



Study of Sheet Structures in Eruptive Solar Flares



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Project Summary

- ▶ Observations of high-energy emission from solar flares often reveal the presence of large sheet-like structures, sometimes extending over a space comparable to the Sun's radius. These sheets exist in a very important region where the magnetic field is expected to produce large sheets of electrical current. In this project, we will measure the physical conditions in these sheets to understand how the conditions control the magnetic reconnection and energy release in flares.





Fig. 1 : Schematic illustration of the reconnection model of a solar flare. Thick solid lines show magnetic field. Arrows indicate the plasma bulk flow.



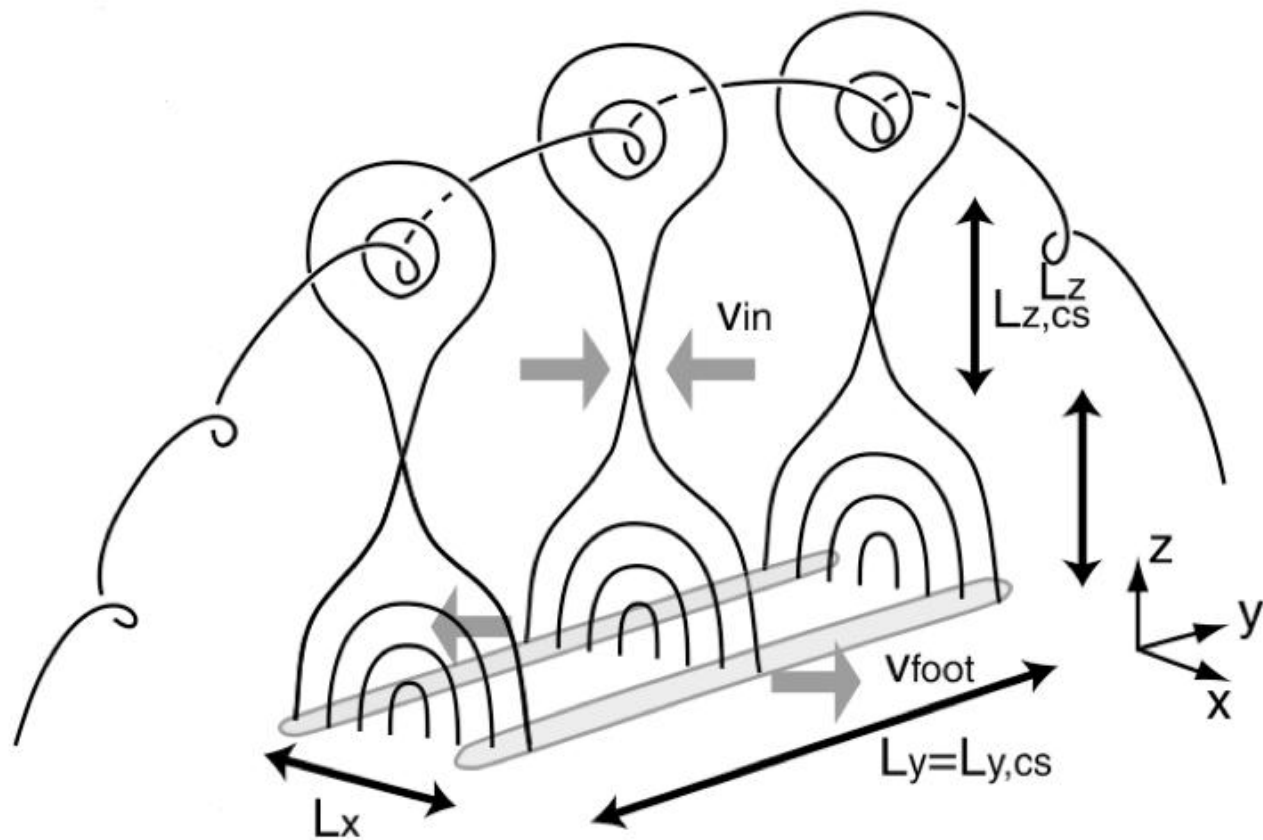


FIG. 1.—Schematic illustration of the reconnection model of a two-ribbon flare.

"It is crucial to obtain these ambient coronal parameters and as many facets of the [current sheet] properties as possible by observational means so that the post-CME current sheet models can be scrutinized more effectively."



