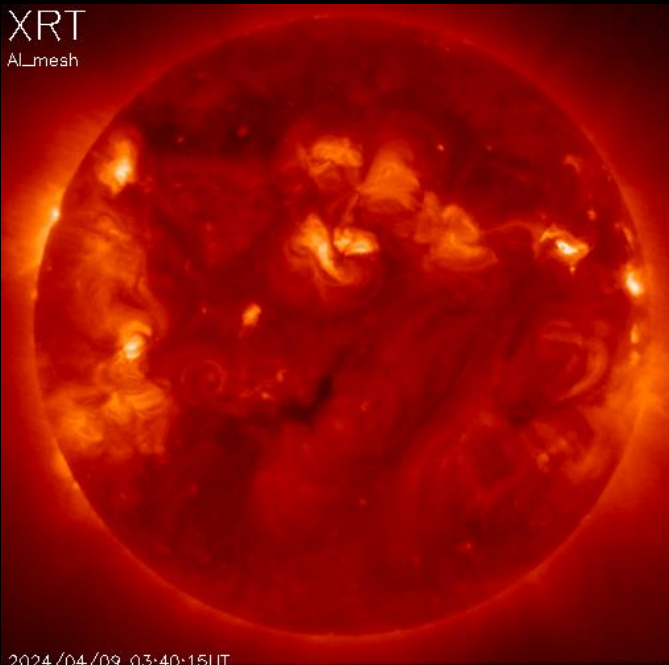


Midterm Presentation

Kelvin Scheurer

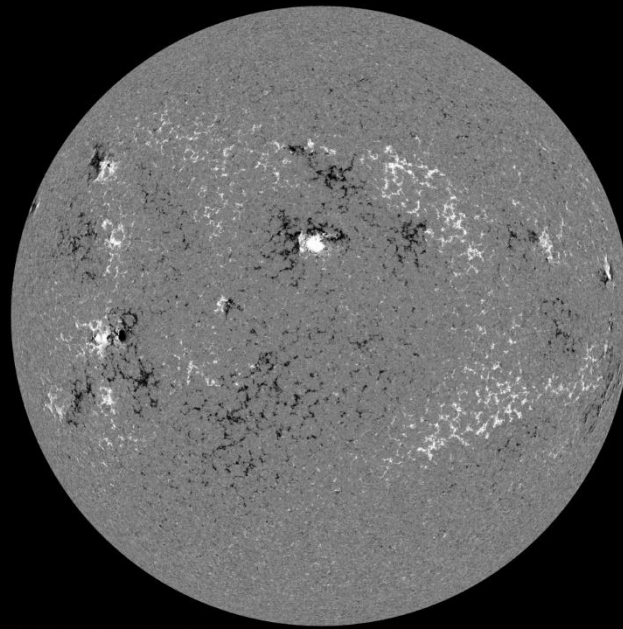
Mentor Dr. Keiji Yoshimura

XRT
AL_mesh



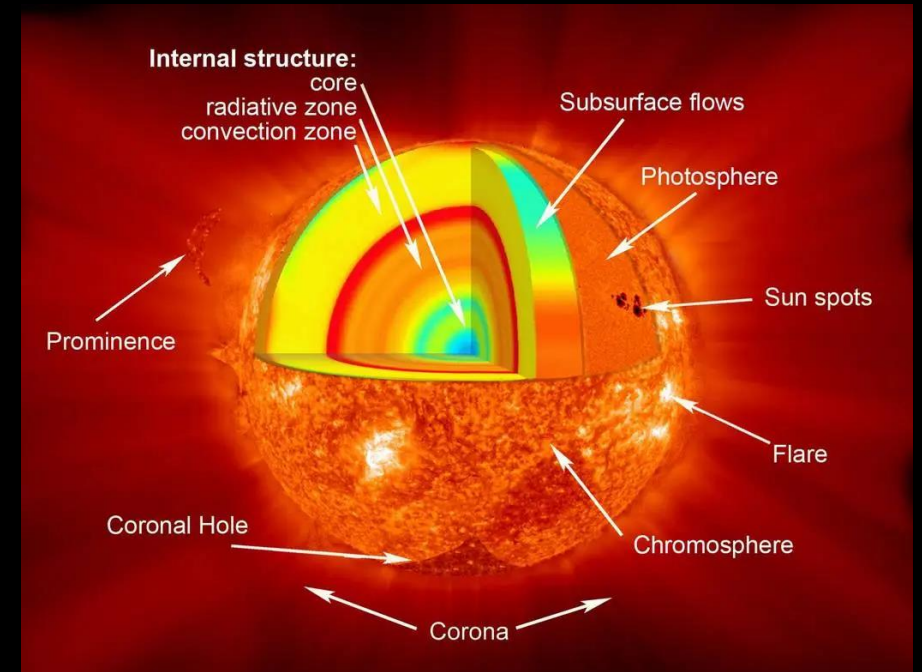
2024/04/09 03:40:15UT

Soft X-ray image
Hinode/XRT



SDO/HMI Quick-look Magnetogram 2024/03/01 00:00

Magnetogram
SDO/HMI



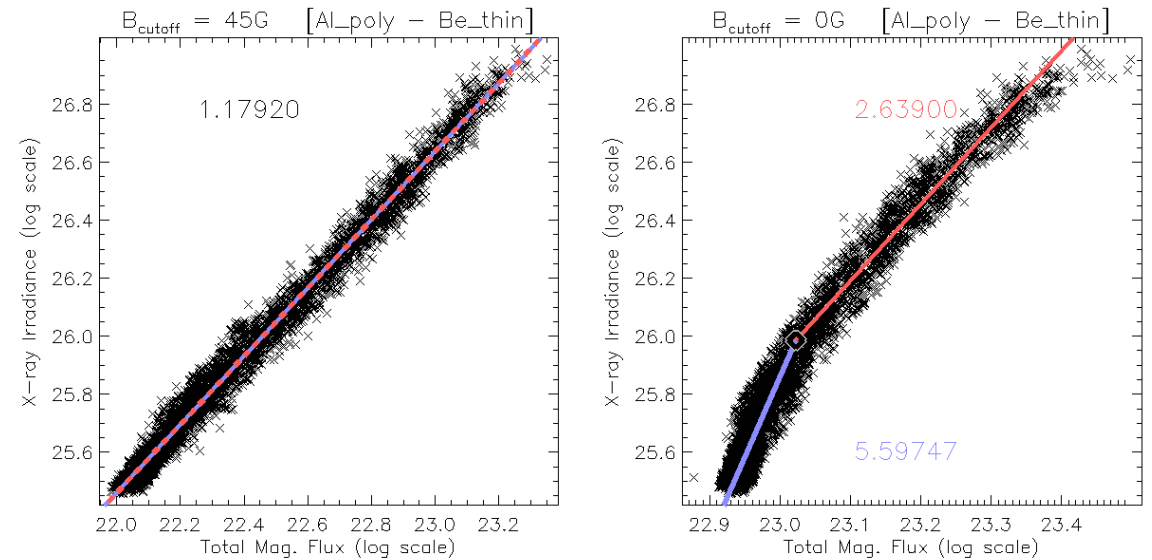
[Image from NASA article](#)

