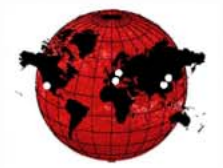
GI Project, Space Weather Research Lab, NJIT

1. Status of Global Halpha Network
2. A case study of filament eruption observed by STEREO
3. Coronal Implosion

Global High Resolution Hα Network To Support STEREO

Global High Resolution Hα Network



GLOBAL HIGH-RESOLUTION Hα NETWORK

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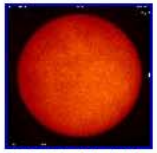		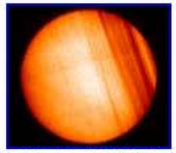	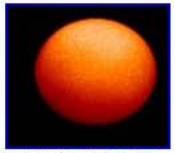			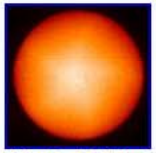	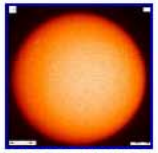
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			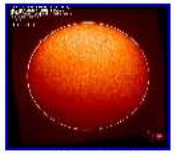				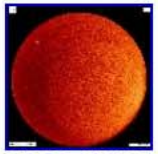
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Upper Panel: Original data. *Lower Panel*: Contrast enhanced images.
Please click on the images to view the 2K x 2K versions.

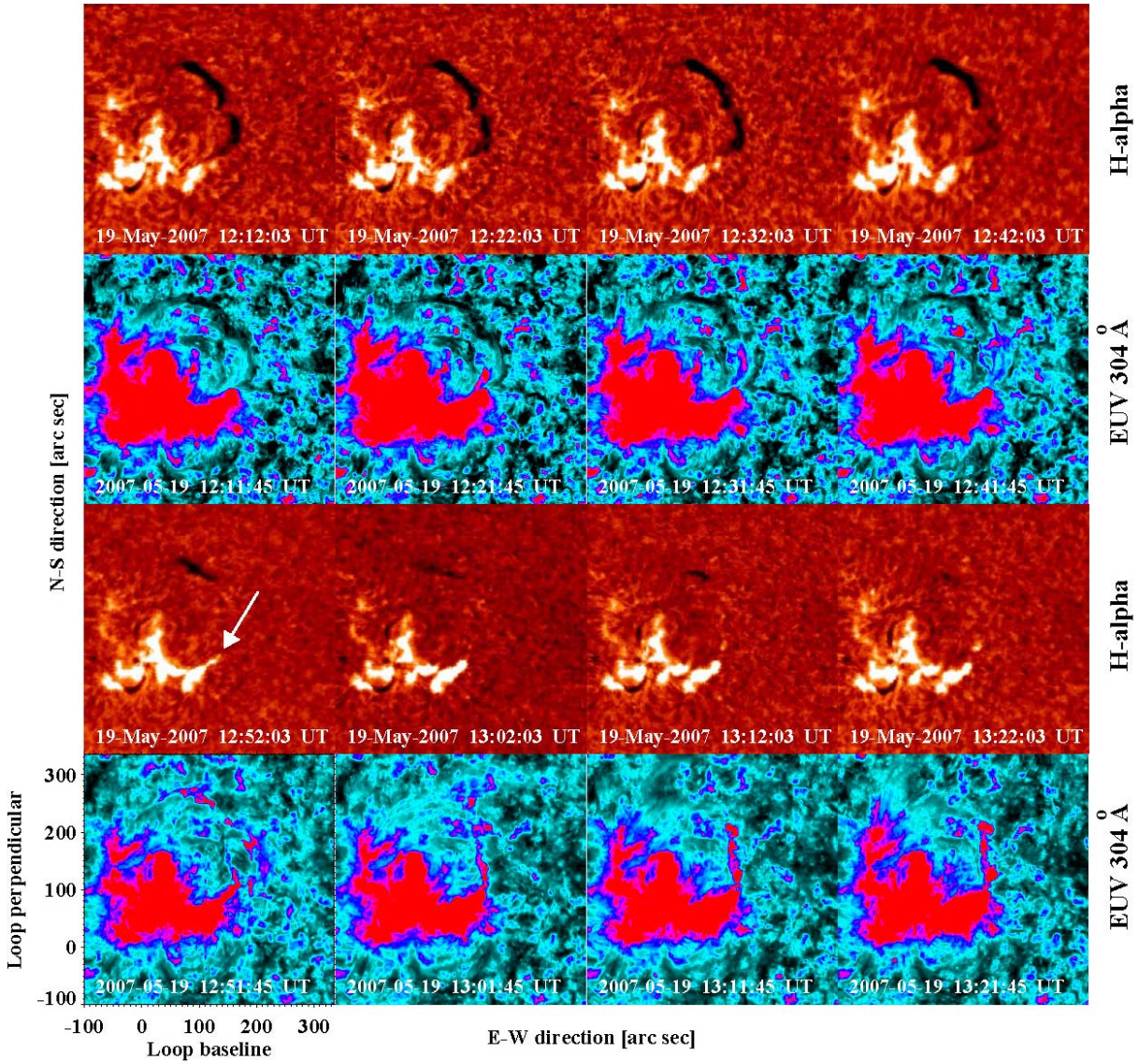
Global High Resolution Hα Network

- Provide complete data sets for correlative studies with other ground- (magnetic field; white light) and space-based observations (SOHO, TRACE, RHESSI, HINODE, STEREO)
- filament disappearance and coronal mass ejections
- magnetic field configurations and CMEs driving mechanisms
- CME Initiating active regions and interplanetary magnetic fields
- Studies of solar flares jointly with RHESSI
- Filament Oscillations; Moreton Waves; Differential Rotation
- Large scale flows in active regions
- Providing high quality data for solar activity forecasting

