

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

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Introduction



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

GUILLERMO STENBORG

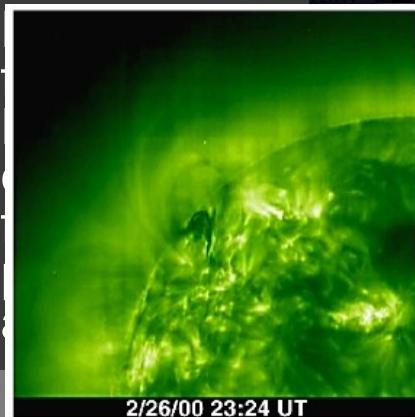
Department of Physics, Catholic University of America, 620 Michigan Avenue, NE,
Washington, DC 20064; stenborg@kreutz.nascom.nasa.gov

AND

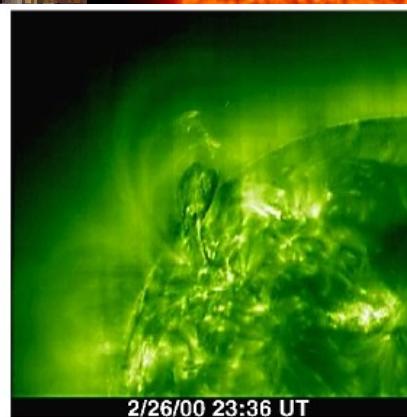
ANGELOS VOURLIDAS AND RUSSELL A. HOWARD

Code 7663, Naval Research Laboratory, Washington, DC 20375;
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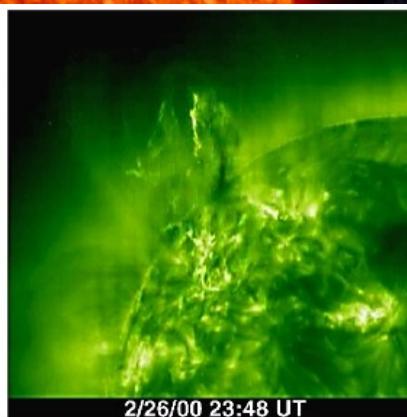
Received 2007 May 15; accepted 2007 November 6



