



---

**Analysis and Modeling of Two Flare Loops  
Observed by SDO/AIA and Hinode/EIS**

**Ying Li** & Jiong Qiu  
*Montana State University*

June 14 2012

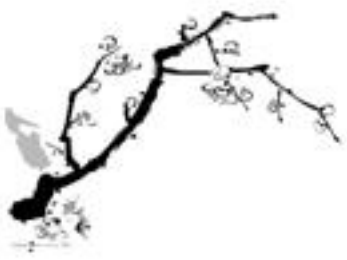




# Contents

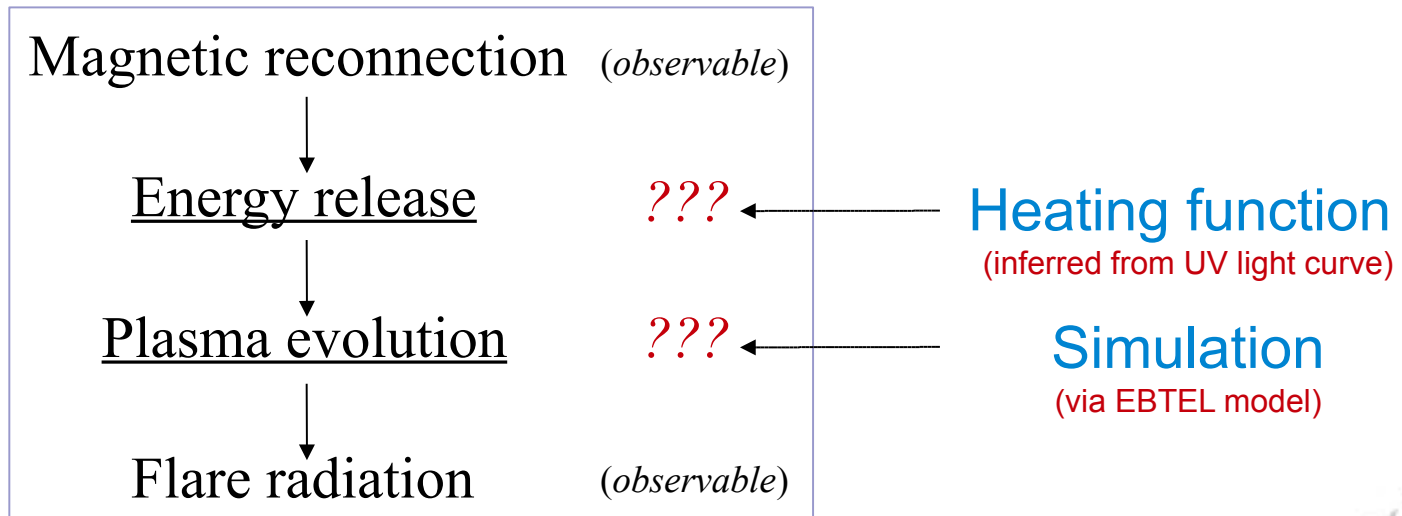
- Background
- Method
- Results
- Discussion

