

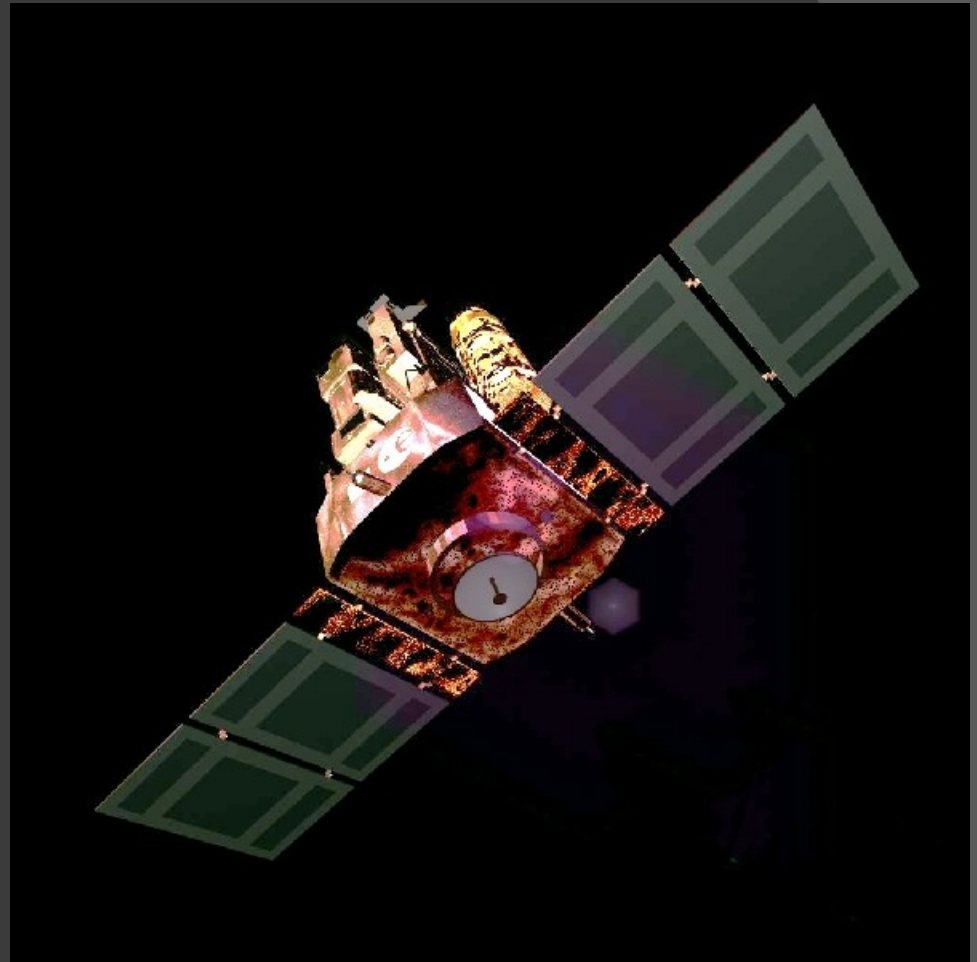
Ron Caplan
Math 336
Final Presentation
December 8th, 2008

IMAGE ENHANCEMENT OF EXTREME ULTRA- VIOLET SOLAR IMAGES

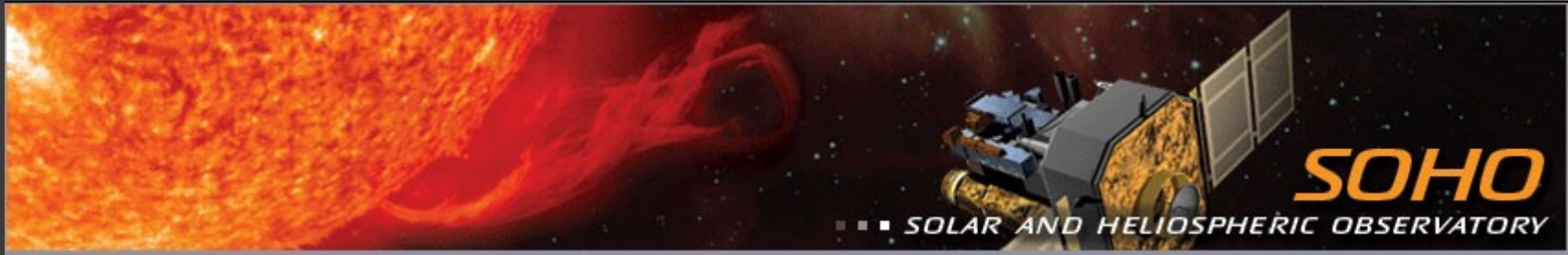
Images courtesy of SOHO/[instrument] consortium. SOHO is a project of international cooperation between ESA and NASA. where [instrument] stands for the name of the instrument that acquired the data

Overview

- ⦿ Introduction
- ⦿ RAW Data
- ⦿ Pre-processing
 - Format
 - Degridding
- ⦿ Stationary Wavelet Transform
- ⦿ Results
 - My results
 - Paper's Results
- ⦿ Conclusion