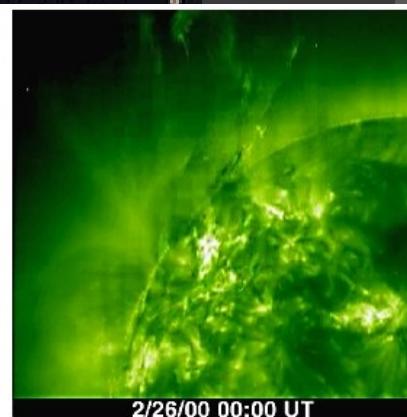
2/26/00 23:24 UT



2/26/00 23:36 UT



2/26/00 23:48 UT



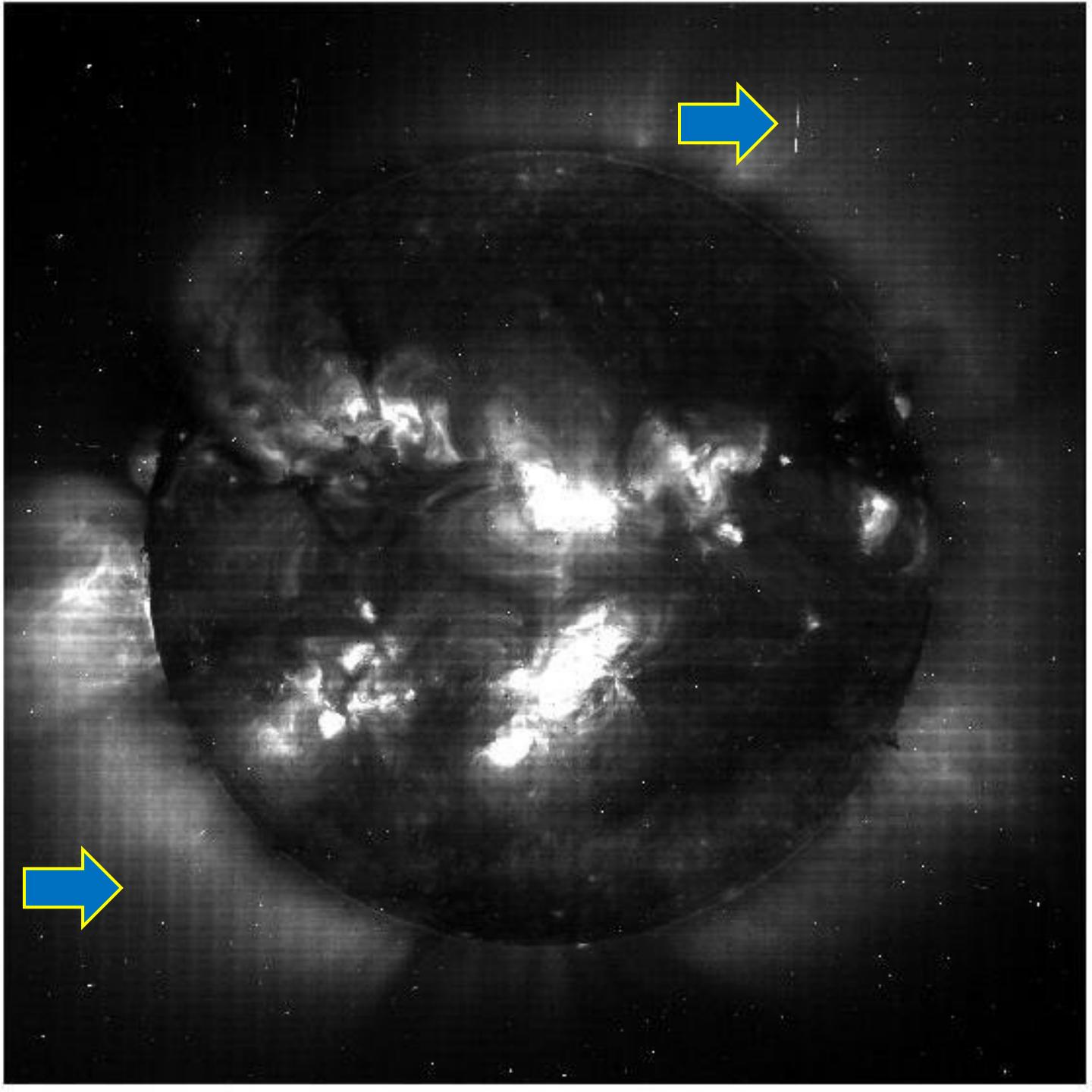
2/26/00 00:00 UT

Raw Data