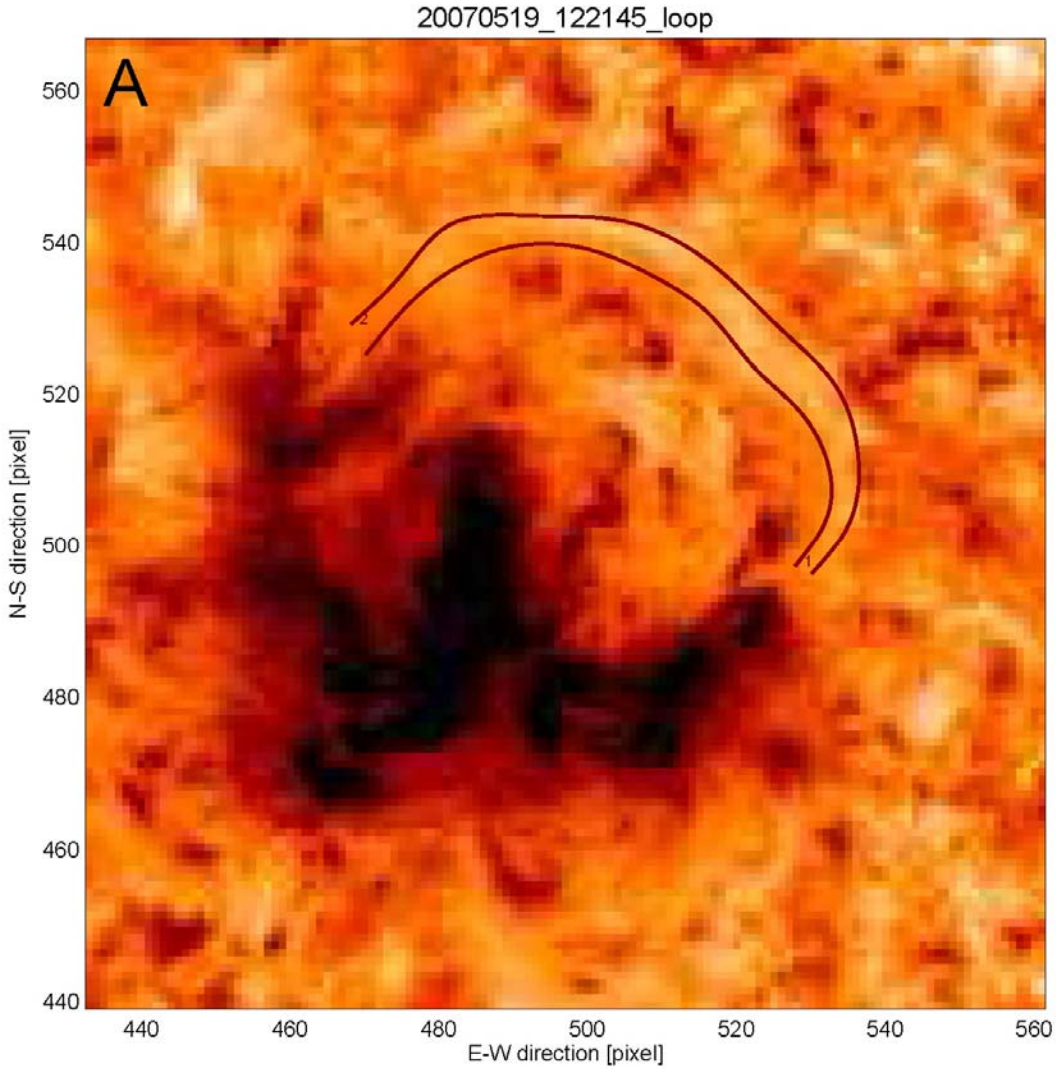
GlobalHα Network
Improvement of Data Service

