



OBSERVING AND IMAGING THE SUN

Theo Ramakers
PSSG 2011-09-30

Charlie Elliott Chapter
of the Atlanta Astronomy Club



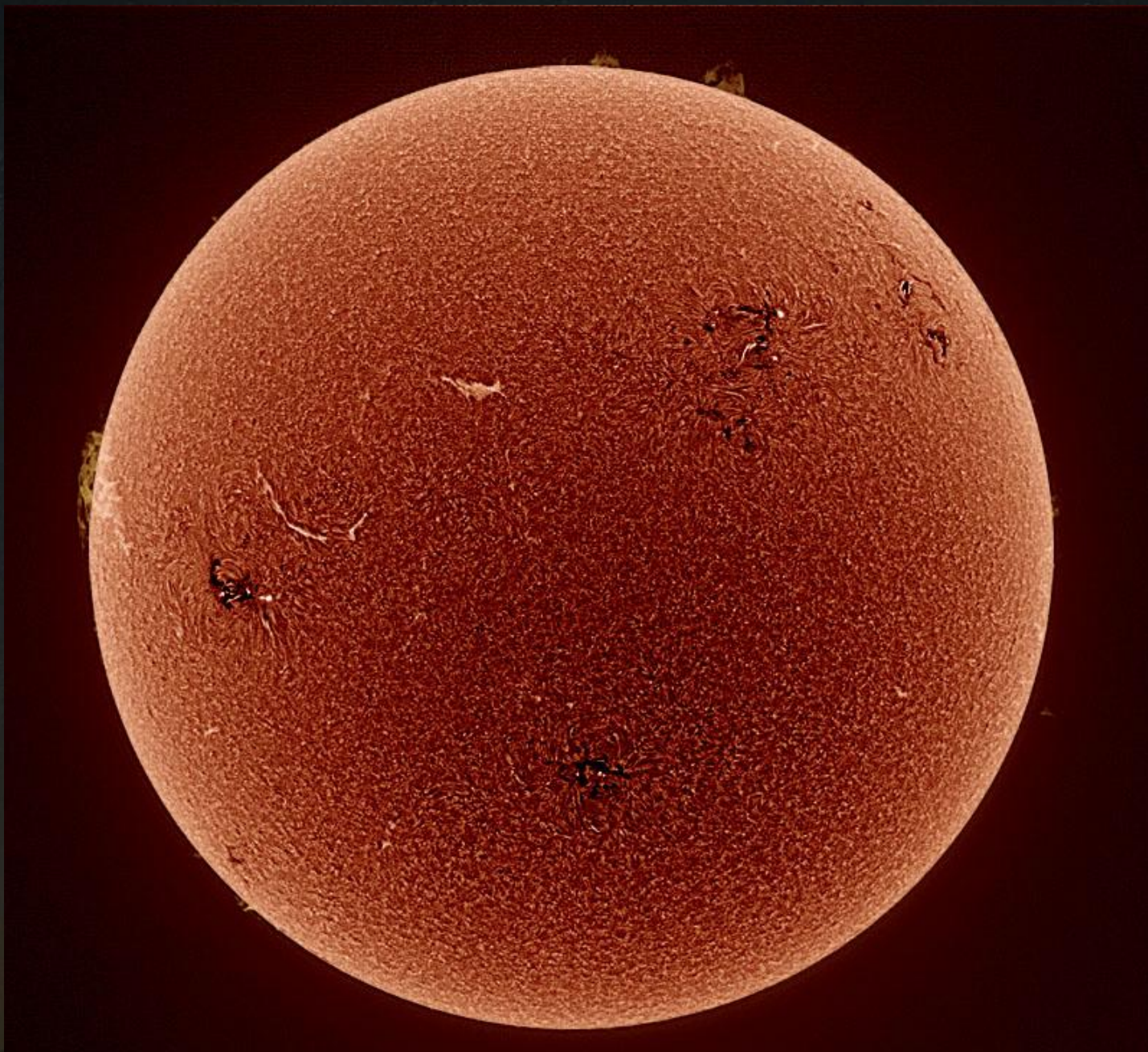
OBSERVING AND IMAGING THE SUN

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OBSERVING AND IMAGING THE SUN