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

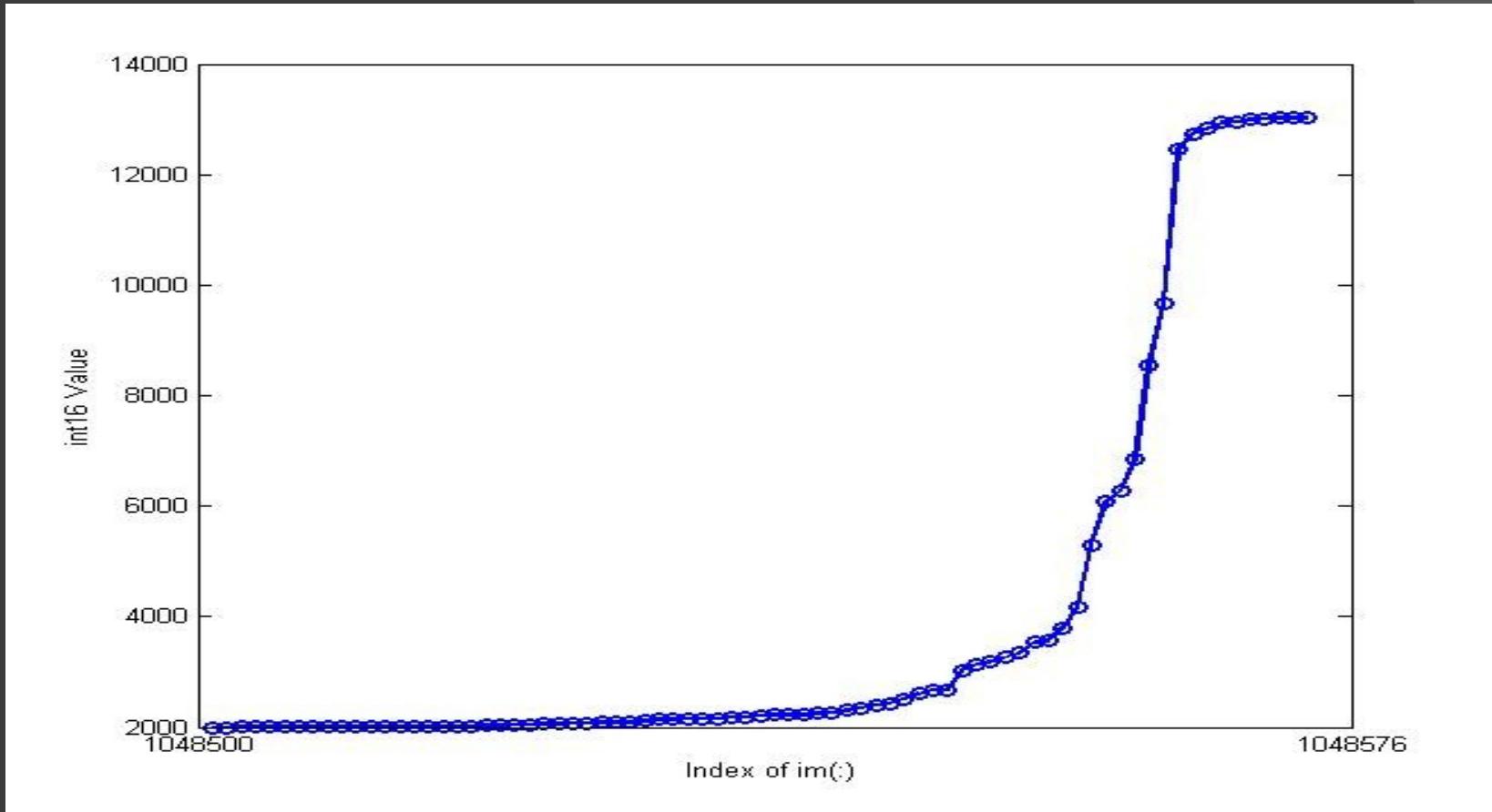
Issues

- Grid patterns
- Noise

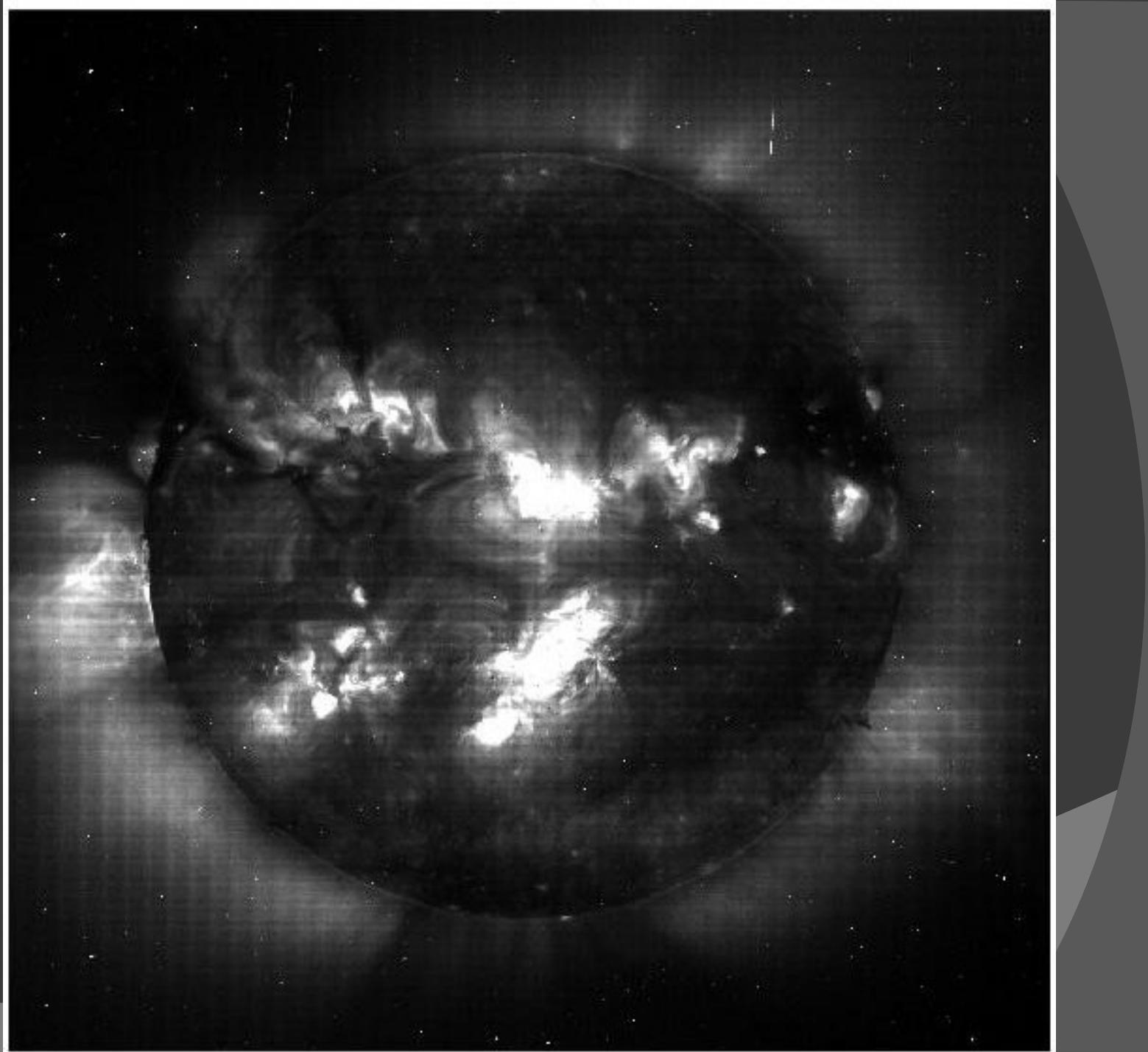


Pre-Processing

- Rescale RAW data extremes:

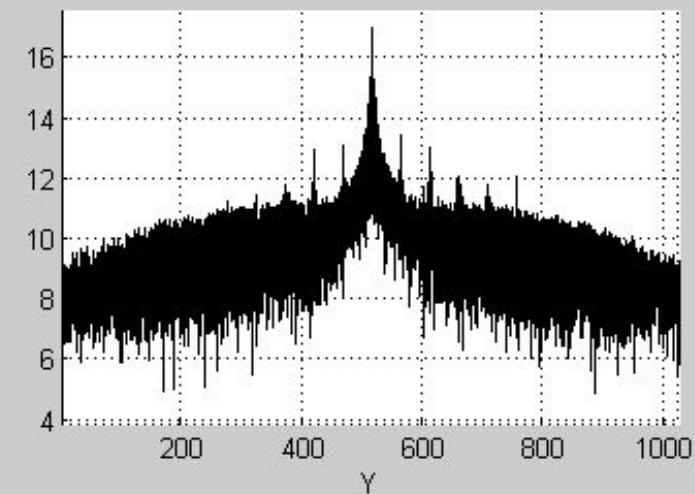
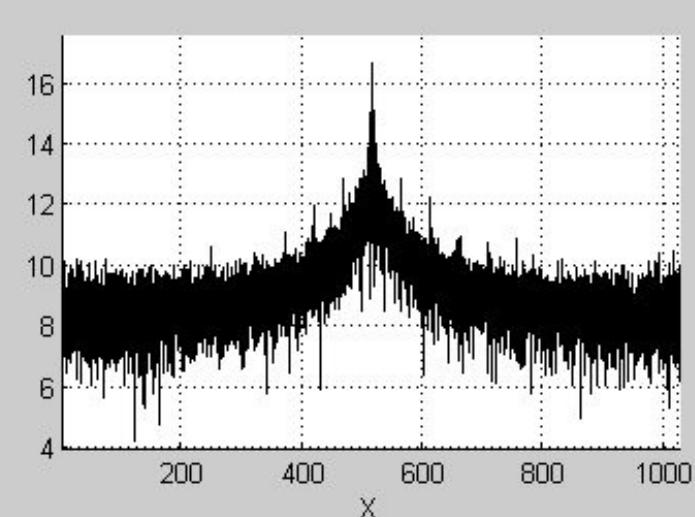


$$if(im1(i, j) > 2400) \text{ then } im(i, j) = 2400 + \left[100 \frac{im1(i, j)}{\max(im1(i, j))} \right]$$
$$if(im1(i, j) == 0) \text{ then } im(i, j) = 800$$

