Downflows along an off-limb loop seen both in 30.4nm and Hα

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in cooperation with:

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Norway

Outline

1. EIT shutterless sequence of 11 July 2001 (30.4nm)
2. Co-registration of EIT 30.4nm and BBSO Hα images
3. Detailed comparison of both data sets
4. Conclusions and interpretation

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1. EIT shutterless sequence of 11 July 2001 (30.4nm)
   - Propagating disturbances
   - Multiwavelength study of downward motion
2. Co-registration of EIT 30.4nm and BBSO Hα images
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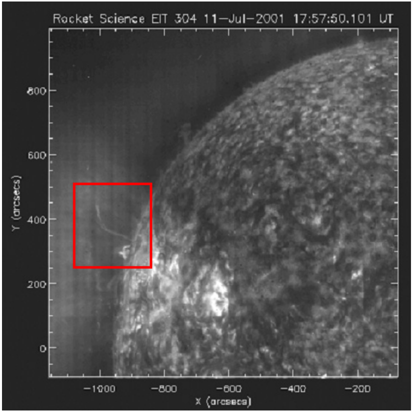

11 July '01 16:01-18:28 UT

Interesting features:

intensity variations along off-limb half loop:

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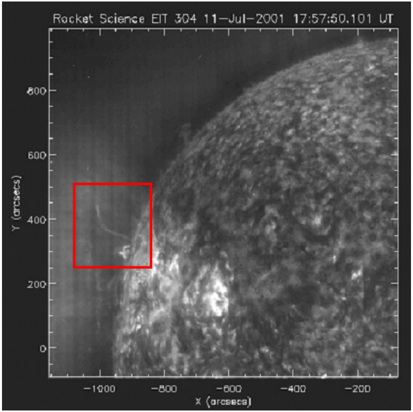

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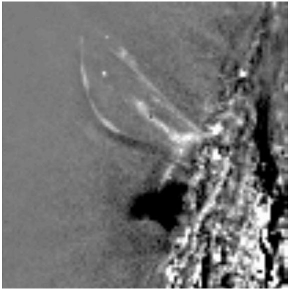
Interesting features:

intensity variations along off-limb half loop:

waves? OR falling plasma?

related to flare south of it?



Multiwavelength study of downward motion *(De Groof et al.'04)*

Instrument	Bandpass	Time	Cadence	# Images
EIT	30.4nm	16:00-18:28	~68 s	120
TRACE	17.1nm	16:00-18:20	30 s	227
SXT	Soft X-ray	15:10-16:12	irregular	33
	Soft X-ray	16:46-17:50	irregular	33
	Soft X-ray	18:25-19:20	irregular	14
Big Bear	Hα	15:43-00:33	30 s	1060 (56)
EIT	17.1nm	01:00-19:16	~6 h	4
EIT	19.5nm	00:00-23:48	12 min	111
EIT	28.4nm	01:06-19:22	~6 h	4

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no intensity variations!

Lower Temperatures (Hα):

bright signature of loop's footpoint
+ bright dots, exactly at place of bright EIT 'blobs'

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2. Co-registration of EIT 30.4nm and BBSO Hα images
   - Aims and problems
   - Camera model for perspective images
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Co-registration of 30.4nm and Hα images

Aim: Overlay EIT and BBSO Hα images and compare on a pixel-to-pixel basis

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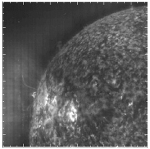
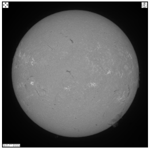


BBSO



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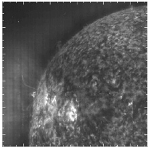

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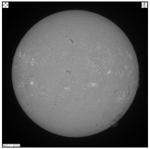

Problems:

	EIT	BBSO
different FOV	18.2'x18.2'	35.7'x35.7'
diff. spatial resolution	2.6"/pixel	1.05"/pixel
diff. time resolution	68s	30s
image deformations		
calibration of figures		

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	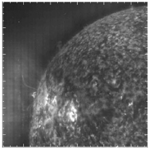	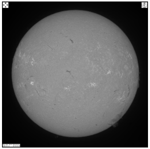