Sun AR1277,79,80,81,82,83 2011-09-02 14:26 UT CR2114 SM40 DMK41AU02.AS Theo Ramakers Social Circle



OBSERVING AND IMAGING THE SUN

Theo Ramakers
PSSG 2011-09-30

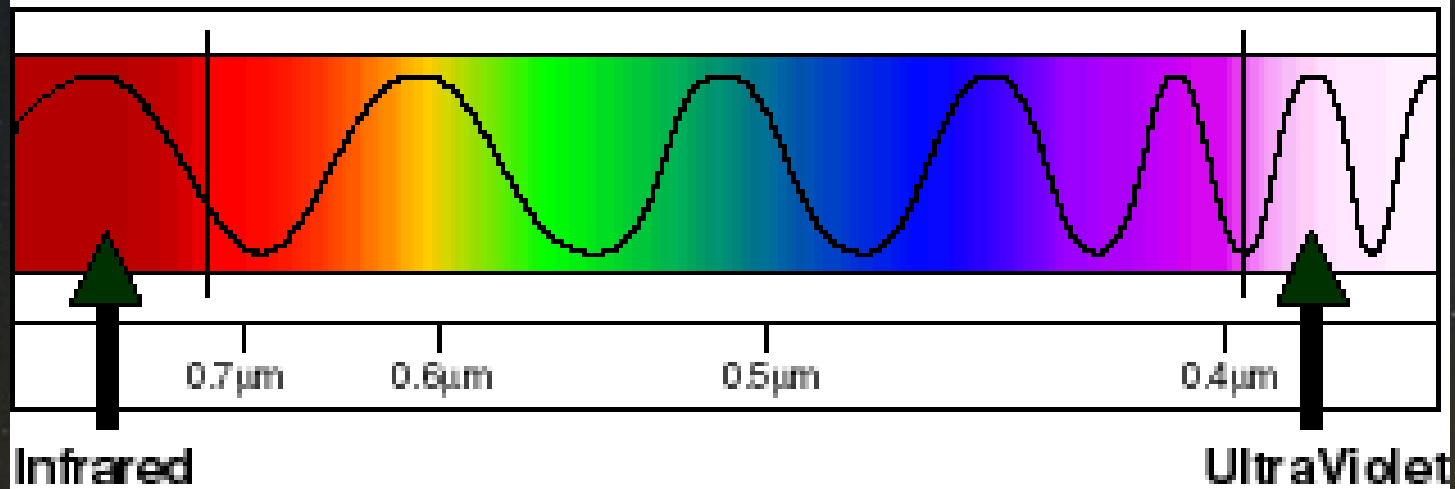


Composition of the Sun

	% atoms	% mass
Hydrogen	91.2	71.0
Helium	8.7	27.1
Oxygen	0.078	0.97
Carbon	0.043	0.40
Nitrogen	0.0088	0.096
Silicon	0.0045	0.099
Magnesium	0.0038	0.076
Neon	0.0035	0.058
Iron	0.0030	0.14
Sulfur	0.0015	0.040



