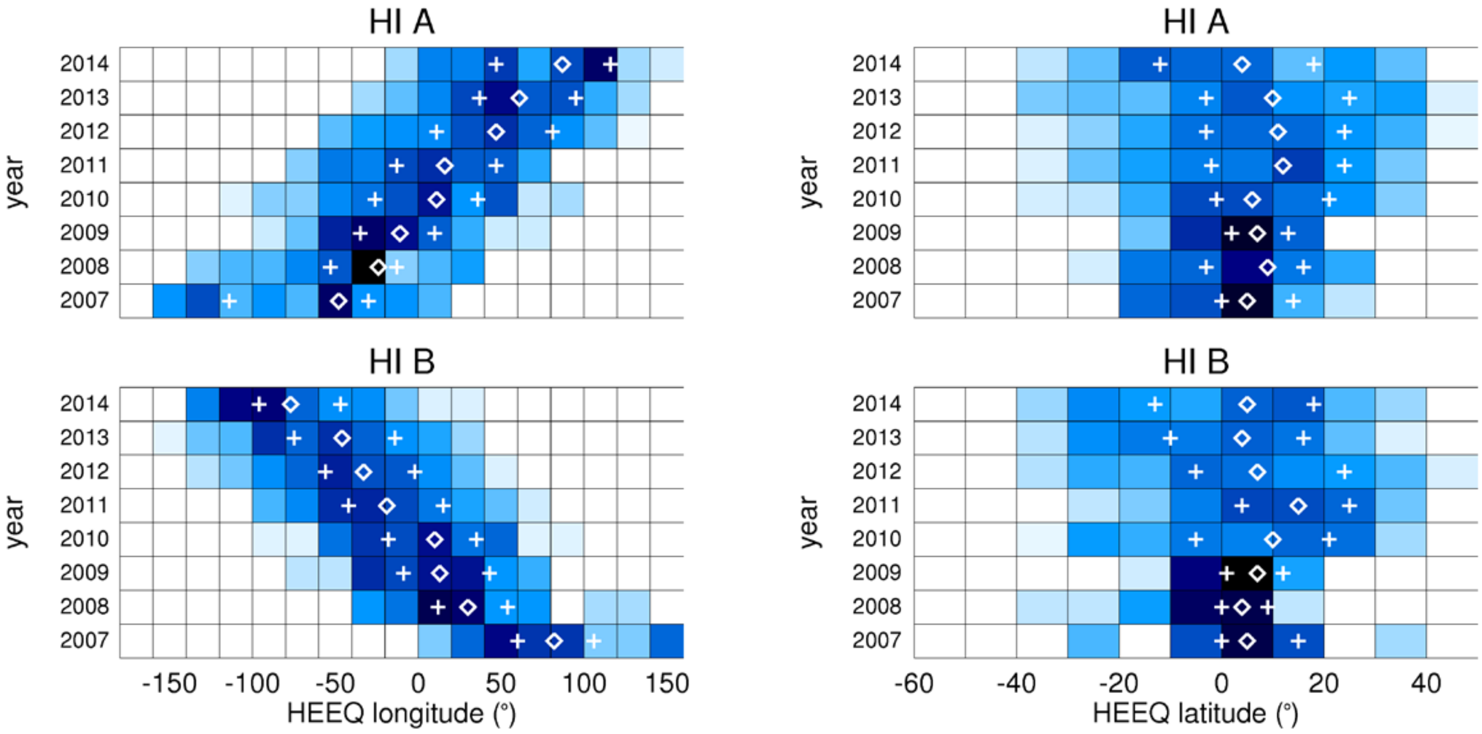
CME Statistical Properties



- CME latitude distributions consistent with established behaviour

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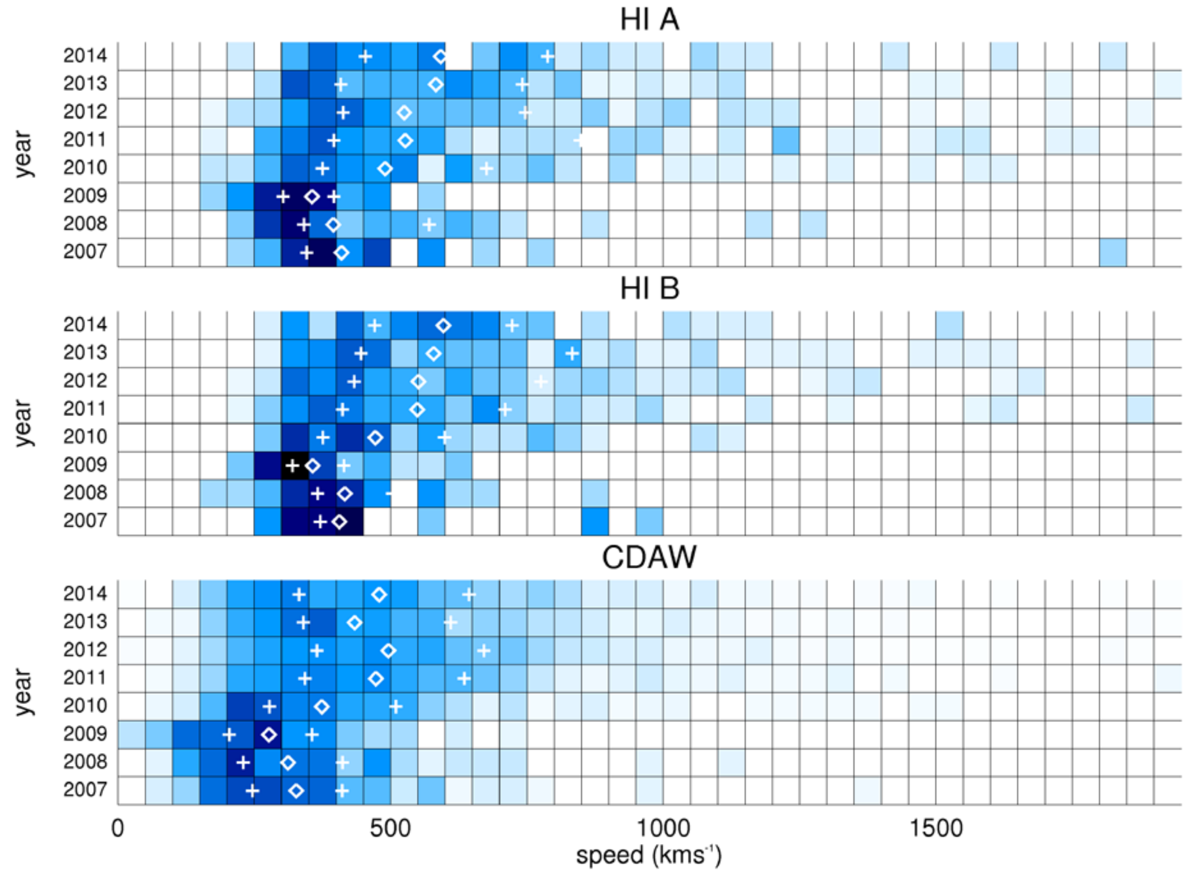
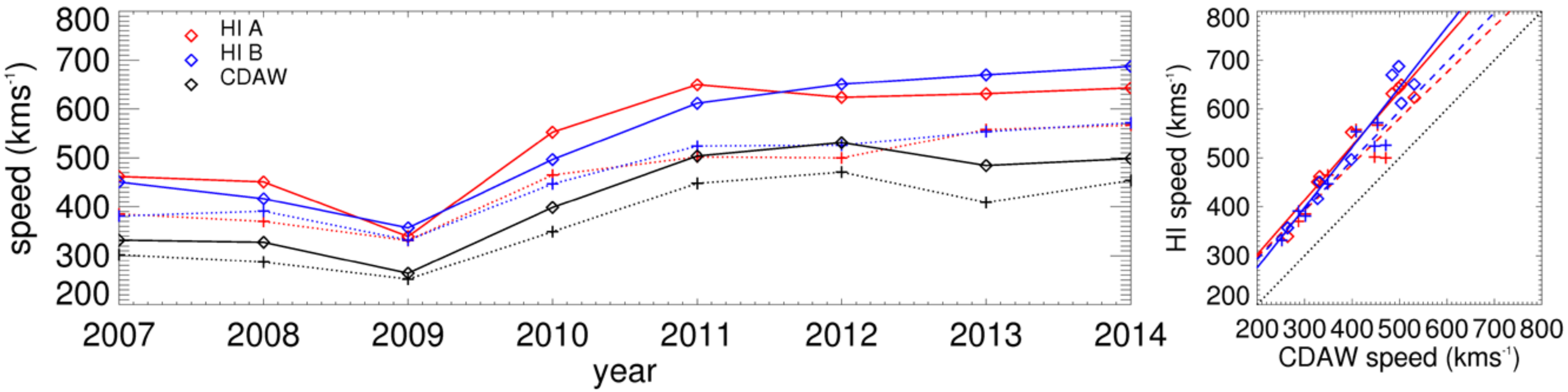
CME Statistical Properties