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	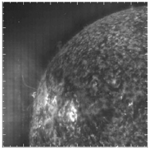	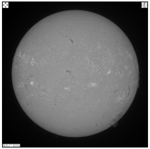
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	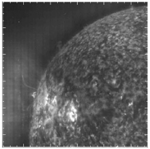	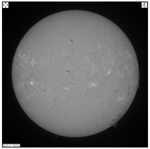
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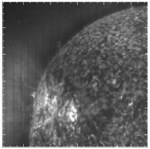

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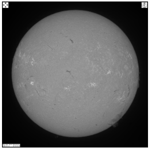

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Co-registration of 30.4nm and Hα images

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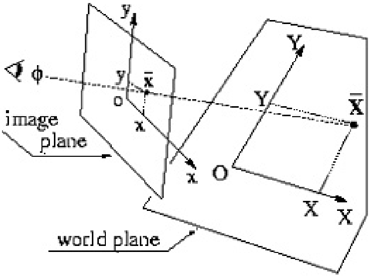
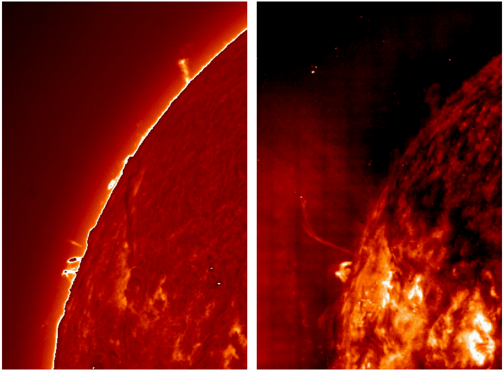
Method: Camera model for perspective images



Camera model for perspective images

1. Select 1 BBSO image of region of interest & 1 co-temporal EIT 30.4nm image



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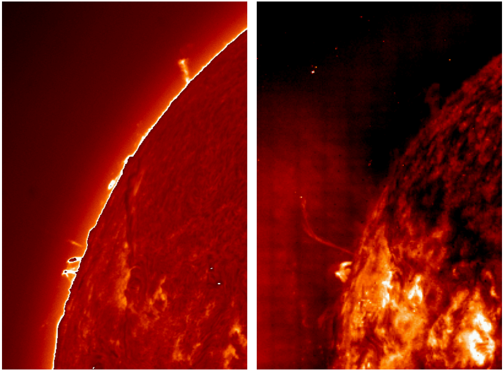
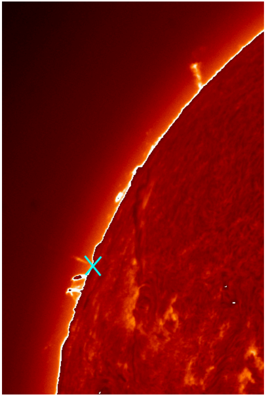
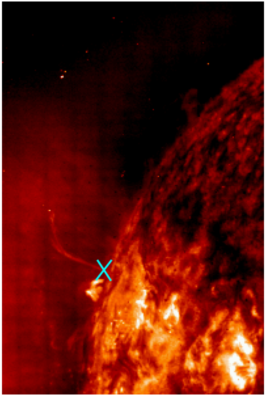


- Take the EIT-cut slightly larger than the BBSO selection
- Transform both to 400x600 pixels
- Enhance & calibrate to show maximal contrast

Camera model for perspective images

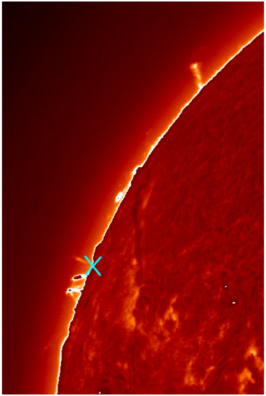
2. Choose 5 locations which can be recognized in both images

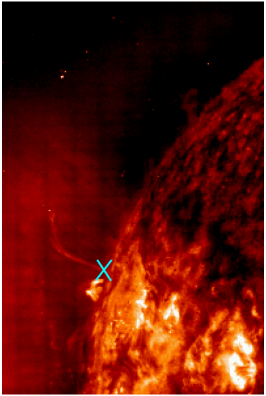




Camera model for perspective images

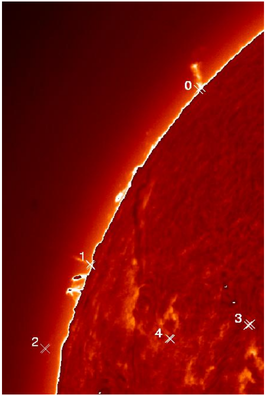
3. Construct a transformation matrix by using these 5 point pairs