Visible Light Region of the Electromagnetic Spectrum



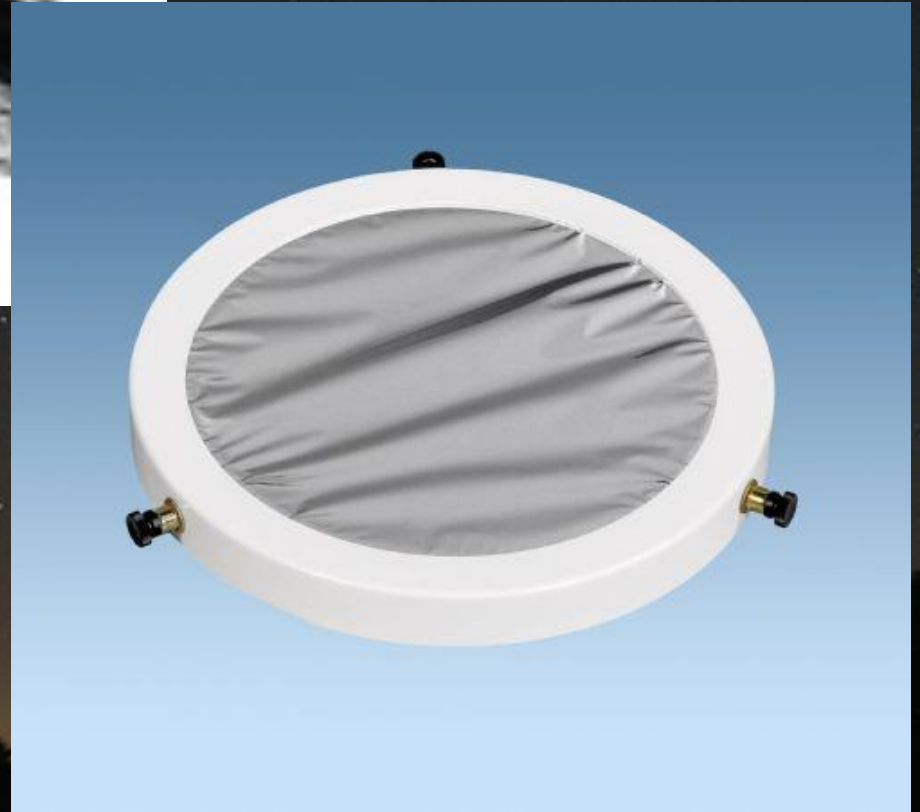


Simplest way to observe the Sun: Eclipse Glasses





Visible Light Filters: Milar Film and Glass





Visible Light Blocking Filters or Herschel Wedges





Visible Light Solar Scope