Study of a STEREO Filament

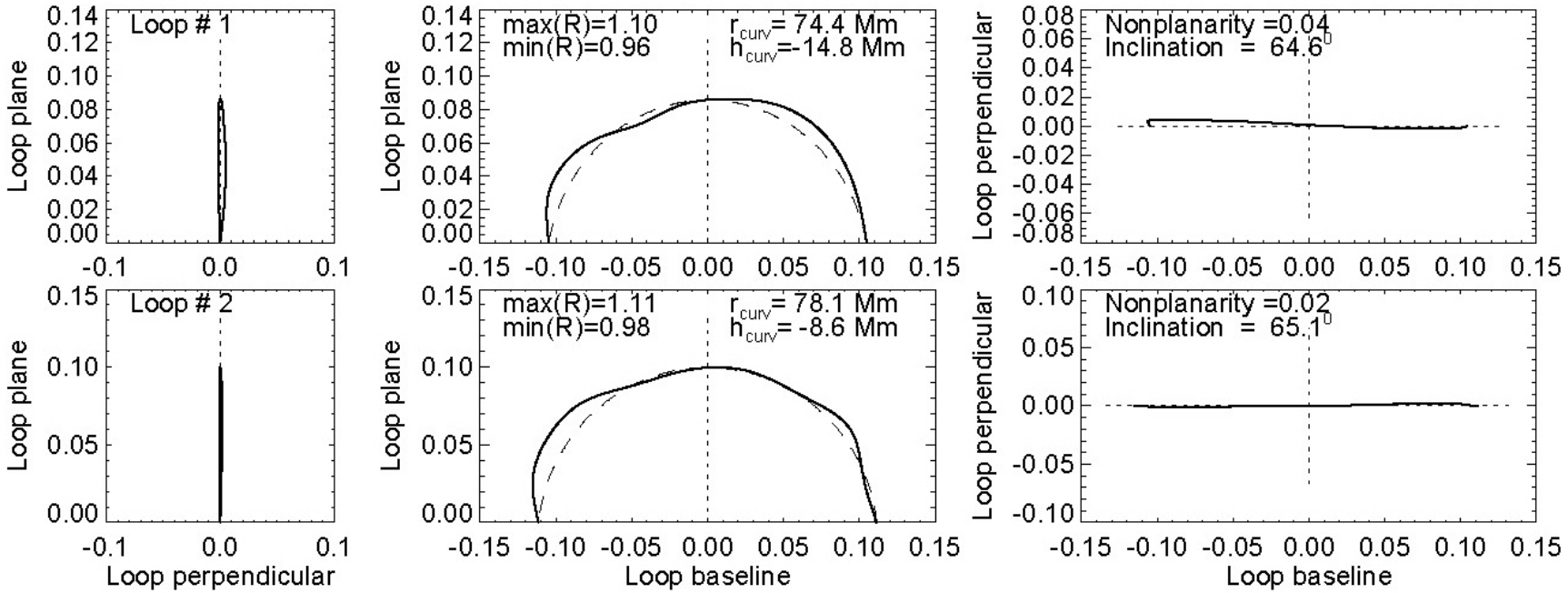
- By Yan Xu et al., (Solar Physics topical issue)



Simultaneous heating of filament in H-alpha and EUV 304 Å



http://www.lmsal.com/~aschwand/stereo/stereo_soft/software2.html



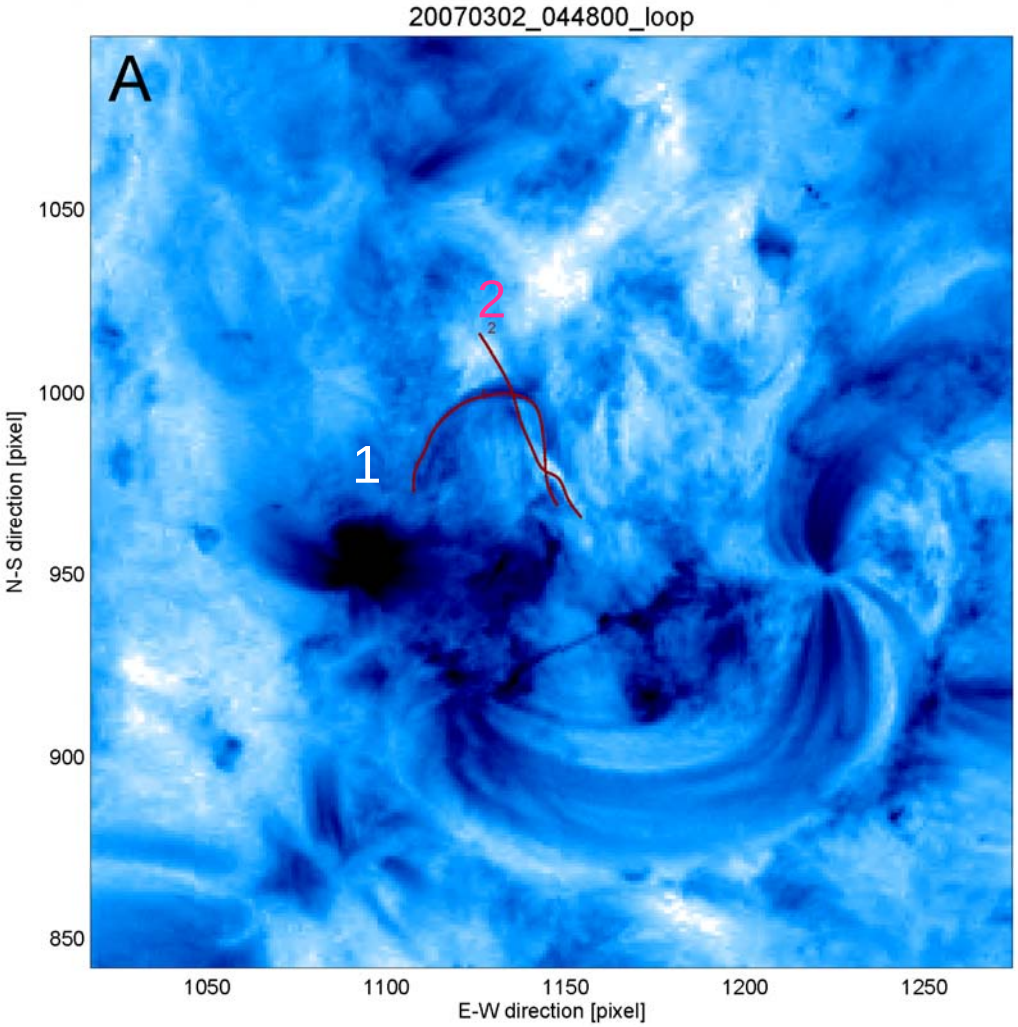
The filament's altitude in EVU 304 Å is 59.7 to ± 86.7 Mm.