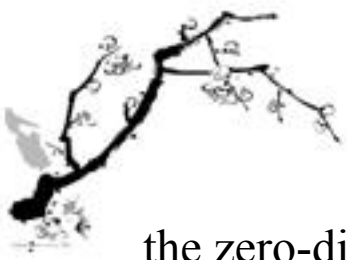




# Background

## Flare heating issue





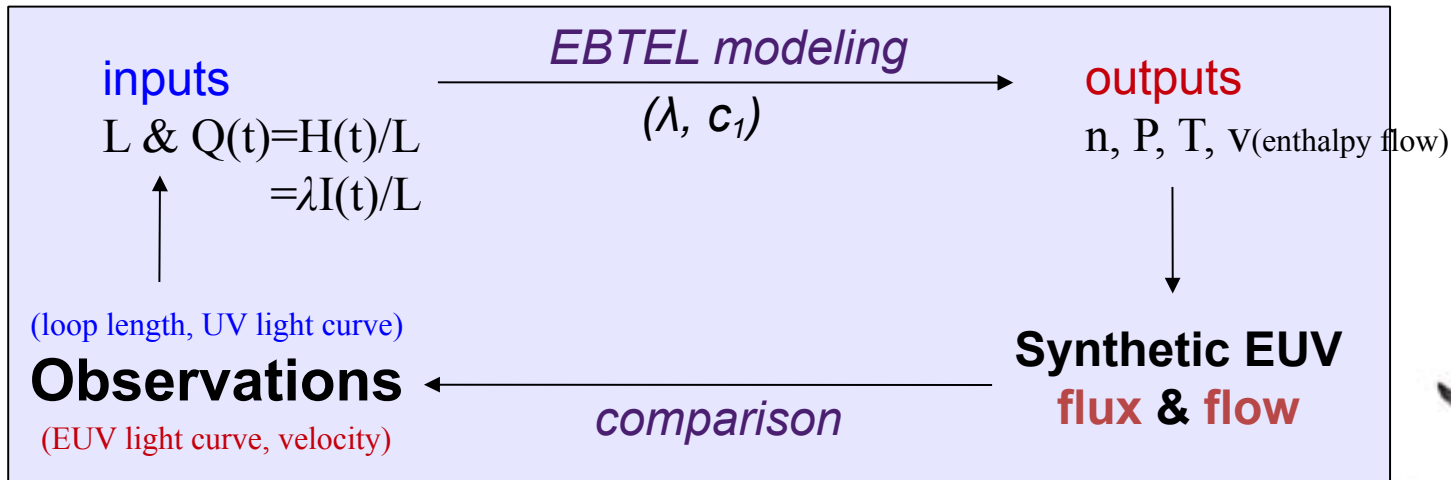
# Method

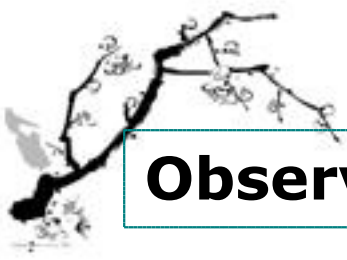
the zero-dimensional **E**nthalpy **B**ased **T**hermal **E**volution of **L**oops model (EBTEL; Klimchuk et al. 2008)

$$\frac{dn}{dt} = -\frac{2c_2}{5k_B T} \left[ \frac{F_c}{L} + c_1 n^2 \Lambda(T) \right]$$

$$c_1 = \frac{R_{tr}}{R_c}$$

$$\frac{dp}{dt} = \frac{2}{3} [Q(t) - (1 + c_1) n^2 \Lambda(T)]$$



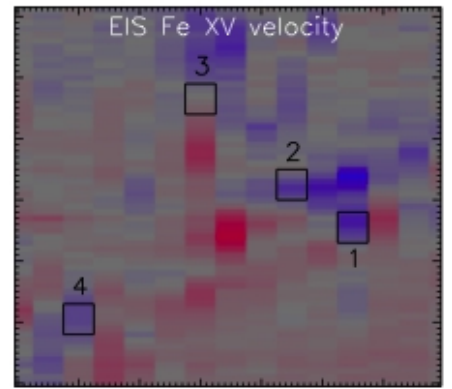
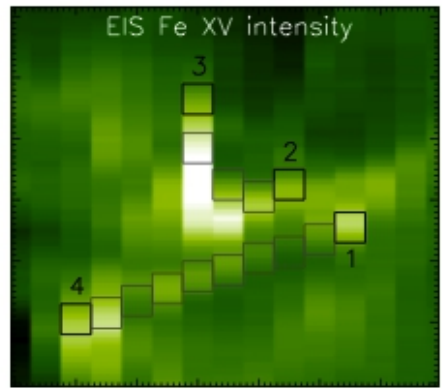
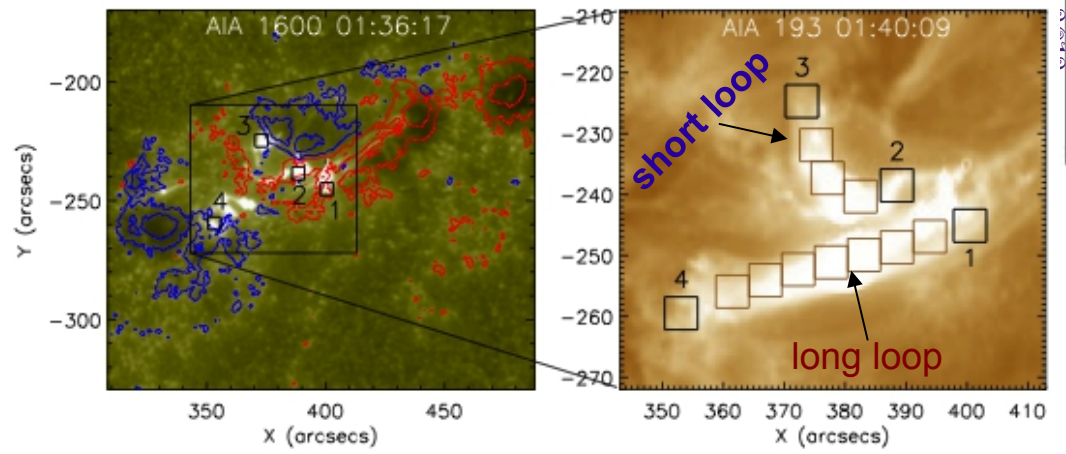
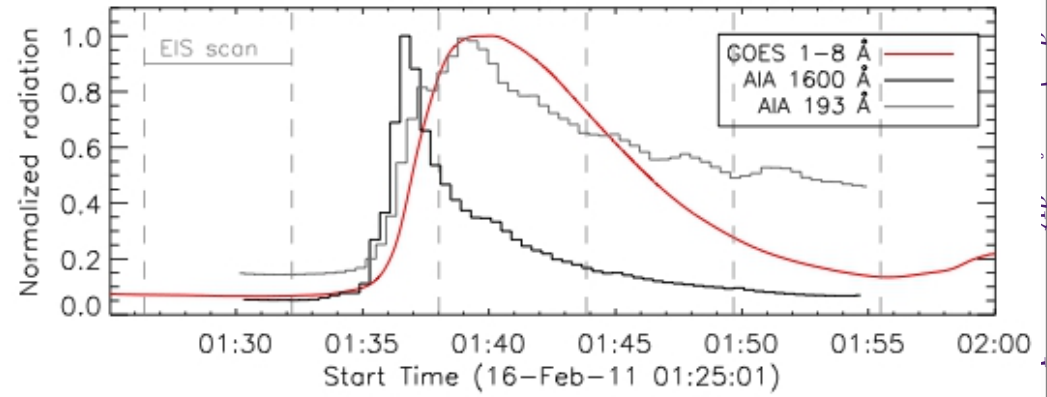


