Observations of Complex Flaring Topologies

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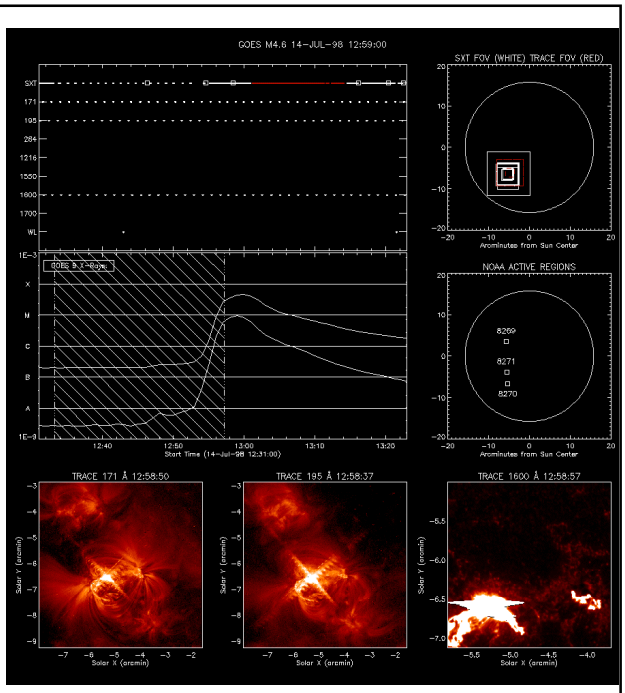
Outline

- TRACE Flare Observations
  - The web page
  - Data sets
  - UV & EUV data
- Good Flare: 1998 Bastille Day
- Bad Flare: 1998 Sep 23
- Modeling Requirements

Flare Observations

Finding useful multi-mission data sets is difficult. The TRACE flare catalogue is available on the web for your one-stop flare shopping needs.

To date TRACE has seen:
29 X-flares
224 M-flares
177 C-flares



Web Page:
http://hea-www.harvard.edu/SSXG/kathy/flares/flares.html

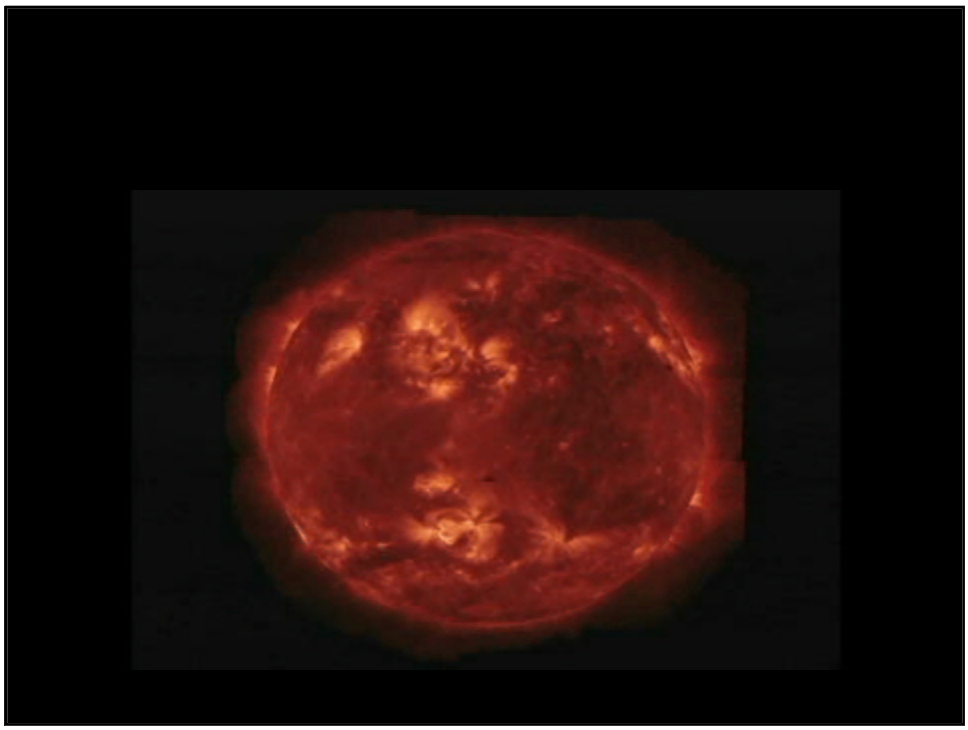
Data Sets

- Alignment of TRACE Images
  - UV - EUV Align the series of UV and EUV images separately. Then use known offsets to align UV & EUV images.
  - UV data shows magnetic structures in the chromosphere that can be aligned with magnetogram