We assume that the filament in H-alpha should have the same inclination angle as that in EUV. Therefore the estimated height in H-alpha is ranged from 47.2 to 69.5 Mm.

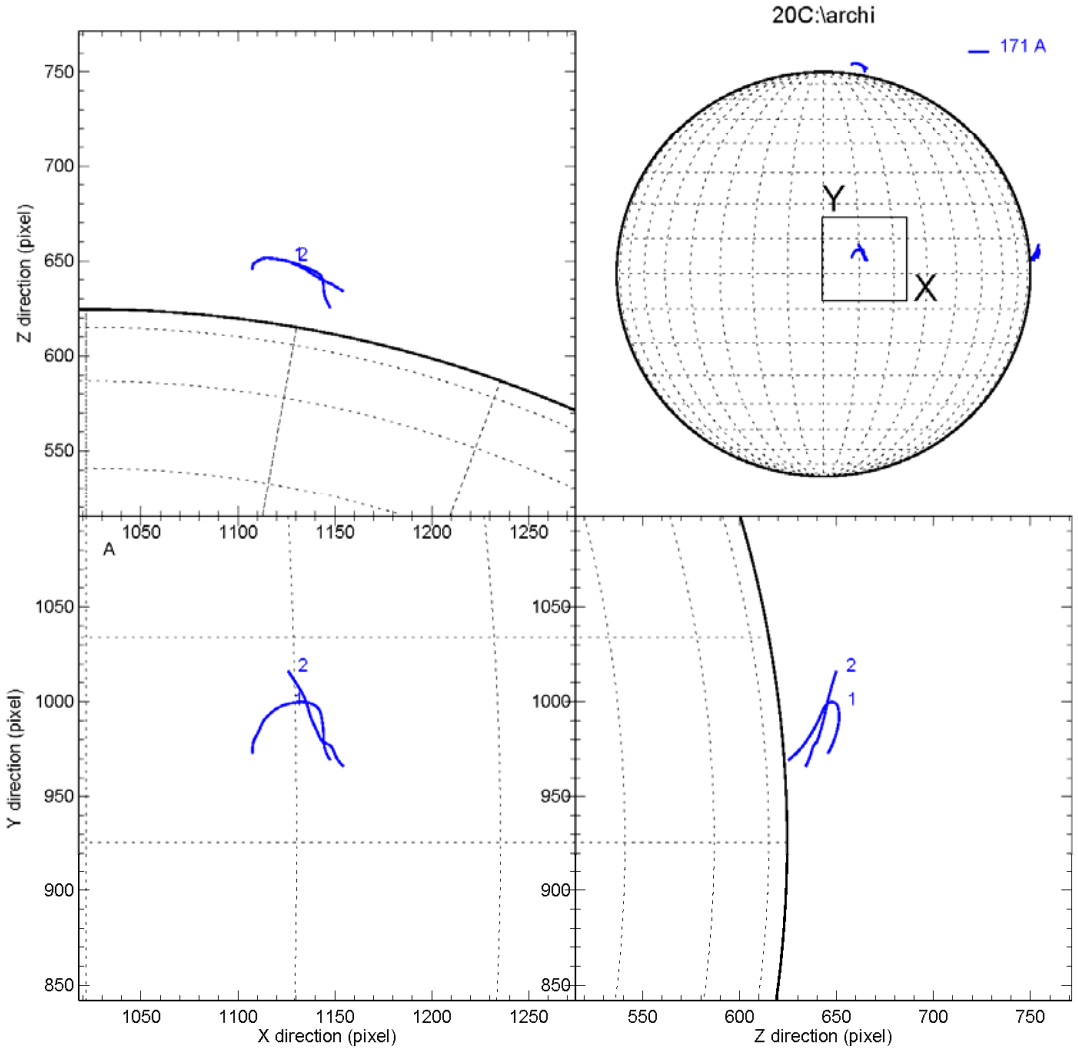
- Before Flare

1 → Sigmoid structure

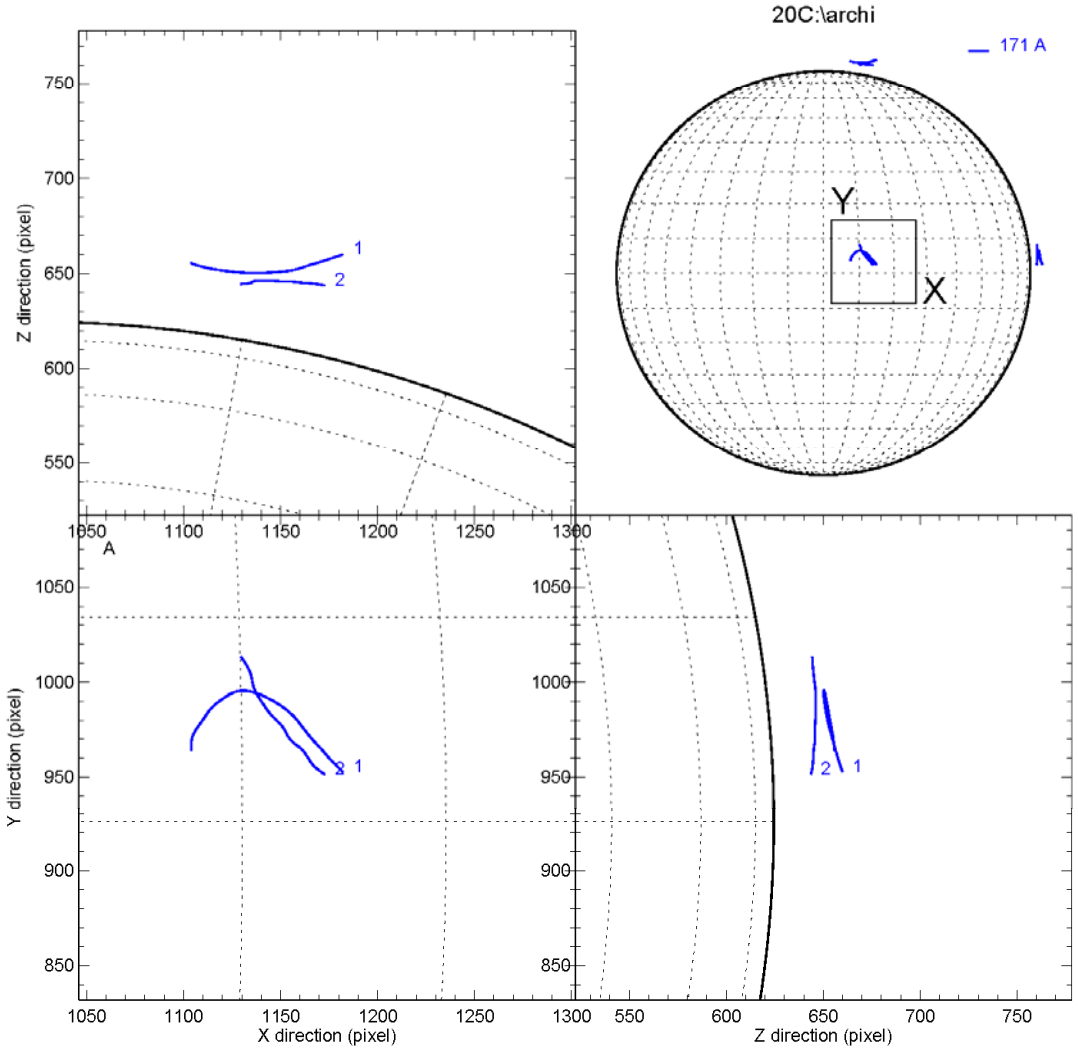