- Stacked annual speed histograms from HELCATS HI catalogues and LASCO CDAW catalogue (Yashiro et al. 2004)

CME Statistical Properties



- Same solar cycle trend seen in HI and LASCO
- Mean speed are greater in HI by ~120kms^{-1}
- Due to 'projection effects' in coronagraph speed estimates

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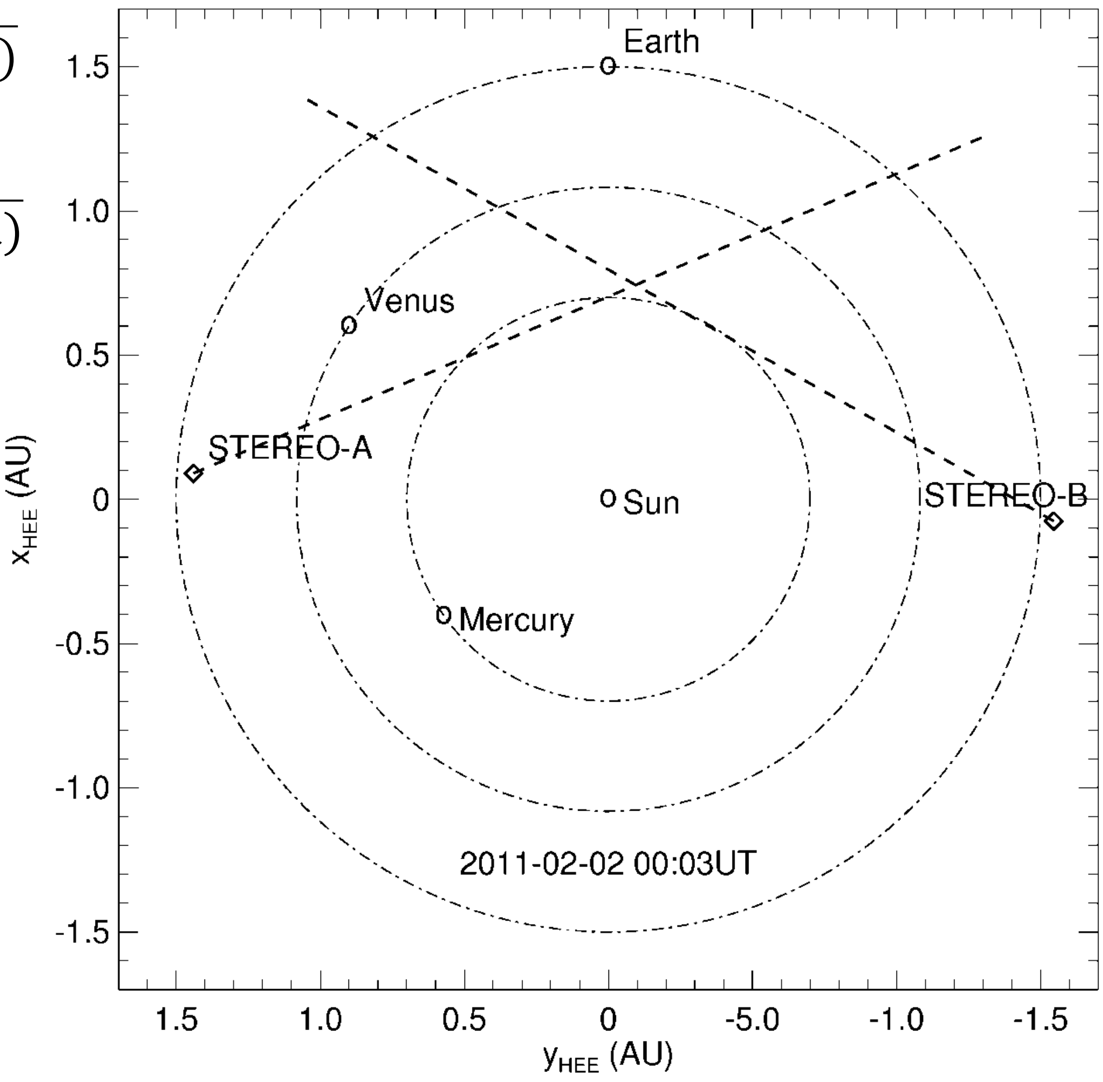
Stereoscopic Modelling

$$v(t - t_0) = \frac{r_A \sin(\varepsilon_A\,(t))\sin(1+\lambda)}{\sin(\varepsilon_A(t) + \varphi_A) + \sin(\lambda)}$$

$$= \frac{r_B \sin(\varepsilon_B(t))\sin(1+\lambda)}{\sin(\varepsilon_B(t) + \varphi_B) + \sin(\lambda)}$$

(Davies et al. 2013)