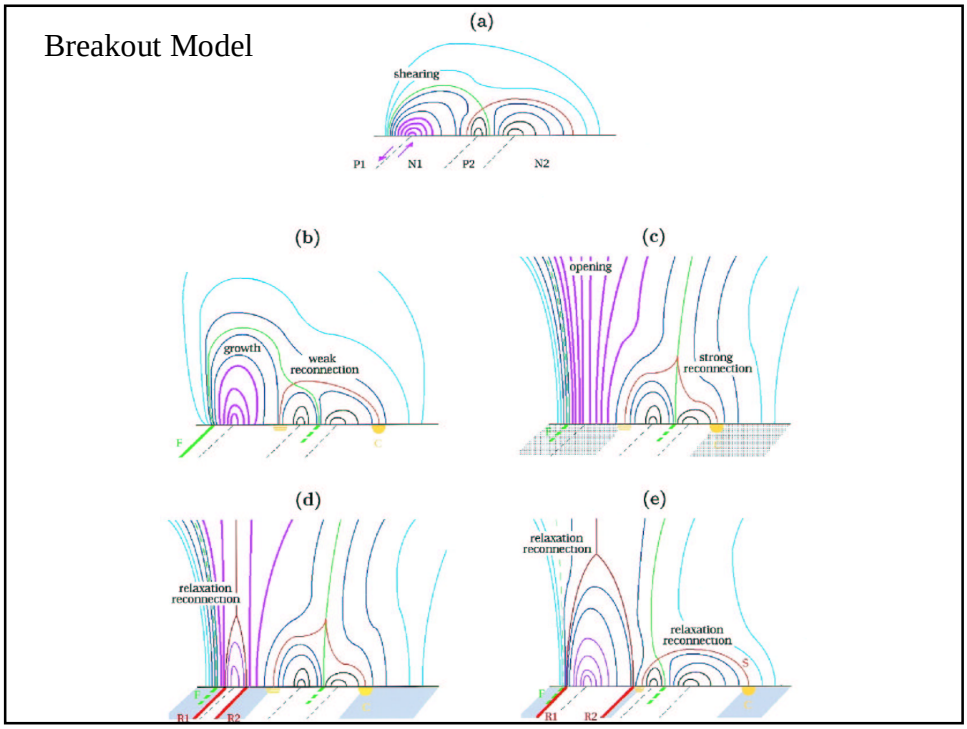
Bastille Day 1998

- 12:59 UT M4.6, AR 8270, δ-spot
- SOHO out of contact
- SXT observed the decay only

- First observation of oscillation coronal loops
- Interesting pre-flare dynamics that strongly support the “Breakout Model”