2 → Filament



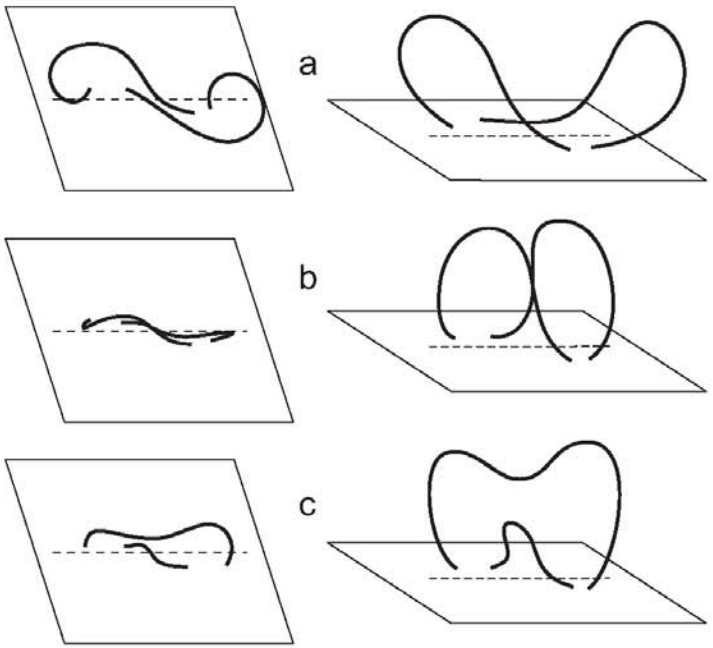
- Before Reconnection



- After Reconnection



Reconciliation



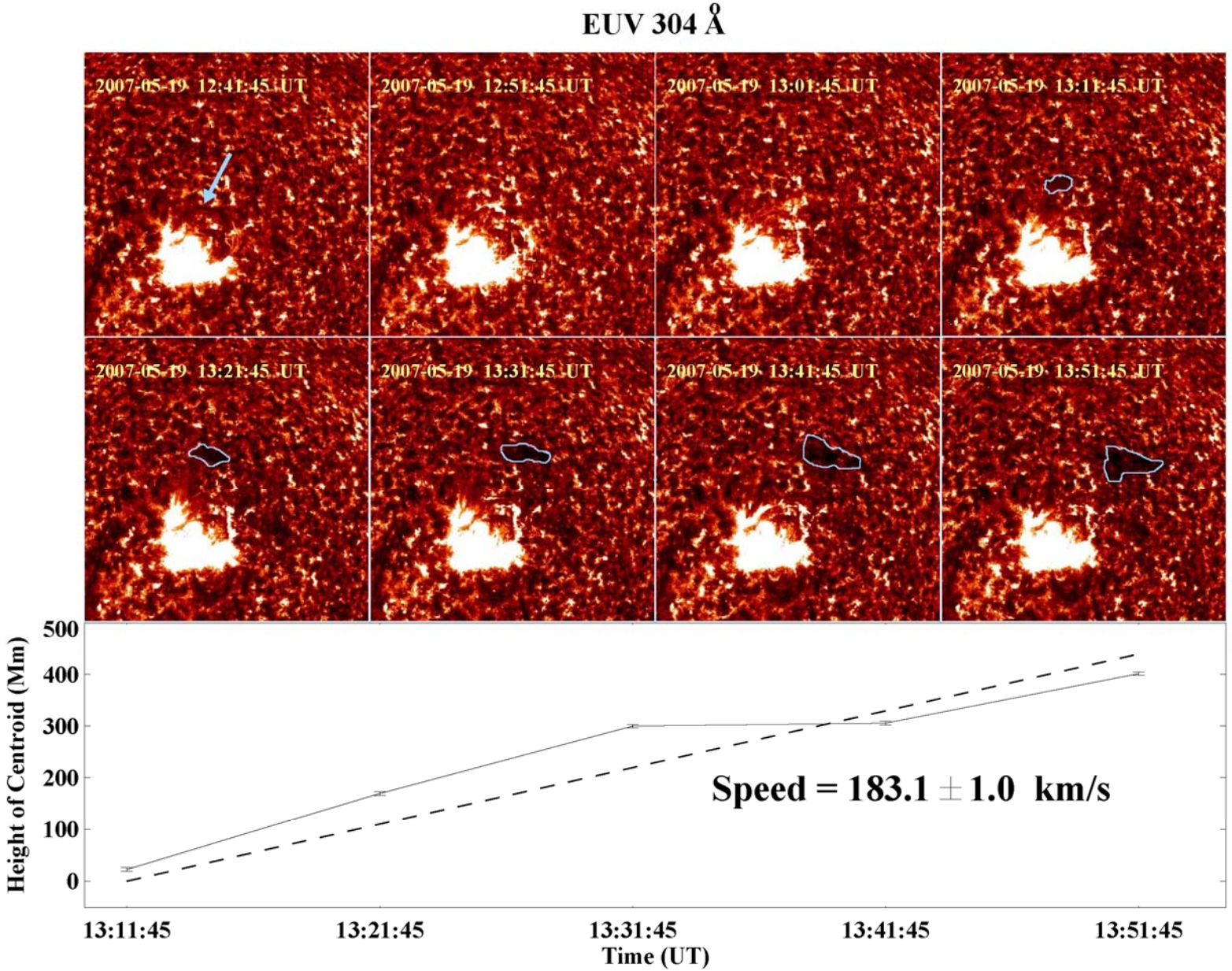
(a): Same initial configuration as tether-cutting. Keep in mind the reverse S-shaped sigmoid is associated with the counter-clockwise rotation of the filament