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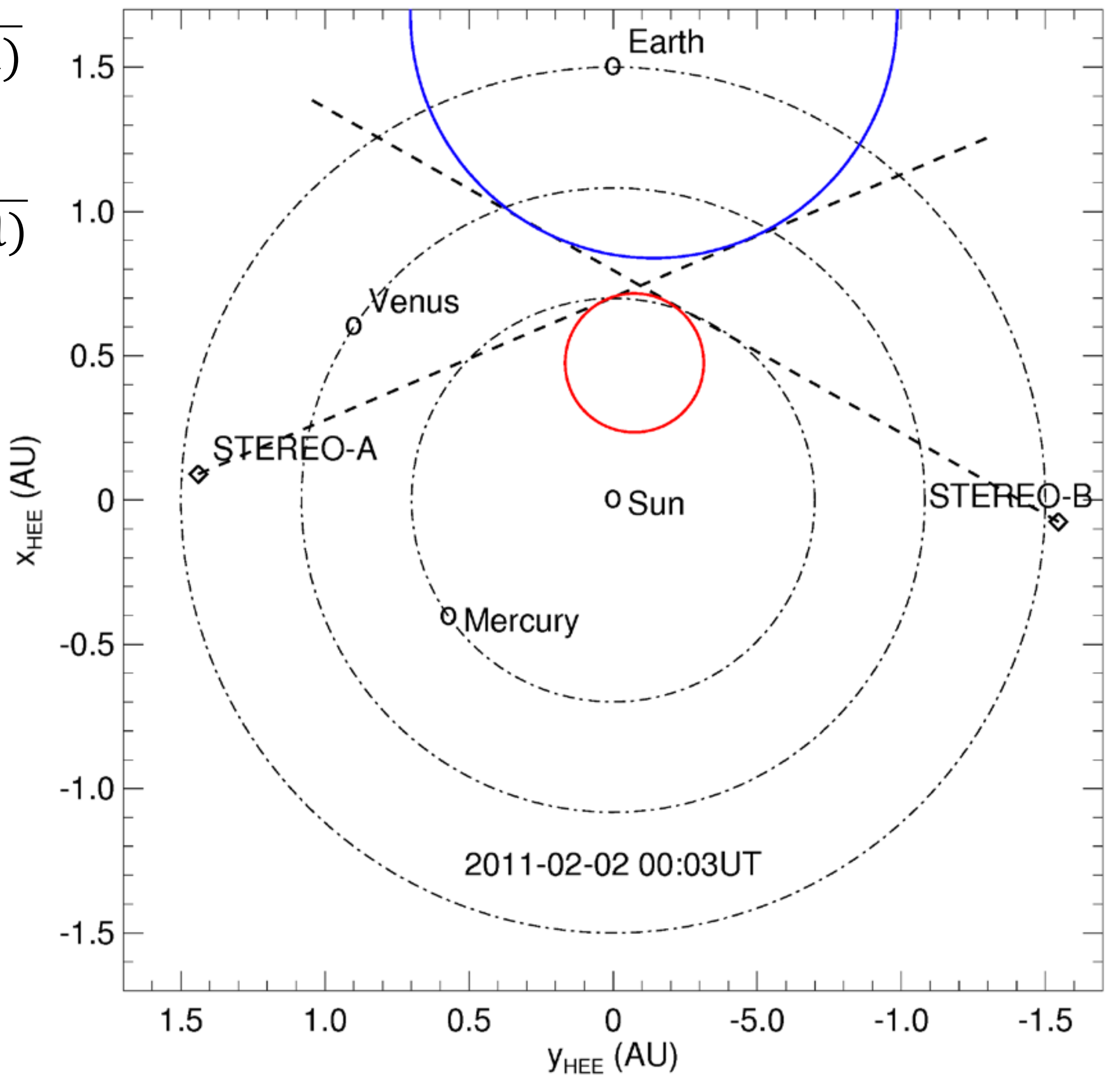

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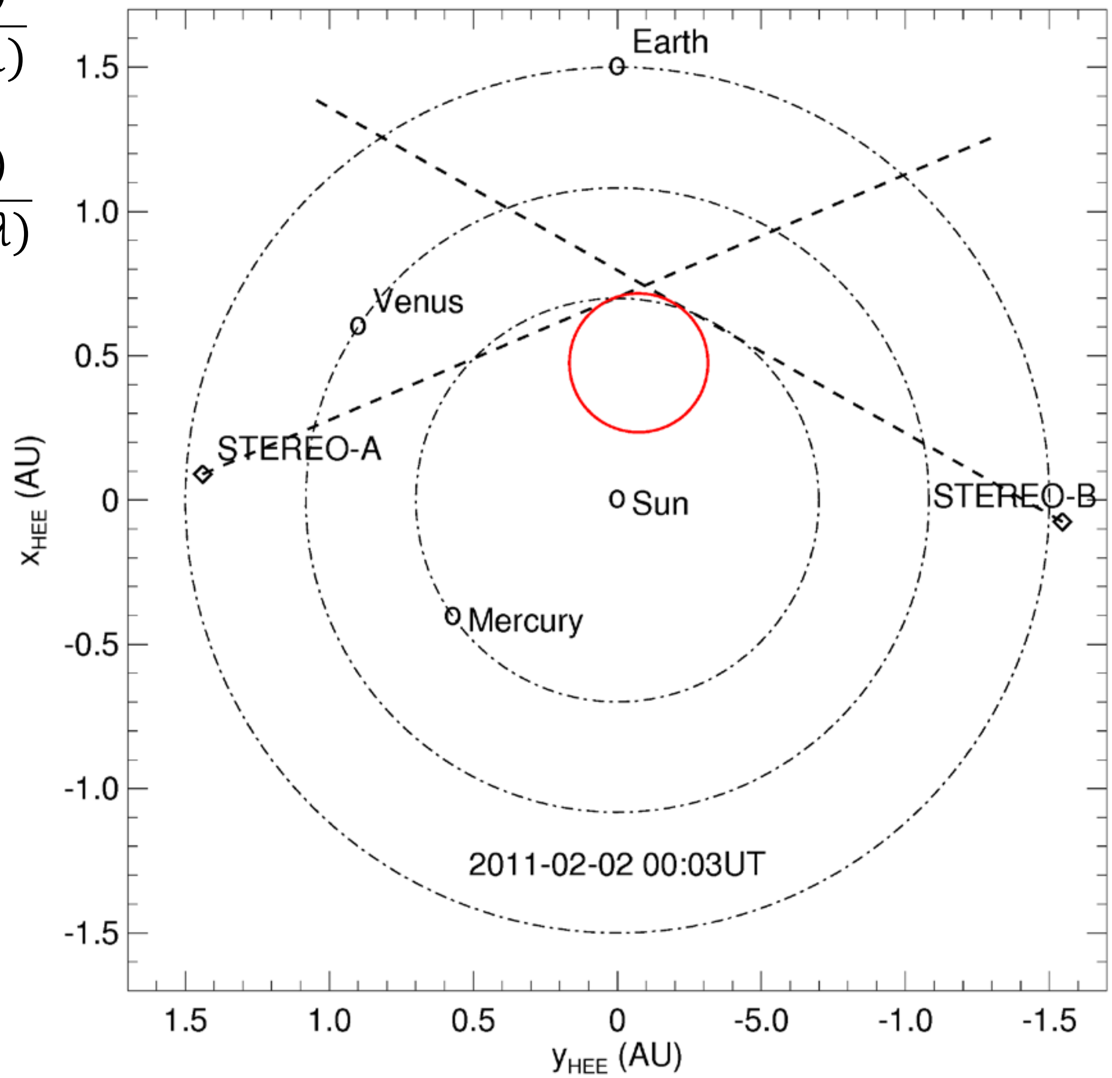

