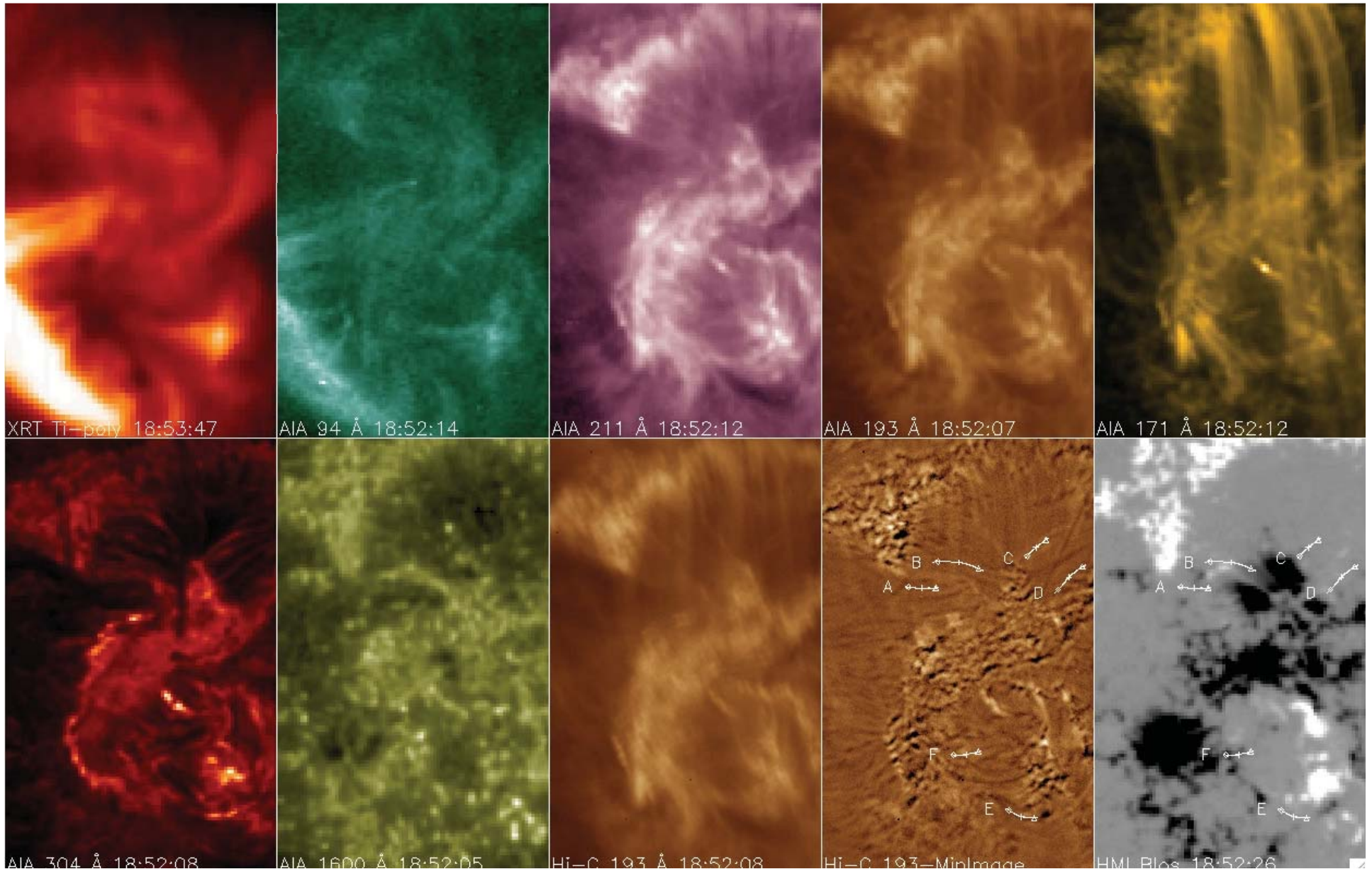# The Evolution of Transition Region Loops Using IRIS and AIA

A. Winebarger (MSFC), B. De Pontieu (LMSAL), B. Fayok (UAH), S. Bradshaw (Rice University)

Background

- Inter-moss transition region loops have been observed in EUV images (Hi-C and AIA).