Project Motivation

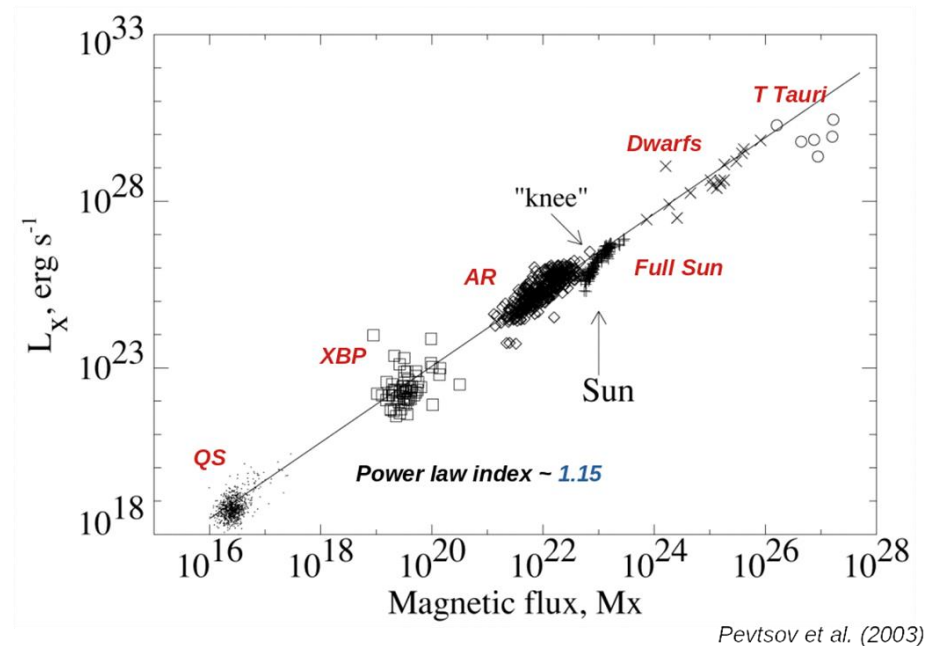
- Surface of Sun approximately (6,000K)
- Corona $> 1,000,000\text{K}$
- Find characteristics of unknown heating mechanisms
- Use XRT (X-ray telescope) aboard the HINODE space telescope to observe the corona
- Use HMI (Helioseismic and Magnetic Imager) aboard SDO (Solar Dynamics Observatory) to observe magnetic fields
- Pevtsov et al (2003) showed relationship between X-ray luminosity and magnetic flux, leads into previous work

Previous Work Yoshimura et al(2024)

- Reproducing the knee structure
- Used Hinode/XRT and SDO/HMI data
- Results show reproduction of knee is dependent on parameters chosen



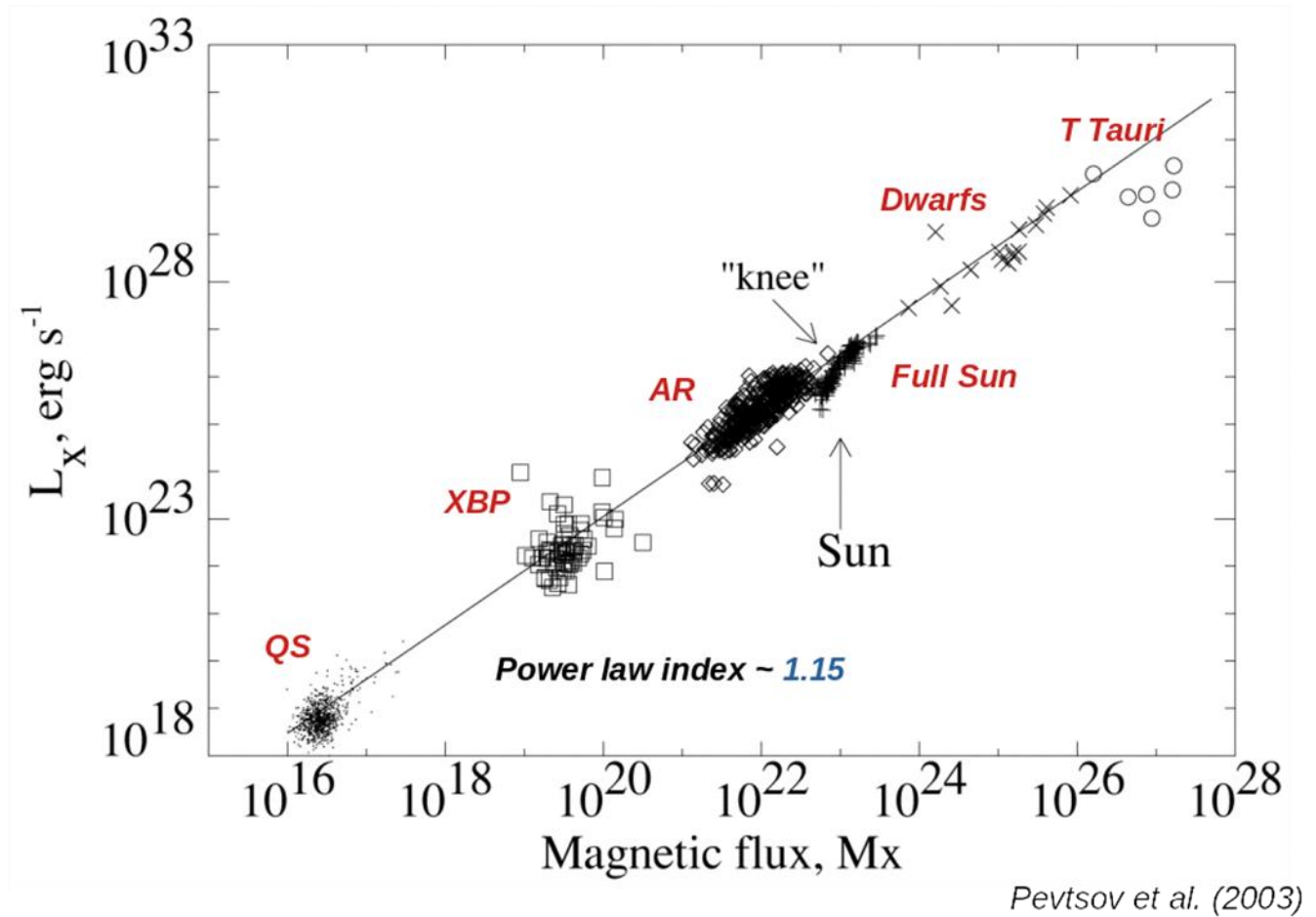
Relationship between X-ray luminosity and magnetic flux