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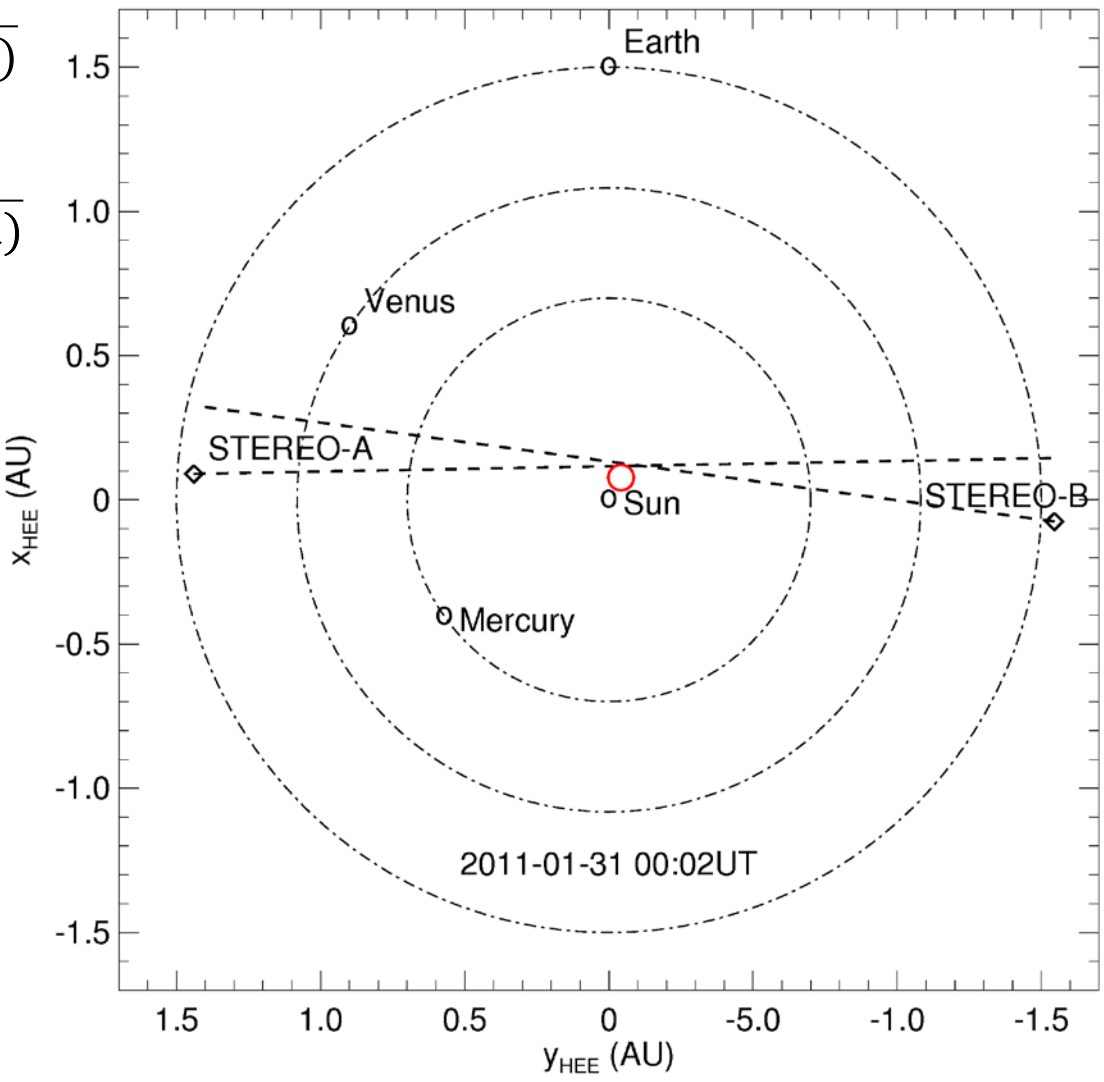

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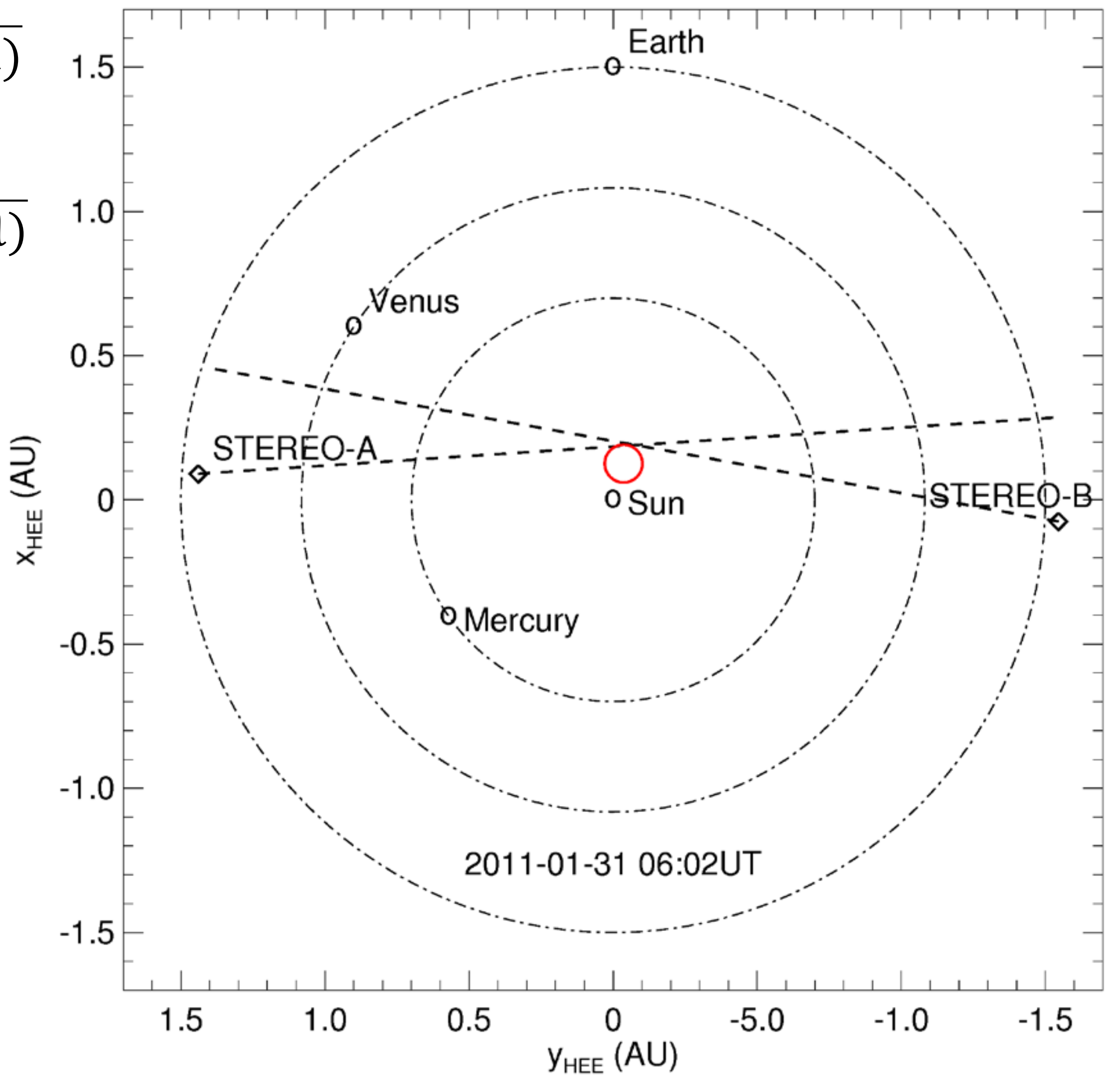