- These loops were < 8 Mm long and have lifetimes less than 80 s.

- This is due to weak transition region lines in the EUV passbands, primarily O IV/V.

Hi-C and AIA observations

XRT Ti-poly 18:53:47
AIA 94 Å 18:52:14
AIA 211 Å 18:52:12
AIA 193 Å 18:52:07
AIA 171 Å 18:52:12
AIA 304 Å 18:52:08
AIA 1600 Å 18:52:05
Hi-C 193 Å 18:52:08
Hi-C 193-MinImage
HMI Blos 18:52:26

Background

- After IRIS launch, it was confirmed that these loops appear in IRIS 1400 A slit jaw images.

- Additionally, many other loops that appear in IRIS do not appear in AIA.

- These loops are out of ionization equilibrium.

- Ionization equilibrium of TR lines requires 10s of seconds, approximately the lifetime of the loops.

Goal

- Develop a method to identify loops in IRIS and AIA.

- Model the energy requirements using code that account for non-equilibrium ionization.

- *This talk provides an update on the methodology to identify and tag the TR loops in IRIS and AIA and to demonstrate the requirement for non-ionization equilibrium.*

Example IRIS 1400 A Data

- IRIS slit jaw movie

Example lightcurve

To identify "events", we first smooth the lightcurve, identify the maximum and minimum points, apply additional threshold criteria.
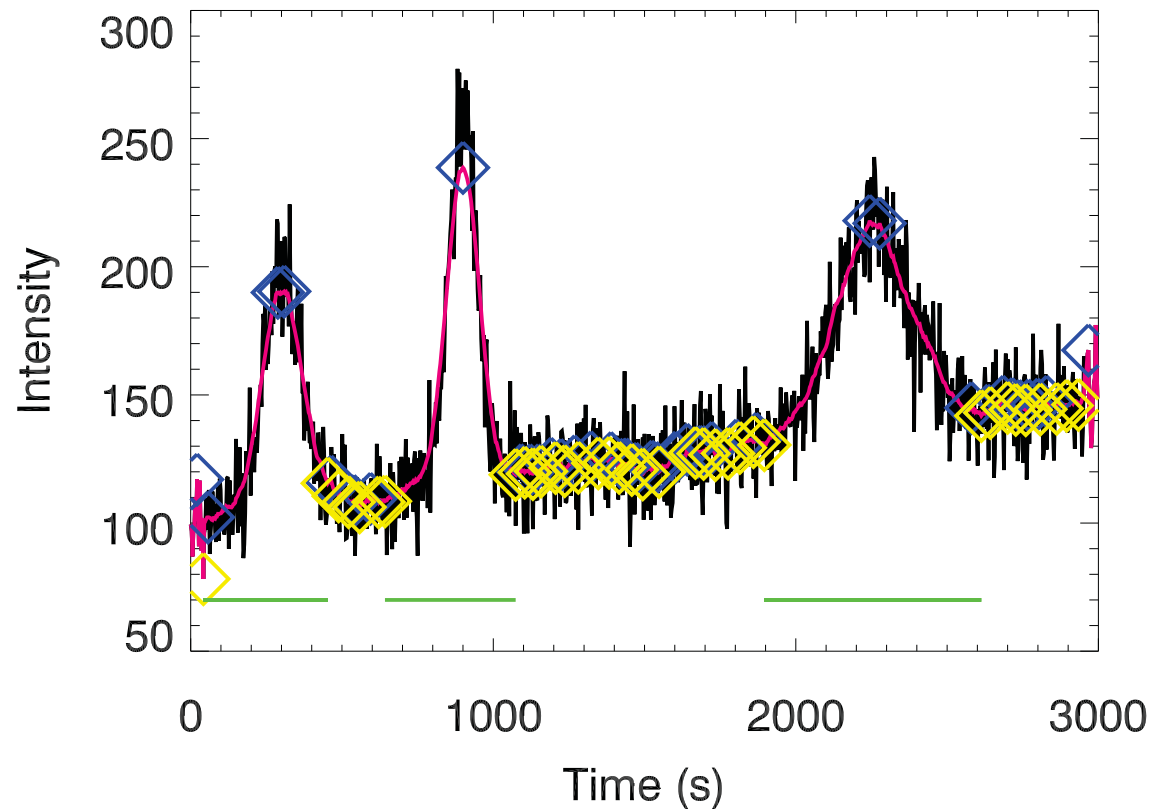
Original light curve with noise

