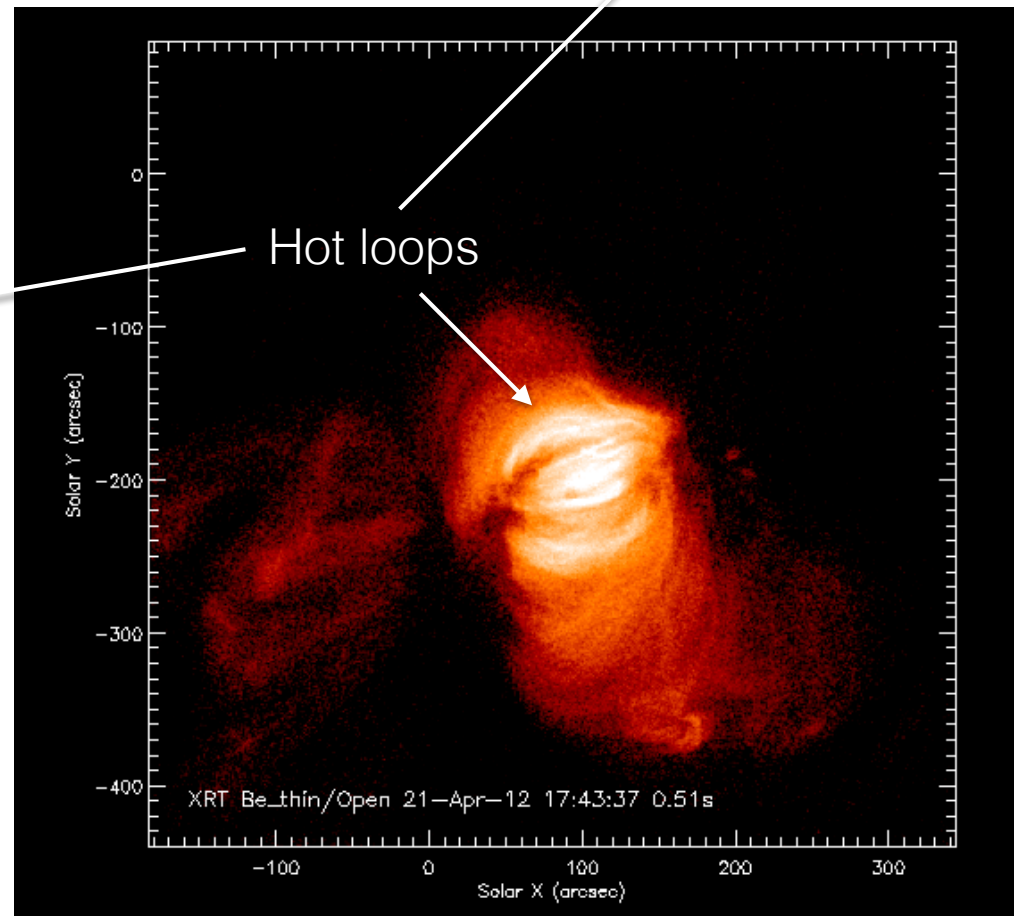
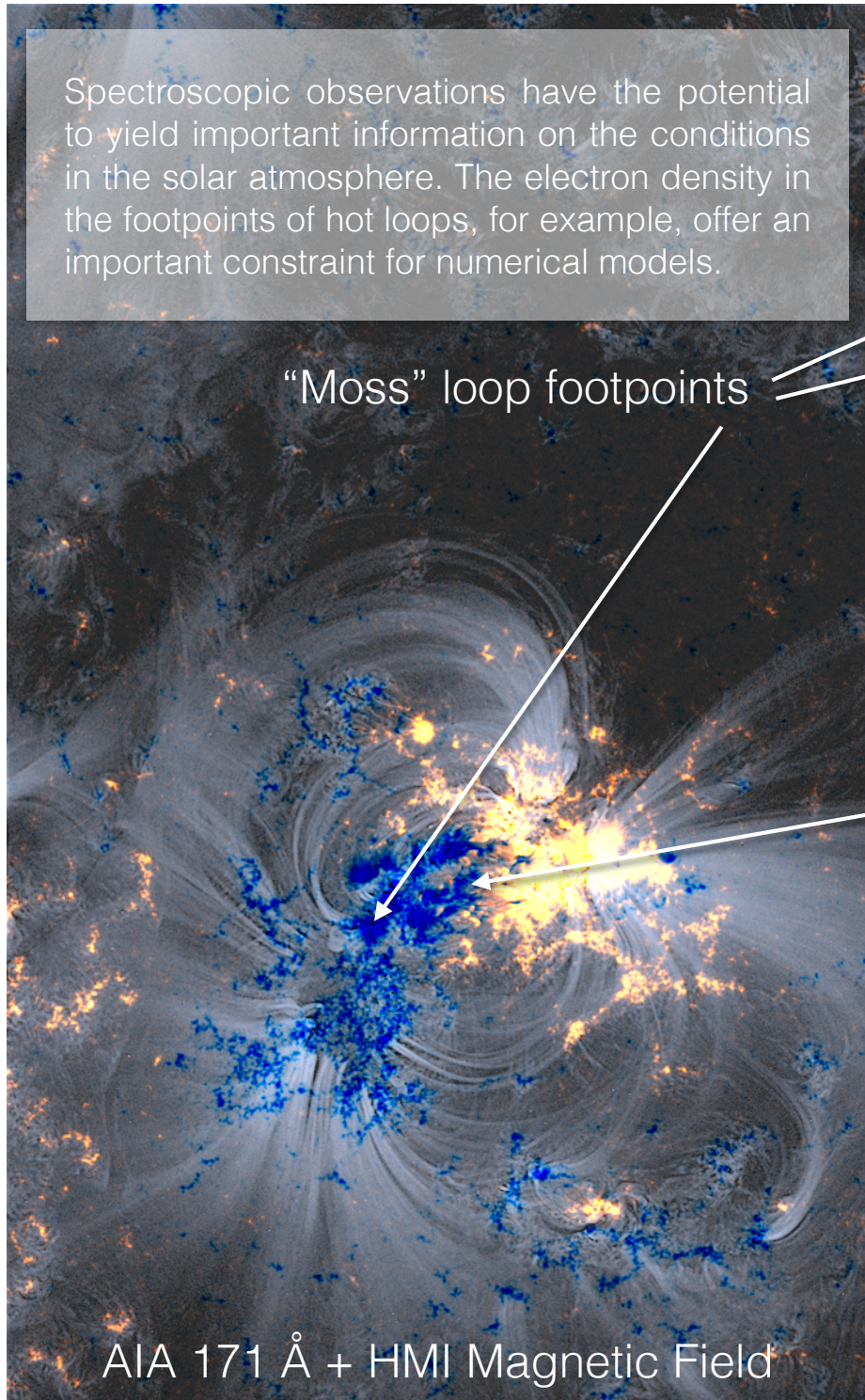