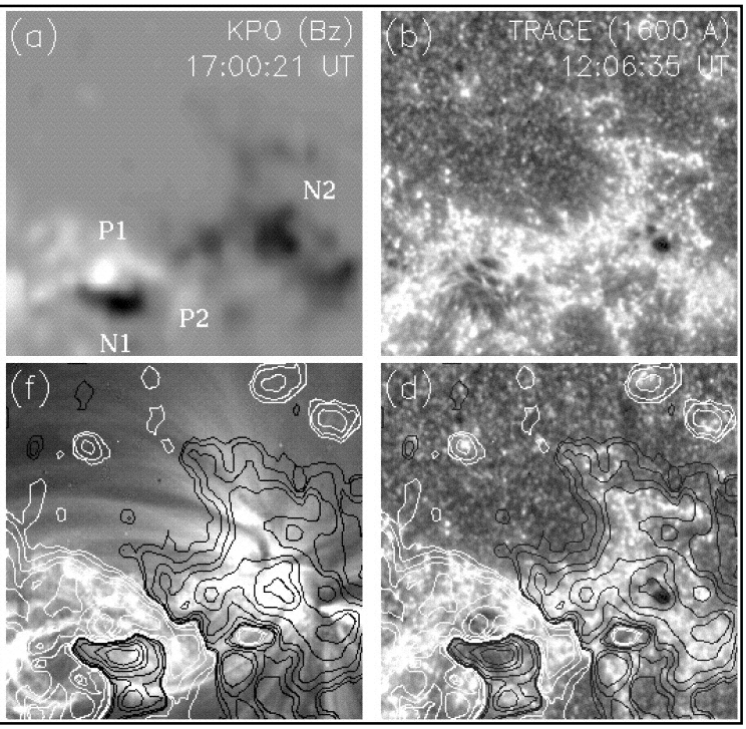


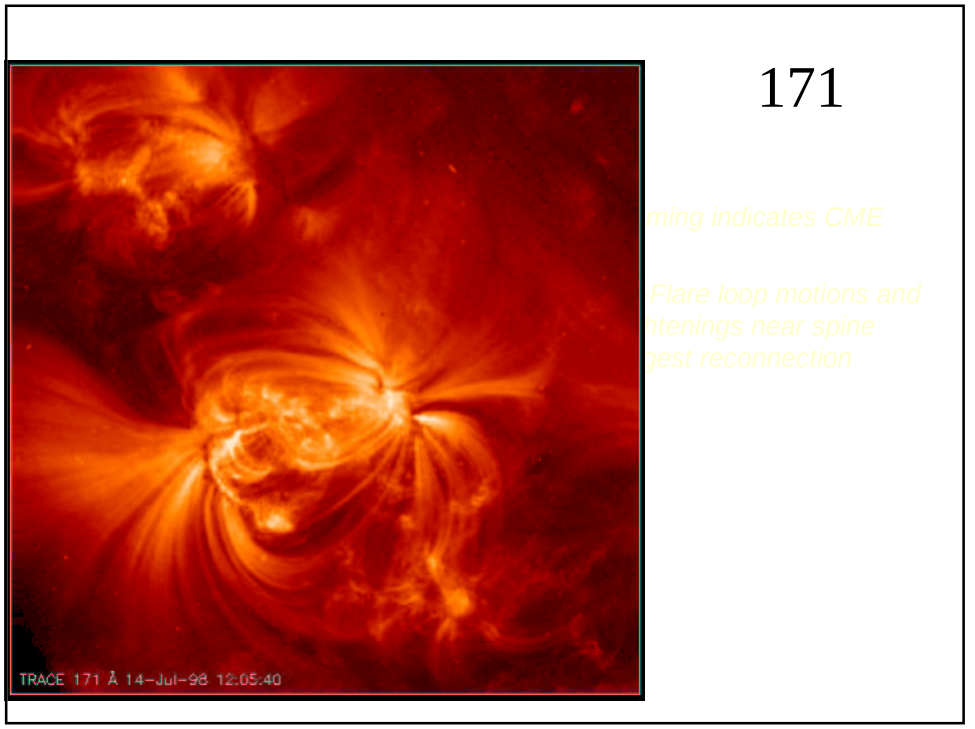
Breakout Model

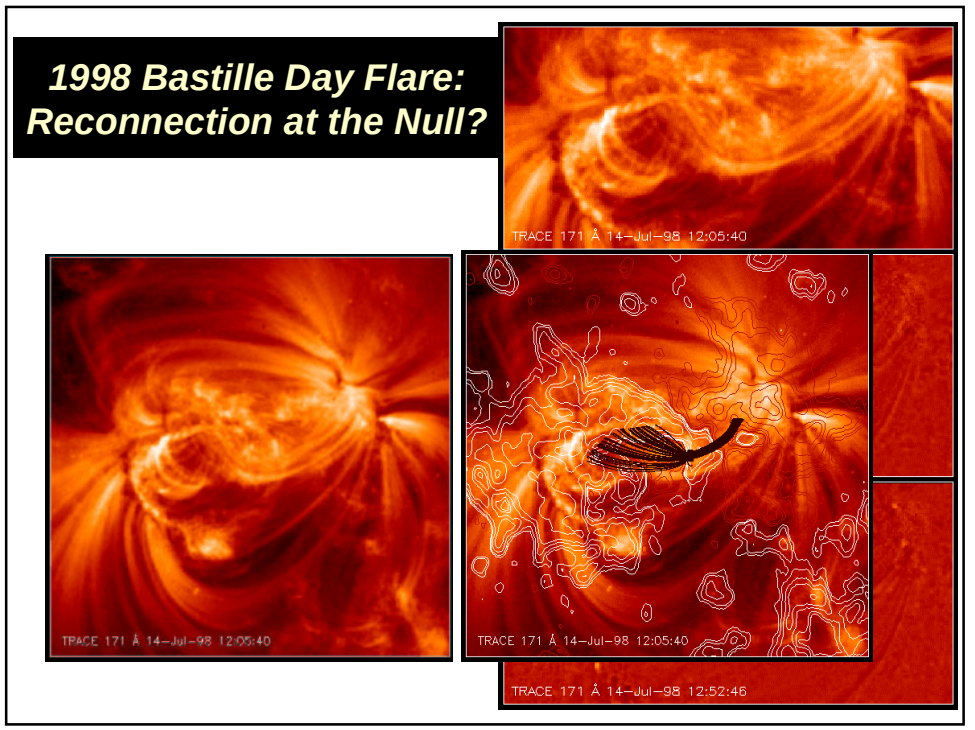


Alignment

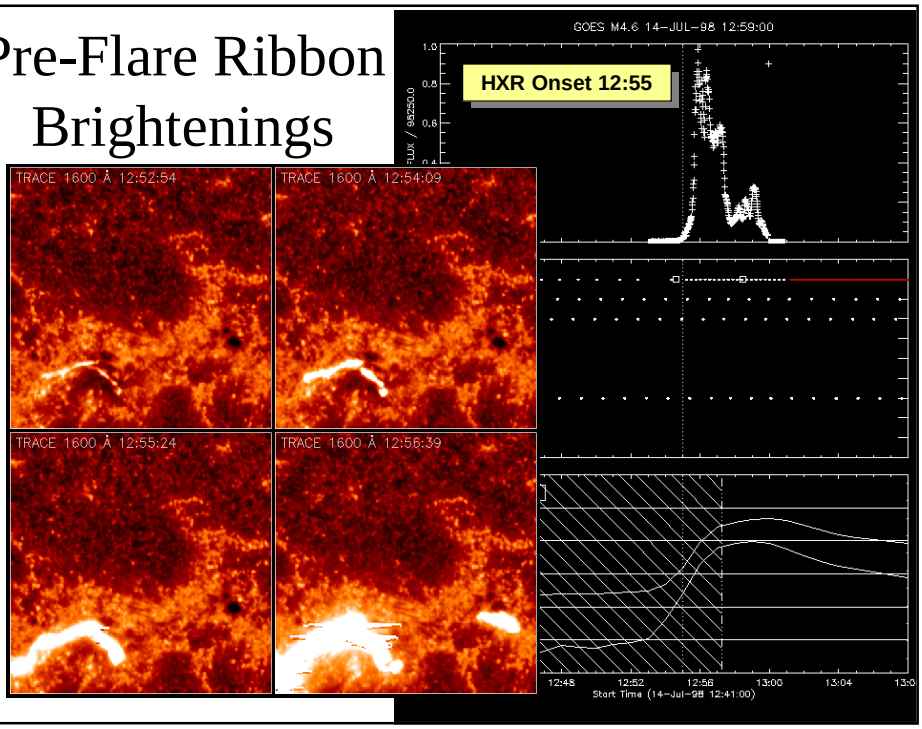
KPNO 6 hours after flare



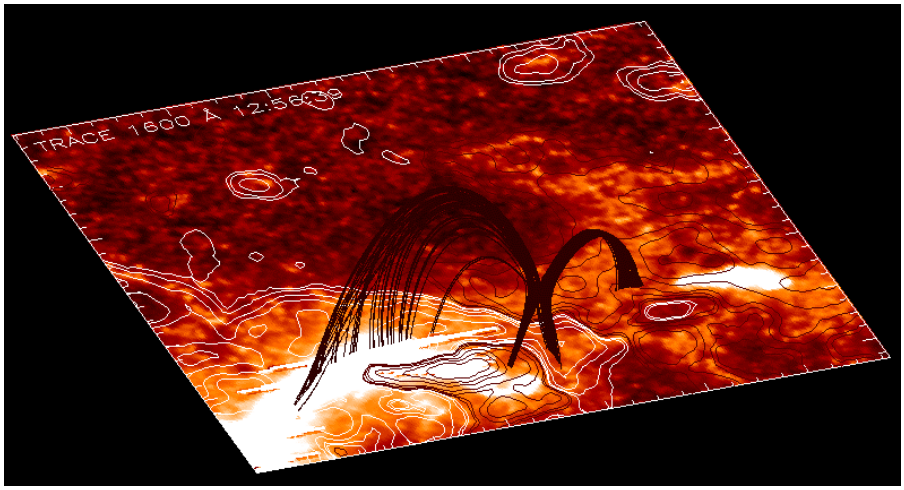

171
ming indicates CME
Flare loop motions and
ntenings near spine
gest reconnection
TRACE 171 Å 14-Jul-98 12:05:40


1998 Bastille Day Flare:
Reconnection at the Null?
TRACE 171 Å 14-Jul-98 12:05:40
TRACE 171 Å 14-Jul-98 12:05:40
TRACE 171 Å 14-Jul-98 12:05:40
TRACE 171 Å 14-Jul-98 12:52:46