Smoothed light curve

Maximum points
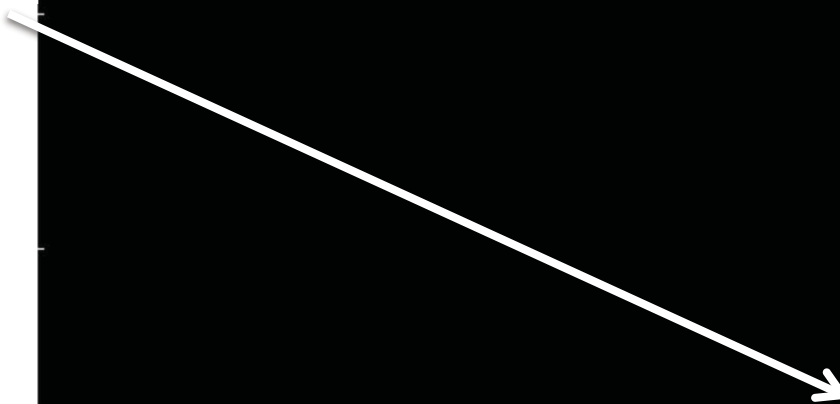
Minimum points
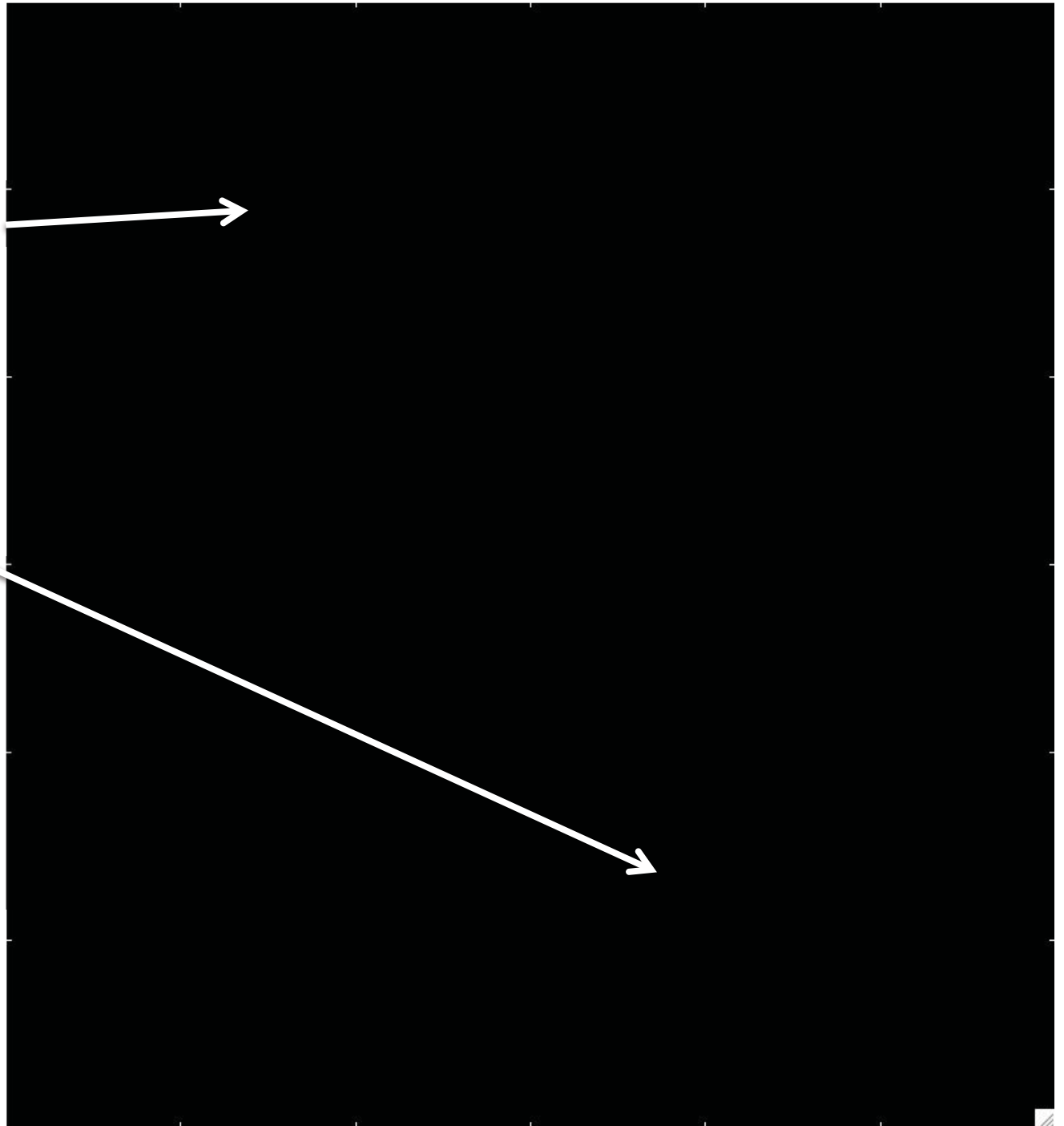
Events identified