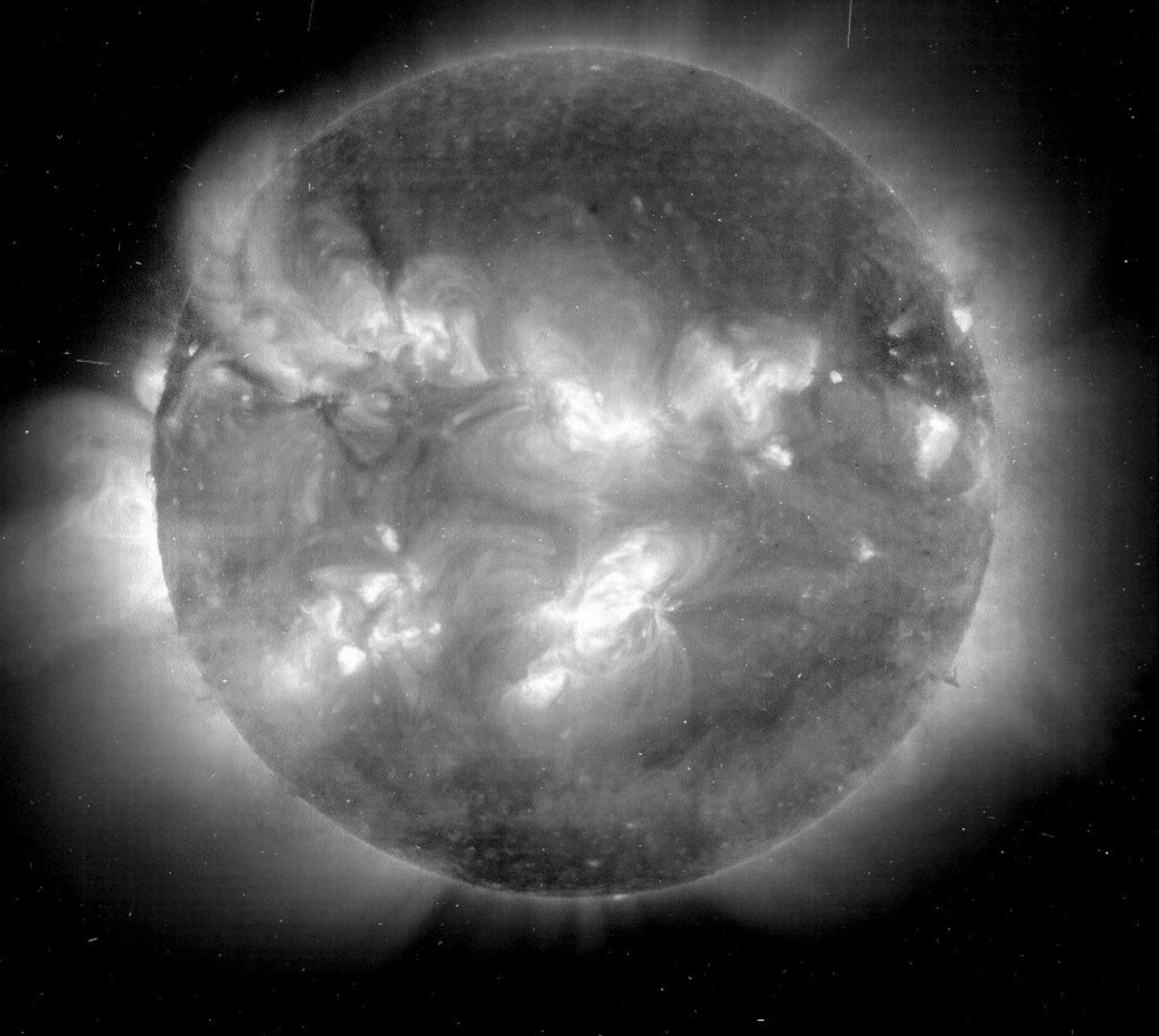


Pre-Processing

- De-grid using manual threshold-based notch filter on fft2 of image: $T = 0.1 \max(im(x_{-r} : x_{+r}, y_{-r} : y_{+r}))$