Introduction



A FRESH VIEW OF THE EXTREME-ULTRAVIOLET CORONA FROM THE APPLICATION OF A NEW IMAGE-PROCESSING TECHNIQUE

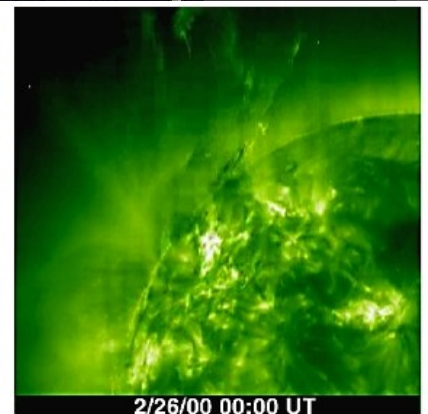
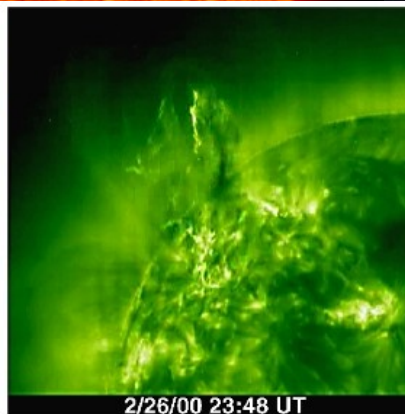
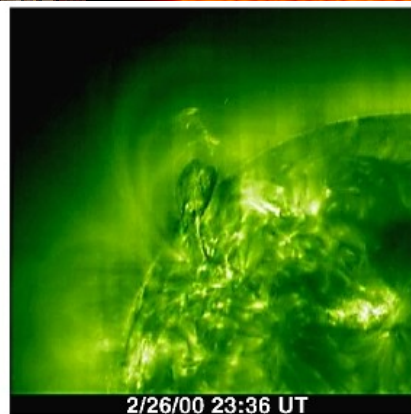
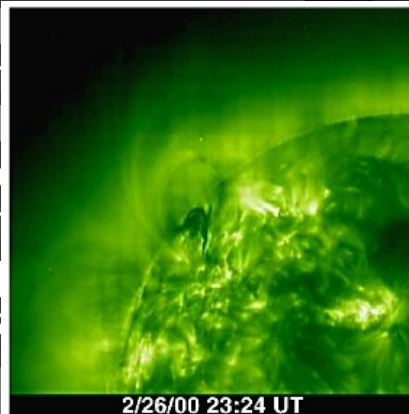
GUILLERMO STENBORG

Department of Physics, Catholic University of America, 620 Michigan Avenue, NE,
Washington, DC 20064; stenborg@kreutz.nascom.nasa.gov

AND

ANGELOS VOURLIDAS AND RUSSELL A. HOWARD

Code 7663, Naval Research Laboratory, Washington, DC 20375;
vourlidas@nrl.navy.mil, russ.howard@nrl.navy.mil
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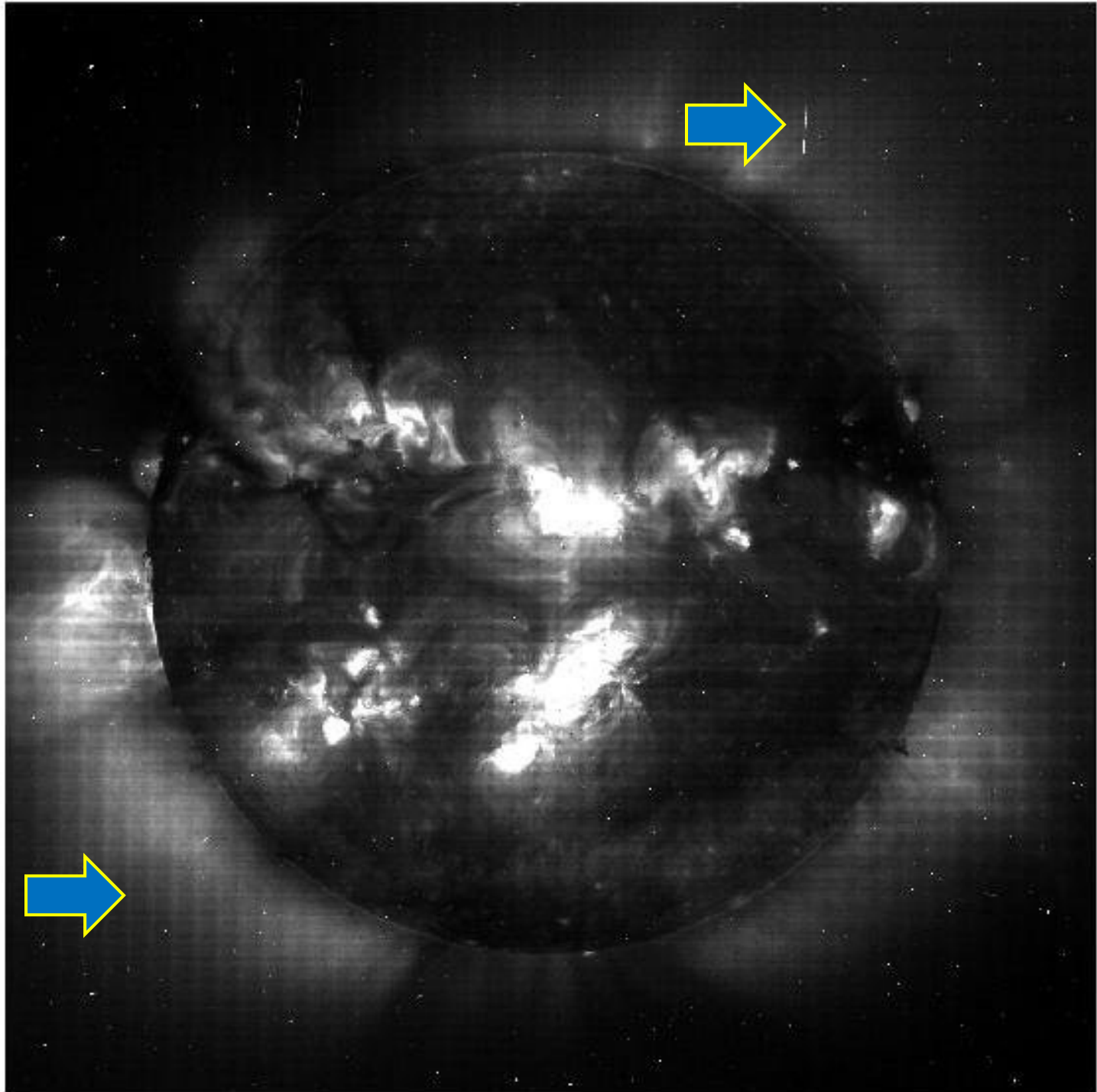
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Raw Data