Pre-Flare Ribbon Brightenings

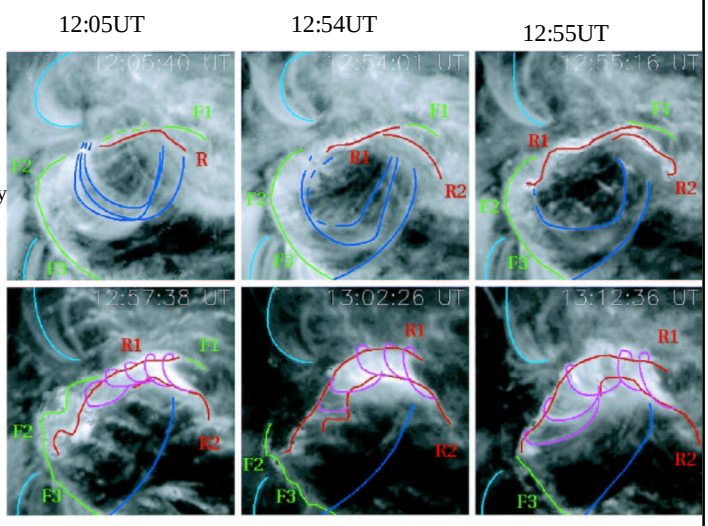


Pre-Flare Ribbon Brightenings



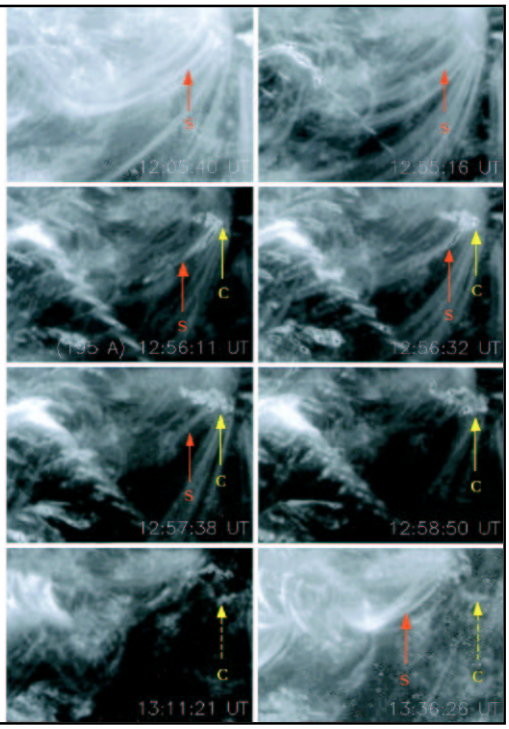
Event List

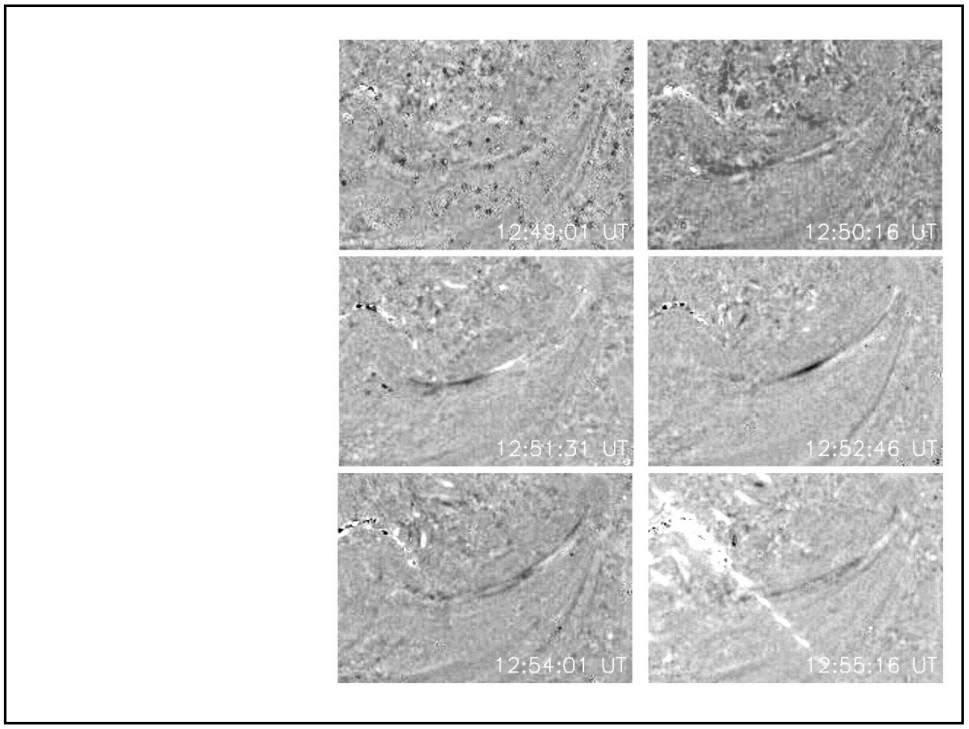
•12:05 First Image F1-3
•12:54 Start of Impulsive phase R1-2 brighten
•12:55 R1-2 become longer R1-2 from double J feature
•12:57 Post flare loops: R1-R2;
•12:59 GOES Peak Intensity
•13:02 F2 fades away



Spine Field Line Events

•12:05 First Image
•12:51:31First S pulse (seen next page)
•12:56:11 Second S pulse; C appears
•12:59 GOES Peak Intensity
•13:36 S loop reappears with different LH footpoint.