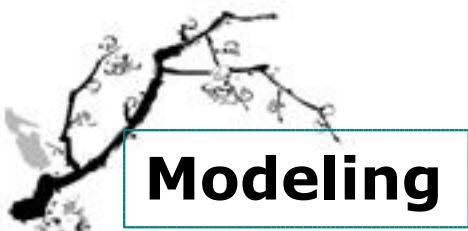
# Observations

an M1.0 flare  
on 2011 Feb. 16  
in AR 11158

AIA imaging data  
EIS spectroscopic data

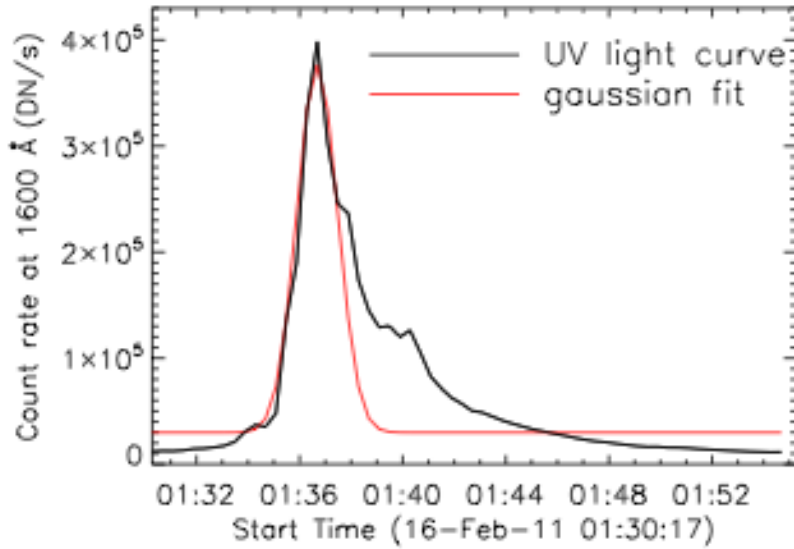
two distinctive loop systems  
treated as two big loops  
four footpoints, each 5" by 5"





