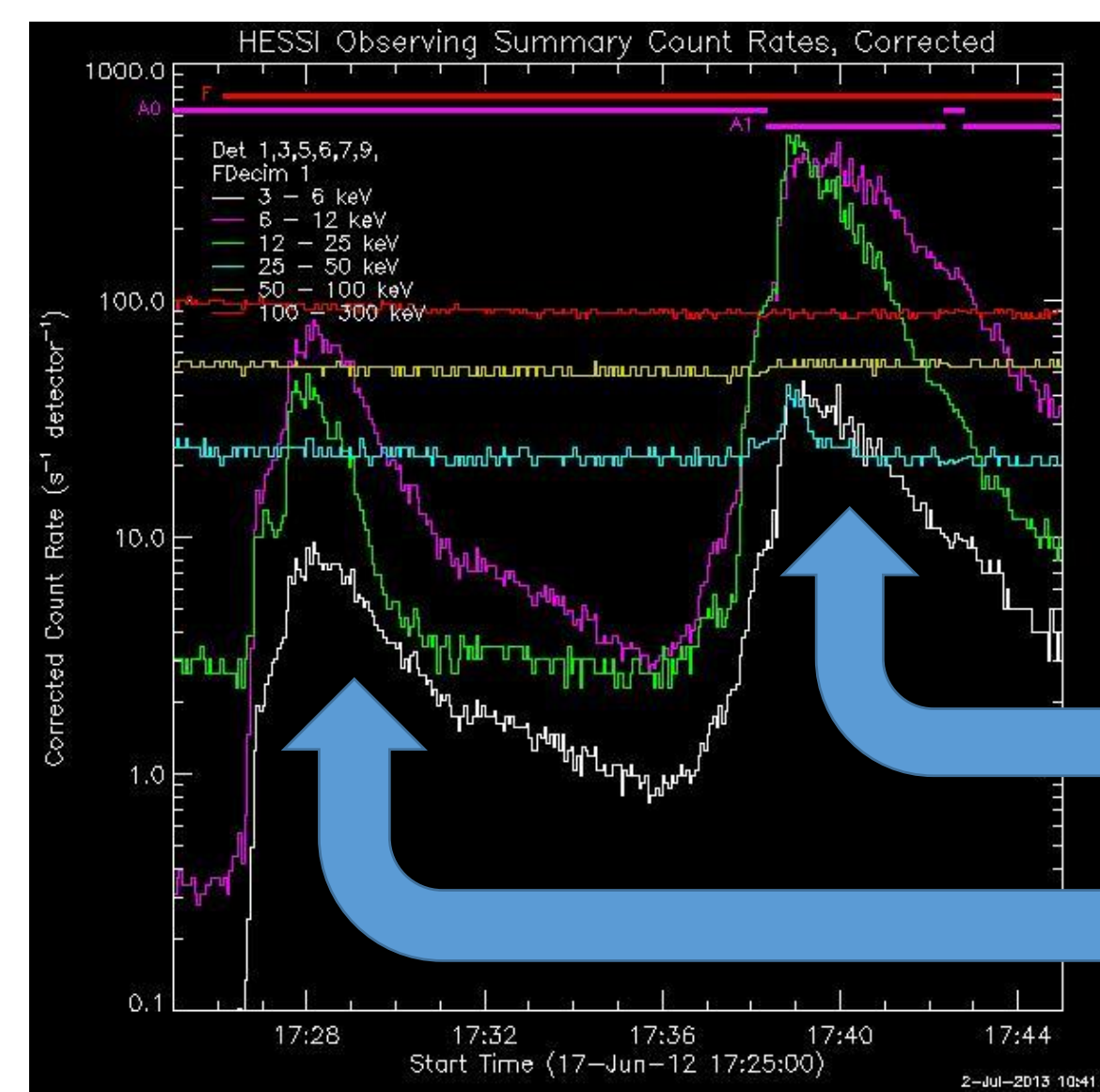


## Introduction

We are investigating the heating of solar flares using the EBTEL (0D Enthalpy Based Thermal Evolution of Loops) model by calculating the heating rate and comparing with actual observed results. The results produced from EBTEL are very similar to the observed findings. We will then try to improve the EBTEL model using these and further results.