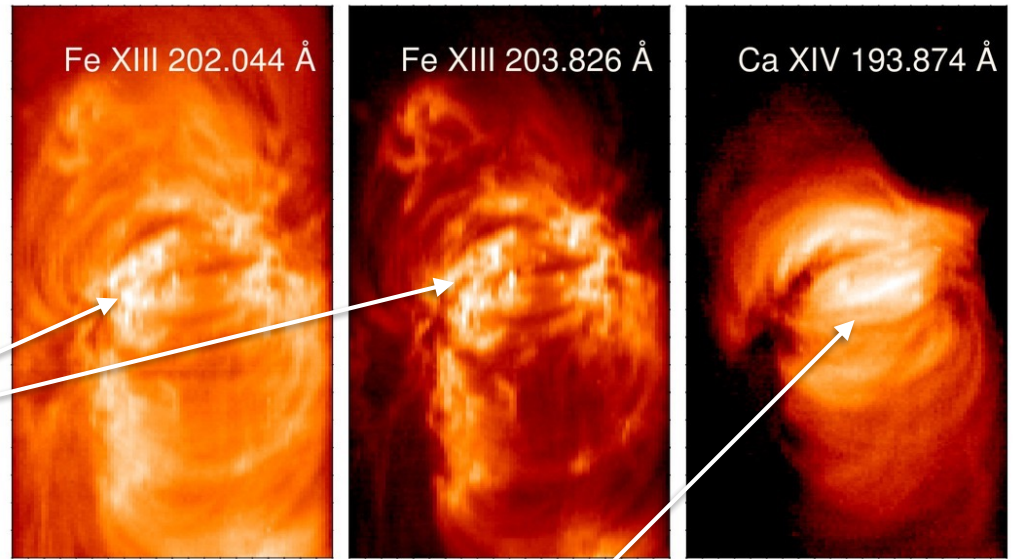