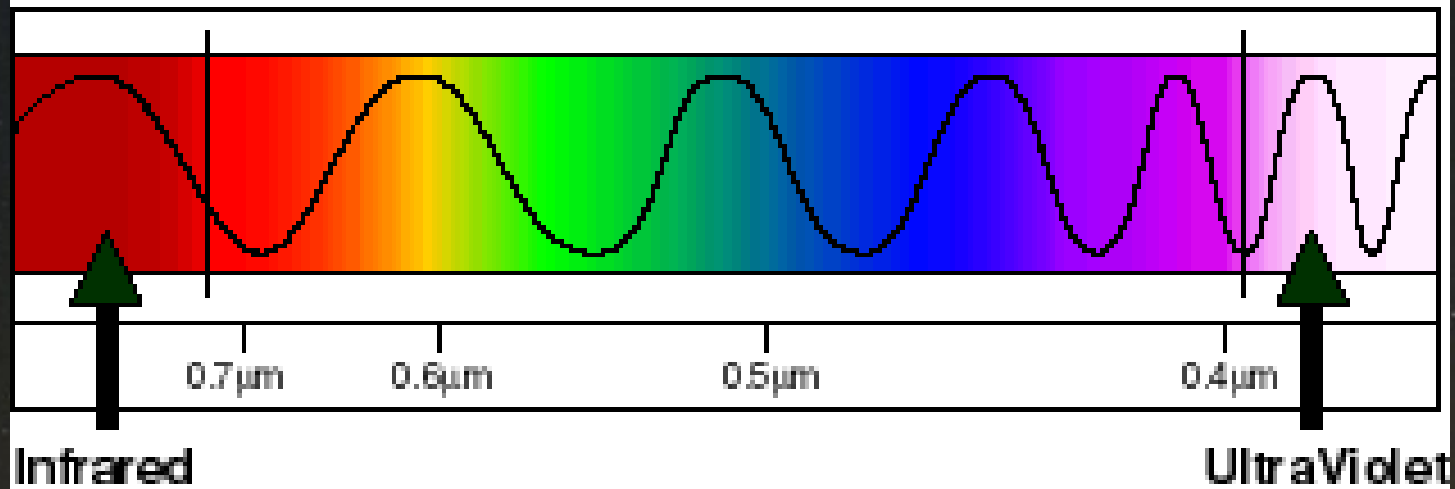


Visible Light Solar Scope



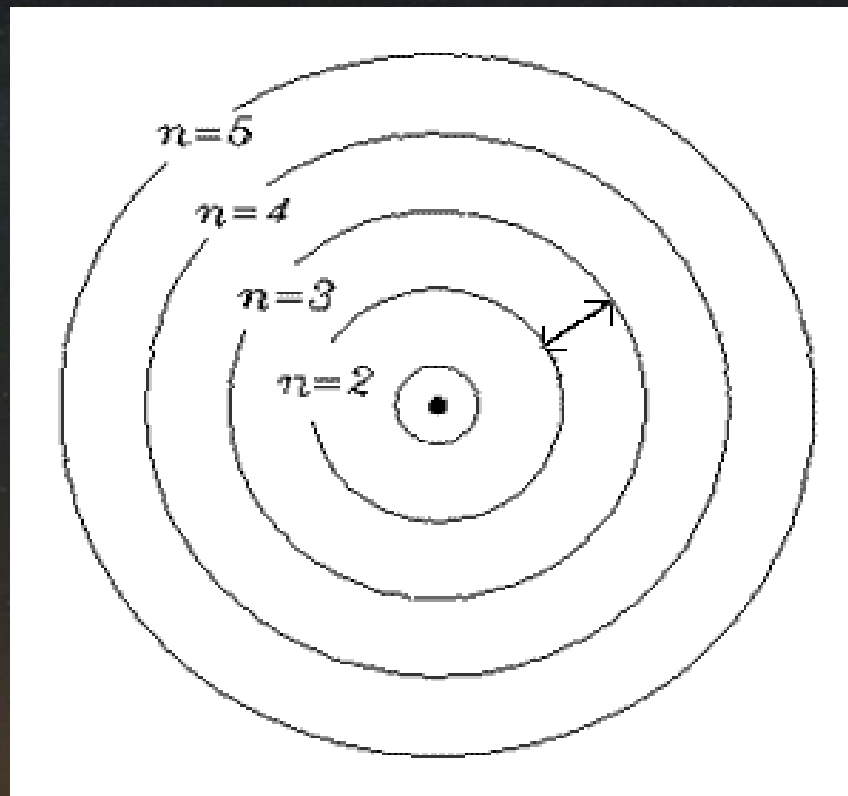


Visible Light Region of the Electromagnetic Spectrum



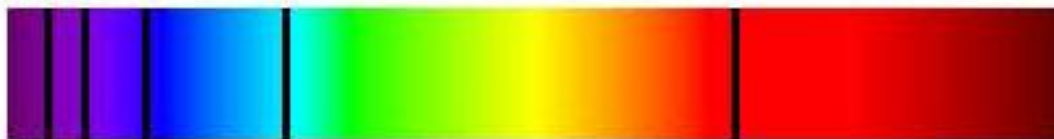


Main Source of energy and the main
absorption/emission of light is caused by Hydrogen fusion