IRIS Events

Moss →

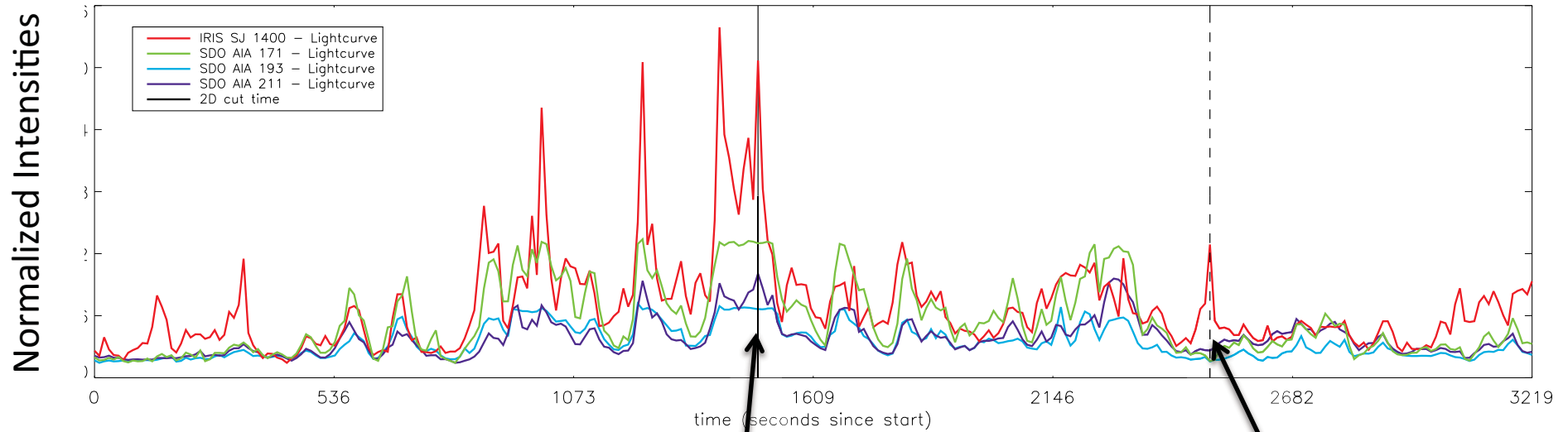Start of event
Peak of event
End of event

Loops →

Currently, we are grouping adjacent pixels to form loops and applying additional criteria to separate the loops from the moss.