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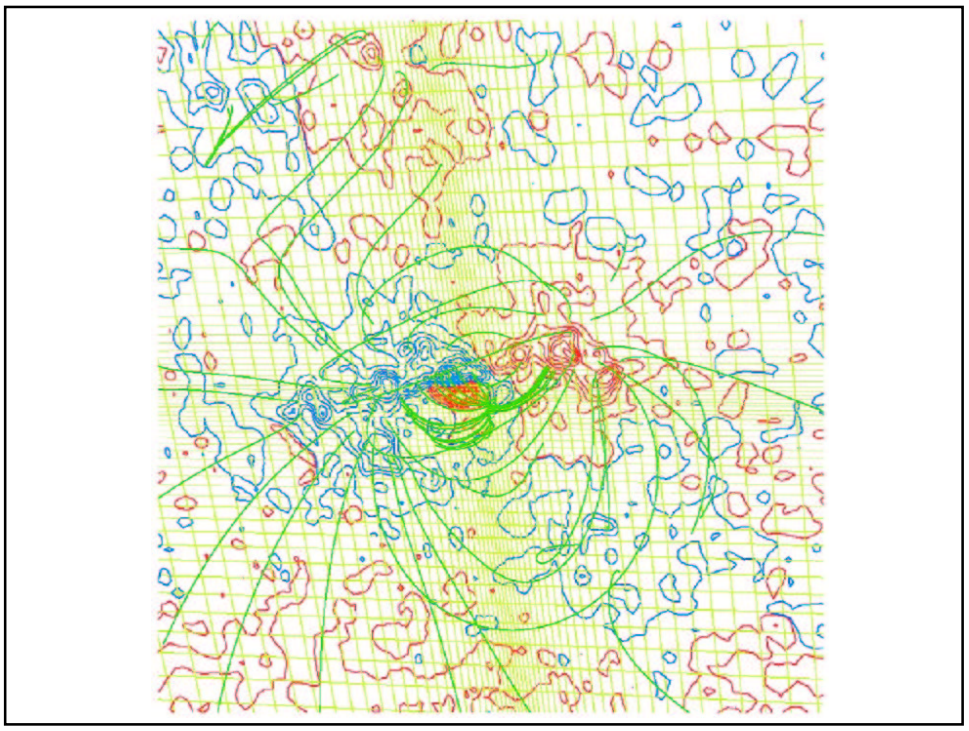
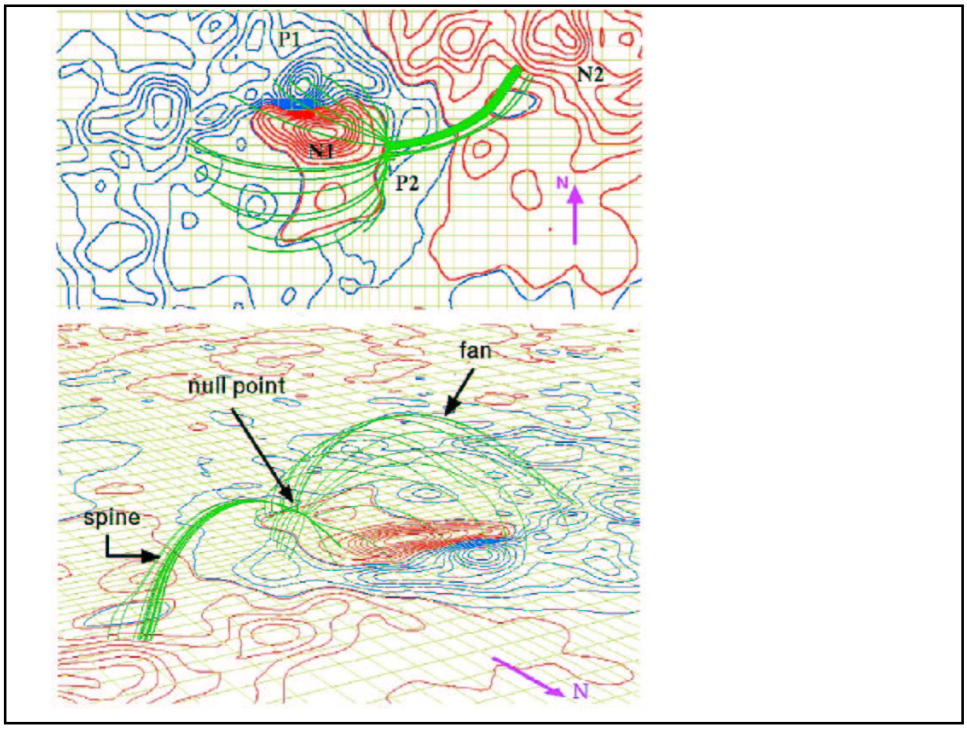
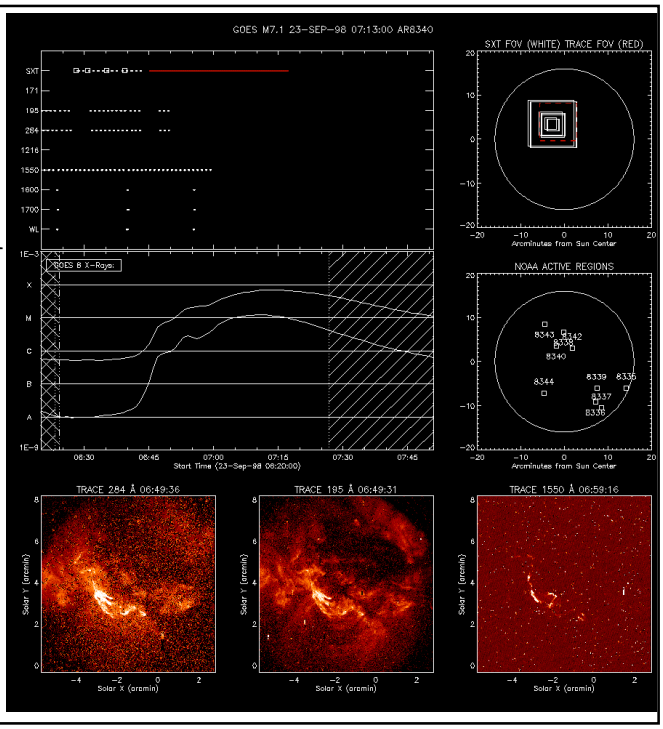
12:50:16 UT
12:51:31 UT
12:52:46 UT
12:54:01 UT
12:55:16 UT