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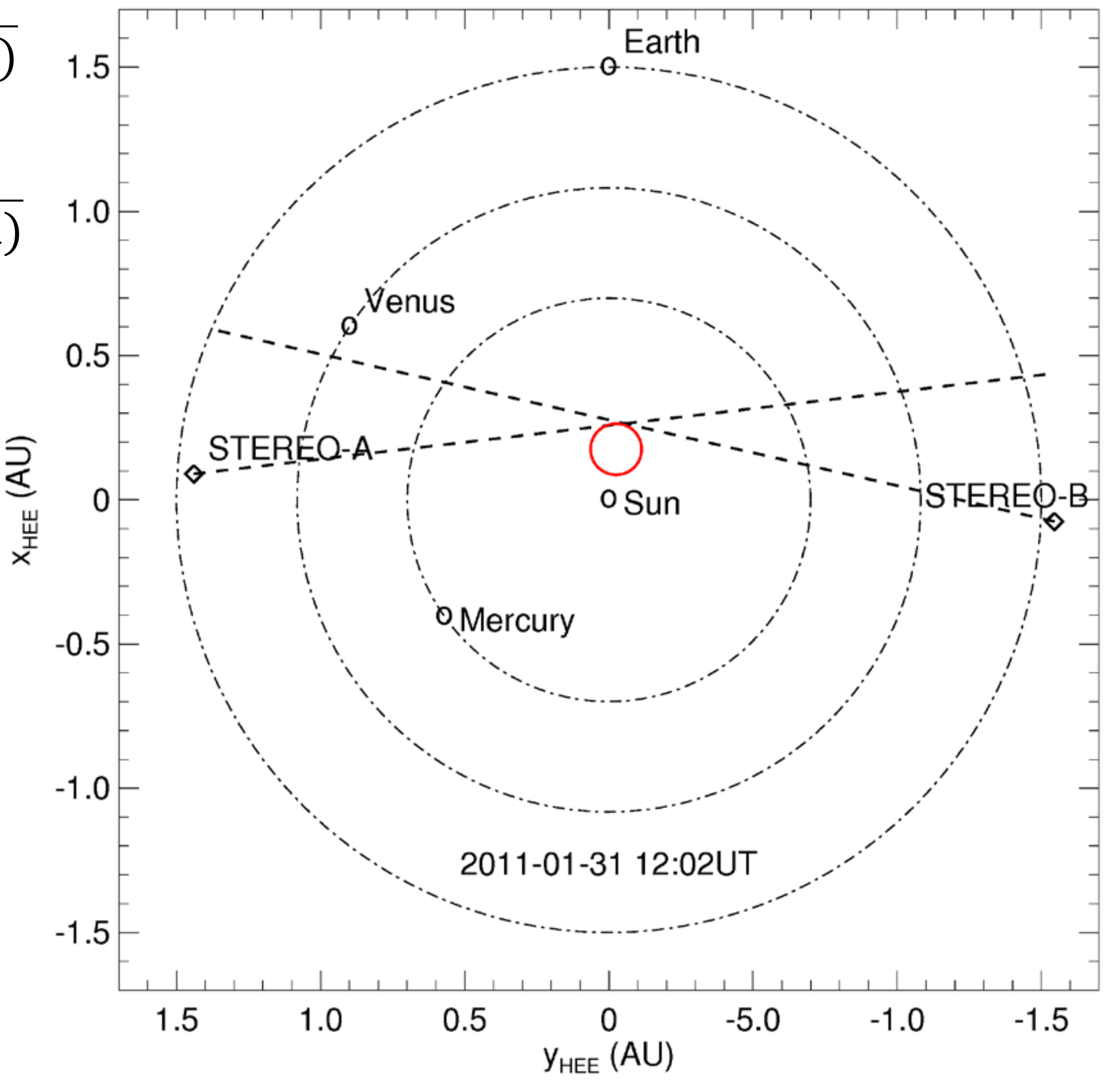

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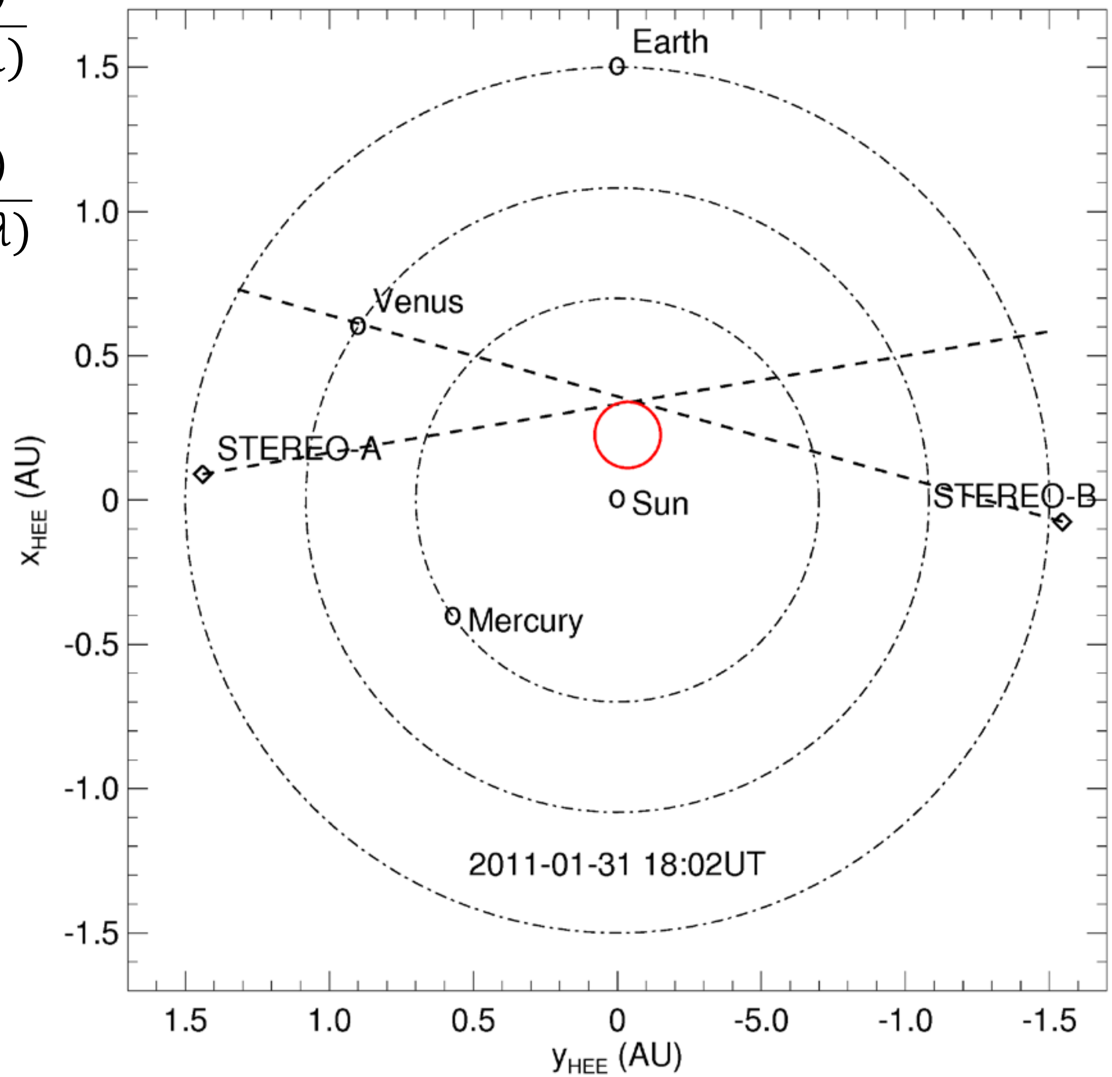