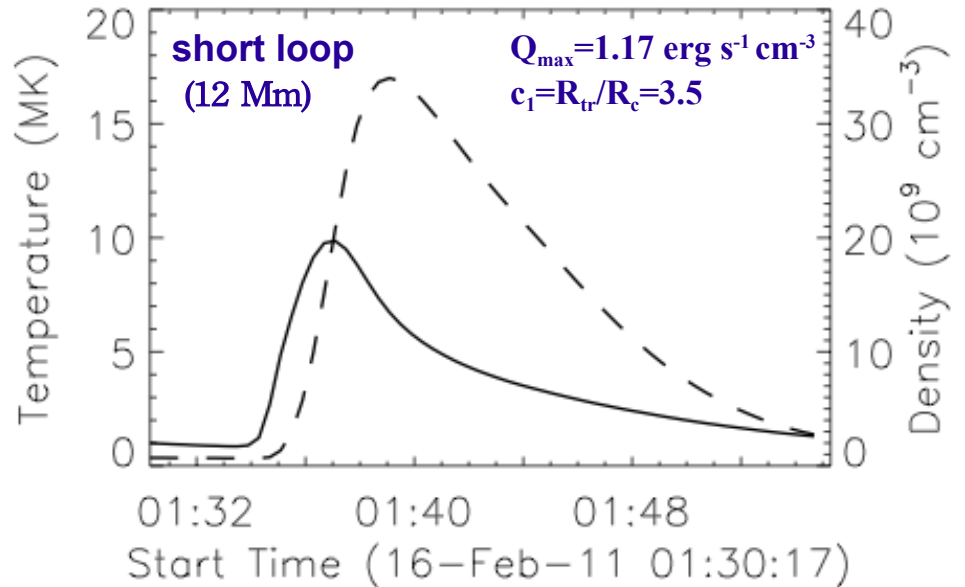
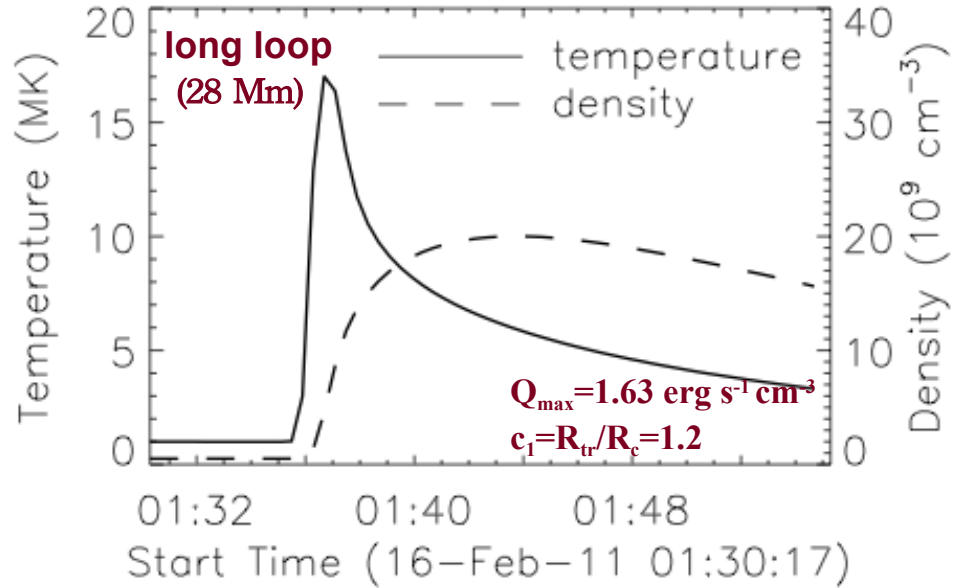
# Modeling

