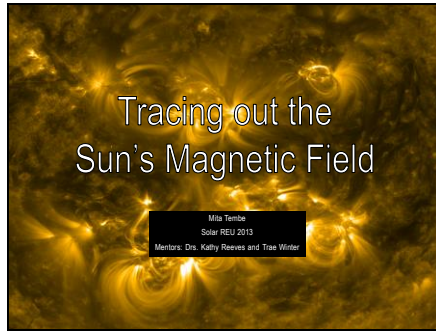


Slide 1



Slide 2

### MAGNETIC FIELD

- Dipole field
  - Active region loops that are not flaring approximate a potential field
- Constant flux condition
  - $\Phi = B \cdot A$
  - $B$  decreases and  $A$  increases as distance from the sun's surface increases
  - Loops should be thicker at the top and thinner at the footpoints
  - However, this has not been observed
- Why is this?

Figure courtesy of Trae Wintler

Slide 3

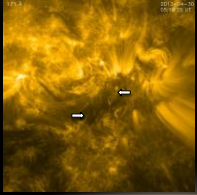
### LOOPS

- Generally static, continuous structures with uniform brightness and width
- Thought to trace out magnetic field lines
- Mass and energy flow easily along field lines, but not across the lines

Slide 4

BLOBS

Blob 0519

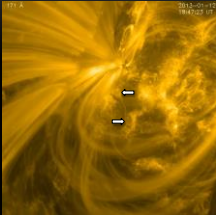


- Dynamic structures
- An intensity that travels from one position to another
- Appear to change as a function of position

However, we concentrated on blobs of plasma traveling along field lines. These are dynamic and transient structures, with apparently changing brightness and width.

Slide 5

Blob 1847



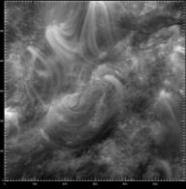
Slide 6

GOALS

- Two Goals:
  - Find if blobs do actually change shape in order to understand more about magnetic field structure
  - Ascertain the sources and causes of the blobs – is there a different type of heating or magnetic field?
- Initial expectations: because magnetic field expands with height to fill volume, loops should appear thicker at their tops

Slide 7

### PREPARING DATA


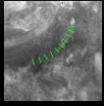


- Diffraction and scattering of light spreads light from a point source into a pattern called the point spread function (PSF)
- Deconvolution involves removing the effect of the PSF in order to create a clearer image
- Prepping involves aligning and derotating the images
- Necessary steps in order to obtain the clearest image possible for analysis

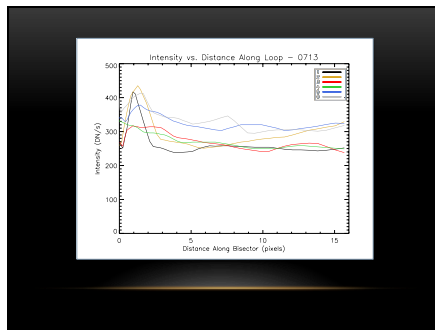
Slide 8

### MEASUREMENTS

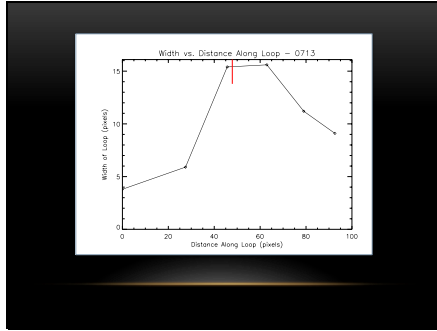
- Defined loops manually using stacks of images and movies
- Created perpendicular bisectors along each section of the loop
- Measured brightness along each bisector
- Measured full-width-at-half-maximum to determine width of loop
- Used maximum brightness as intensity
- Plotted width and intensity against distance along the loop