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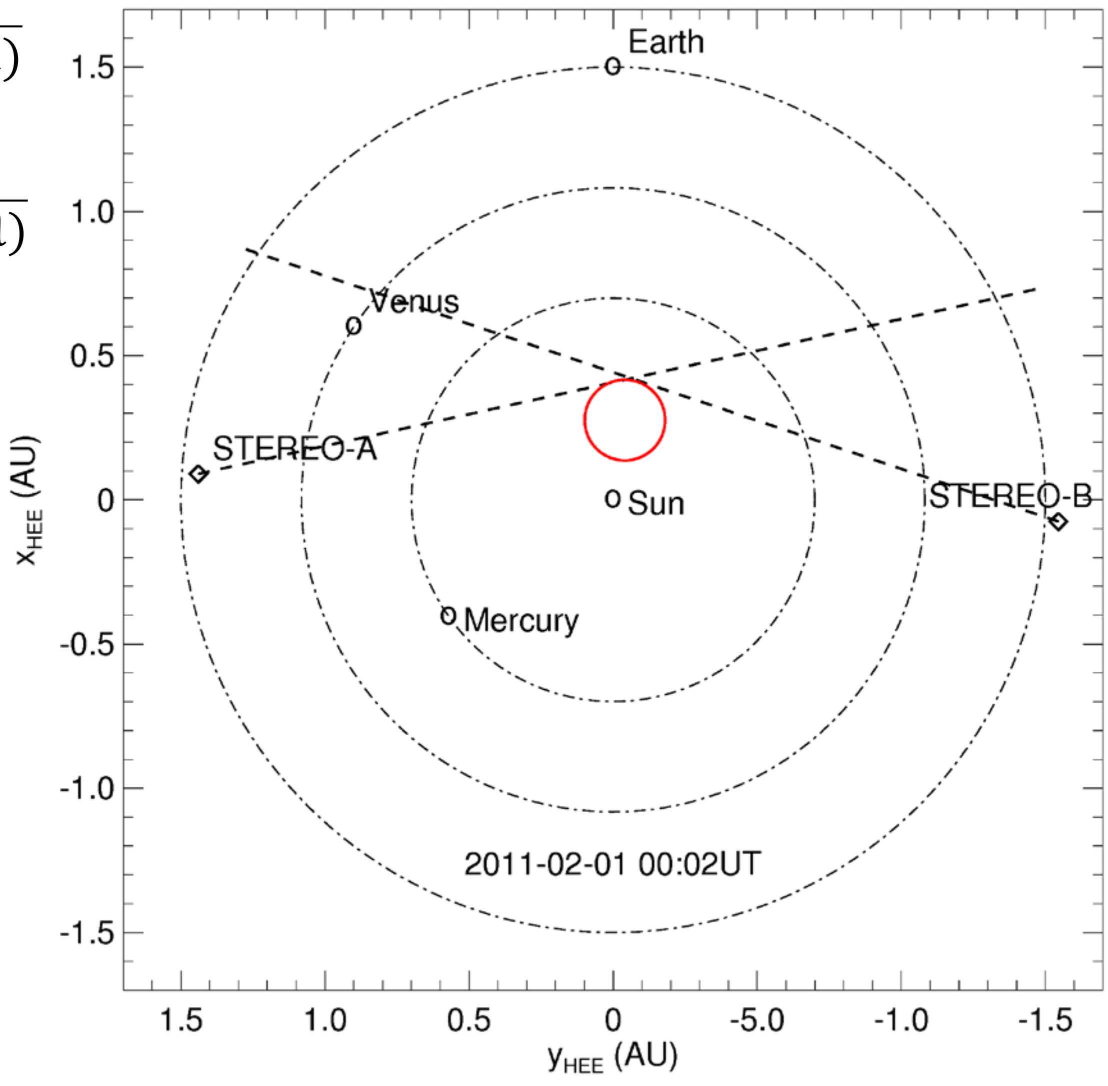

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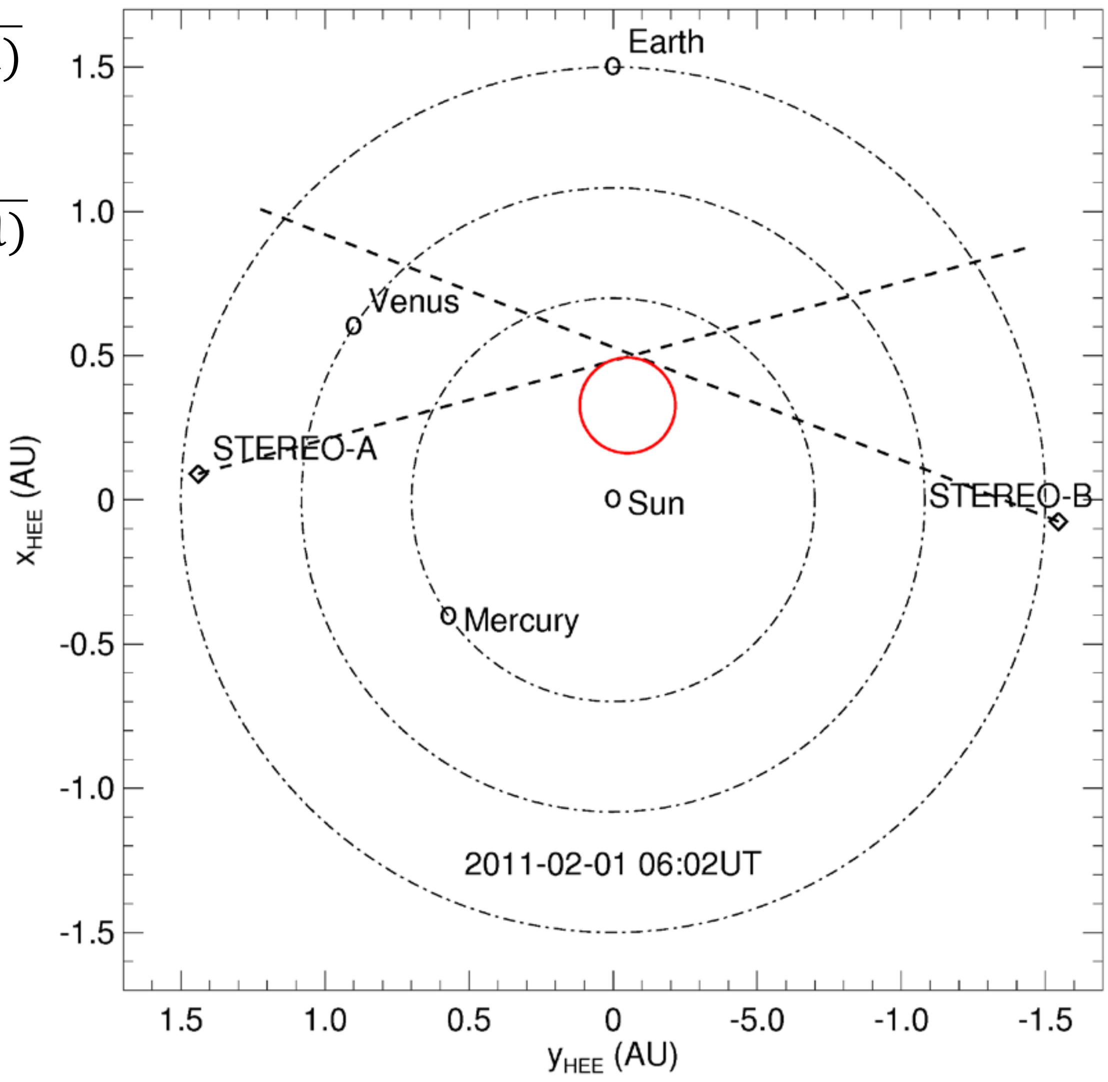