- uint16 Format (0 -> 65,535)
- imagesc(im)
- imadjust(im)

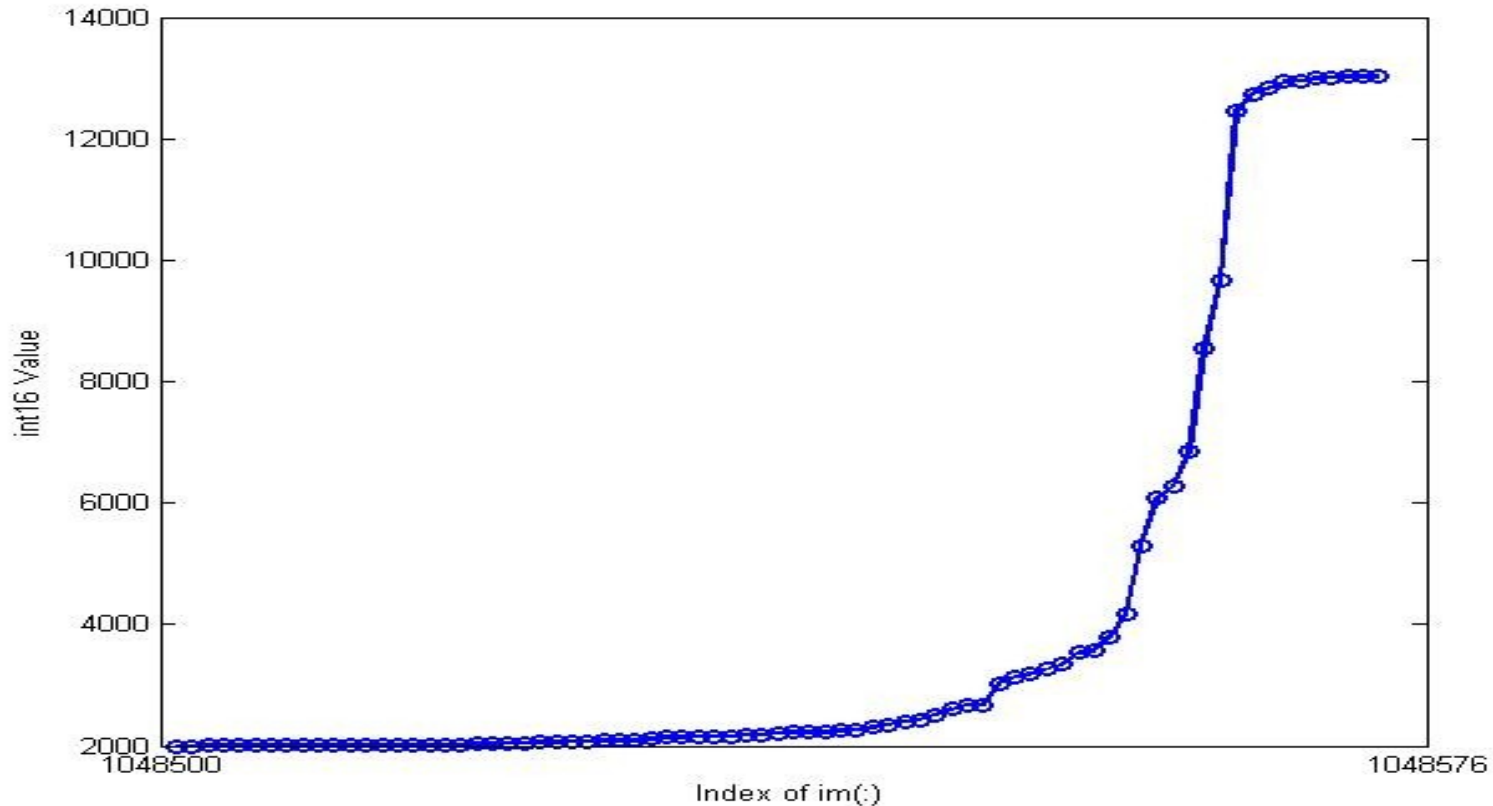
Issues

- Grid patterns
- Noise



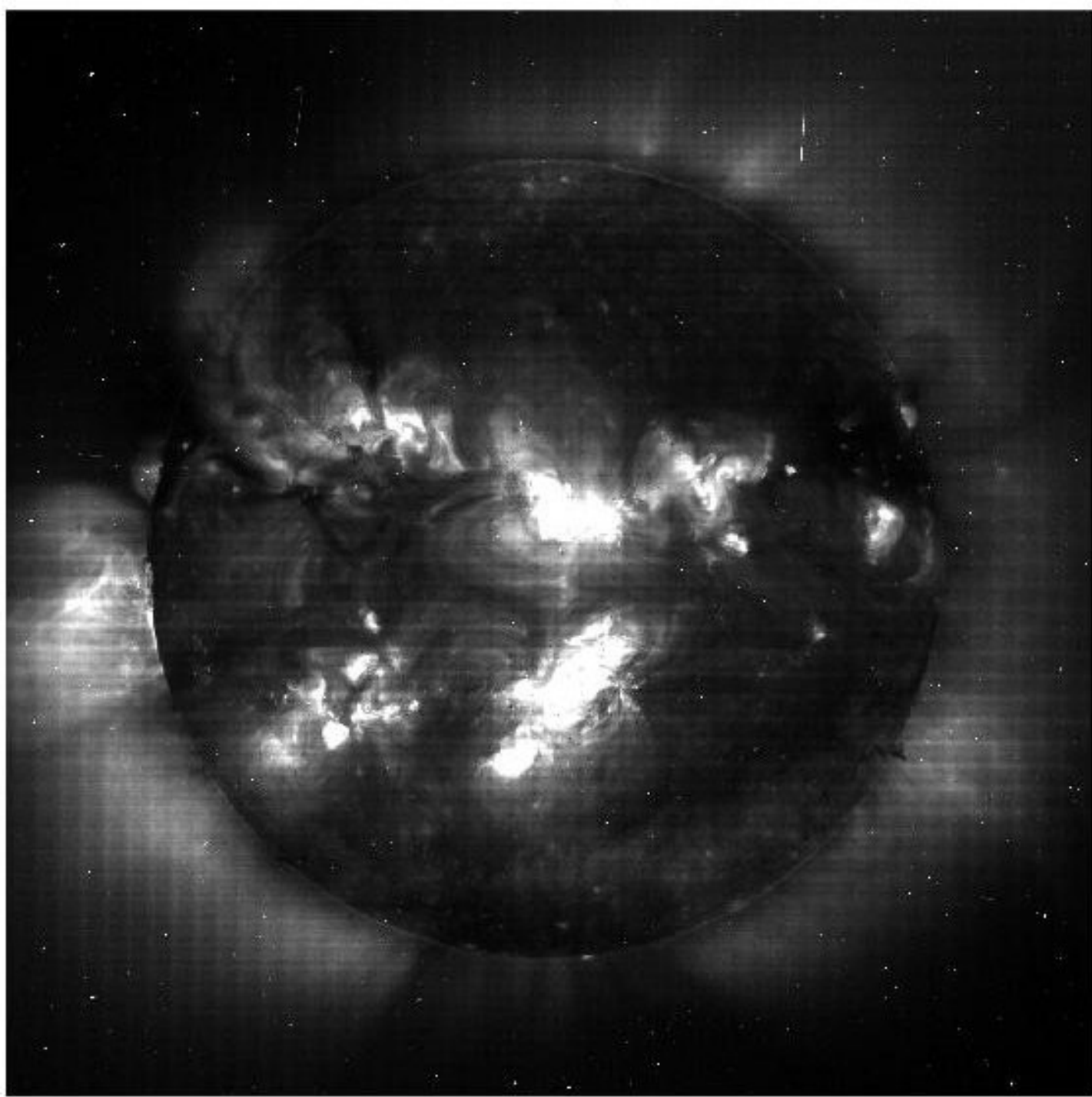
Pre-Processing

- Rescale RAW data extremes:



$$\text{if}(im1(i, j) > 2400) \text{ then } im(i, j) = 2400 + \left[100 \frac{im1(i, j)}{\max(im1(i, j))} \right]$$

$$\text{if}(im1(i, j) == 0) \text{ then } im(i, j) = 800$$

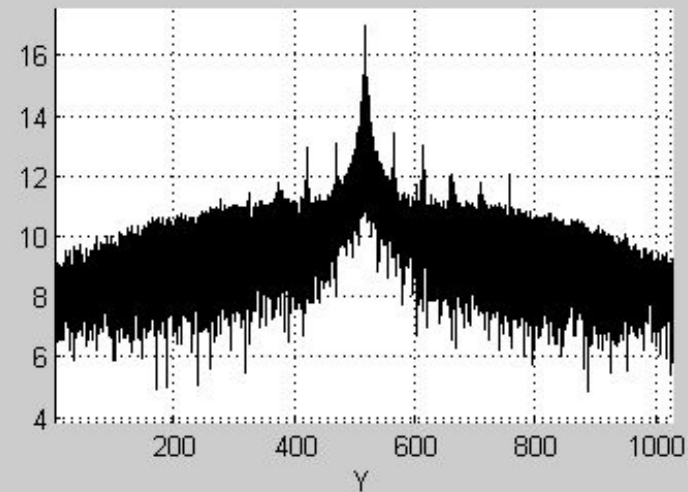
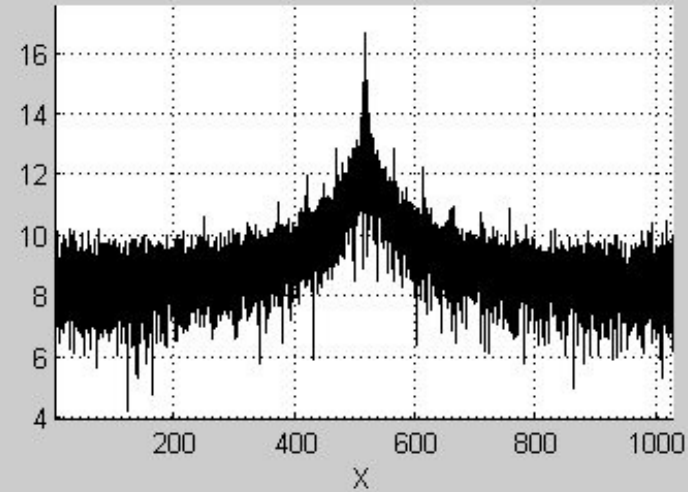
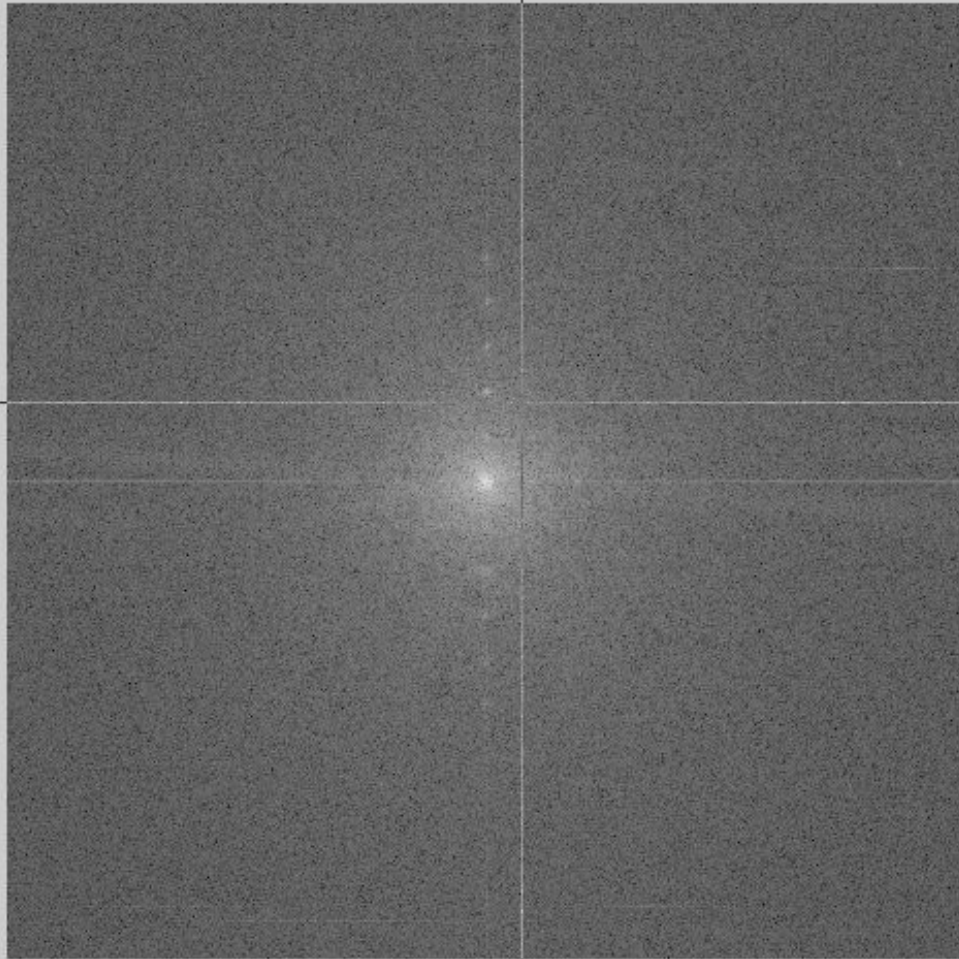


