



Survey of Quiescent Filament Channels at the Current Solar Minimum

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Abstract

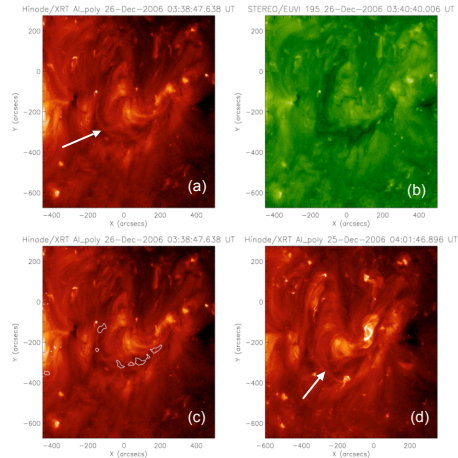
We present preliminary results of an investigation on filament channels on the quiet Sun observed by Hinode/XRT and STEREO/EUVI. The studied filament channels are divided into two types bases on the selection method: Type I channels (low- or mid- latitude) are associated with long and continuous H-alpha filaments; while Type II channels (mid- or high- latitude) are identified according to the cavities on the limb.

Type I Filament Channels

Group	Date	Hemisphere	Sheared loops	Filament Eruption	Post-event Arcade	Associated CME	Cavity?
1	2006-11-01	Southern	Transient	No	No	No	10/277 EL
	2006-12-26	Southern	Transient & Stable	Yes	Yes	Yes	12/197 EL
	2007-01-19	Southern	Transient & Stable	Yes	Yes	No	01/23
2	2007-04-30	Northern	Transient	No	No	No	04/30
	2008-02-02	Northern	Transient	Yes?	No	No	02/05
3	2008-03-02	Southern	Transient	Yes	Yes?	Yes?	03/04
	2008-03-27	Southern	Transient	Yes	No	No	03/30
4	2008-04-24	Southern	Transient	No	No	No	05/02 WL
	2008-11-29	Northern	Yes	No	No	No	11/247 EL
5	2008-12-09	Northern	Yes	Yes	Yes	Yes	12/03 EL

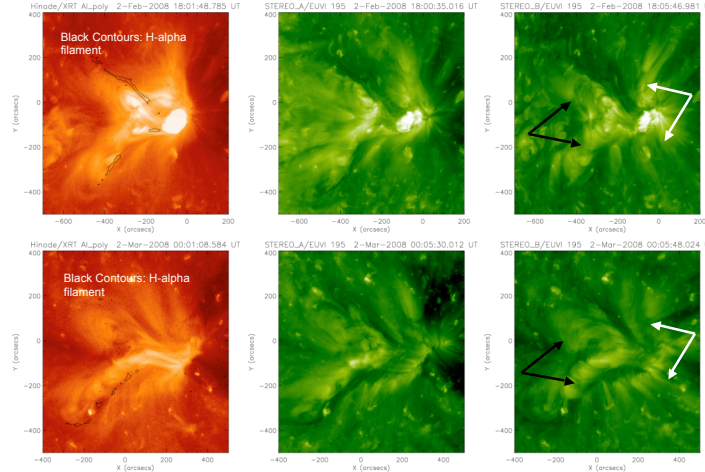
➤ Only five possible cavities are observed by XRT or TRACE, while the filament channels are on the limb. The visibility of cavity may be affected by the direction of the filament channels or some bright active regions close by.

Table 1—Summary of the 10 Type I filament channels on the quiet Sun. The dates in the second columns are the dates when the filament channels are close to the solar center.

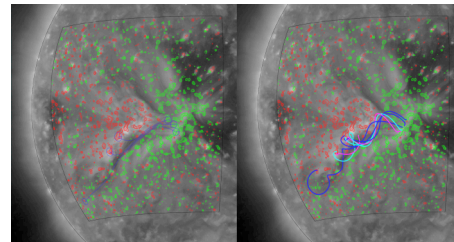


➤ Filament Channels on the quiet Sun are often observed as dark channels in X-rays (a) and EUV (b).