## The Observed Flare

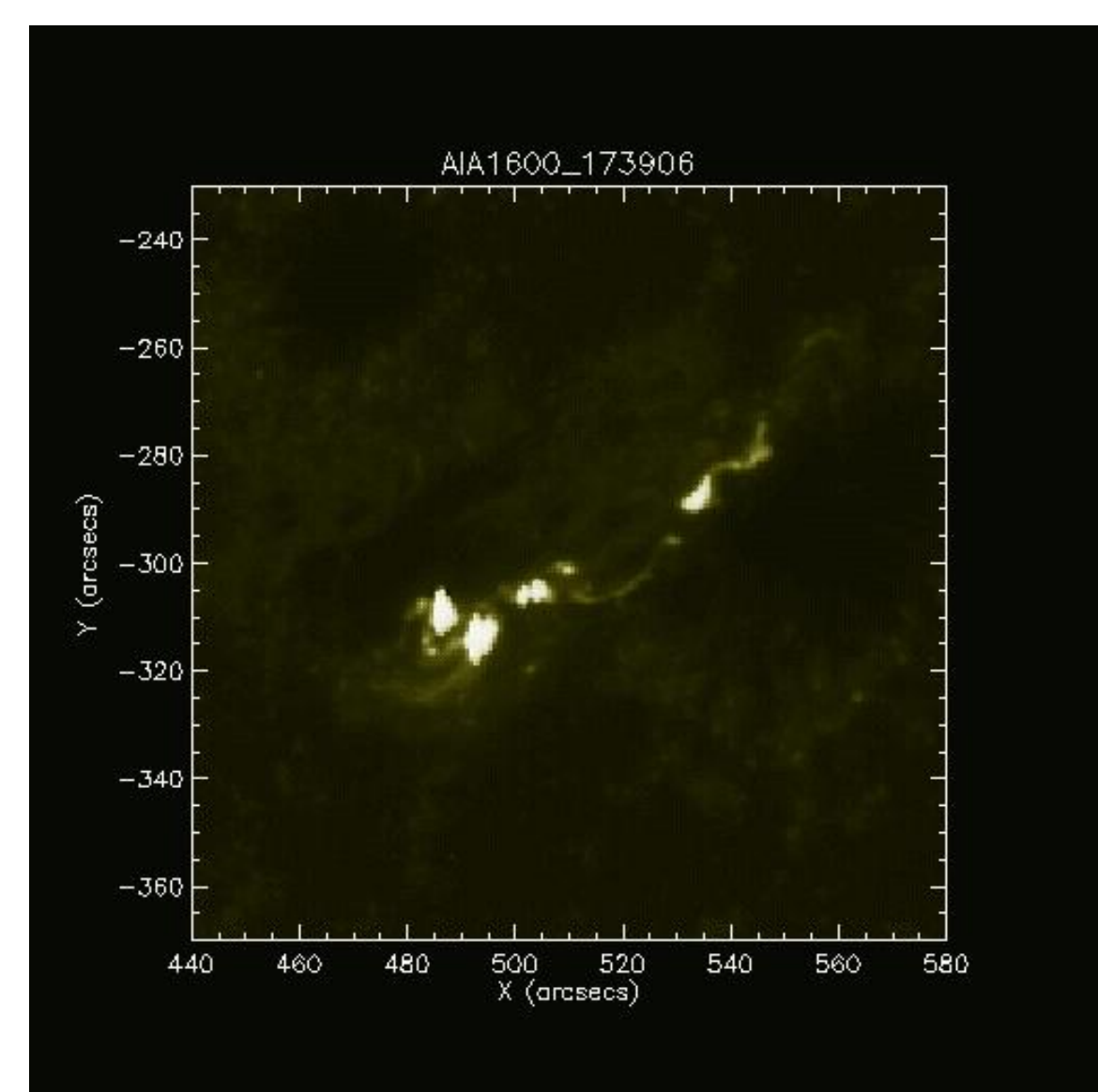
The flare being analysed occurred at about 1739 UTC on 17<sup>th</sup> June 2012 with a smaller flare occurring about 10 minutes earlier.