(b): Two elbow-like field lines are pushed together due to the writhing motion (cf. Gibson & Fan 2006)

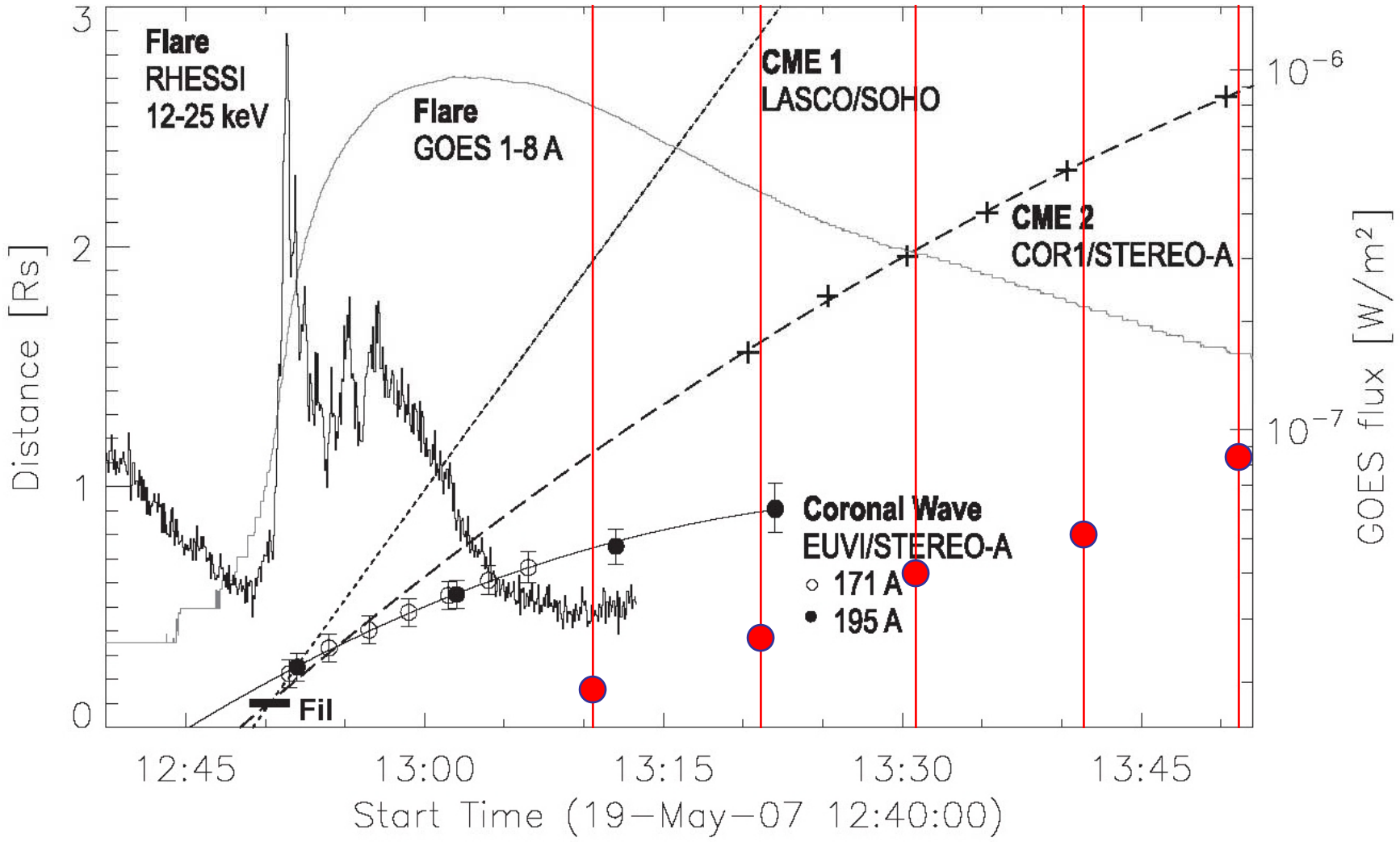
(c): Reconnection at the opposing higher arched portions, as opposed to the lower dipped portions in 'conventional' tether-cutting.