Camera model for perspective images

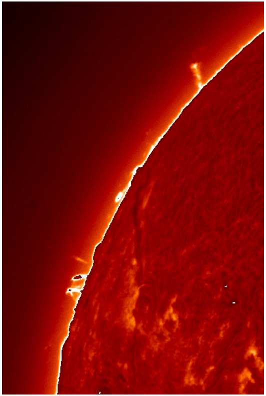
4. Transform the 5 EIT points to the Big Bear image to evaluate the transformation method

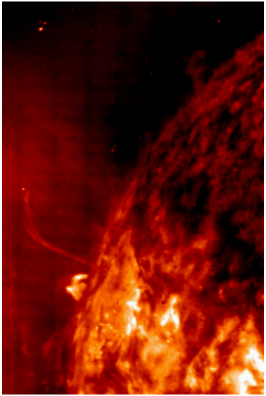


(Mathematical details: see paper)

Camera model for perspective images

5. Transform the whole EIT image to the coordinate system of the Big Bear image





Flashback

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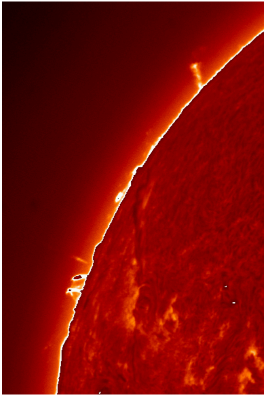

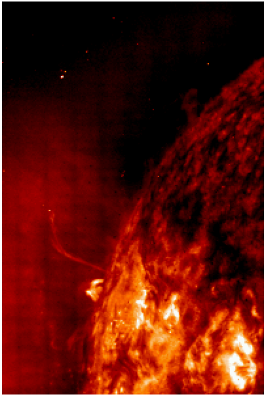

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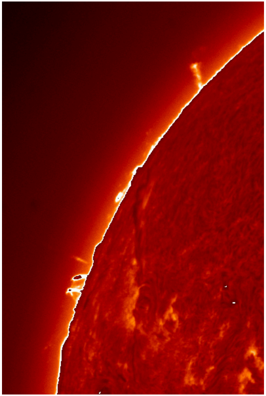

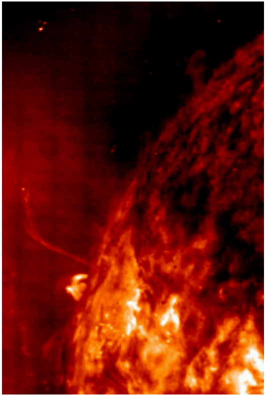

Flashback

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1 EIT shutterless sequence of 11 July 2001 (30.4nm)

2 Co-registration of EIT 30.4nm and BBSO Hα images

3 Detailed comparison of both data sets
- Visualization of co-registered images
- Comparison of downflows: blobs and speeds
- Comparison of downflows: blob appearance

4 Conclusions and interpretation

Visualization of co-registered images

Aim: Overlay EIT and Big Bear images in such a manner that:

- bandpass in which each feature was seen is still visible
- overlapping features are clearly recognized
- series of images (movies) can be overlayed

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Visualization 1: Contours

- colour = BBSO Hα
- contours = EIT 30.4nm

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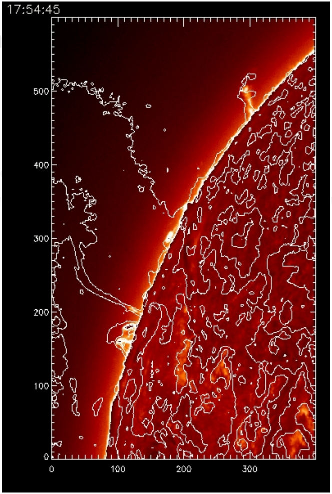

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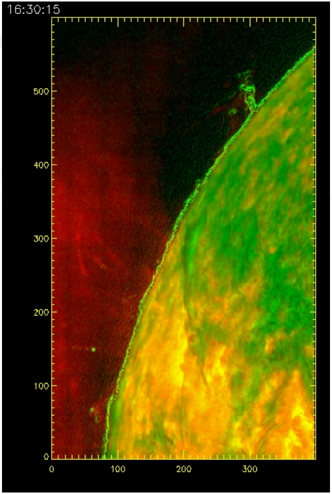