Project Objective

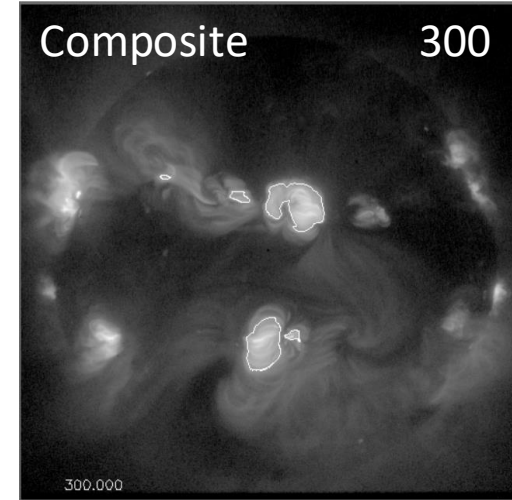
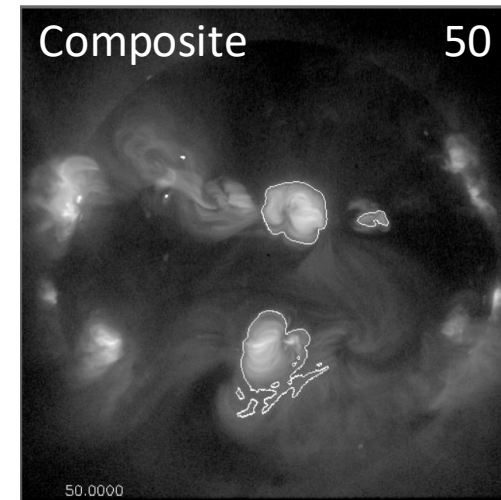
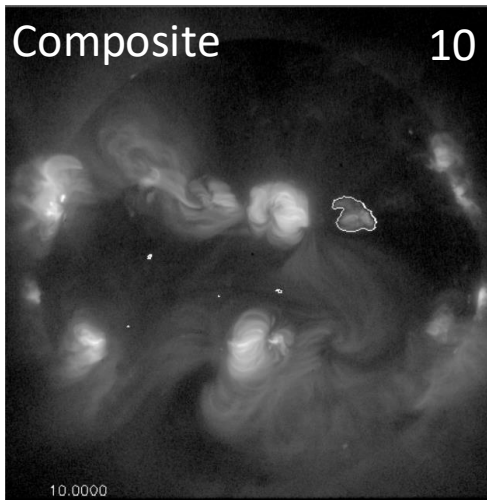
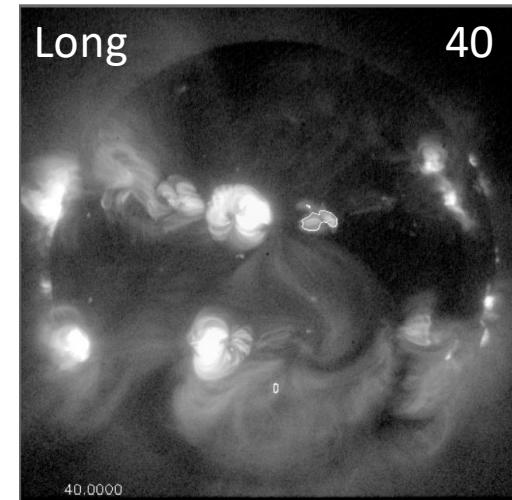
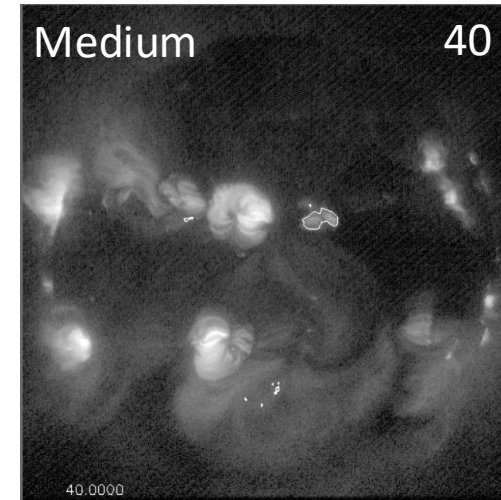
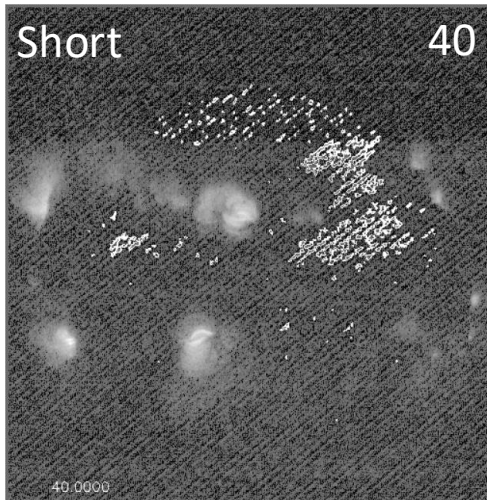
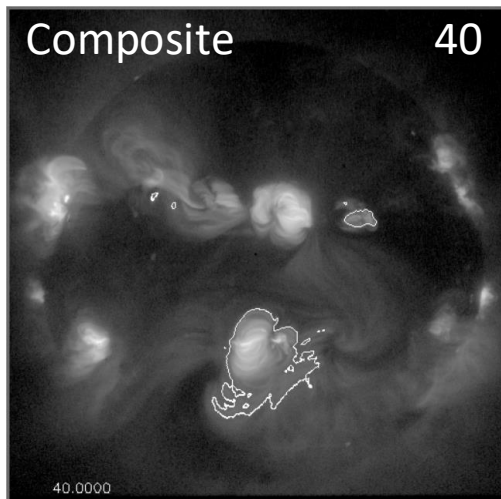
- Expand data regions to check parameter dependency
- Plot between XBP (X-ray bright points) and AR (active region)