- Reconnection within the filament → filament separation
- Reconnection above the filament → newly reconnected higher loop lying above the dark filament
- Newly reconnected lower loop has a sigmoidal shape, as opposed to compact loop in 'conventional' tether-cutting

- Dr. Rui Liu's Thesis



30 October 2008



Veronig et al. 2008

Coronal Implosion

Rui Liu et al.

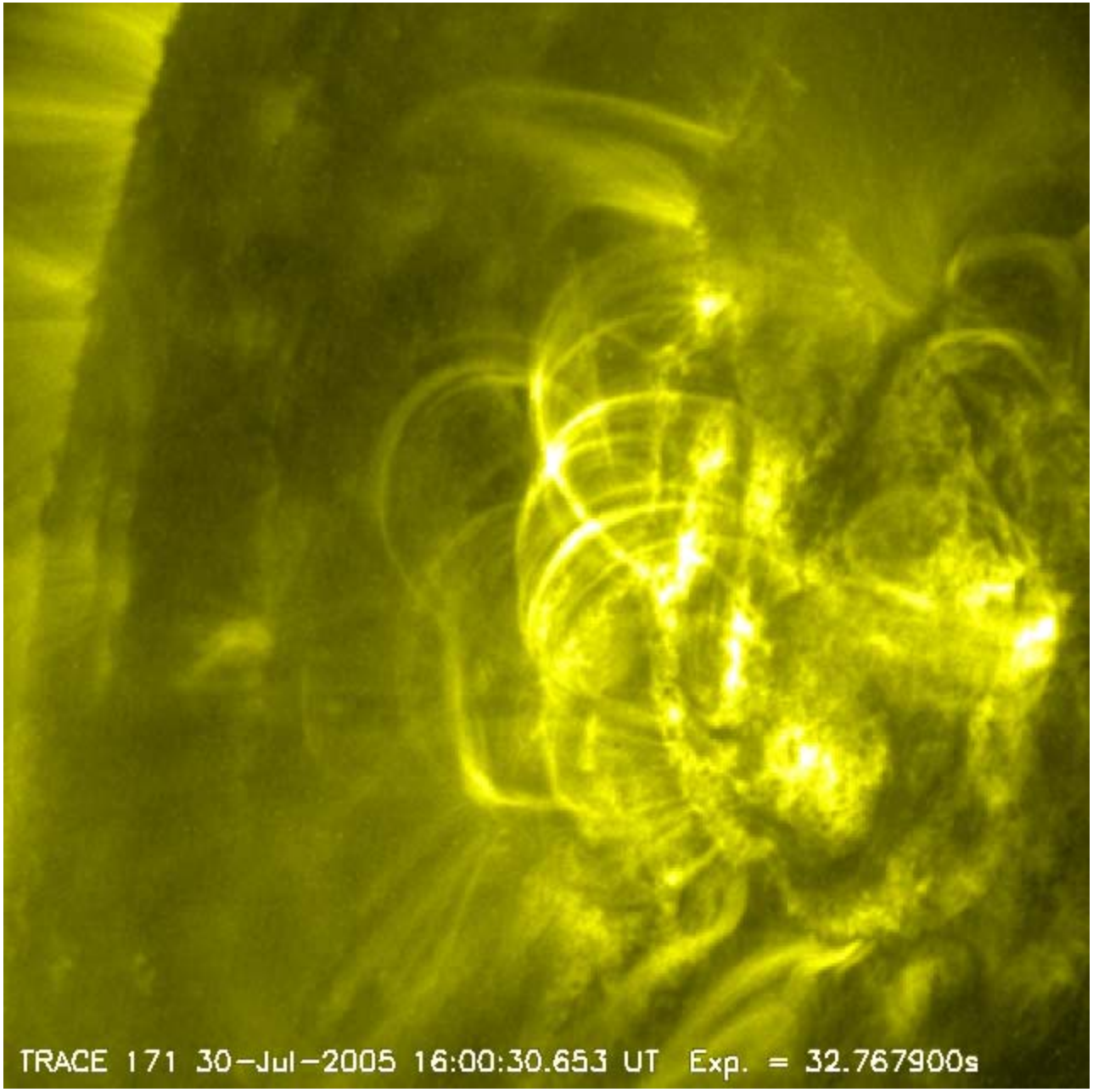
Introduction

- Inevitability of coronal implosion (Hudson 2000)
  - Coronal transients derive energy directly from magnetic field
  - Gravitational potential energy plays no significant role
  - Low plasma β

$$\Longrightarrow \int_V \frac{B_f^{\,2}}{8\pi} dV \downarrow \Rightarrow \frac{B_f^{\,2}}{8\pi} \downarrow$$

$$-\nabla\left(\frac{B_f^{\,2}}{8\pi}\right) + \frac{1}{4\pi}(\vec{B}_c \cdot \nabla)\vec{B}_c \approx 0$$