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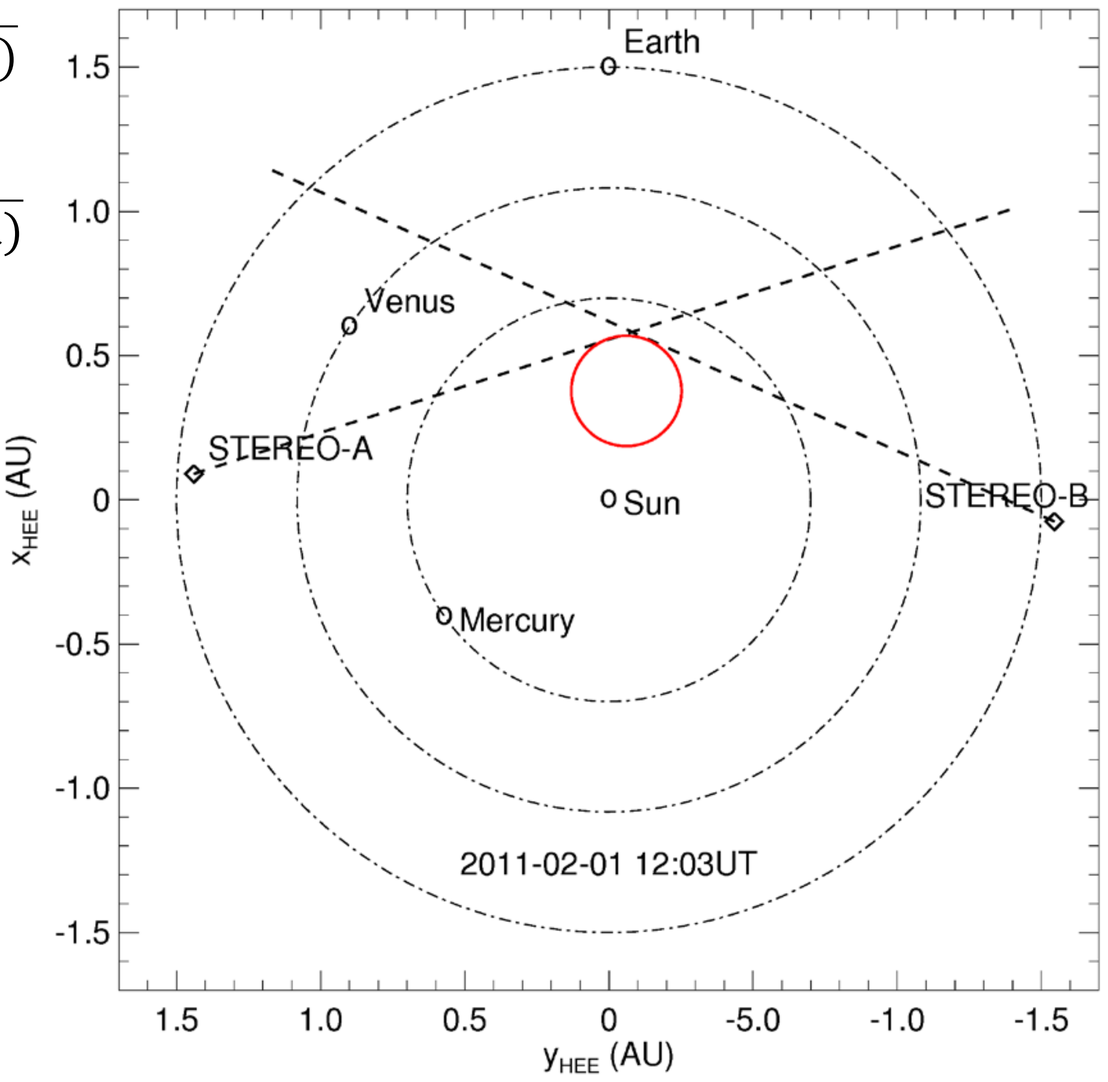

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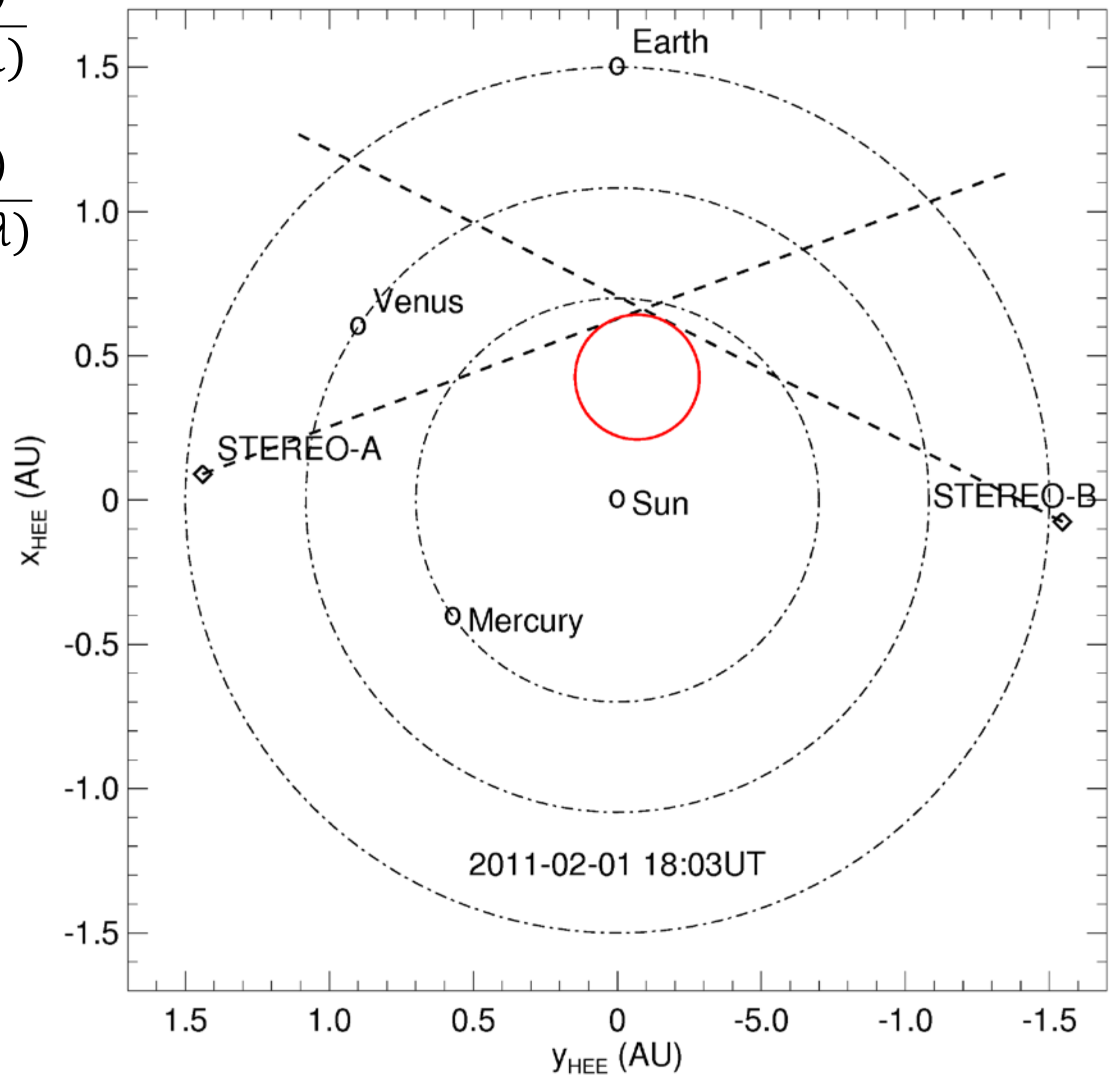