Relationship between X-ray luminosity and magnetic flux



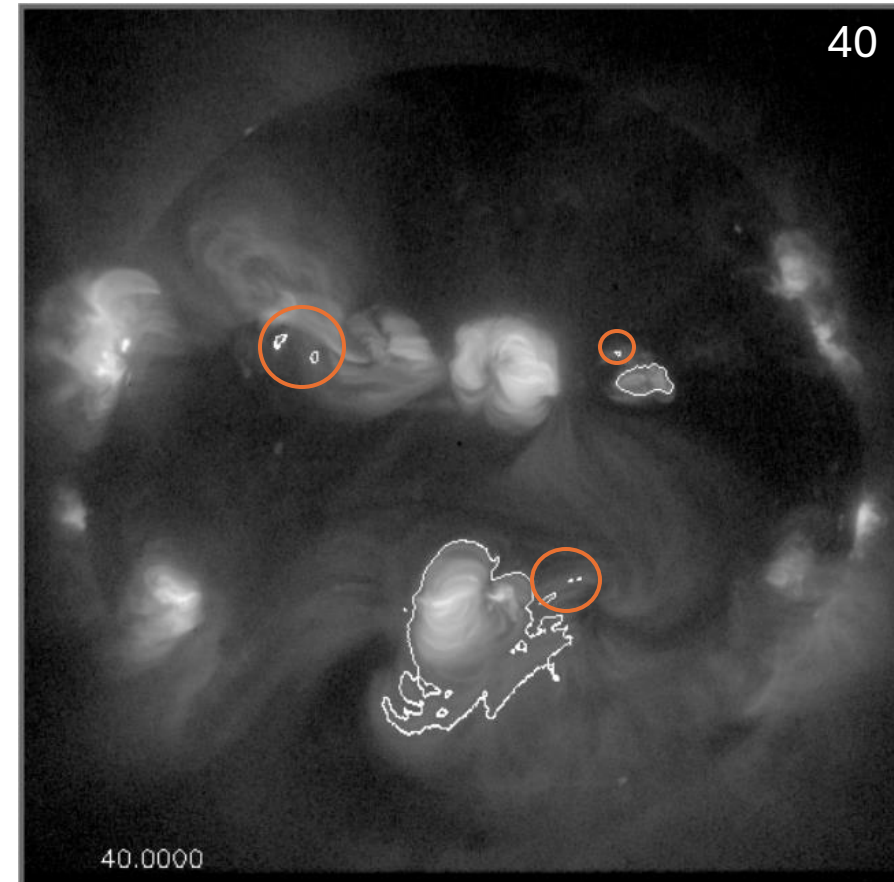
Progress

- Started with XRT data
- Exposure time
- Composite images
- Thresholds
- Date images taken 7/12/2022



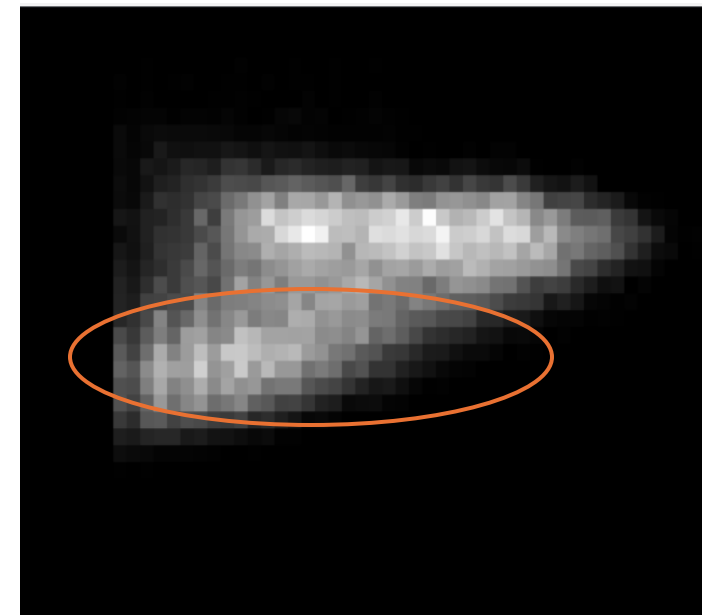
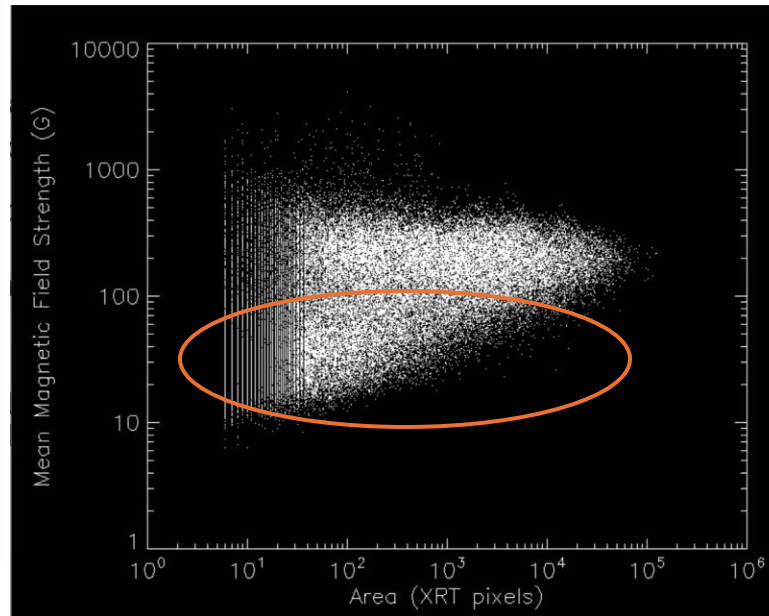
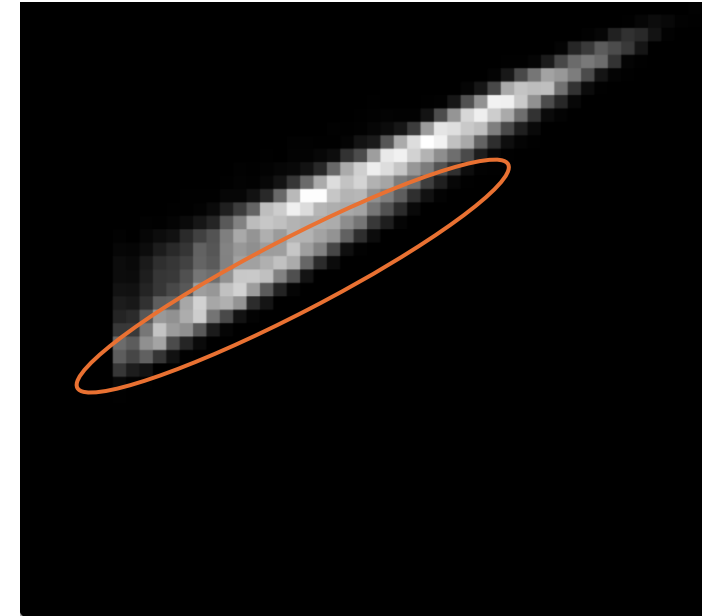
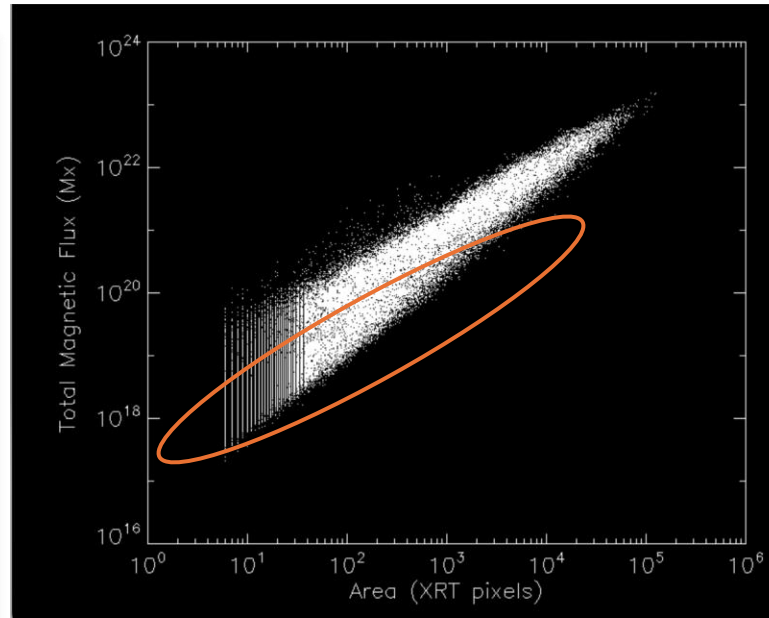
Progress