The Fraunhofer Absorption lines for the element Hydrogen

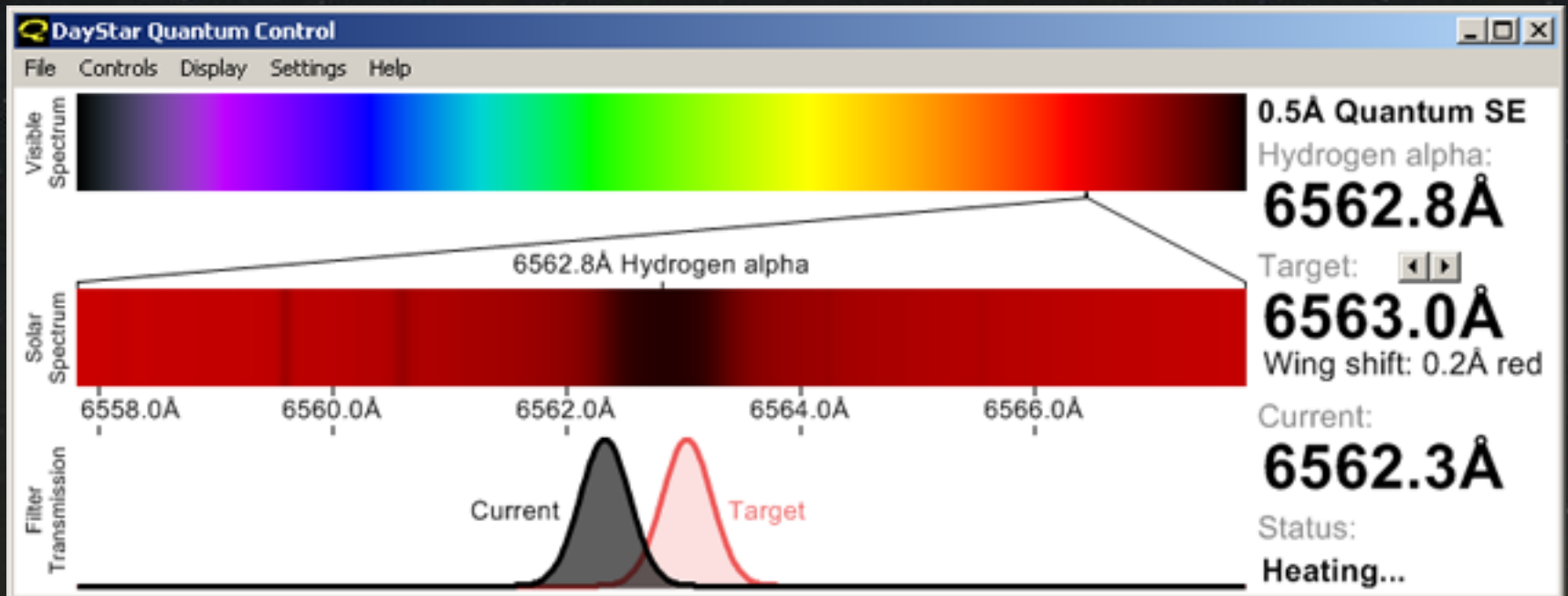


The Emission lines for the element Hydrogen which correspond to the absorption lines for the same element



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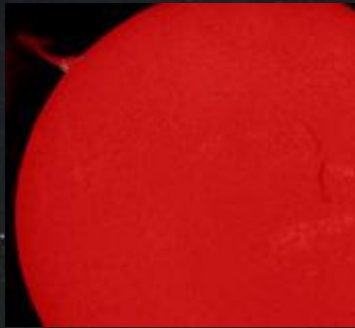