## Heating function



## Plasma evolution

ajf

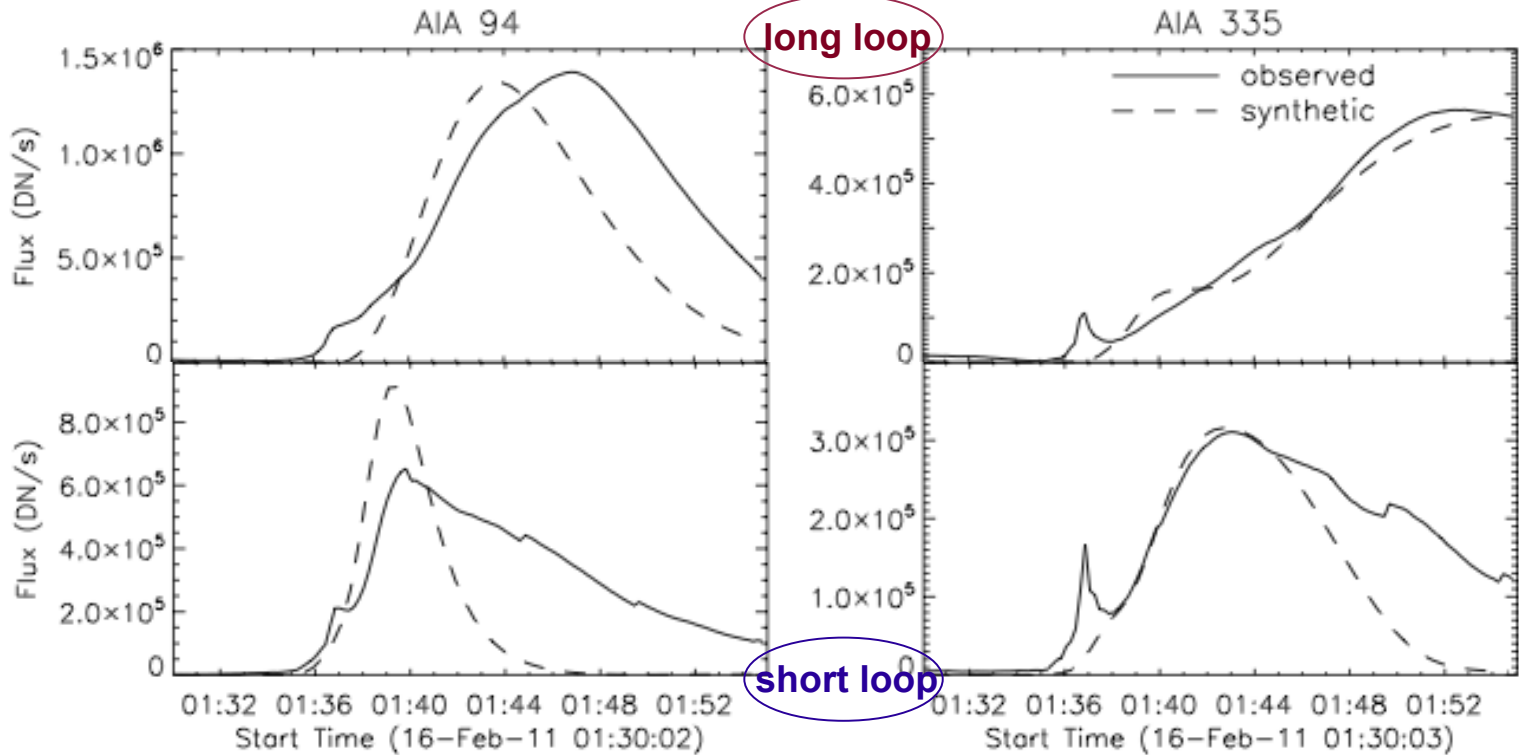


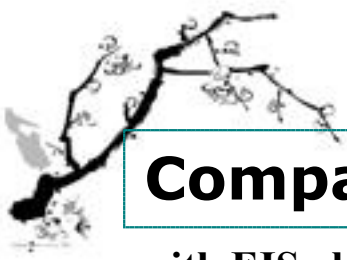


# Comparison

with AIA observations

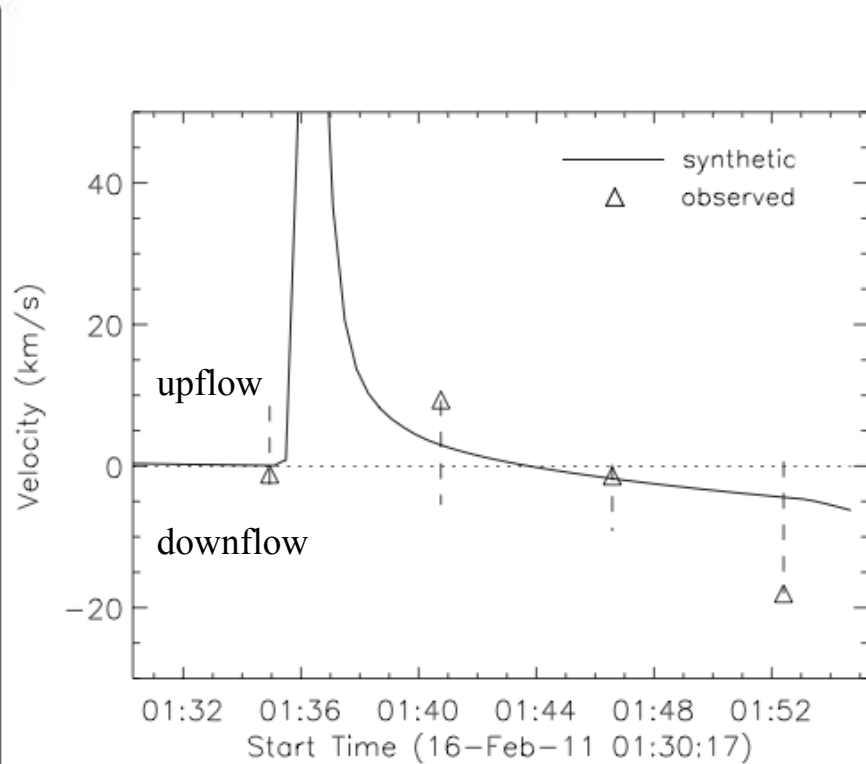