- Incorporated HMI data
- Projected the selected ARs onto HMI and calculated the total magnetic flux
- Threshold selects using x-ray intensity so non-ARs could be selected
- Use HMI data to further filter data



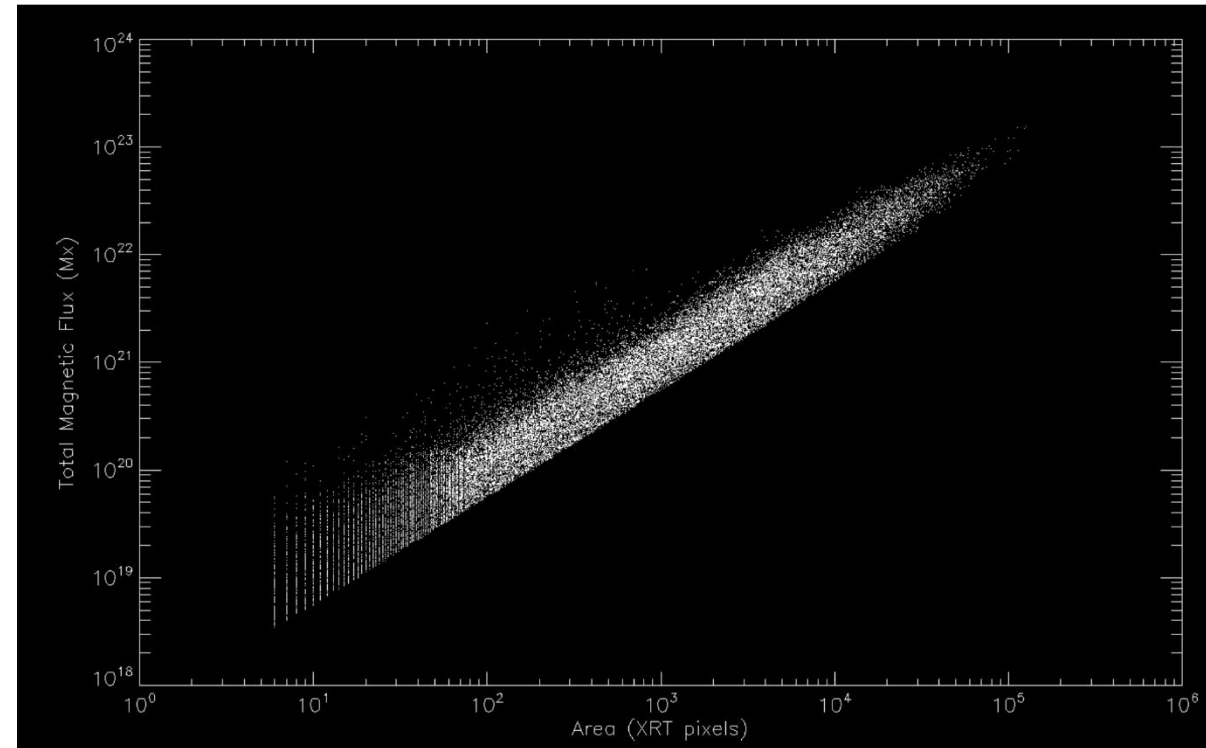
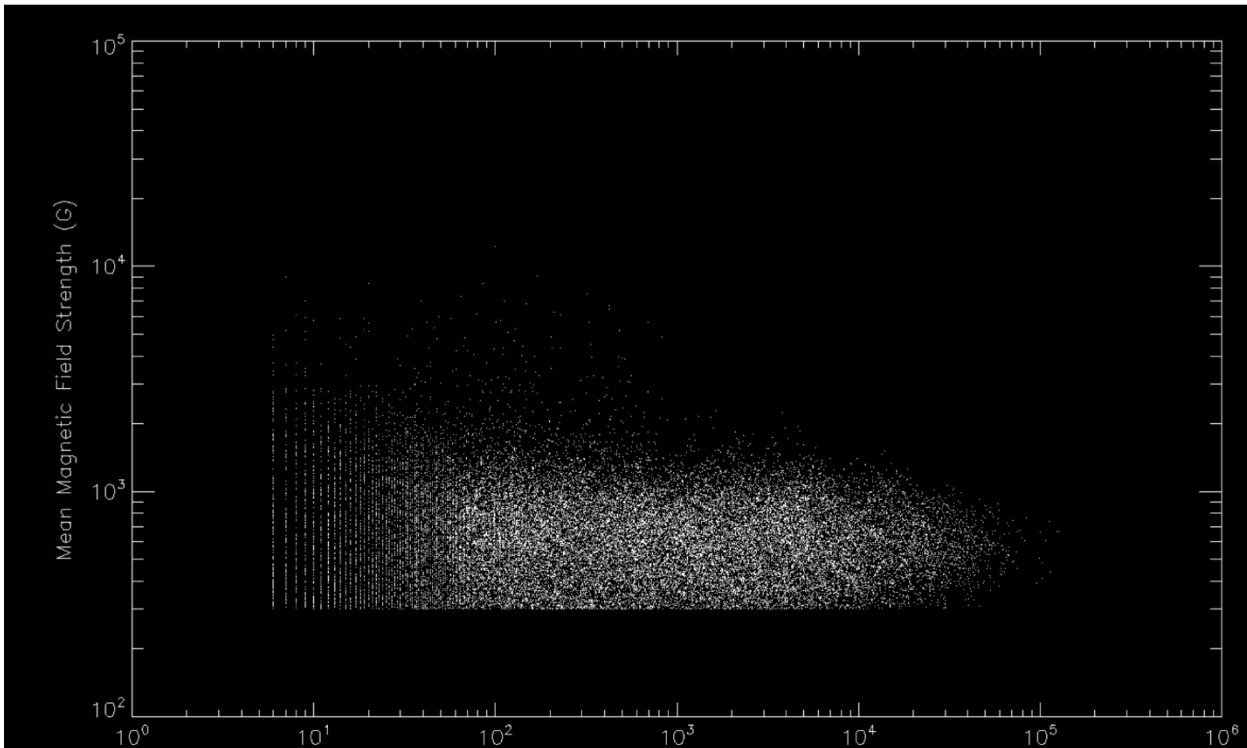
Progress