Process

1. Select Data
2. Prep Data using XRT_prep
 1. Cleans up Data
3. Align Data using XRT_align_cube
4. Ratio to create temperatures using XRT_Teem



XRT Teem

- ▶ Purpose of program is to get coronal temperatures using the filter ratio method
- ▶ Different filters respond differently to X-Rays
- ▶ Relation between temperature, energy, and wavelength



Code

- ▶ Restrictions: Filter Combinations must be different, Images must be the same size, and Time between images must be less than 10 seconds

```
counter=0
```

```
for i=0,sz(3)-2 do begin
```

```
    if index[i].ec_fw1 ne index[i+1].ec_fw1 or index[i].ec_fw2 ne index[i+1].ec_fw2 then begin
```

```
        if image_diff[i] lt 10 then begin
```

```
            xrt_teem,index(i),data(*,*,i),index(i+1),data(*,*,i+1),te,em,et,ee,/corona, bin=4
```

```
            te1(*,*,counter)=te(*,*)
```

```
            em1(*,*,counter)=em(*,*)
```

```
            et1(*,*,counter)=et(*,*)
```

```
            ee1(*,*,counter)=ee(*,*)
```

```
            counter=counter+1
```

```
        endif
```

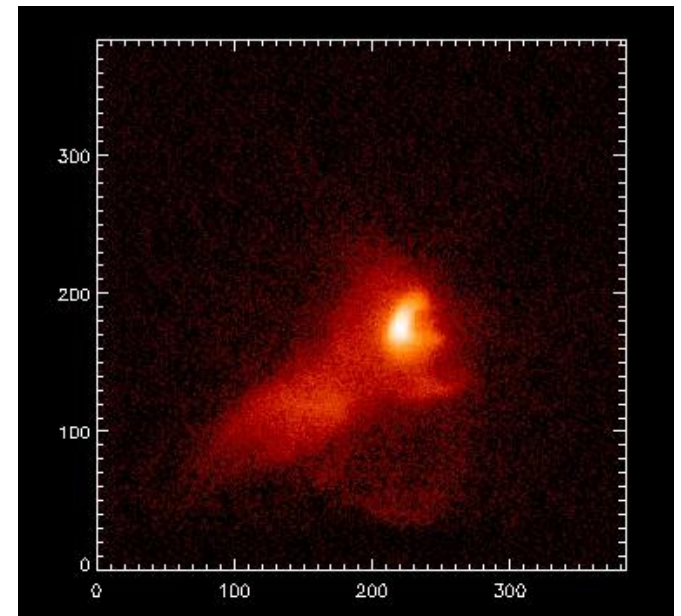
```
    endif
```

```
endfor
```



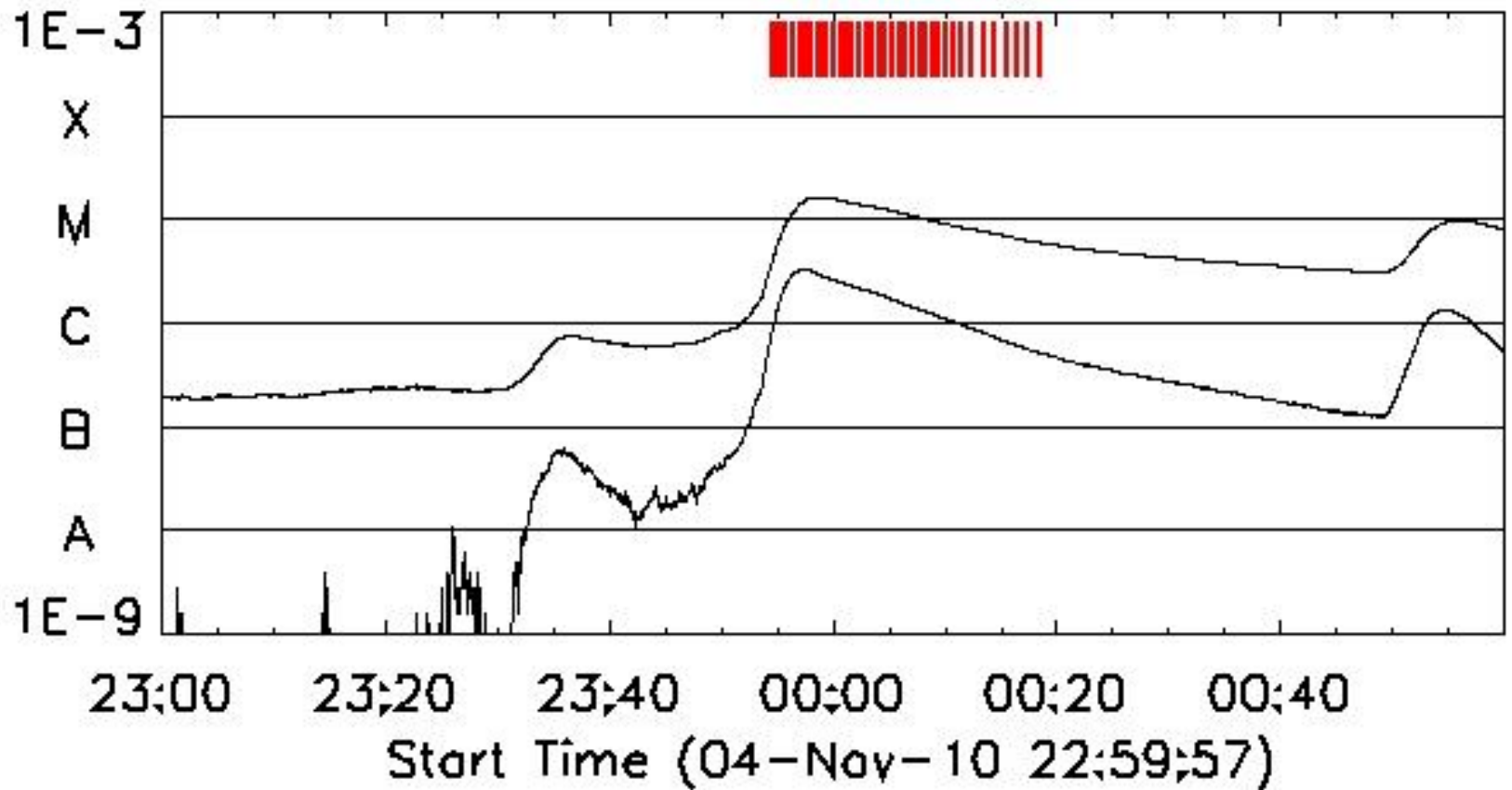
Flare 1

- ▶ Nov 4, 2010 Time: 23:54-00:19
- ▶ Original data set: 198 images
- ▶ Filter Ratio: Open/Al_thick and Open/Be_thick
- ▶ Start: 23:30, Max: 23:58
End: 00:12
- ▶ Temp Data set: [384, 384, 38]
(76 images used)
- ▶ Min: 6.33 Max: 7.18