Spectroscopic observations have the potential to yield important information on the conditions in the solar atmosphere. The electron density in the footpoints of hot loops, for example, offer an important constraint for numerical models.

“Moss” loop footpoints



A Cartoon

Loops are magnetic structures that confine plasma.

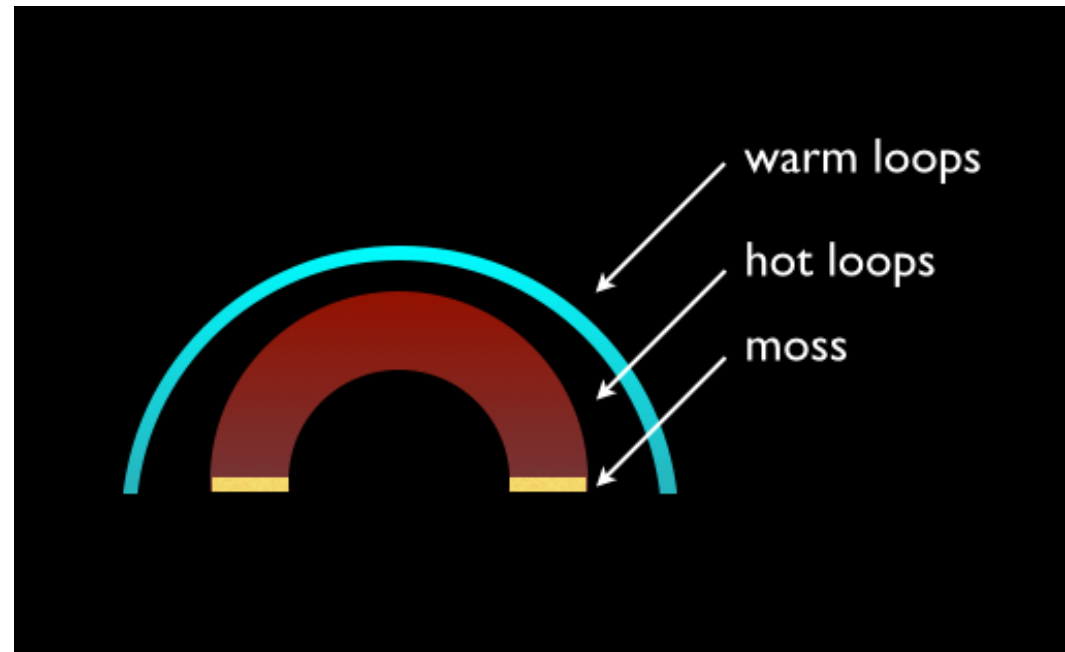
Loops generally have the highest temperatures at the apex

There is temperature gradient from the apex to the footpoint.

As the loop temperature goes through 1 MK the emission is bright in emission lines from Fe IX - Fe XIII. This is the “moss”.

The properties of the moss, such as the electron density, offer important boundary conditions for numerical loop simulations.

Overlying 1 MK loops can complicate the interpretation of the moss.



Several Relevant Papers:

<http://adsabs.harvard.edu/abs/1994ApJ...422..412P>

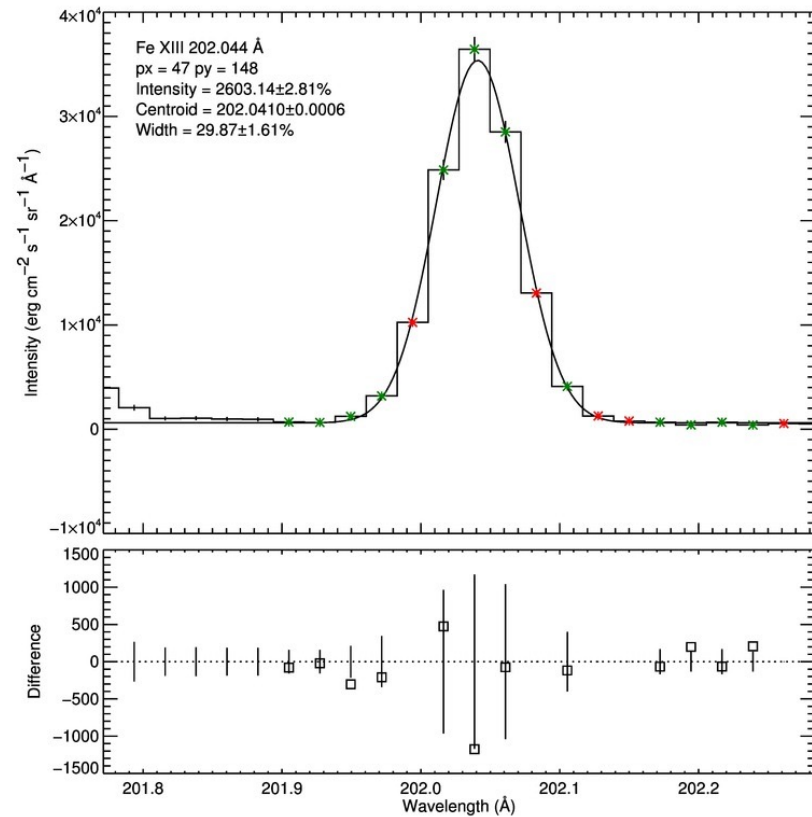
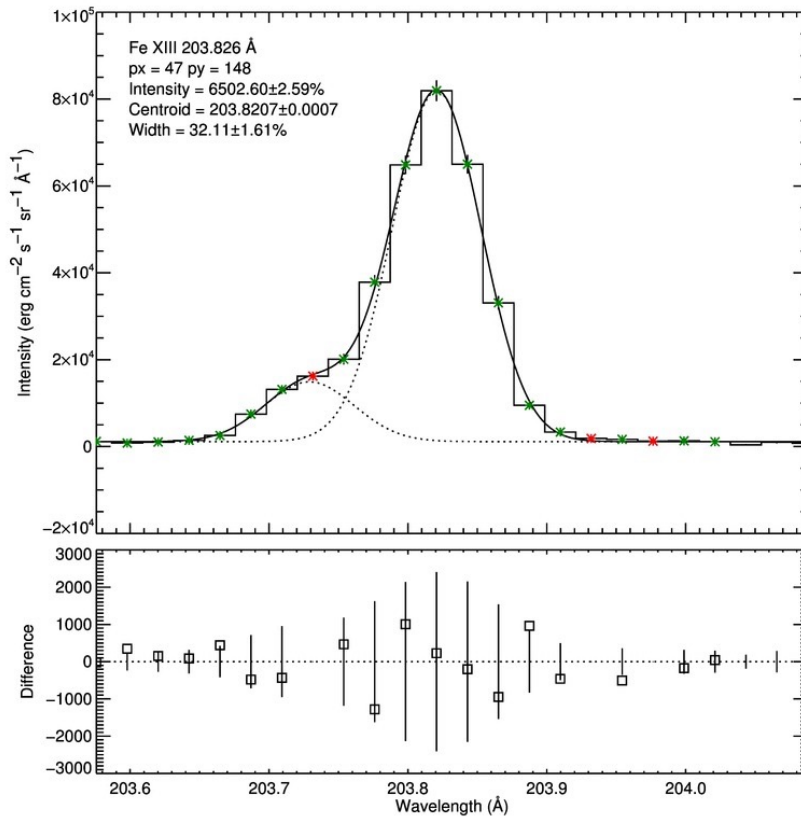
<http://adsabs.harvard.edu/abs/1999ApJ...519L..97B>

<http://adsabs.harvard.edu/abs/1999ApJ...519L..97B>

<http://adsabs.harvard.edu/abs/2000ApJ...537..471M>

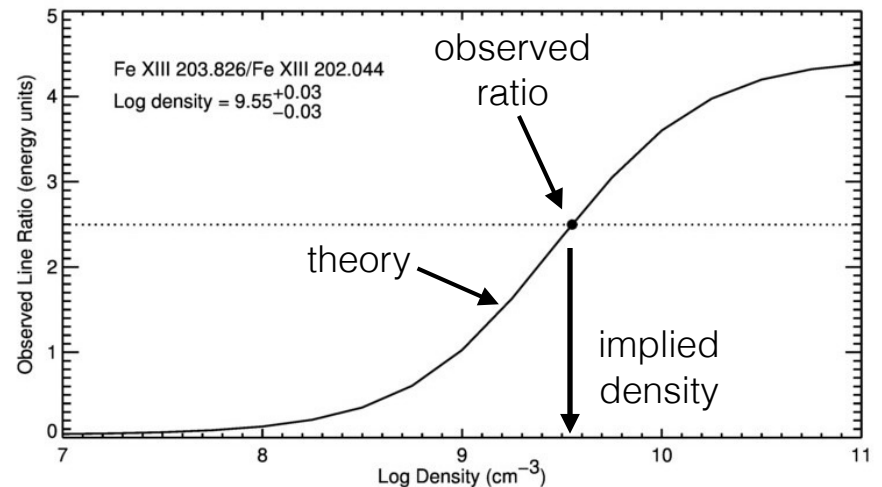
<http://adsabs.harvard.edu/abs/2008ApJ...677.1395W>