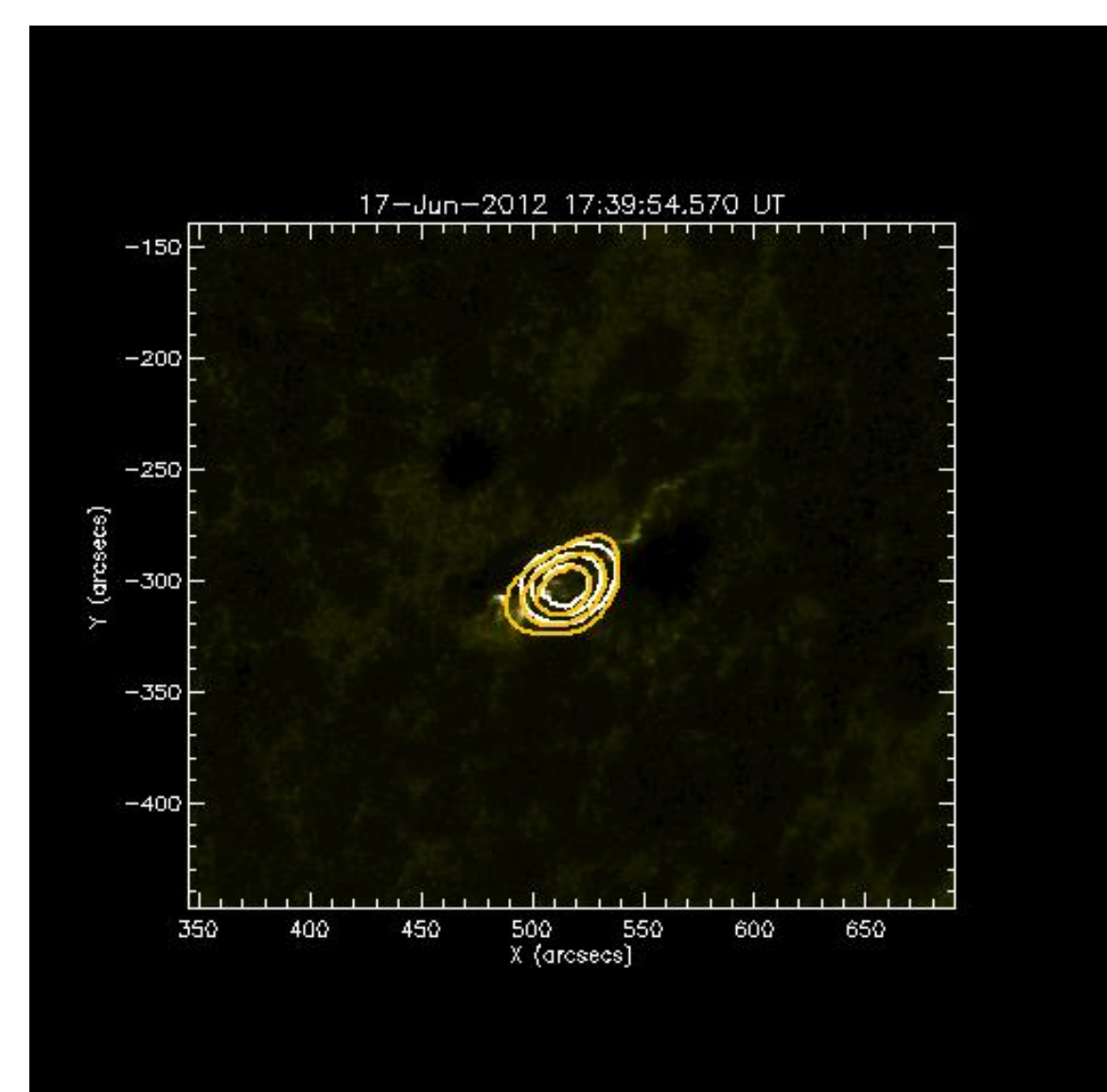
RHESSEI imaging data

Flare at 1739

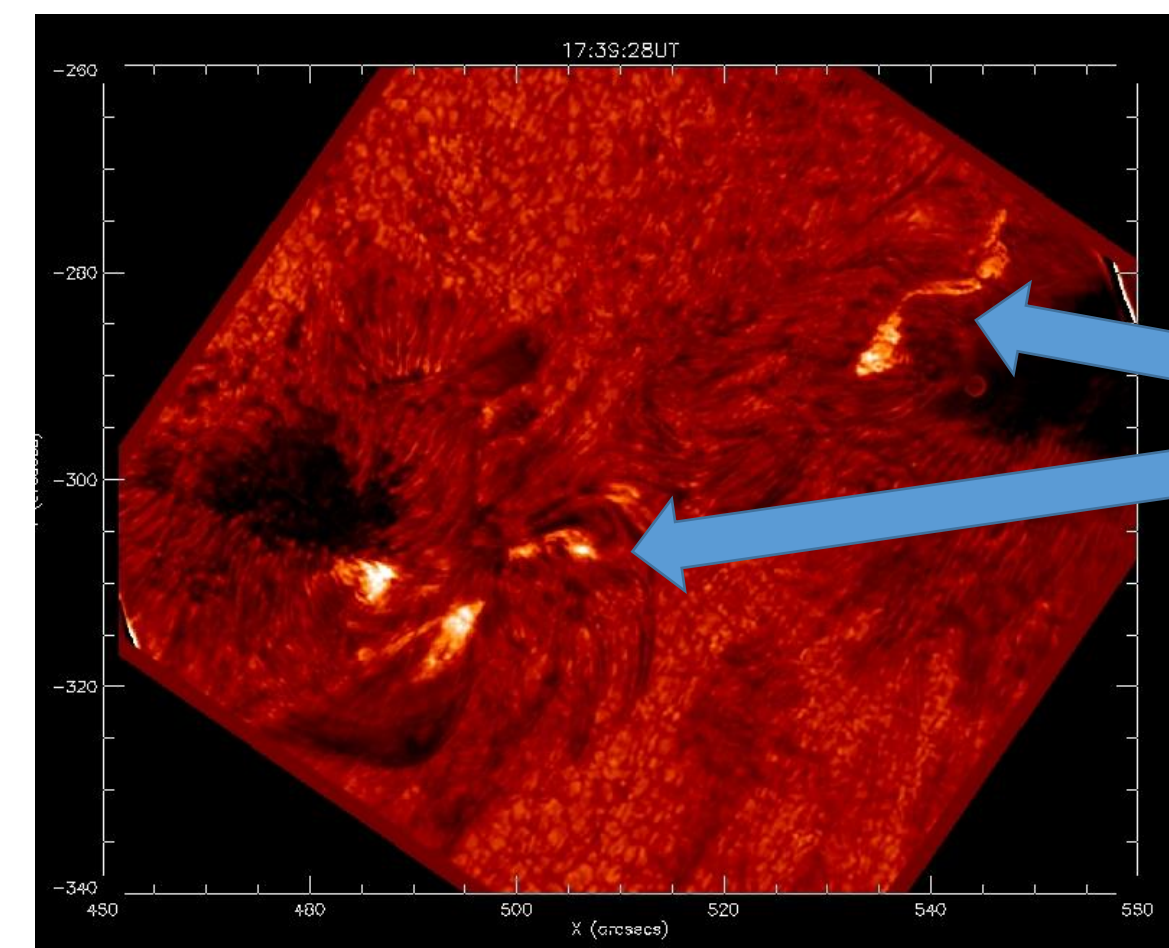
Smaller Flare



AIA 1600  
data used in  
calculations  
at 17:39:06



RHESSEI Data  
Orange: First peak  
White: Second peak



High resolution  
He I 10830 data  
showing two  
different flares

## EBTEL Model

The basic equations that describe the evolution of the spatially averaged pressure  $\bar{P}$  and number density  $\bar{n}$  in time  $t$  are

$$\frac{d\bar{P}}{dt} = \frac{2}{3} \left( \bar{Q} - \frac{1}{L} (R_c + L_t) \right)$$