- Original
- My De-Grid
- Official Image



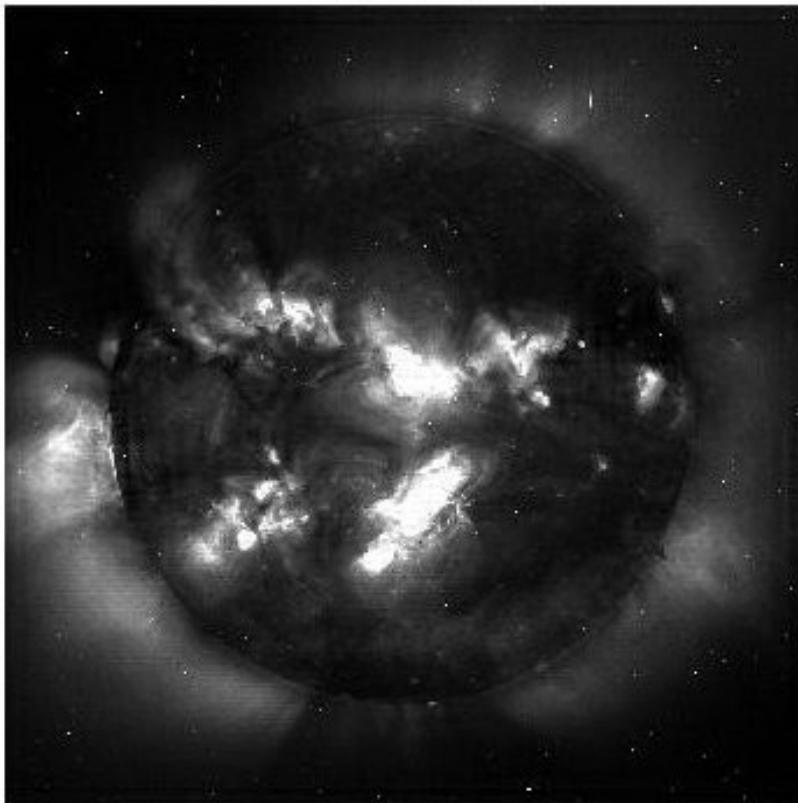
Stationary Wavelet Transform

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

Two-Dimensional SWT

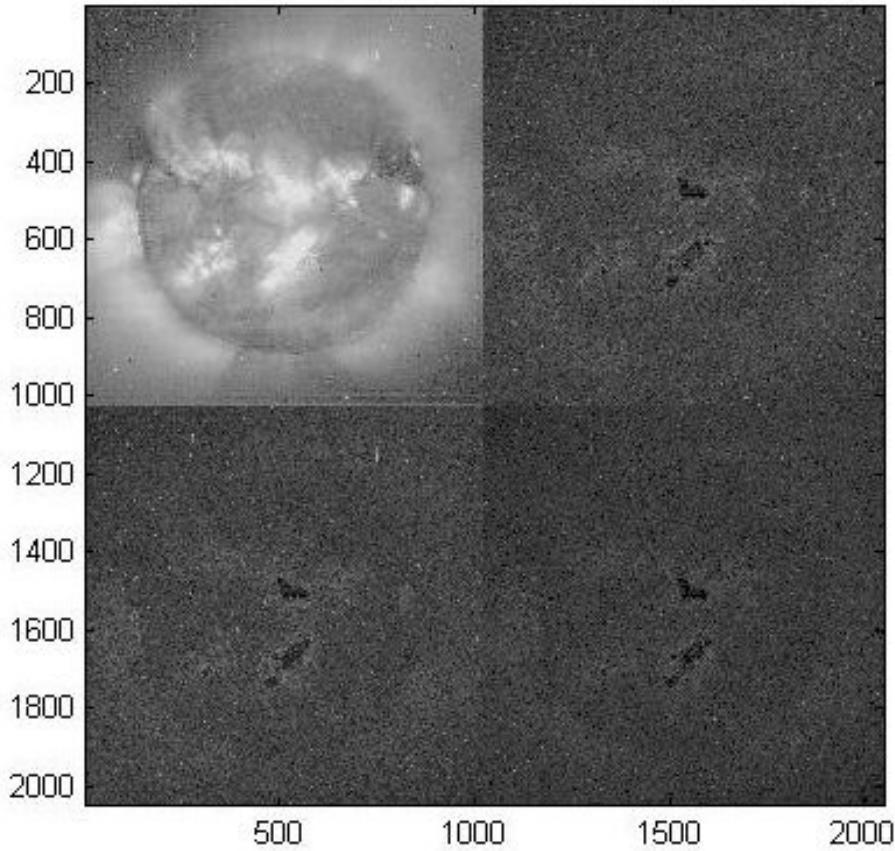
Decomposition step

Original image