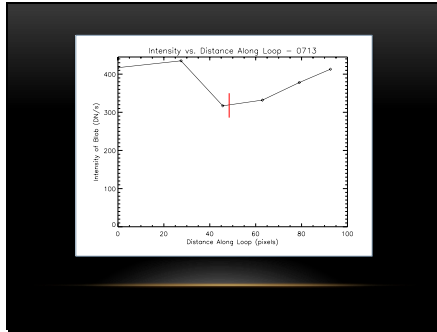
Slide 9



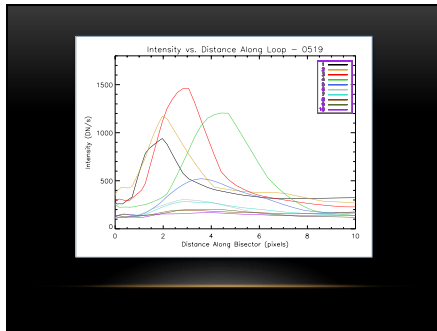
Slide 10



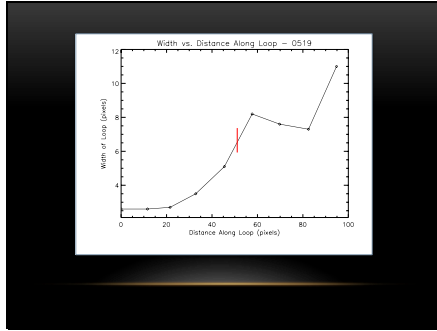
Slide 11



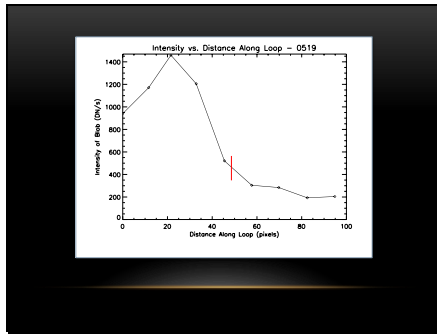
Slide 12



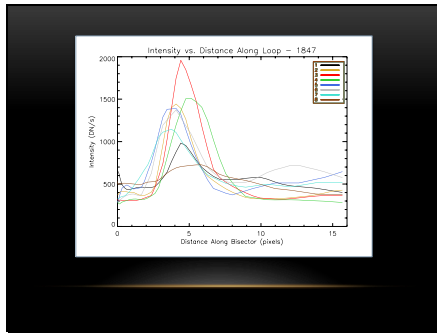
Slide 13



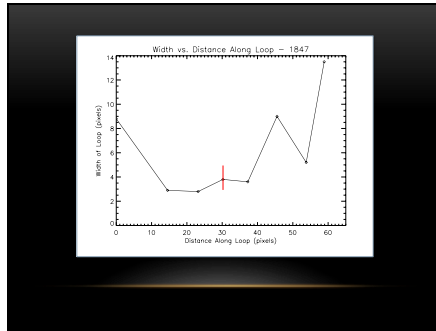
Slide 14



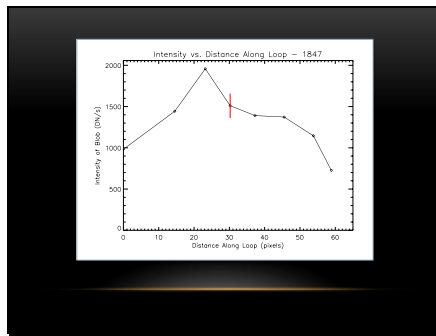
Slide 15



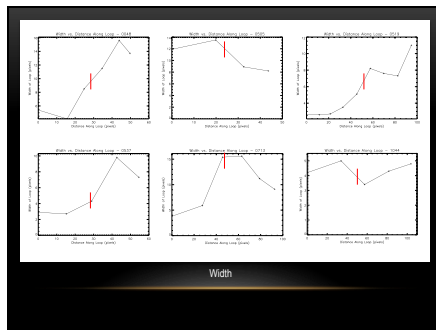
Slide 16



Slide 17

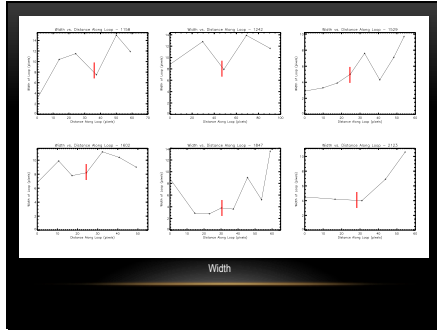


Slide 18

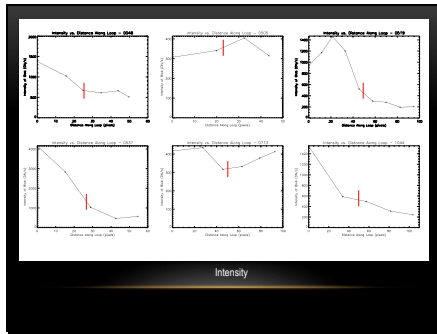


Twelve loops were analyzed and these data plotted for all of them.