Example IRIS and AIA Data

- IRIS and AIA movie

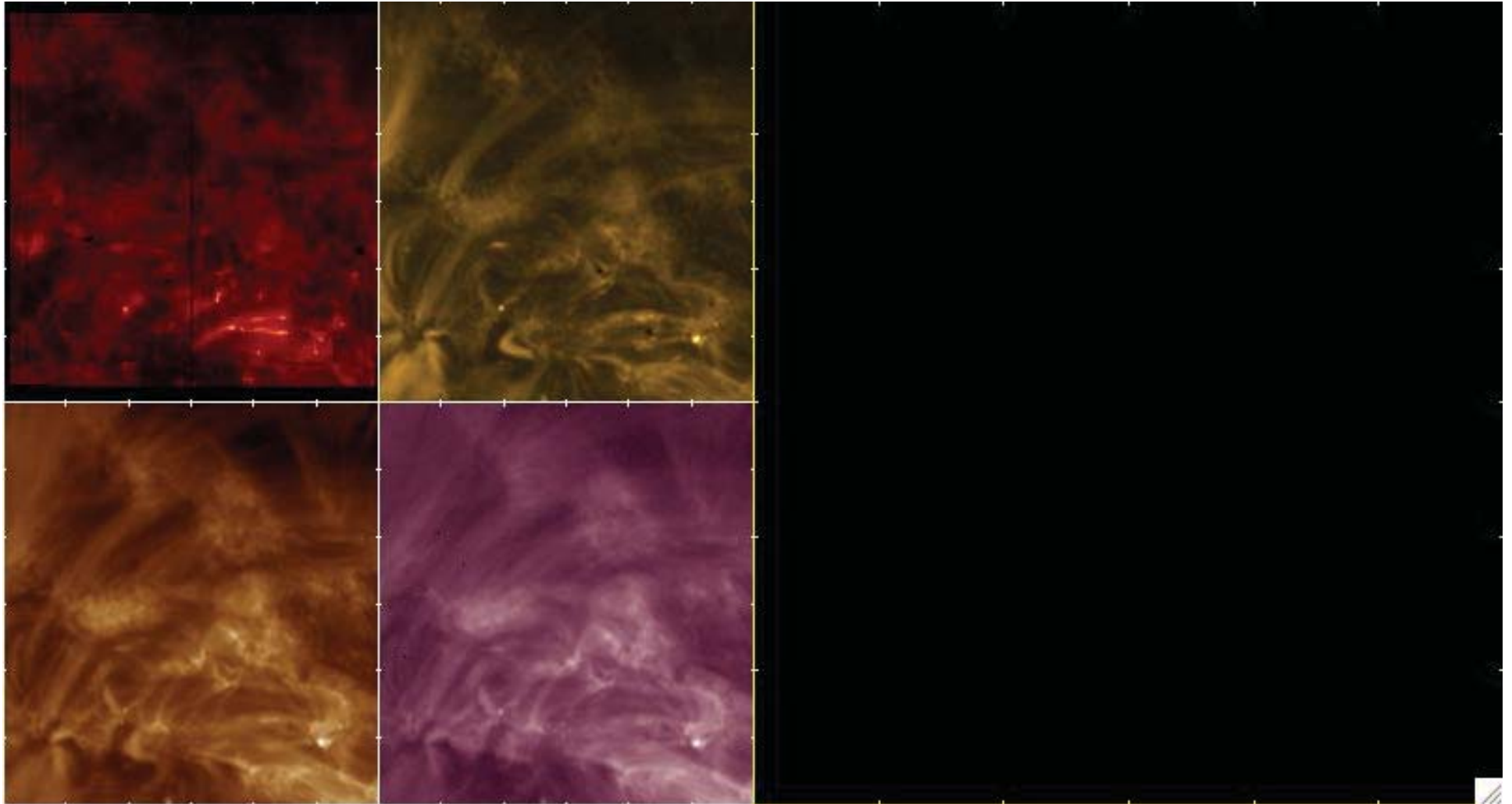# Example IRIS and AIA Data

IRIS 1400 SJ data
AIA 171
AIA 193
AIA 211

A brightening occurs simultaneously in IRIS and AIA

A brightening occurs only in IRIS

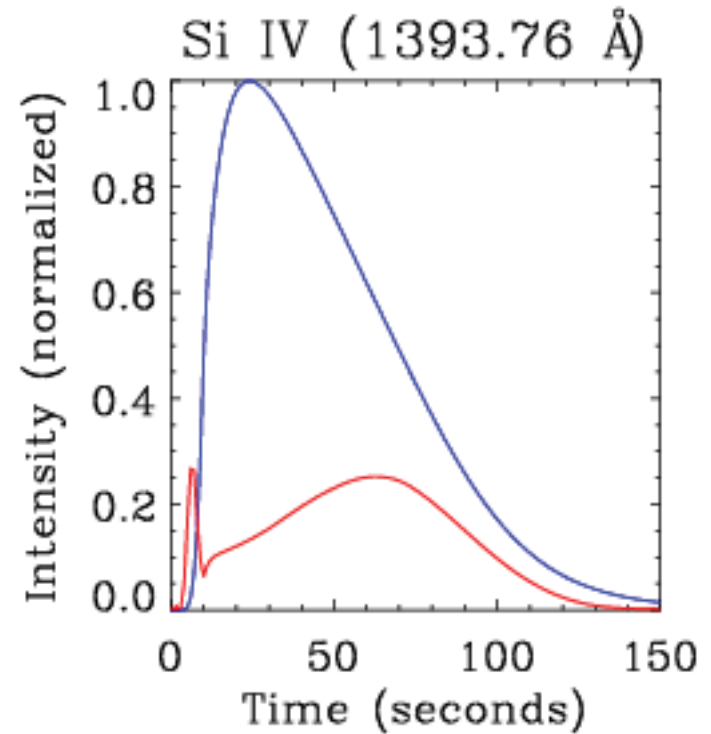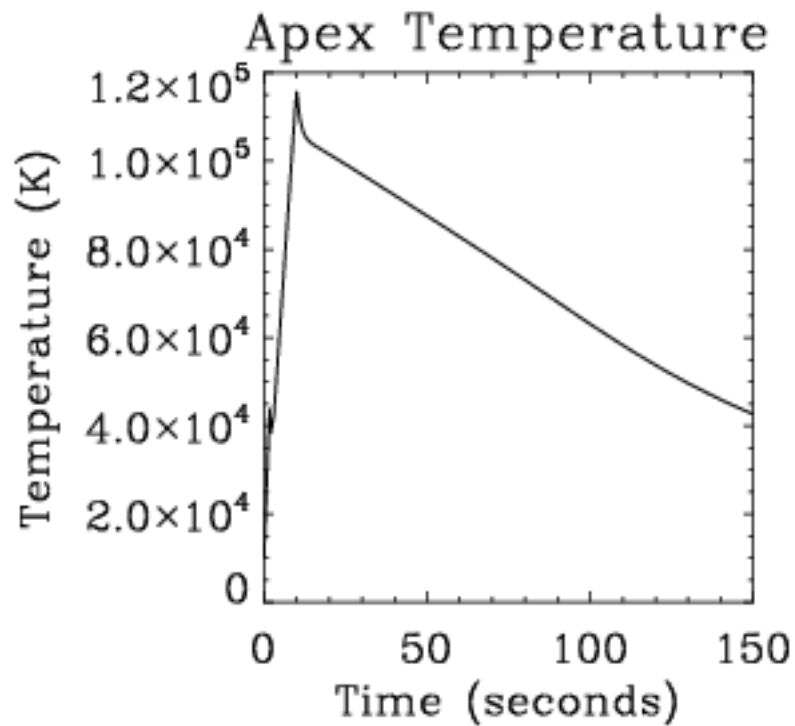# Example IRIS and AIA Data

IRIS only   IRIS + 1 AIA   IRIS + 2 AIA   IRIS + 3 AIA

Need for NE HD Solutions

- 14 Mm loop
- 10 s uniform heating applied
- Solutions assuming ionization equilibrium and non-equilibrium are shown.
- The non-equilibrium light curve is similar to observed light curves.

Summary

- We have provided an update on a study of transition region loops.

- We have developed a technique to detect loops.

- We have confirmed the need for non-equilibrium modeling.