Band pass and visual effect of it

0.8

0.7

0.6



0.5

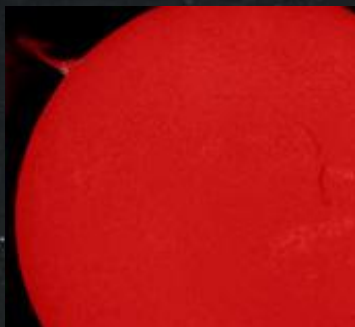
0.4

0.3



Band pass and visual effect of it

0.8



0.7



0.6

0.5

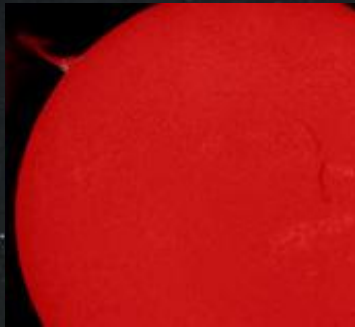
0.4

0.3



Band pass and visual effect of it

0.8



0.7



0.6



0.5

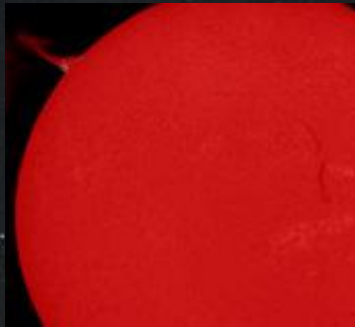
0.4

0.3



Band pass and visual effect of it

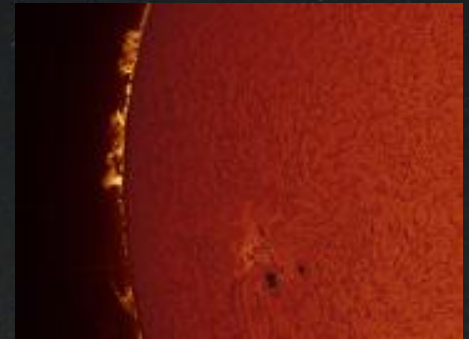
0.8



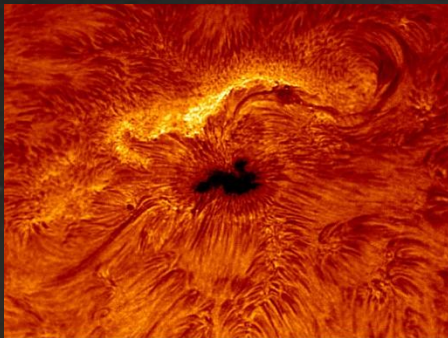
0.7



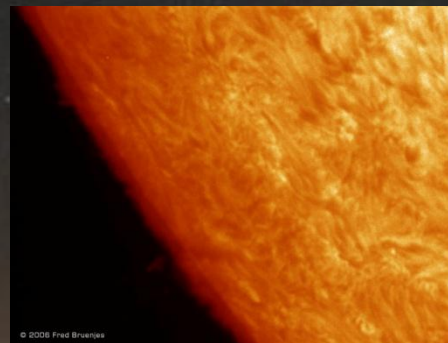
0.6



0.5



0.4



0.3



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Dedicated H-Alpha Solar Scopes



Dedicated H-Alpha Solar Scopes



Lunt LS60Ha



Dedicated H-Alpha Solar Scopes



Lunt LS60Ha



Coronado SolarMax 90



Dedicated H-Alpha Solar Scopes

.... But if you are cost conscious.....



Dedicated H-Alpha Solar Scopes

.... But if you are cost conscious.....



Coronado SolarMax40, PST-H-Alpha, or Lunt LS35-Ha



Dedicated H-Alpha Solar Scopes

.... But if you are cost conscious.....



Coronado SolarMax40, PST-H-Alpha, or Lunt LS35-Ha



Dedicated H-Alpha Solar Scopes

.... But if you are cost conscious.....



Use a H-alpha filters with a good blocking filter combination



Dedicated H-Alpha Solar Scopes

.... But if you are cost conscious.....

My original blocking filter was mismatched with the aperture of my H-a filter. Observing was fine, but the detail for imaging was not there



What about Calcium-K observing?

I can't see anything with the un-aided eye,
but my camera does very good at it. ☺



Light from singly-ionized calcium ions in the Sun's upper photosphere and chromosphere (up to 2000 km altitude).

Because the blue Calcium K Line (393.3 nm) is sensitive to magnetic fields, magnetically active structures show up in high contrast against the surrounding chromosphere.

Places where moderate magnetic fields exist show up bright whereas images of high magnetic fields are dark