- Graphed total magnetic flux against area
- Graphed mean magnetic field strength against area
- 2d Histograms
- Data includes QS (quite Sun) and AR data



Current Progress Continued

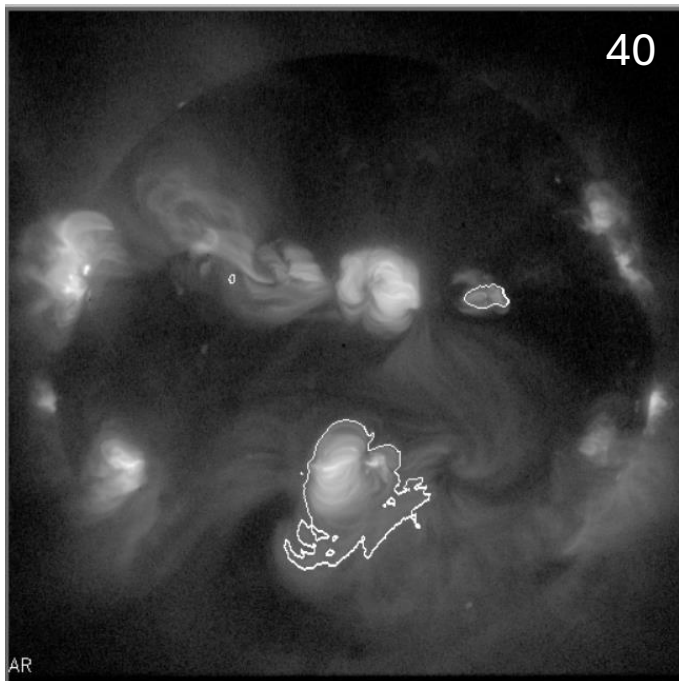
- Removed QS data (100 gauss filter applied)



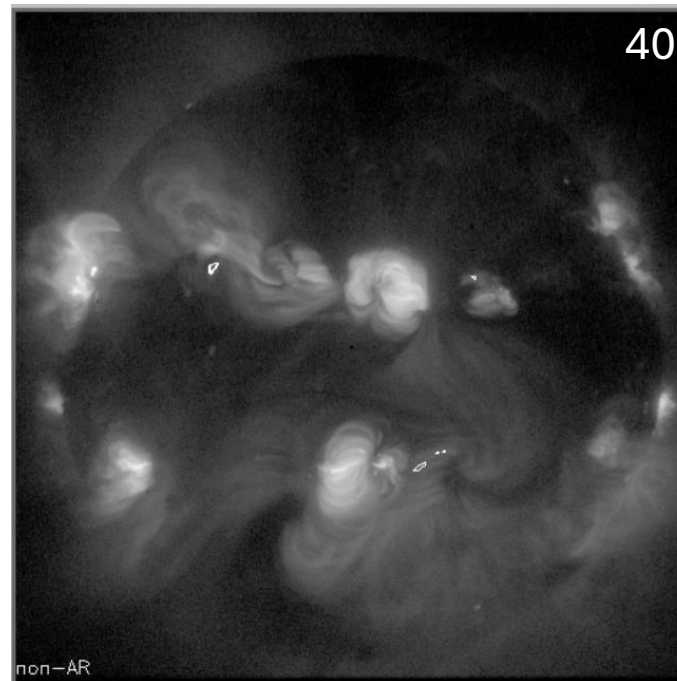
Current Progress Continued

- Applied 100 gauss filter to help further improve selection of ARs
- Images taken 7/12/2022