Visualization 2: Colours

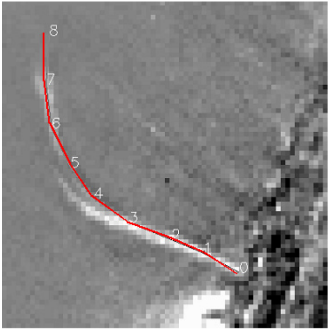
- green = BBSO Hα
- red = EIT 30.4nm
- yellow = overlaps

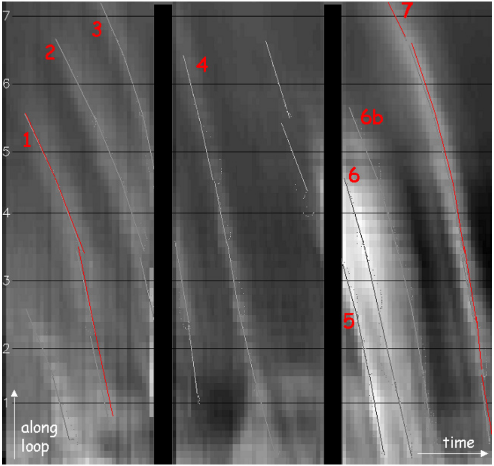
Comparison of downflows: blobs and speeds

1. Outline loop structure → make (location-time) plot

EIT 30.4nm

(De Groof et al. '04)





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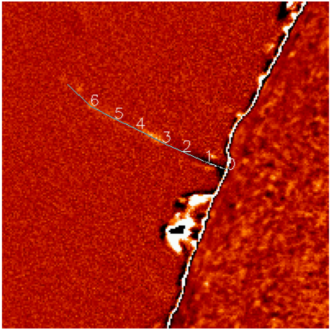
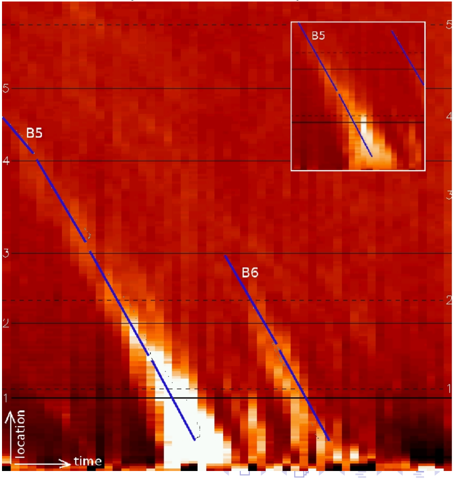
BBSO Hα