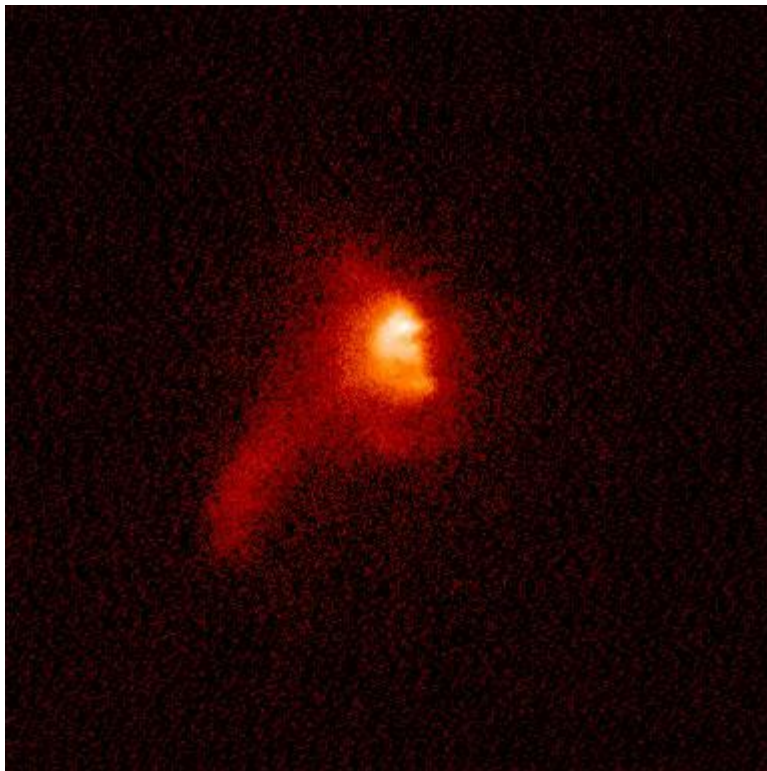


GOES Plot

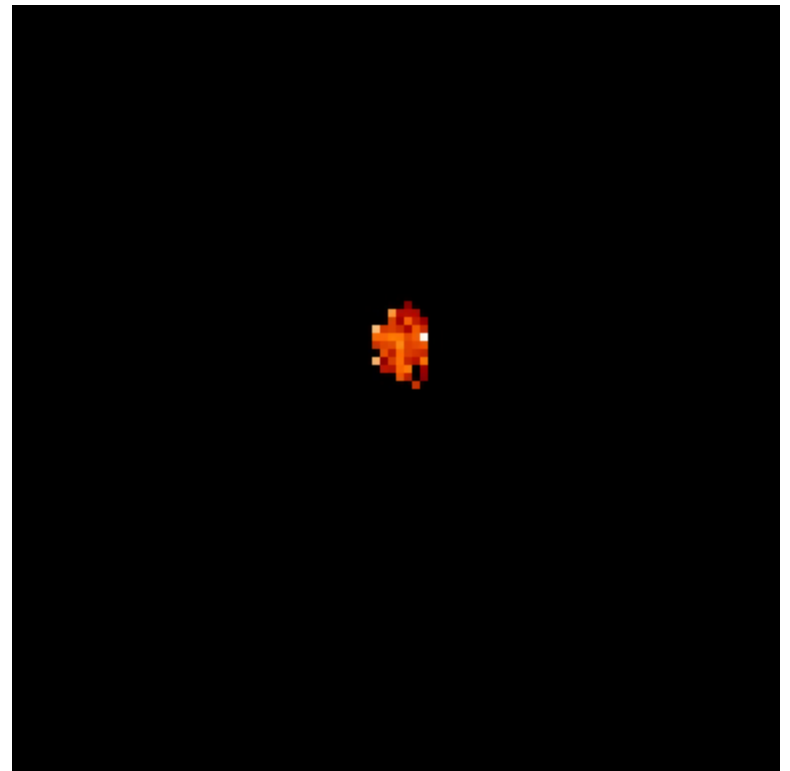
GOES 15 X-Rays:



Prepped and Aligned Data

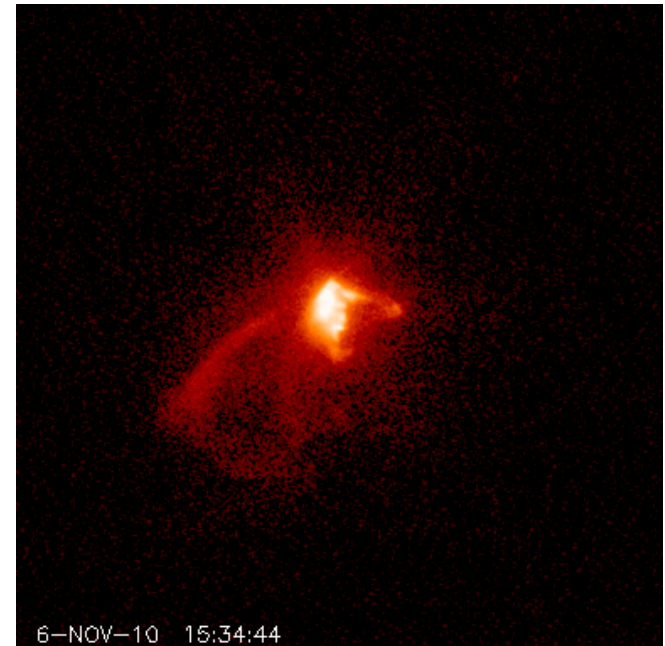


Temperatures

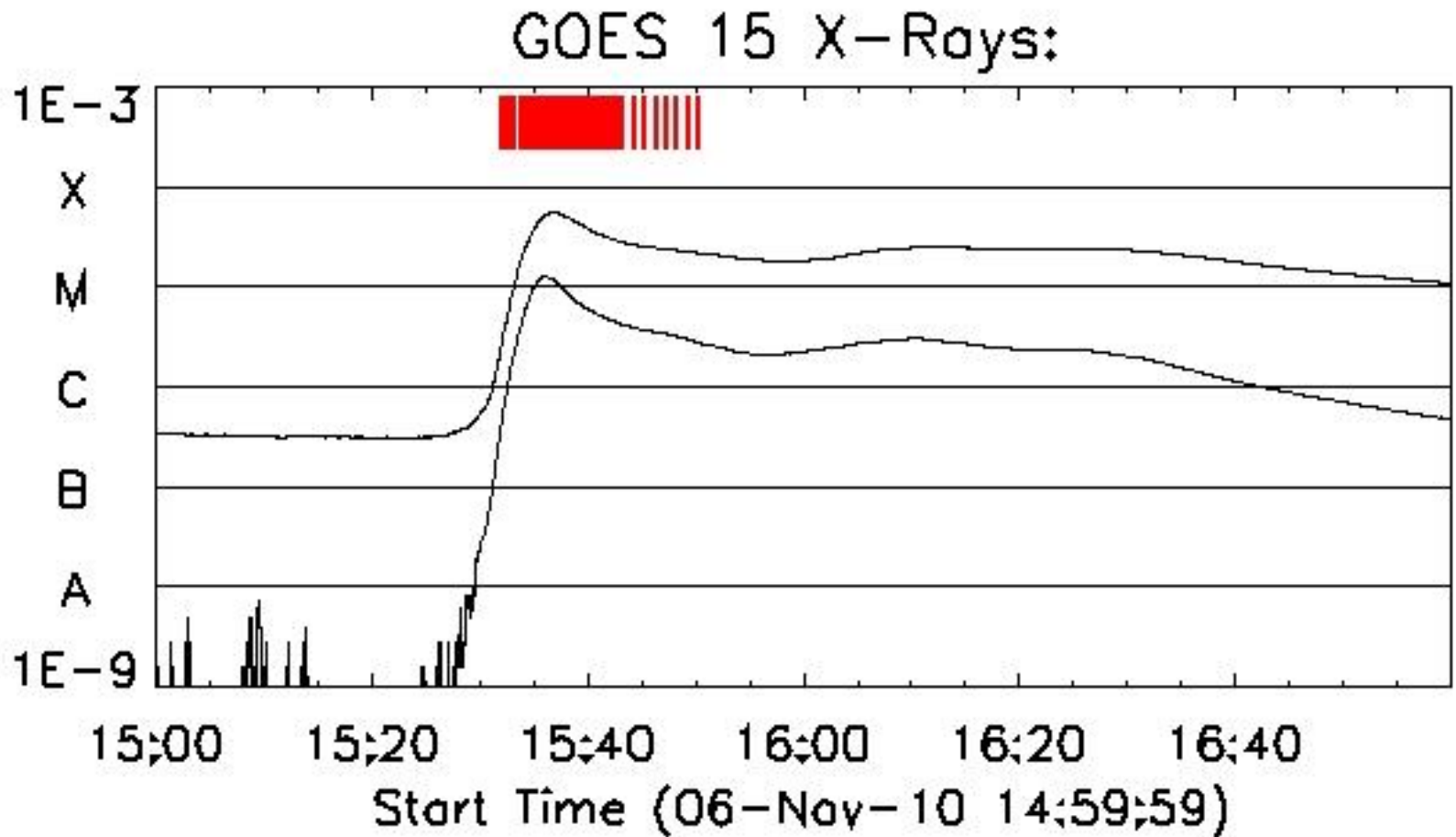


Flare 2

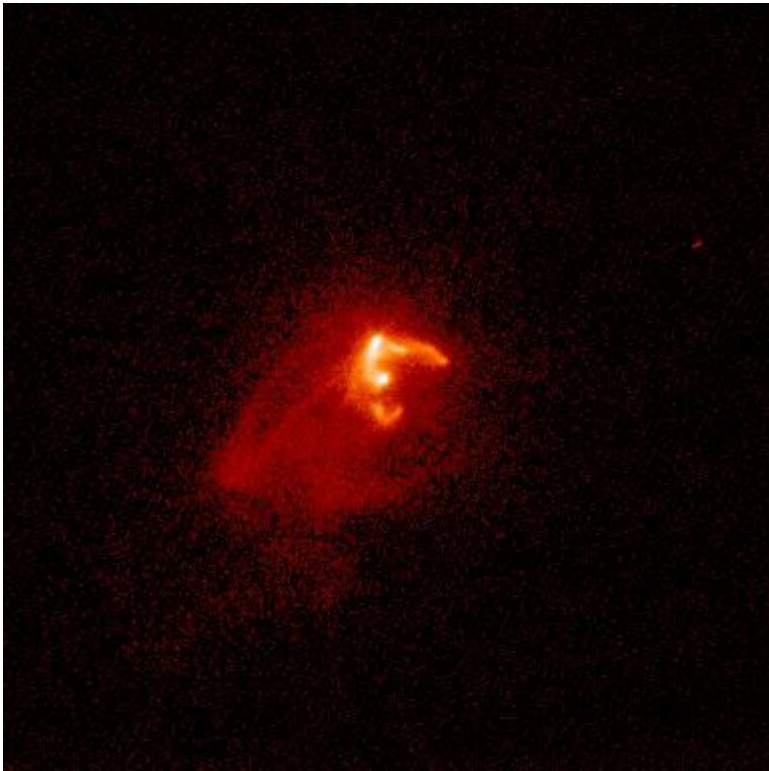
- ▶ Nov 6, 2010 Time: 15:00-18:00
- ▶ Original data set: 406 images
- ▶ Filter Ratios: Open/Al_thick and Open/Be_thick
- ▶ Start: 15:27, Max:15:36,
End:15:44