## Synthetic VS Observed EUV flux in 94 & 335



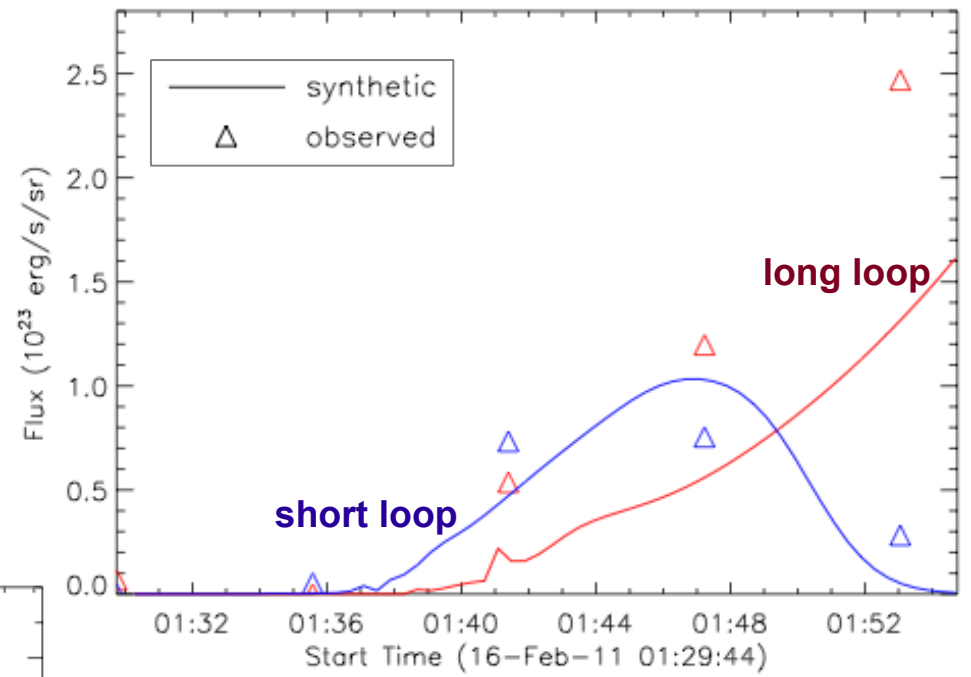


# Comparison

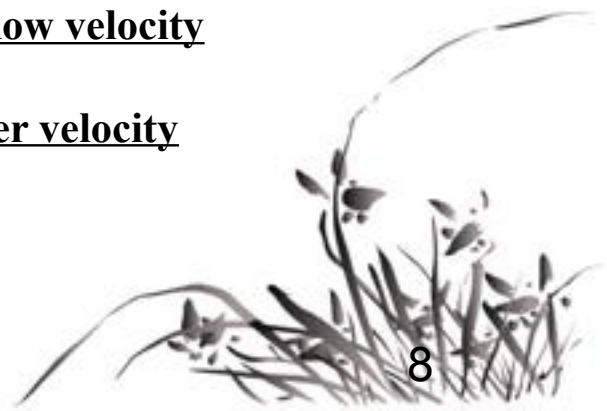
with EIS observations



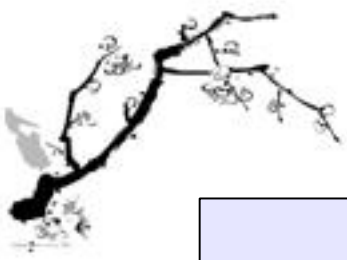
## Synthetic VS Observed Fe XV intensity