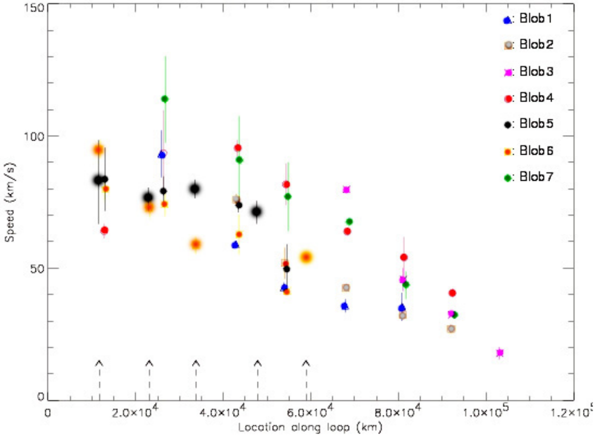
—: EIT speeds



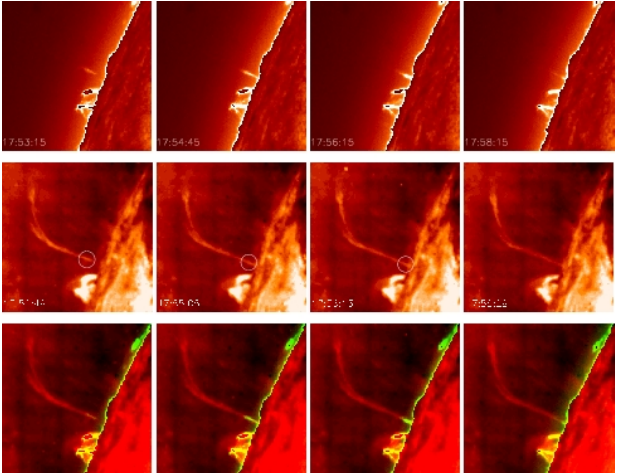


Comparison of downflows: blobs and speeds

2. Calculate local velocities by ridges in the plots



Comparison of downflows: blob appearance



- Hα blobs smaller and more compact than EIT blobs
- Hα images only show blobs close to limb
- Only in Hα, the blob brightens up while falling down

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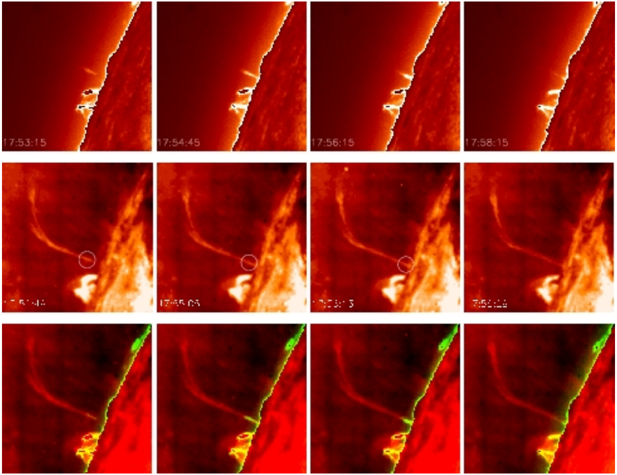

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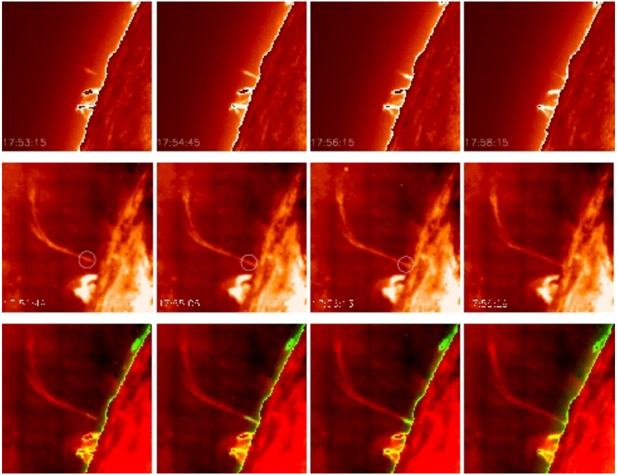

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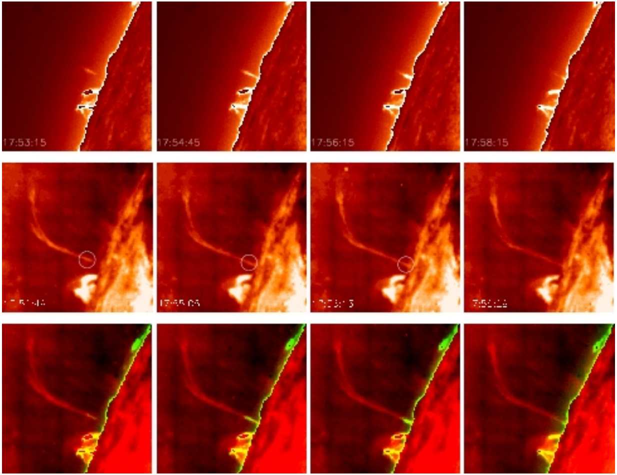

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- **Important similarities**
  - both data sets show bright blobs moving down
  - same locations and similar (increasing) blob speeds
- **Differences in blob appearance**
  - smaller and more compact in Hα
  - difference in intensity high above the limb
  - variation in the blobs' intensity while falling down

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    - *high blobs too hot for Hα*
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  - variation in the blobs' intensity while falling down
    - *instrumental effect*
    - *cooling loop*

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Conclusion

Same cool plasma is seen by both instruments, falling down. Differences in the spectral width ($\rightarrow$ plasma temperature) lead to different blob appearance

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How do the blobs form?
Why do they behave like this?

One of the most promising theories to explain this is presented in the following talk!