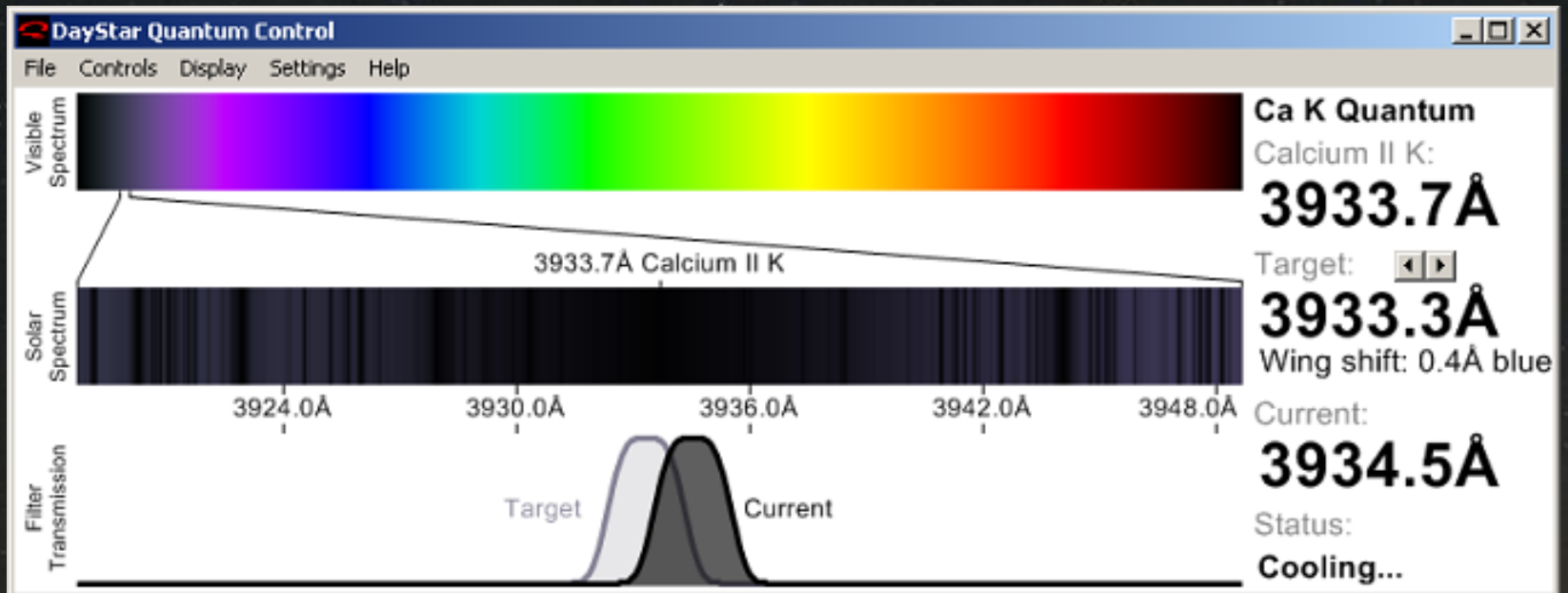
TWO strong absorption lines at 393.3nm and at 396.9nm, known as the K and H lines.

Researchers have previously avoided the H line for academic research, as it is very close to the Hydrogen Epsilon line.

However, as the visual spectrum ends at approximately 400nm, the further we venture below this wavelength, the more difficult it is for observers to visually see the image. The H line for visual observations, is much closer to the visual spectrum