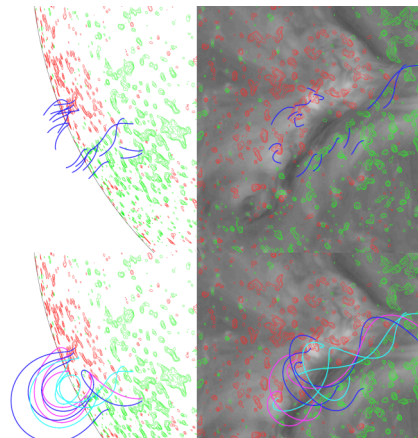
➤ Sometimes, sheared loops (indicated by white arrows) within the filament channel can often be observed in X-rays, but not in EUV. Some sheared loops are stable (a couple of days, (a)), while others are transient structures (less than 1 hour, (d)).



➤ Two sides of the filament channels are asymmetric in both X-rays and EUV. The eastern side (black arrow) has curved bright features, while the western side (white arrows) has straight faint features.



A nonlinear force-free field model for the filament channel on 2008-03-01. The filament path is shown on the left panel, and several selected field lines representing the flux rope is shown on the right panel.



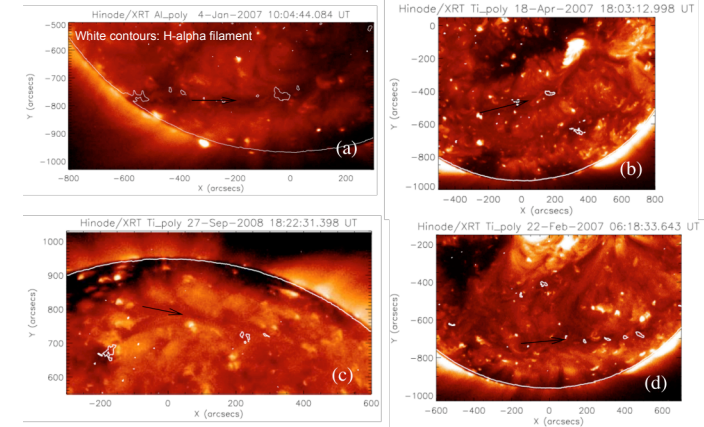
Side (right panels) and front (left panels) views of selected field lines of the NLFFF model. The field lines at height up to $Z=24$ are shown on the top panels, the full field lines are shown on the bottom panels.

➤ The field lines in one polarity turn into the flux rope, while the field lines from the other polarity are open or connected to very distant sources. One end of the filament has stronger fields than the other end.

Type II Filament Channels

No.	Cavity Start Date (days)		Filament Channel	Hemisphere	Filament Eruption
	East limb	West limb			
1	2006-12-27 (6)	2007-01-10 (7)	2007-01-04	Southern	No?
2	2007-02-13 (4)	2007-02-26 (7)	2007-02-22	Southern	No?
3	2007-04-11 (2)	2007-04-25 (3)	2007-04-18	Southern	No?
4	2008-09-15 (6)	2008-10-03 (4)	2008-09-27	Northern	No?
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Table 2— A sample of the 73 Type II filament channels on the quiet Sun. The dates in the fourth columns are the dates when the structure of the filament channels on the disk are well observed.



➤ According to the structure on the two sides of the channel, the 16 well observed type II channels can be divided into two types: curved on the disk side and straight (a, 1) or unclear (b, 4) on the polar side; straight (c, 4) or unclear (d, 7) on the disk side and straight on the polar side.

Summary

➤ Filament Channels are often observed as dark channels in X-rays and EUV. Sheared loops within the Type I channels can be seen in X-rays, but not in EUV.

➤ Possible corresponding cavities on the limb are identified for 5 of the 10 Type I filament channels. While filament channels (type II) on the disk has been identified for all of the 73 studied cavity pairs.

➤ The emission on the two sides of the Type I filament channels is asymmetric in both X-rays and EUV. The eastern side has curved bright features, while the western side has straight faint features.

➤ The 3D magnetic configuration is also asymmetric along the length of the Type I channels. The field lines in one polarity turn into the flux rope, while the field lines from the other polarity are open or connected to very distant sources. One end of the filament has stronger fields than the other end.

➤ The asymmetric emission on the two sides of the channel is not often clearly identified in the Type II filament channels.