Pre-Processing

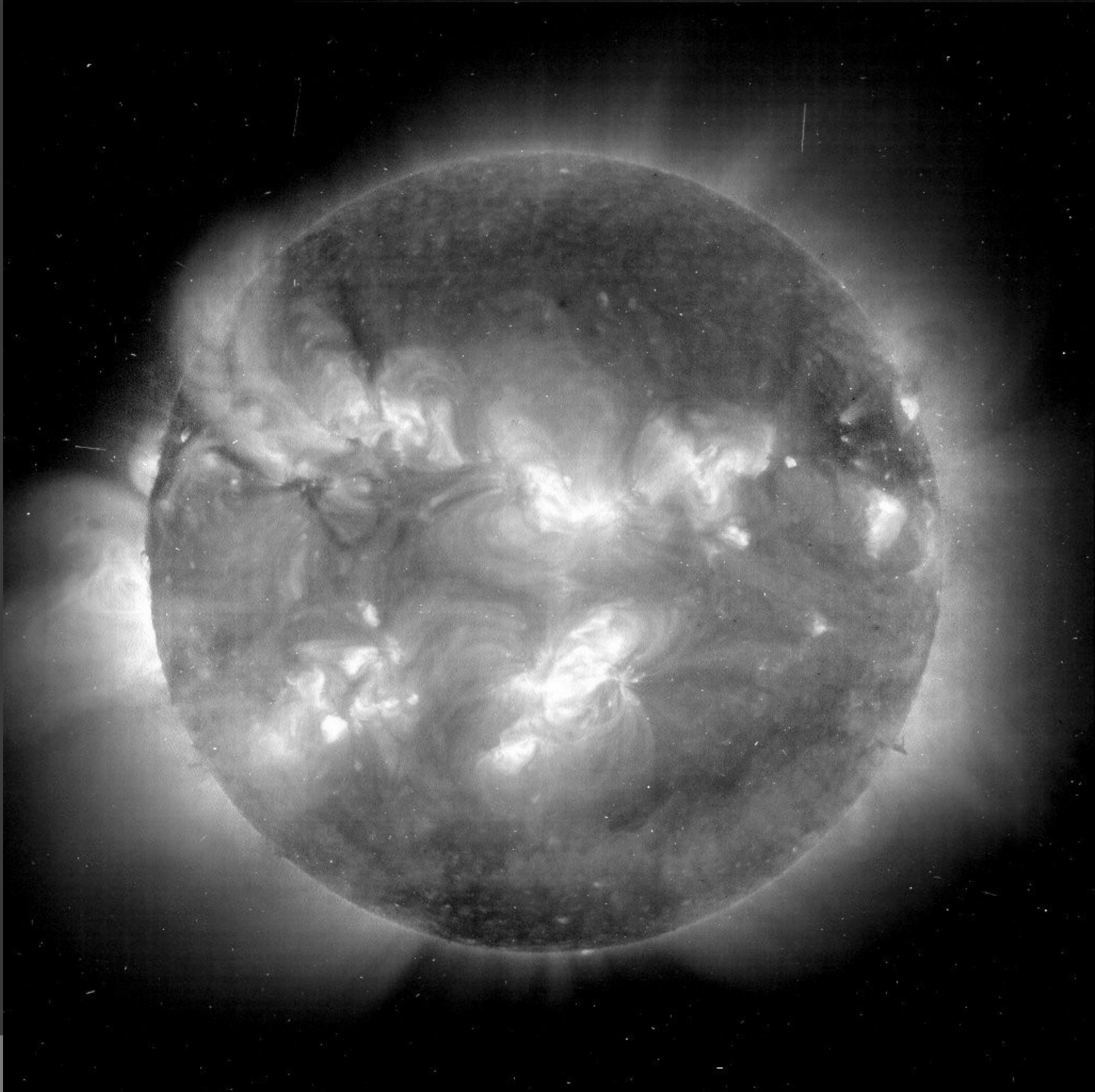
- De-grid using manual threshold-based notch filter on `fft2` of image:

$$T = 0.1 \max(im(x_{-r} : x_{+r}, y_{-r} : y_{+r}))$$

FFT of im1



- Original
- My De-Grid
- Official Image



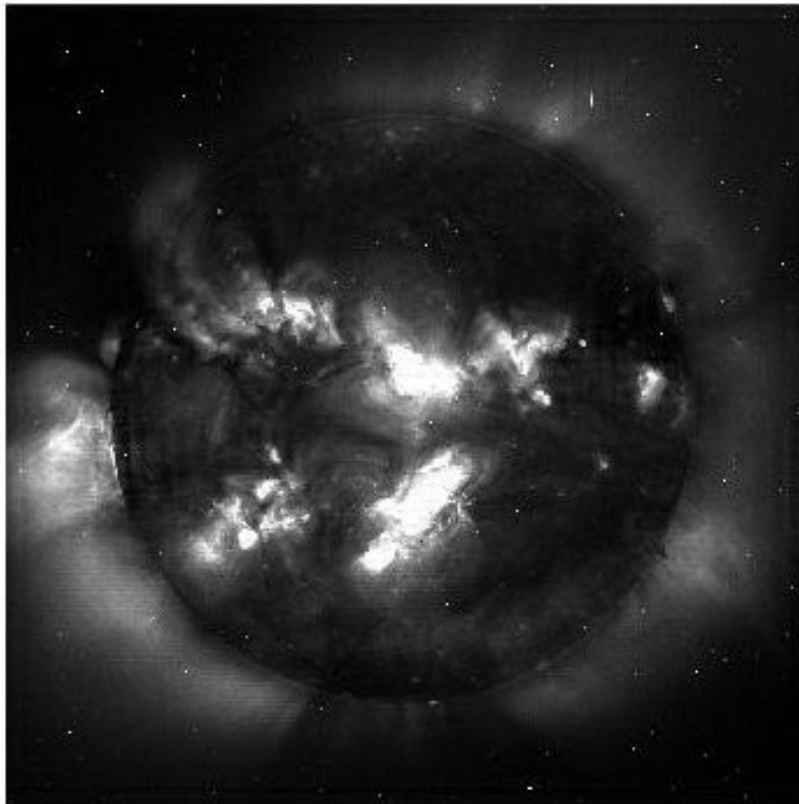
Stationary Wavelet Transform

- ⦿ Kernel (filter) B3-Spline / Biorthogonal 3.3
- ⦿ Upsample filter at each level (pad with zeros)

Two-Dimensional SWT

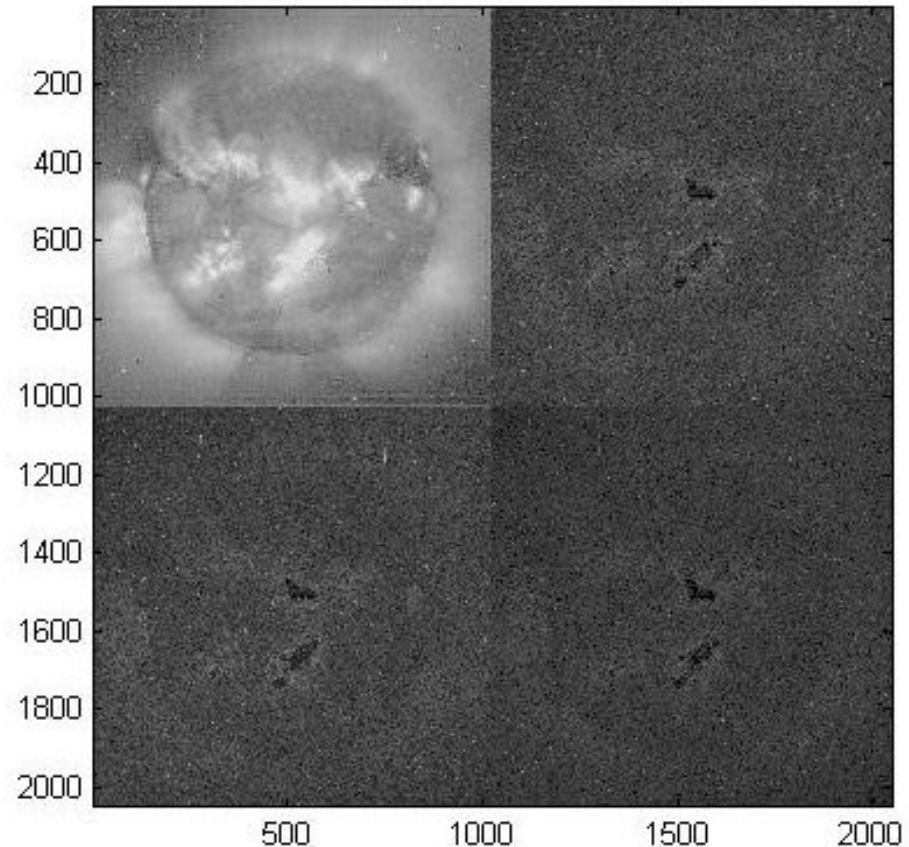
Decomposition step

Original image



columns

SWT dec.: approx. and det. coefs (lev. 1)