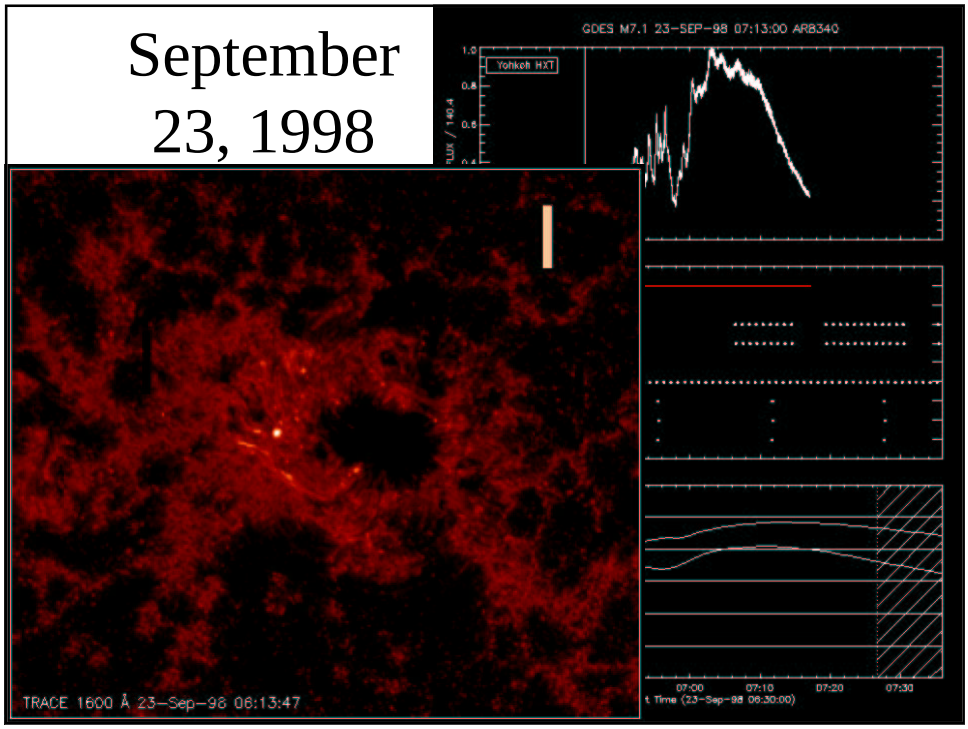




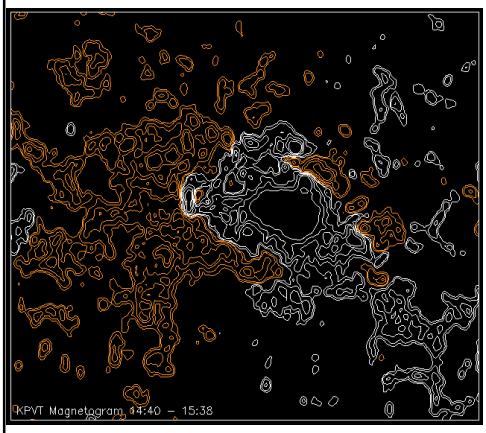
September 23, 1998 07:13 M7.1

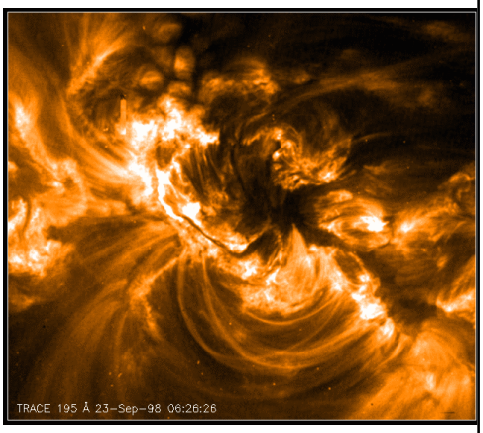


September 23, 1998



1998-Sep-23 Event: Where's the null?