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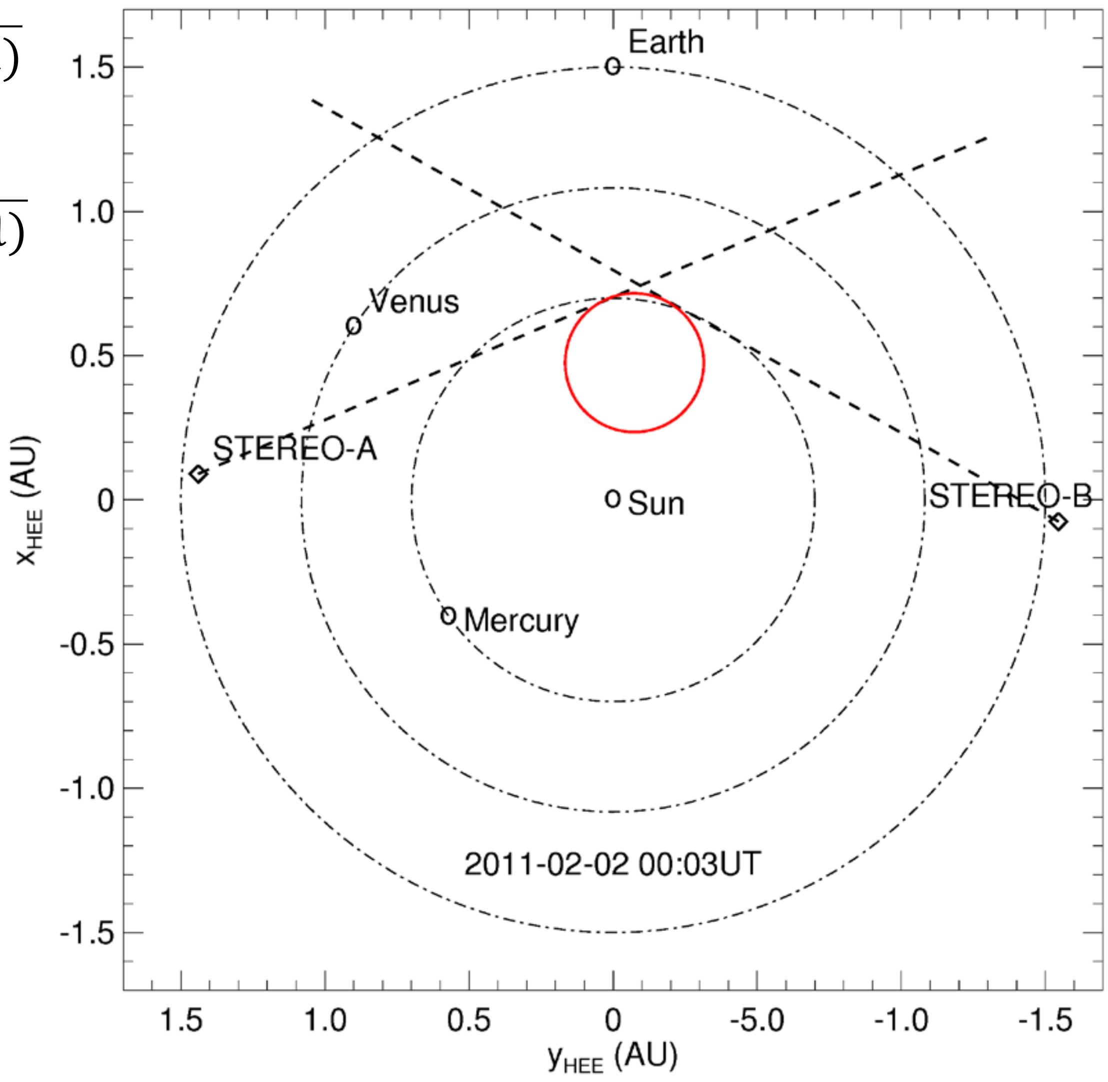
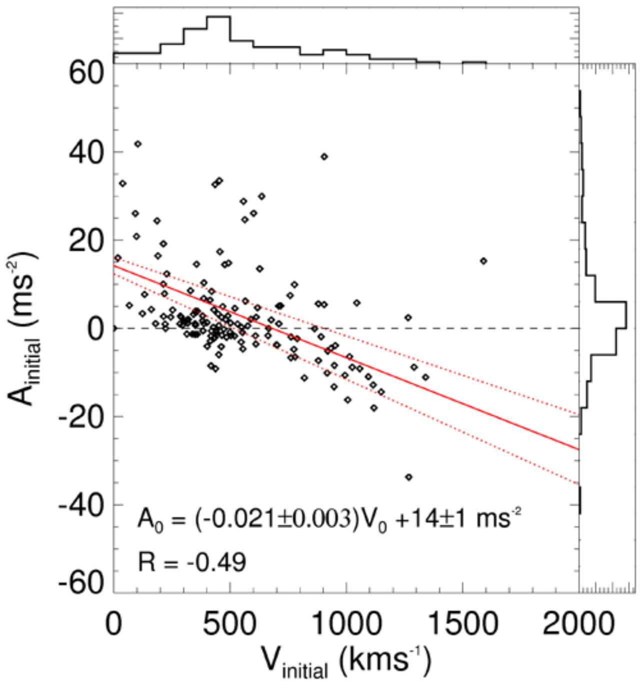
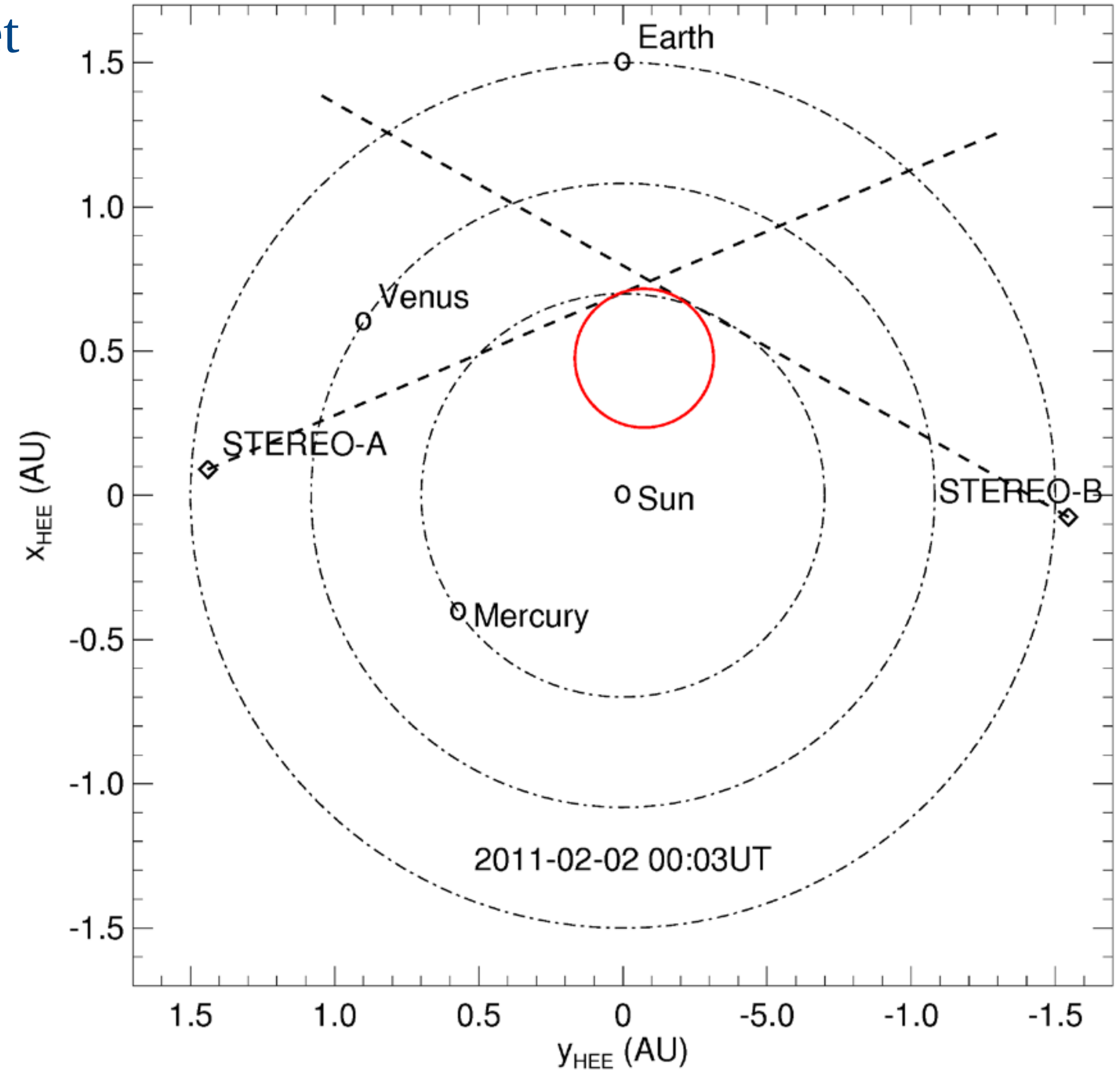


Stereoscopic Modelling

- So far a preliminary subset of 393 CMEs exists





Summary

- Heliospheric Cataloguing Analysis and Techniques Service

  - 1901 CMEs identified throughout the lifetime of HI instruments

  - 1353 CMEs tracked and kinematic properties determined

  - Catalogues agree with established CME behaviour, but show greater speeds

  - Stereoscopic analysis allows study of CME accelerations/deflections in HI

Thanks for listening

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