- Observational evidence of the reduction of magnetic energy in the flaring region
  - Descending flare looptop (Sui & Holman 2003; Sui et al. 2004; Liu et al. 2004, 2008; Veronig et al. 2006; Li & Gan 2005, 2006; Joshi et al. 2008)
  - Converging flare conjugate footpoints along the neutral line (Ji et al. 2004, 2006, 2007)
- Dilemma of coronal implosion: we always observe explosion rather than implosion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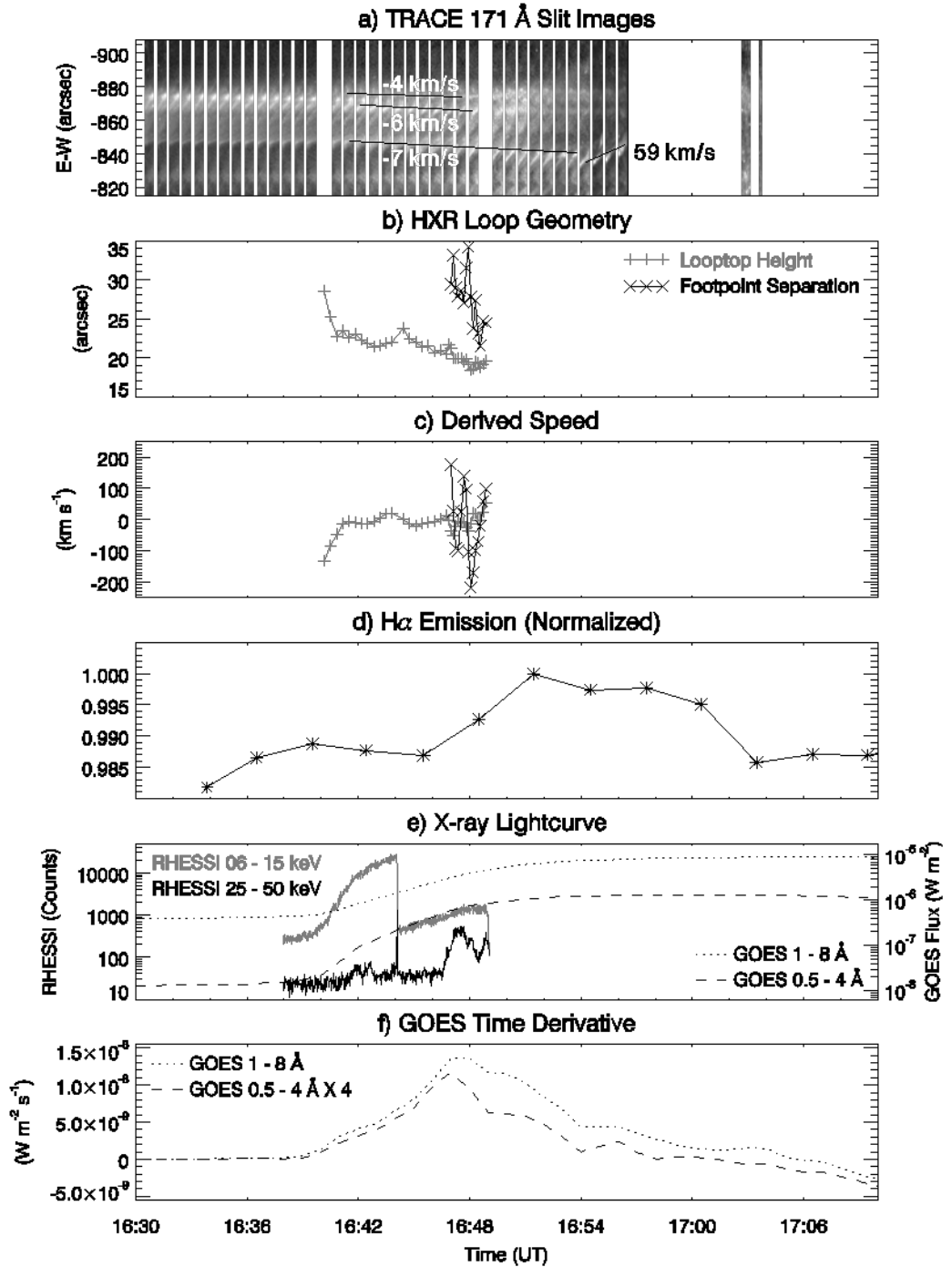

- Contraction started during the pre-heating phase, and continued well into the impulsive phase
- Associated with the descending looptop and the converging conjugate footpoints
- Expansion following the contraction leads to the eruption of the whole magnetic structure

Concluding Remarks

- The third assumption on which the Hudson Conjecture is based, $\beta \ll 1$, is often violated in the flaring region ($\beta >= 0.7$ at the flare looptop in our case)
- Prolonged pre-heating phase dominated by coronal emission, which effectively suppresses explosive chromospheric evaporation, is a necessary condition for the observation of coronal implosion

$$t > \frac{L}{V_A} \approx \frac{5 \times 10^9 \text{ cm}}{10^8 \text{ cm s}^{-1}} = 50 \text{ s}$$