- ▶ Temp Data set: [384, 384, 36]
(76 images used)
- ▶ Min: 6.43, Max:7.66



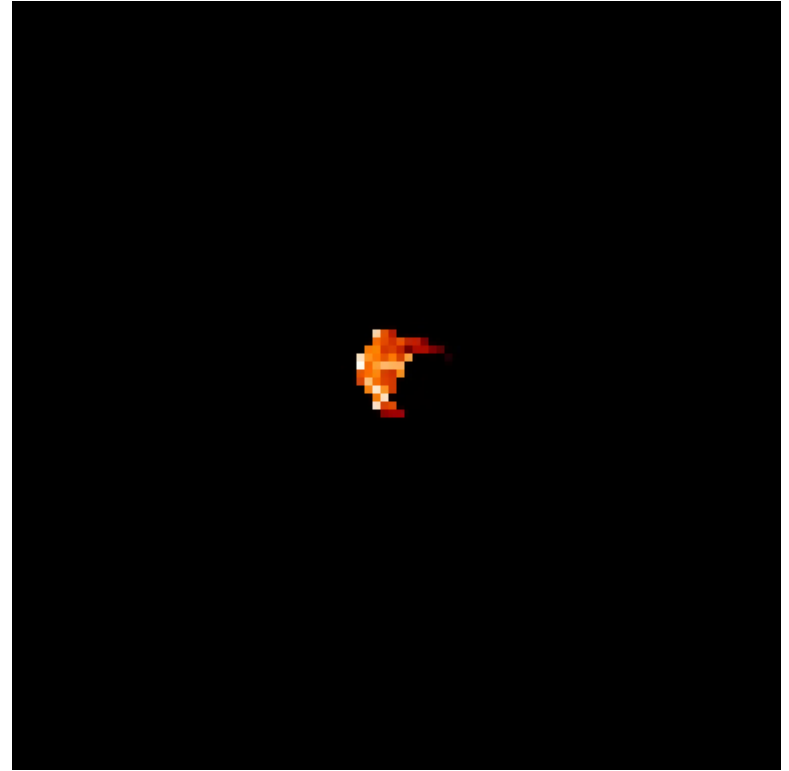
GOES Plot



Prepped and Aligned
Data



Temperatures



Goals

- ▶ Continue to produce temperature for more flares
- ▶ Produce emission measures from XRT Teem
- ▶ Use the emission measure to find the density of the current sheet.