Example Line Ratio



Some atomic levels are metastable and sensitive to collisional de-excitation. Taking the ratio of an emission line from such a level to another emission line from the same ionization stage isolates the density dependence. The ratio of 203.826/203.044 is an example of such a ratio. By comparing the observed line ratio with a theoretical calculation the density at the loop footpoint can be inferred.

The statistical uncertainty for this example is very small. Are we done? How do we include errors in the atomic data and uncertainty in the calibration?



Example Spectrum: eis_l1_20120421_165241.047.148.txt

To illustrate the solar data we've included a spectrum from a single pixel in the moss. It's available as an ASCII text file. The following shows how a line profile can be read and displayed in python.

```
from astropy.table import Table
import matplotlib.pyplot as plt

file = 'eis_l1_20120421_165241.047.148.txt'

title = 'Fe XIII 202.044'
w = 202.044
dw = 0.2
wmin = w + dw
wmax = w - dw

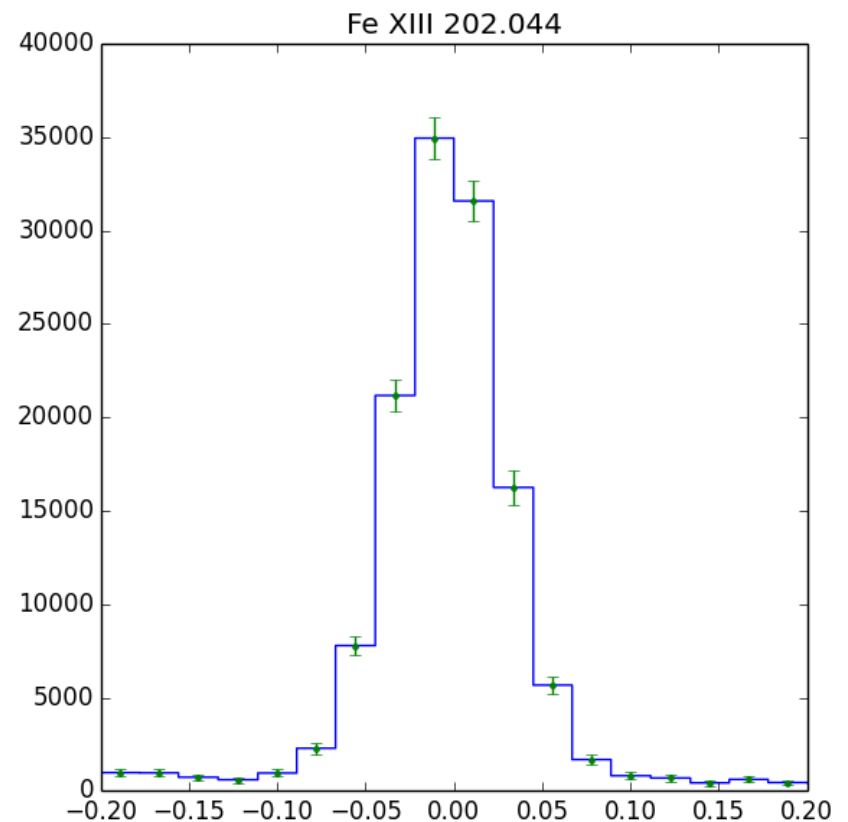
t = Table.read(file, format='ascii.commented_header')

x = t['WAVE'] - w
y = t['INTENSITY']
e = t['UNCERTAINTY']

fig = plt.figure(figsize=(6,6), dpi=100)
fig.set_tight_layout(True)

plt.xlim(-dw, dw)
plt.ylim(0, 40000)
plt.plot(x, y, drawstyle='steps-mid')
plt.errorbar(x, y, yerr=e, fmt='.')
plt.title(title)

plt.show()
```



Note that missing data is indicated with a value of -100.
To conserve telemetry only narrow windows are downloaded
and most of the missing data is not really missing.