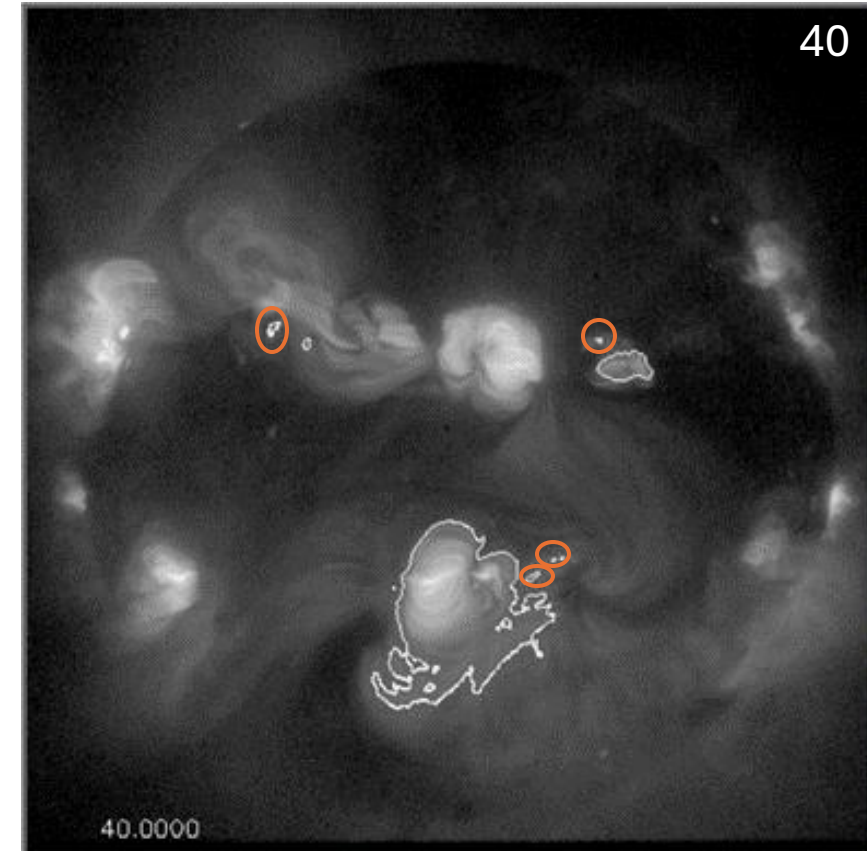
Improved Selection After Filter



Designated Not An AR After Filter

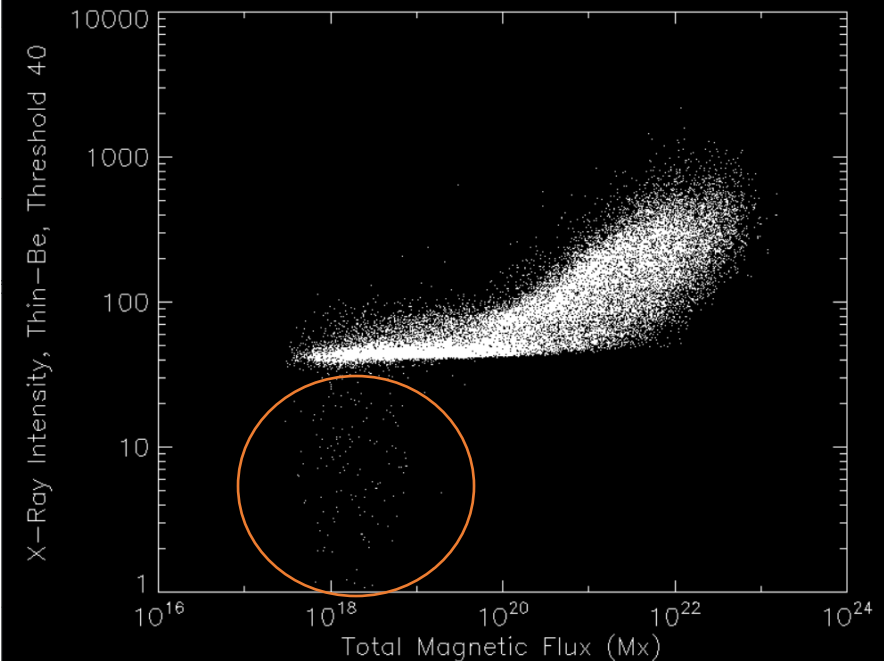
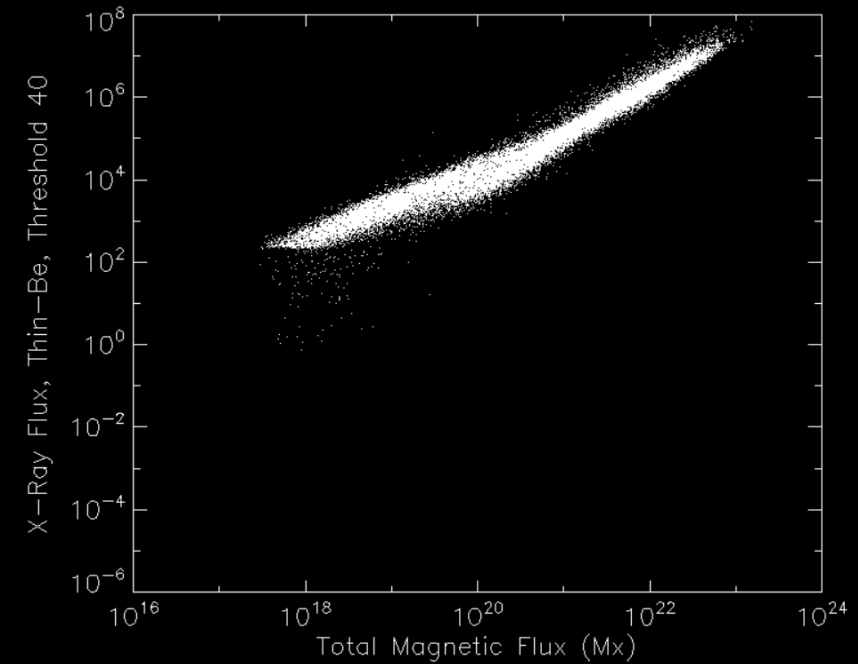


Before Filter



Progress

- X-ray flux and X-ray intensity
- Graph X-ray Flux vs Magnetic Flux
 - Shows preview of final result
- Graph X-ray Intensity vs Magnetic Flux
- Need to improve selection
- Use cutoff with X-ray intensity to remove “no good” data
- Use X-ray flux to calculate luminosity



Progress

- Used the filter ratio method
 - Temperature/emission measure
- Used temperature and emission measure to synthesize the X-ray spectrum
- Get luminosity by integrating over the X-ray spectrum
- Graph Luminosity vs Magnetic Flux