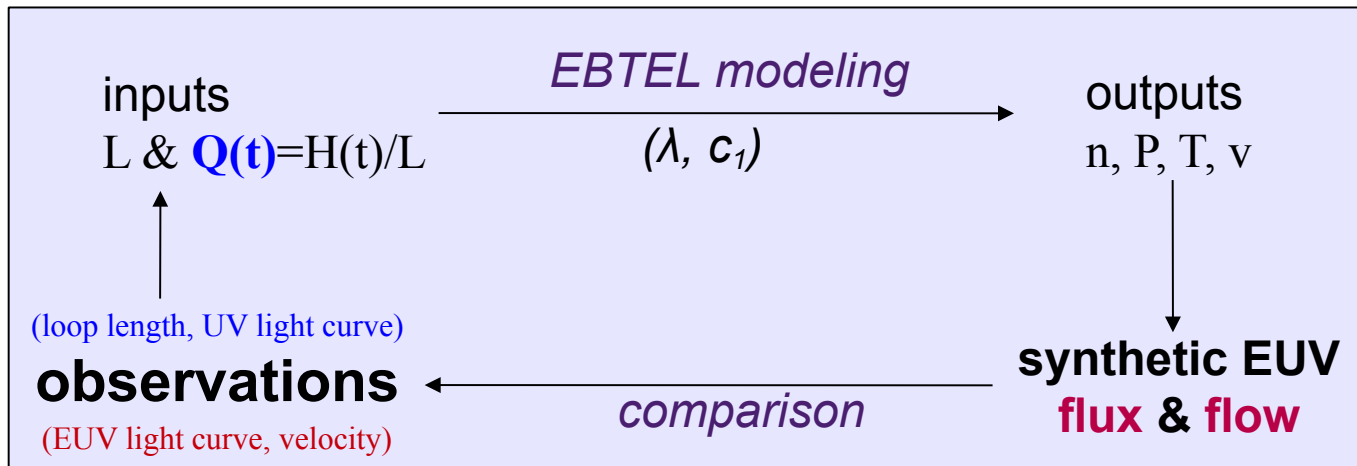
## Synthetic Fe XV flow velocity VS Observed Doppler velocity







# Summary

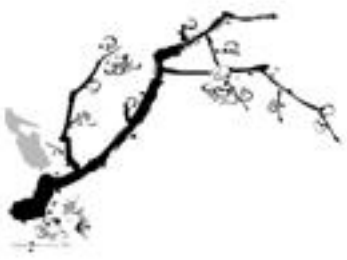


**The model results agree well with observations in many aspects.**  
 (timing & magnitude; using independent instruments)

The two different loops show **different coronal plasma evolution patterns**, with the short loop evolving more quickly than the long loop.

Our results suggest that the **observationally constrained heating rates** and the **EBTEL modeling** with only two free parameters provide a **reasonable description** of the heating and evolution of flare loops.





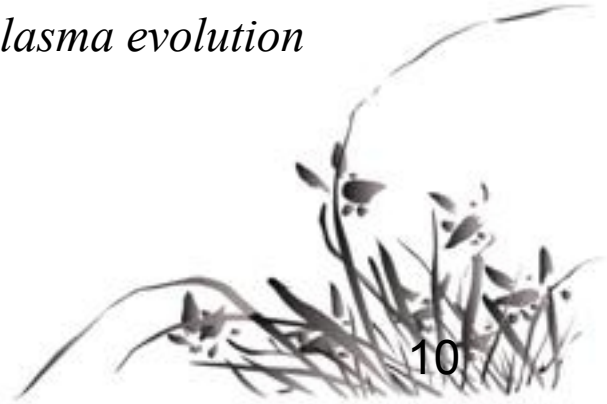
# Discussion

The heating mechanisms and loop dynamics may be different in different loops.  
*(different heating rate and different energy loss ratio)*

Spectroscopic velocity measurements can constrain the EBTEL model.  
*(invokes enthalpy flow in the flare evolution)*

high efficient 0D EBTEL model: *model a good number of loops*  
*statistical investigation*

→ sophisticated 1D hydrodynamic model: *compute the plasma evolution*





Thanks for your attention!  
Thank the meeting organizers!