columns

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

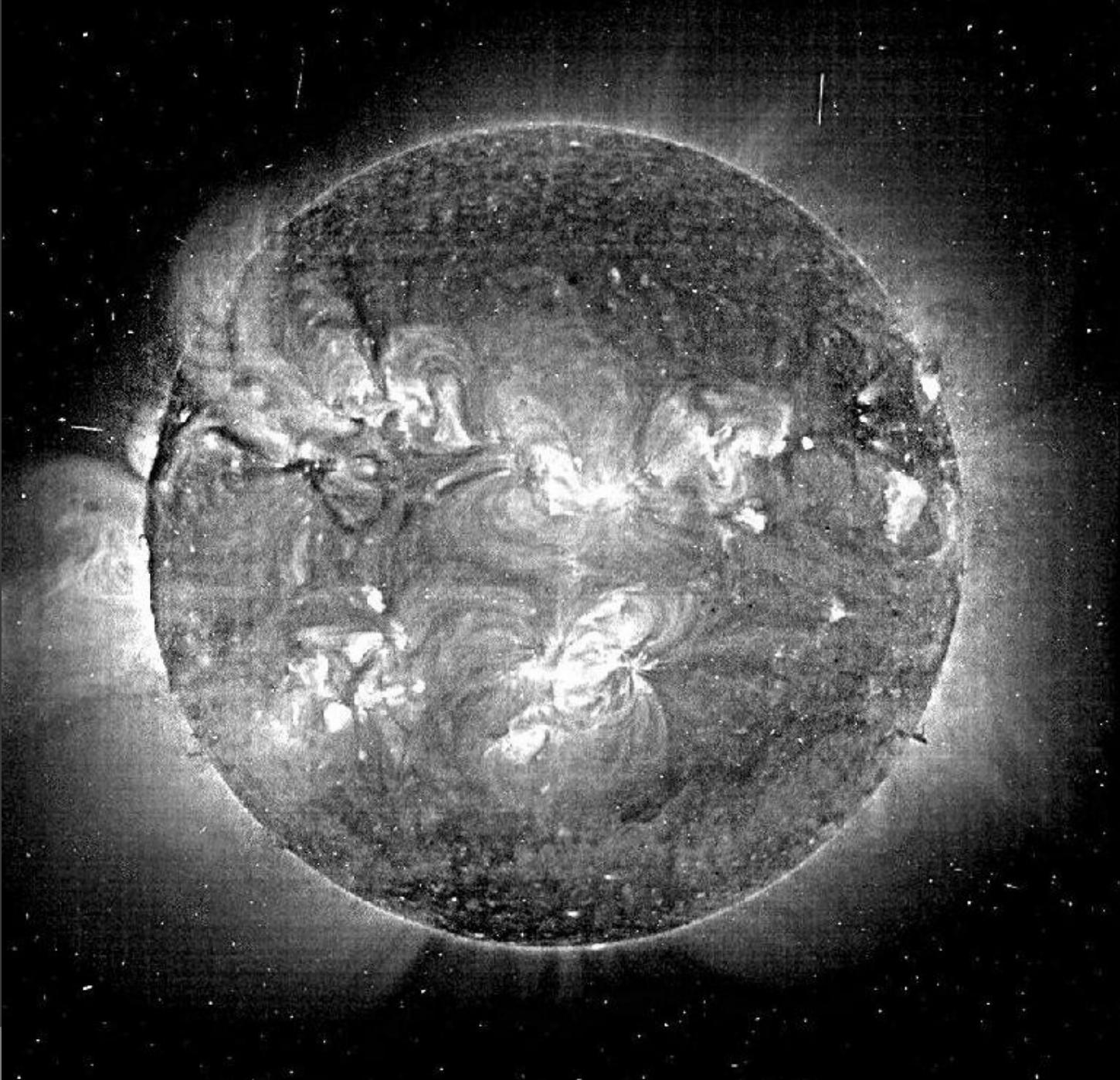


Initialization $G_O = Hi_D$

My results

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

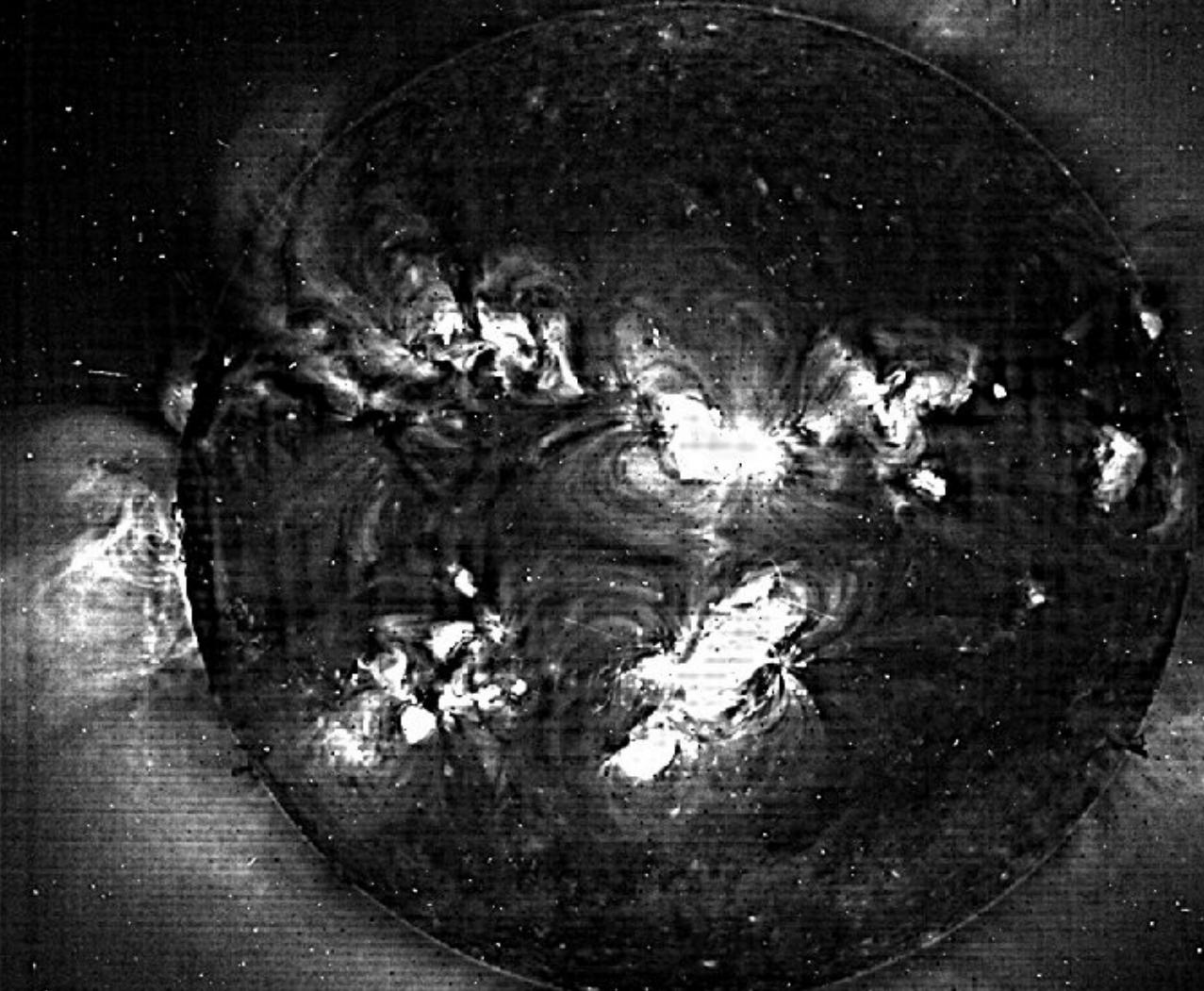
Using official
image:



My results

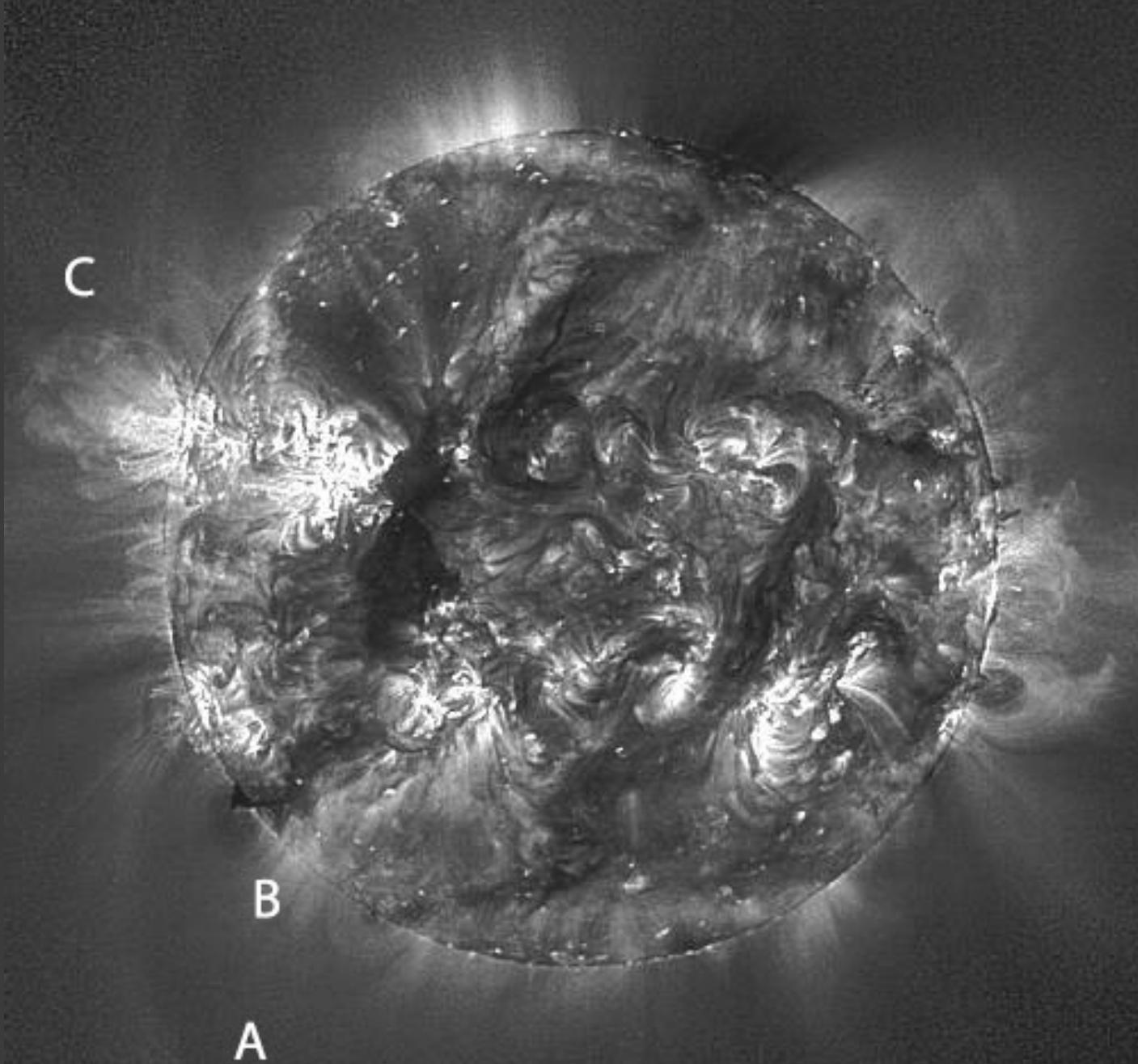
- Using 'bior3.3',
J=5
 $w=[2\ 5\ 4\ 3\ 2]$:

Using my
degrid:



Results from Paper

- 2-Stage Process
- Original image
- Processed image



Conclusion

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