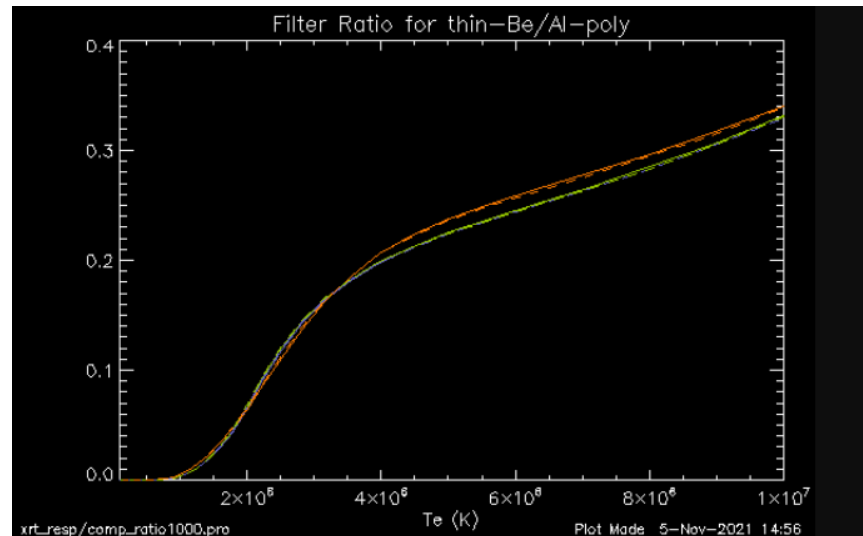
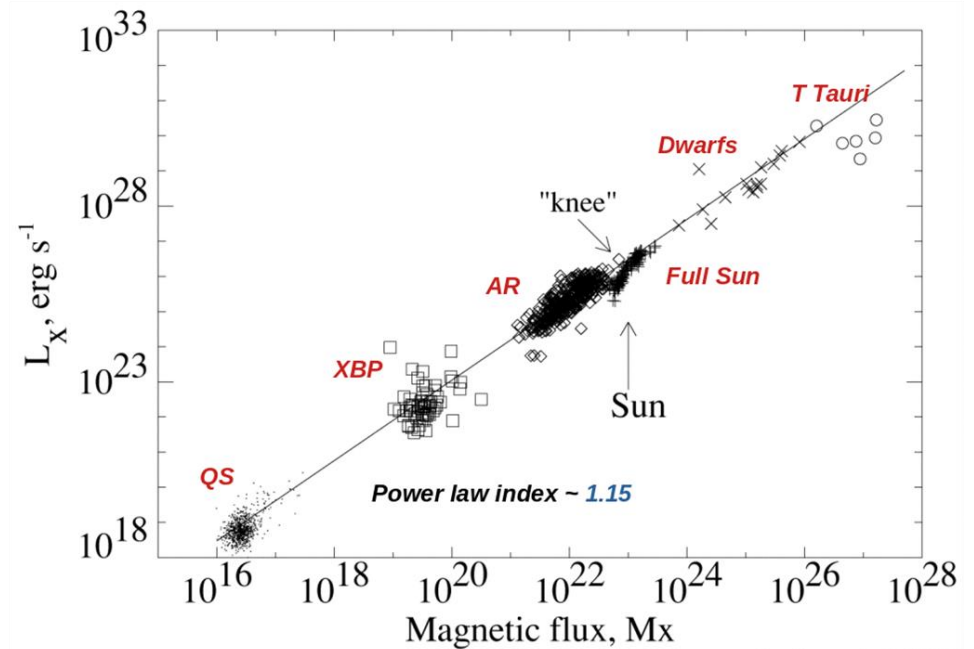


Image from: https://solar.physics.montana.edu/HINODE/XRT/response/comp_ratio1000_tnbe_apol.png

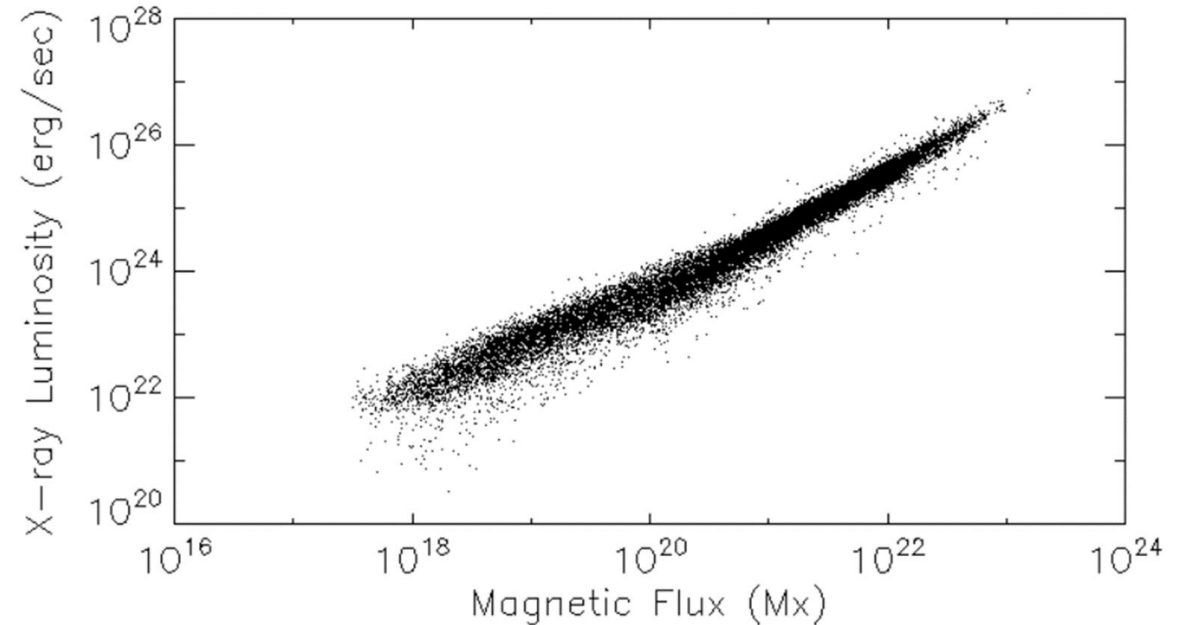
Progress

- Graph of Luminosity vs Magnetic Flux
- Covers gap ranging between the lower XBP and upper AR

Relationship between X-ray luminosity and magnetic flux



Pevtsov et al. (2003)



Next Steps

- Compare Luminosity vs Magnetic flux graphs with different parameters





Questions?