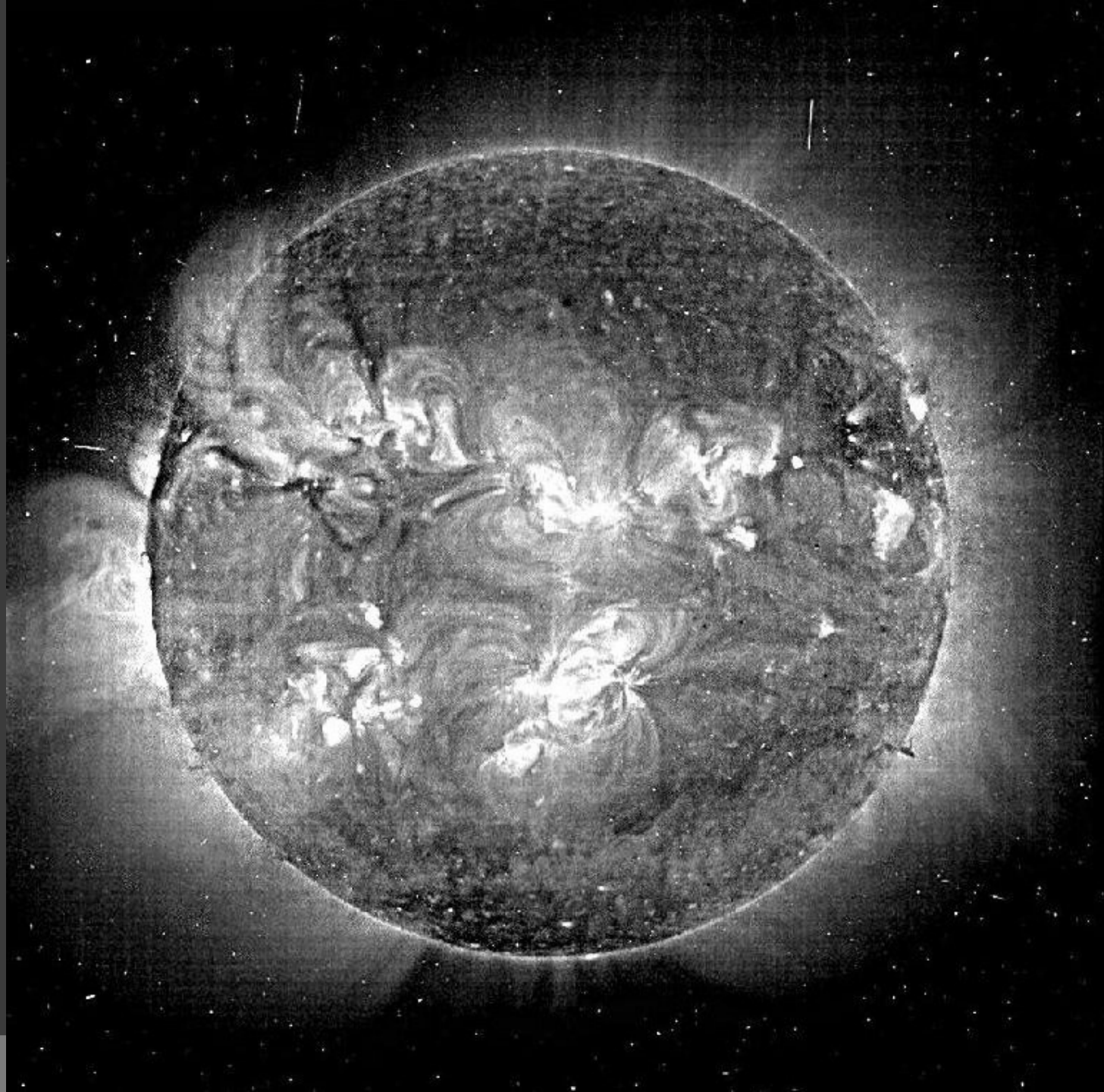


Initialization $G_0 = Hi_D$

My results

- Using 'bior3.3',
 $J=5$
 $w=[2\ 5\ 4\ 3\ 2]$:

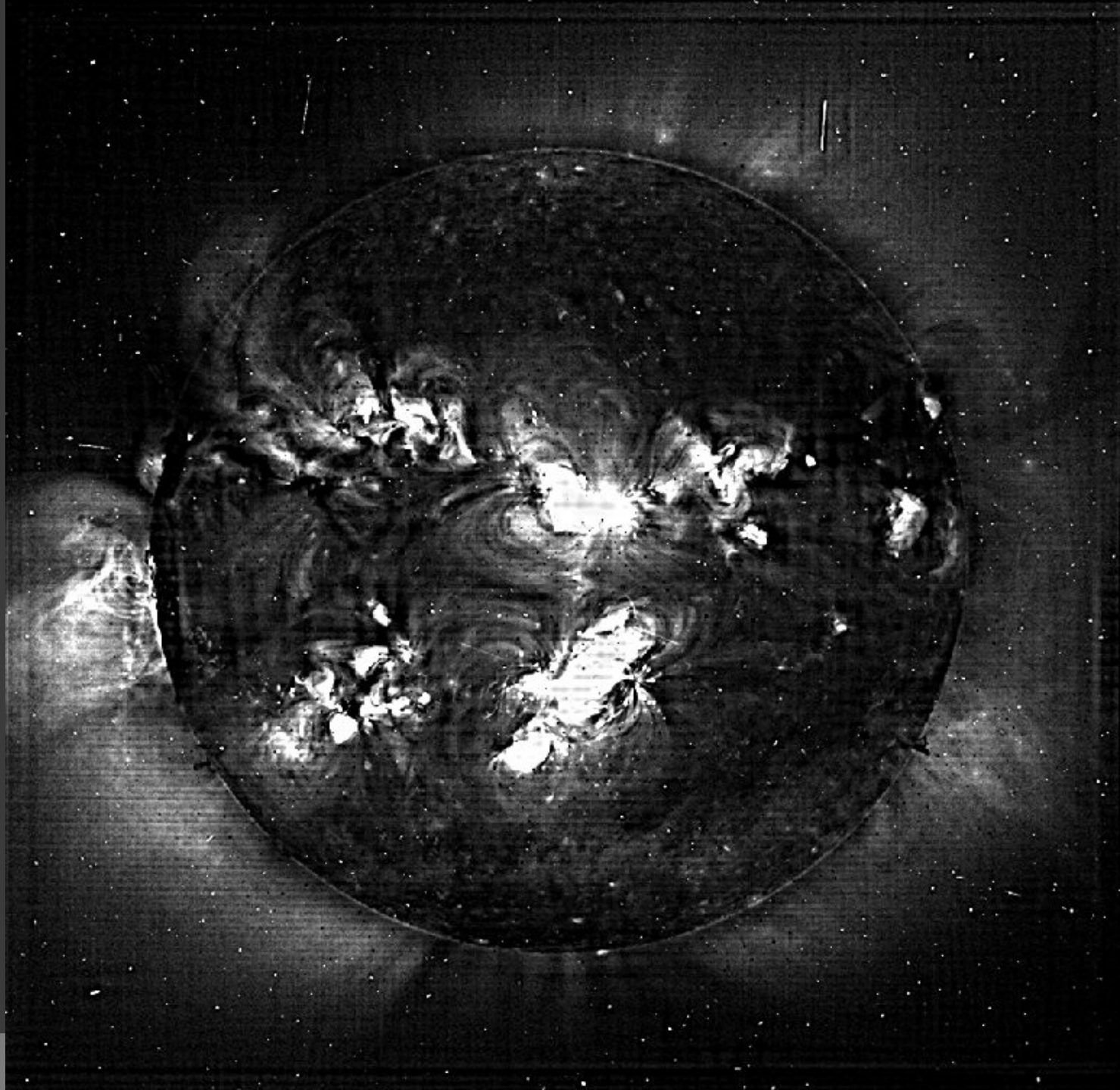
Using official
image:



My results

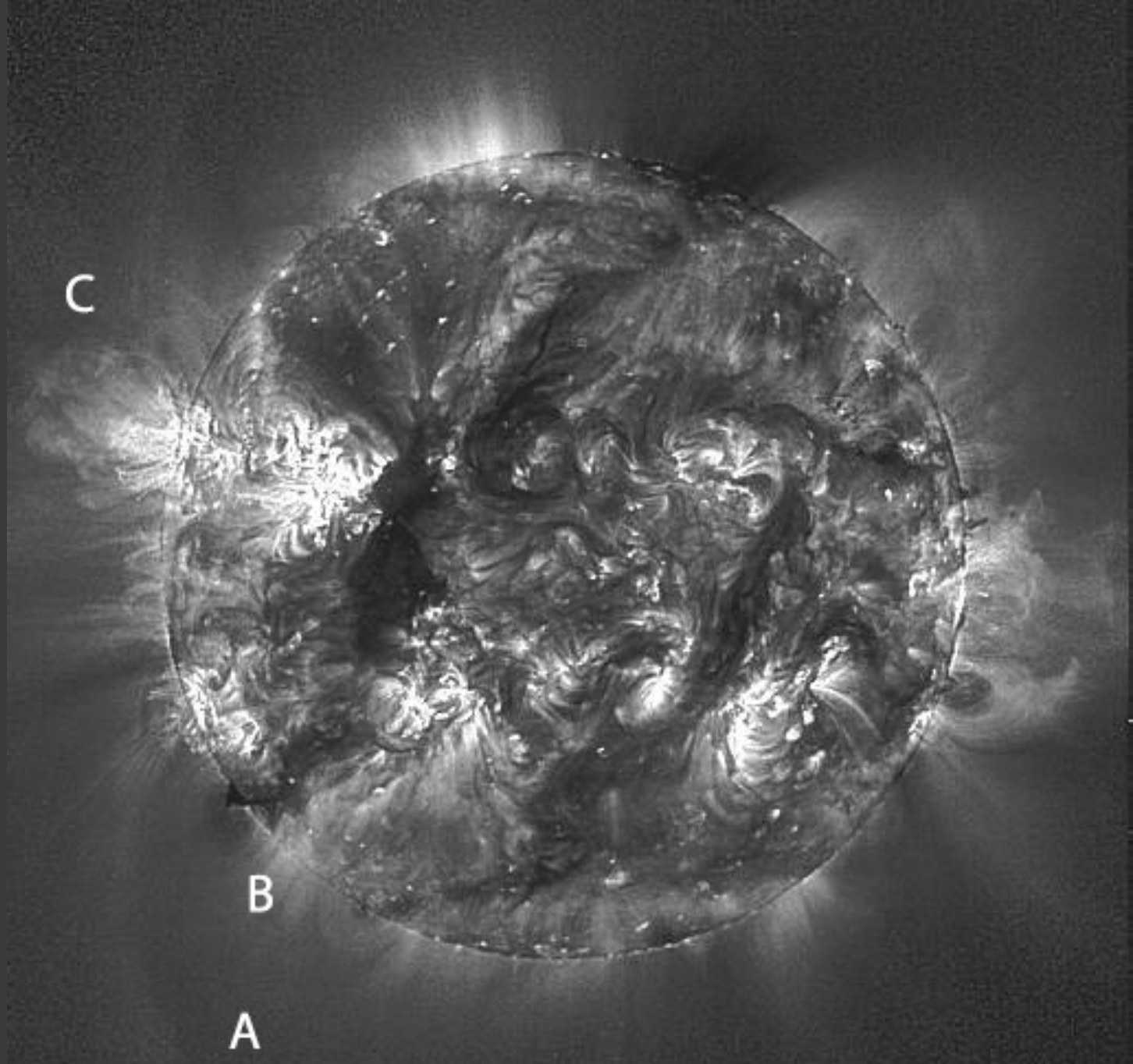
- Using 'bior3.3',
 $J=5$
 $w=[2\ 5\ 4\ 3\ 2]$:

Using my
degrid:



Results from Paper

- 2-Stage Process
- Original image
- Processed image



Conclusion

- ① Process works very well to bring out features not apparent in the images.
- ① Technique is not as simple as it appears...