Observations of Complex Flaring Topologies

Ed DeLuca
SAO

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:

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
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**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”

![Solar Flare Image](image-url)
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Breakout Model

Alignment
KPNO 6 hours after flare
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Flare loop motions and brightenings near spine suggest reconnection.

1998 Bastille Day Flare: Reconnection at the Null?
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Pre-Flare Ribbon Brightenings

Pre-Flare Ribbon Brightenings
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Event List
- 12:05 First Image F1-3
- 12:54 Start of Impulsive phase R1-2 brighten
- 12:55 R1-2 become longer
- 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
- 12:51:31 First 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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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
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