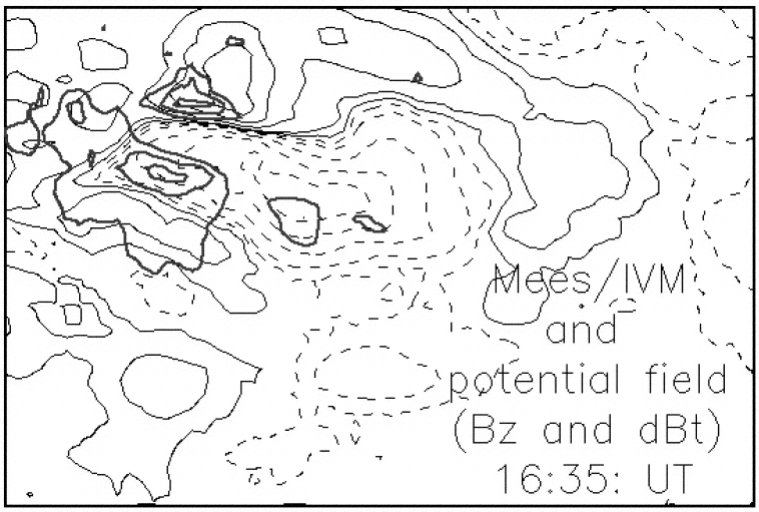


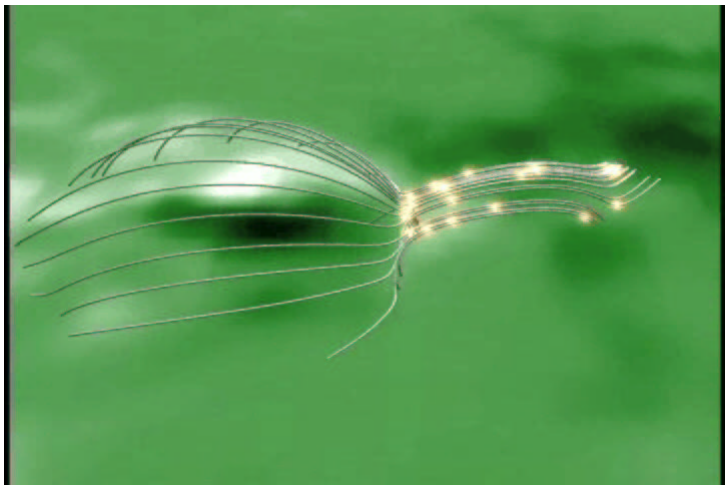
Conclusions

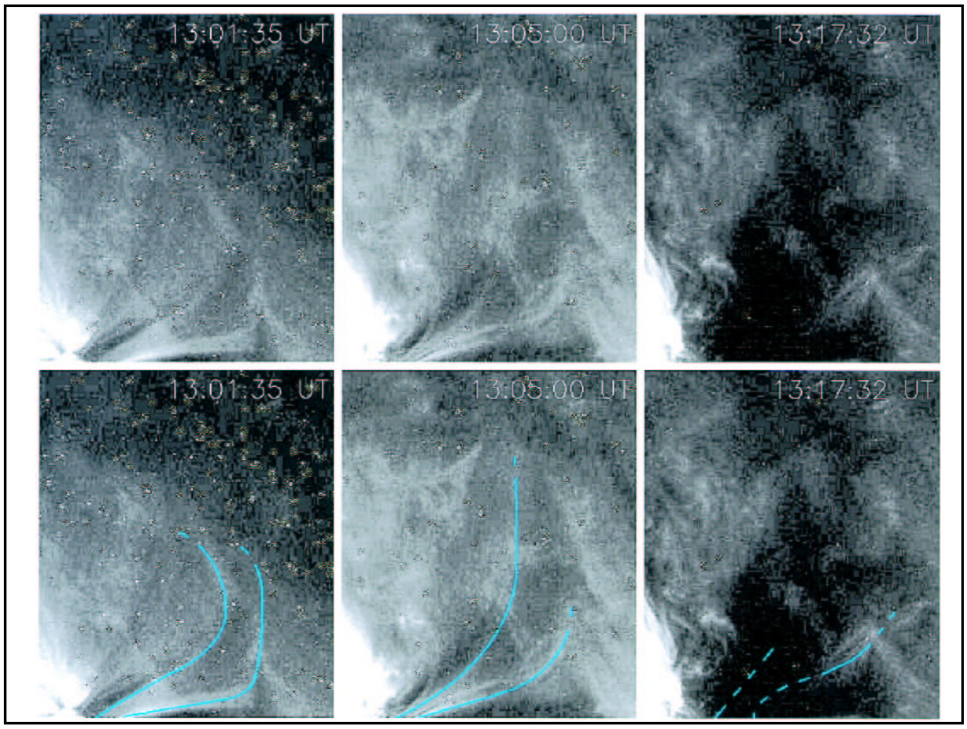
- A combination of high resolution coronal observations, chromospheric observations and photospheric magnetic fields are needed to map the topology of flares.
- We need much better models of coronal magnetic fields and systematic ways of choosing models that are consistent with the observations.
- Multi-thermal observations can be used to map connectivity in more detail.

Modeling Requirements

- Ability to embed local high resolution (vector) magnetic field data with hemisphere line-of-sight observations and synoptic full sphere data.
- Simple force free models that can be fit to different types of observations:
  - coronal connectivity
  - chromospheric brightening
  - filaments channels
- 3-D MHD with plasma and RT


Mees/IVM
and
potential field
(Bz and dBt)
16:35: UT




13:01:35 UT
13:05:00 UT
13:17:32 UT
13:01:35 UT
13:05:00 UT
13:17:32 UT