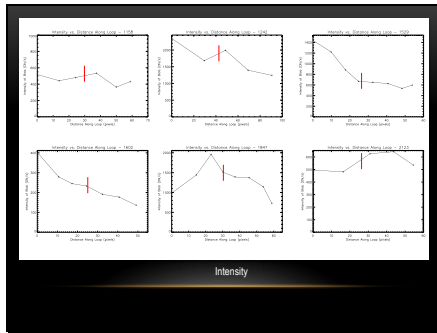
Slide 19



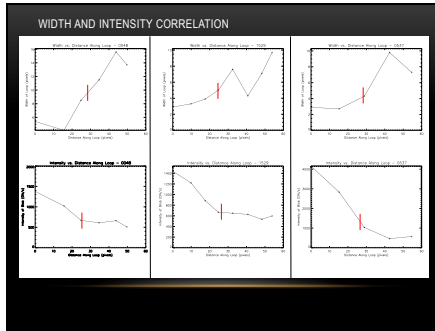
Slide 20



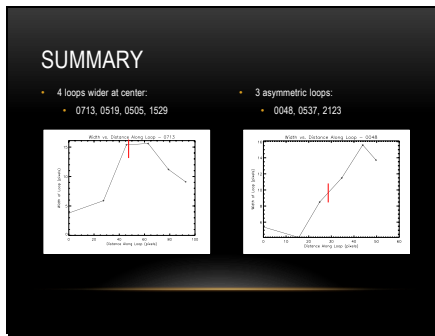
Slide 21



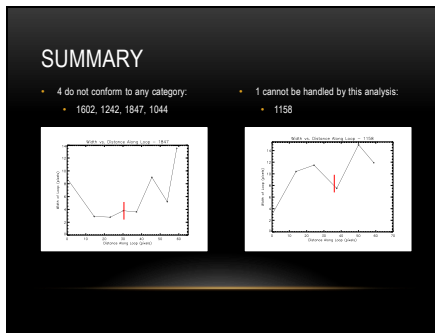
Slide 22



Slide 23



Slide 24





## Slide 25

### CONCLUSIONS

- Several loops demonstrated a greater thickness at their center
- Loops do, in fact, demonstrate a thickening near their tops, as predicted but not previously shown
- Clear correlation between intensity and width
- Several loops thicker on right side (endpoint): due to arbitrary choice of startpoint and endpoints

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### FUTURE QUESTIONS AND RESEARCH

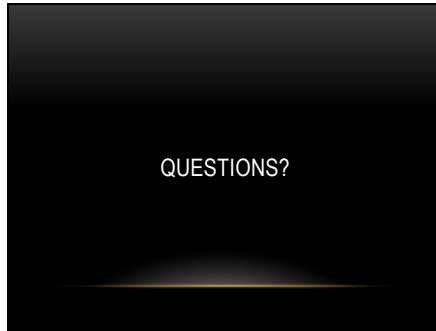
- Measure mass and velocity of blobs to find kinetic energy
- Determine a lower bound for energy required to eject a blob from the surface of the sun
- Conduct observations in different wavelengths: is there a temperature change along the loop?
- Analyze more loops in order to confirm or refute the above results

## Slide 27

### ACKNOWLEDGMENTS

- Mentors Dr. Kathy Reeves and Dr. Trae Winter
- National Science Foundation (Grant AGS-1263241)
- Harvard-Smithsonian Center for Astrophysics
- Dr. Edward DeLuca
- Ms. Sandra Daly and SSXG Administrators
- Fellow Solar and Astronomy Interns

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Slide 29

### RELEVANT FACTS

- 171 Å (UV portion)
- 1 million Kelvin
- Fe IX
- Quiet corona and upper transition region
- 1 pixel = 435 km
- Width ranges from 220 to 7000 km
- Length ranges from 17,000 to 43,000 km
- SDO – inclined geosynchronous orbit, edge of Earth's radiation belt
- Mass
  - Intensity is proportional to  $n_e^2 V$
  - Volume is known from length and width, symmetrical
  - Determine density and find mass
  - Parallel thermal conduction constrains the highly ionized plasma to the field lines

Slide 30

### RELEVANT FACTS

- Publications
  - Klimchuk, et al. 1992
  - Lopez Fuentes, Klimchuk, and Demoulin, 2005
  - Lopez Fuentes, Demoulin, and Klimchuk, 2007
  - DeForest, 2007
  - Klimchuk, Antiochos, and Norton, 2000