$$\frac{d\bar{n}}{dt} = - \frac{c_2}{5c_3 k L \bar{T}} (F_0 + L_t)$$

with

$$R_c = \bar{n}^2 \Lambda(\bar{T}) L$$

$$L_t \propto P$$

$\bar{Q}$ : spatical average volumetric heating rate

$L$ : half loop length

$F_0$ : thermal conduction flux

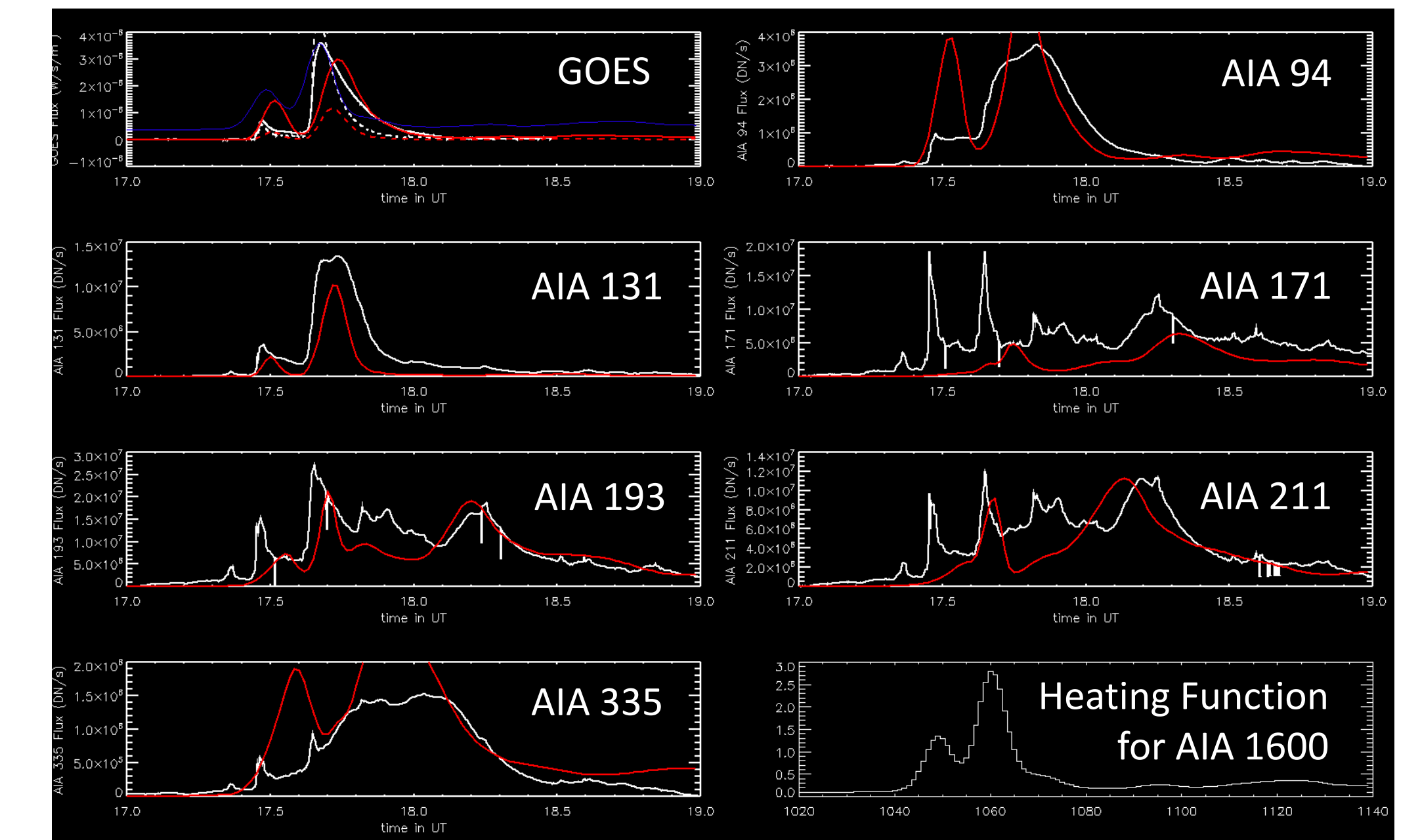
$R_c$ : coronal radiation rate

$L_t$ : energy loss rate through transition region

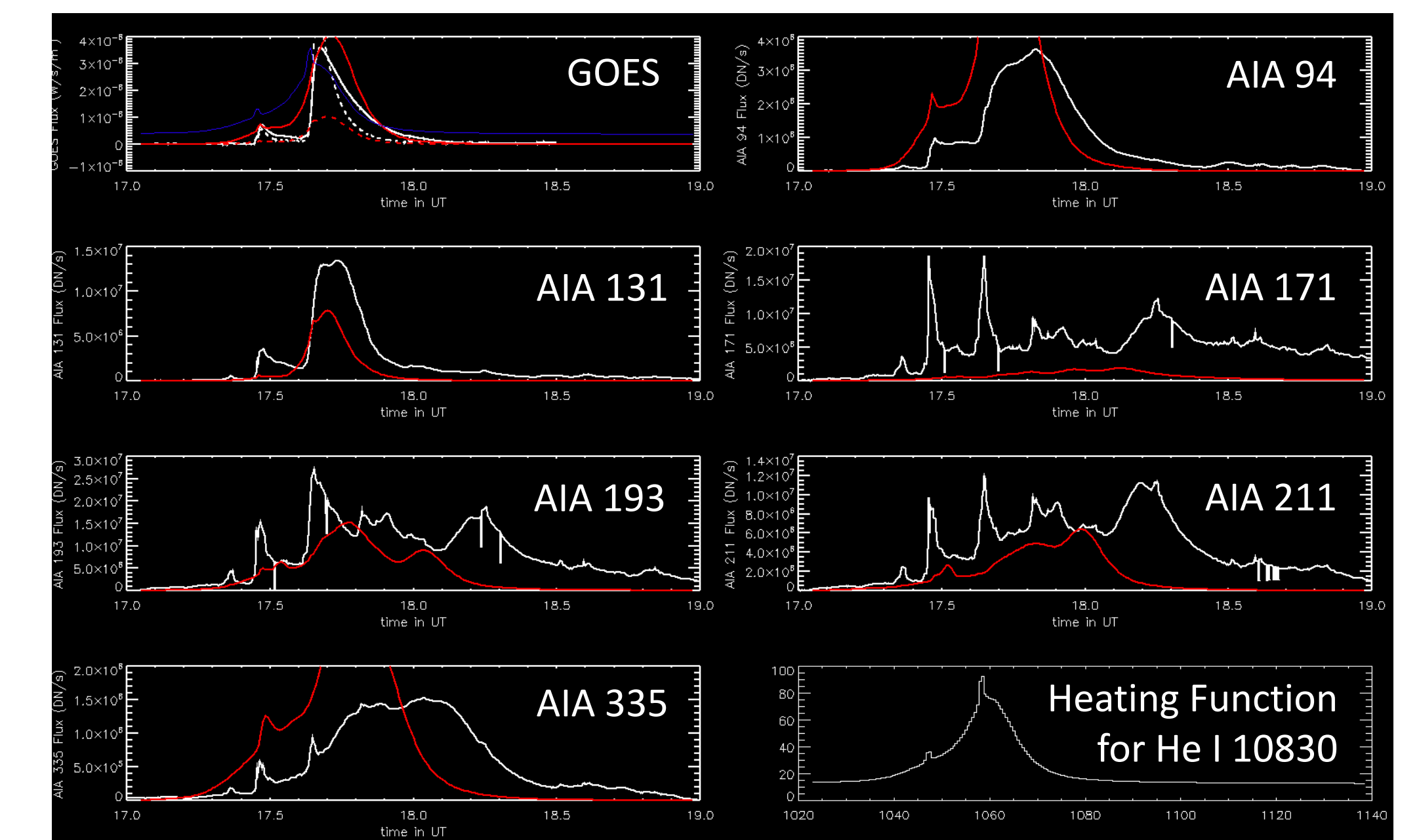
## Results

By adjusting different parameters  $c_0$ ,  $c_1$  and  $c_4$  within the model we look at the different outputs to the EBTEL model and compare them to the observed flare.

So for  $c_0 = 0.7$ ,  $c_1 = 1.5$  and  $c_4 = 0$  and a Gaussian heating function we obtain the following results where red are the EBTEL predicted results and white are the observed flux.



The predicted and actual data match exceedingly well except for a few anomalies which are to be expected. By adjusting the heating function and adjusting the input parameters appropriately you can also get a good match for the shape of the first flare also.



## Conclusion

- The EBTEL model produces good results even though it is highly simplified.
- The heating function generated from He I 10830 is different from AIA 1600

## Continuing Work

- Use the higher resolution He 10830 data to see whether we can gain an extra information from smaller pixel sizes
- Check the reasons that differ the heating functions generated from AIA 1600 and He I 10830
- Add RHESSEI data to the comparisons
- Look at and calculate the footpoint emissions
- Use parameters for each flare that are independent