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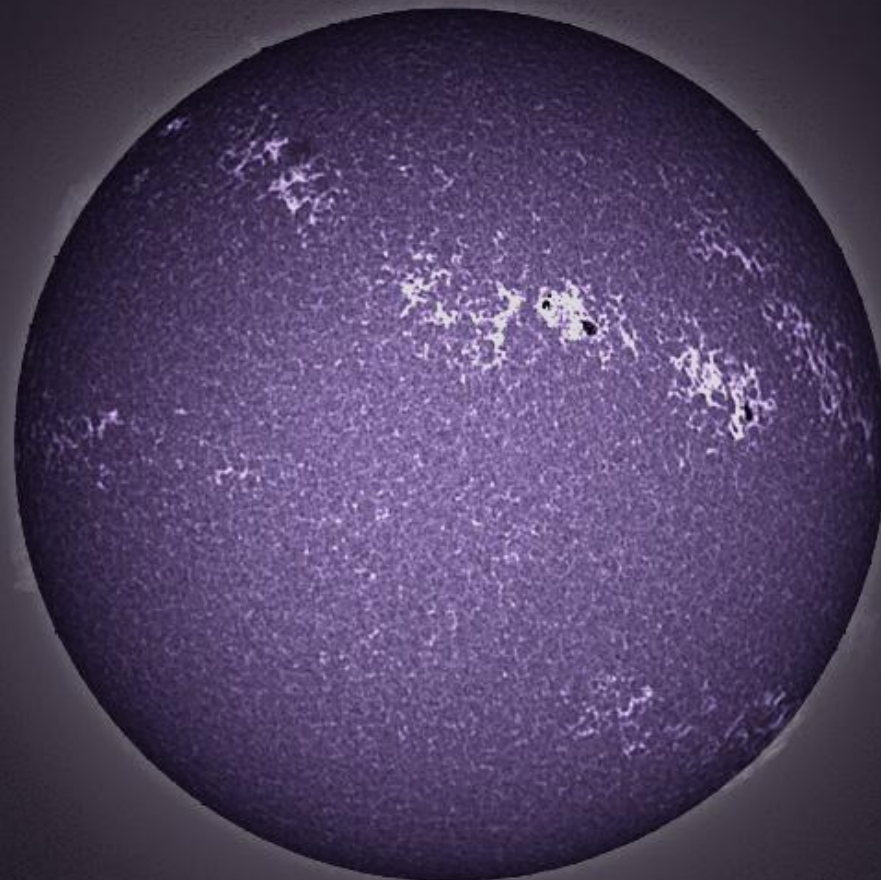
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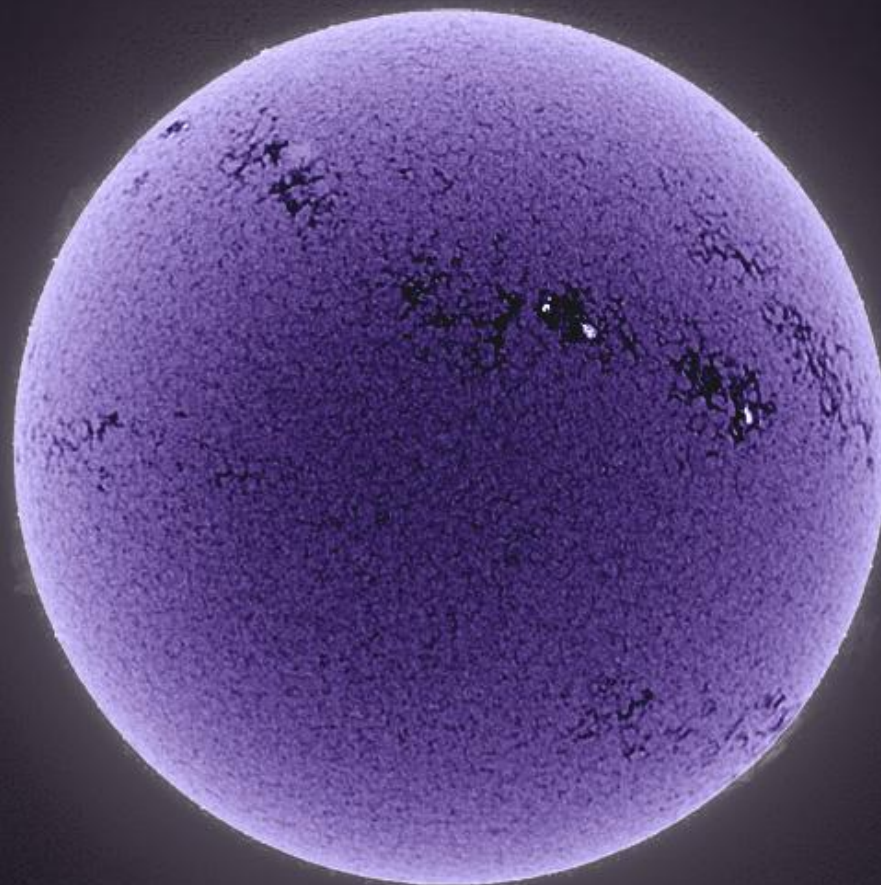
of the Atlanta Astronomy Club



Sun, AR1176, 83, 84 2011-04-04 14:52UT CR2108 PST-CaK, DMK41AU02.AS Theo Ramakers, Social Circle GA

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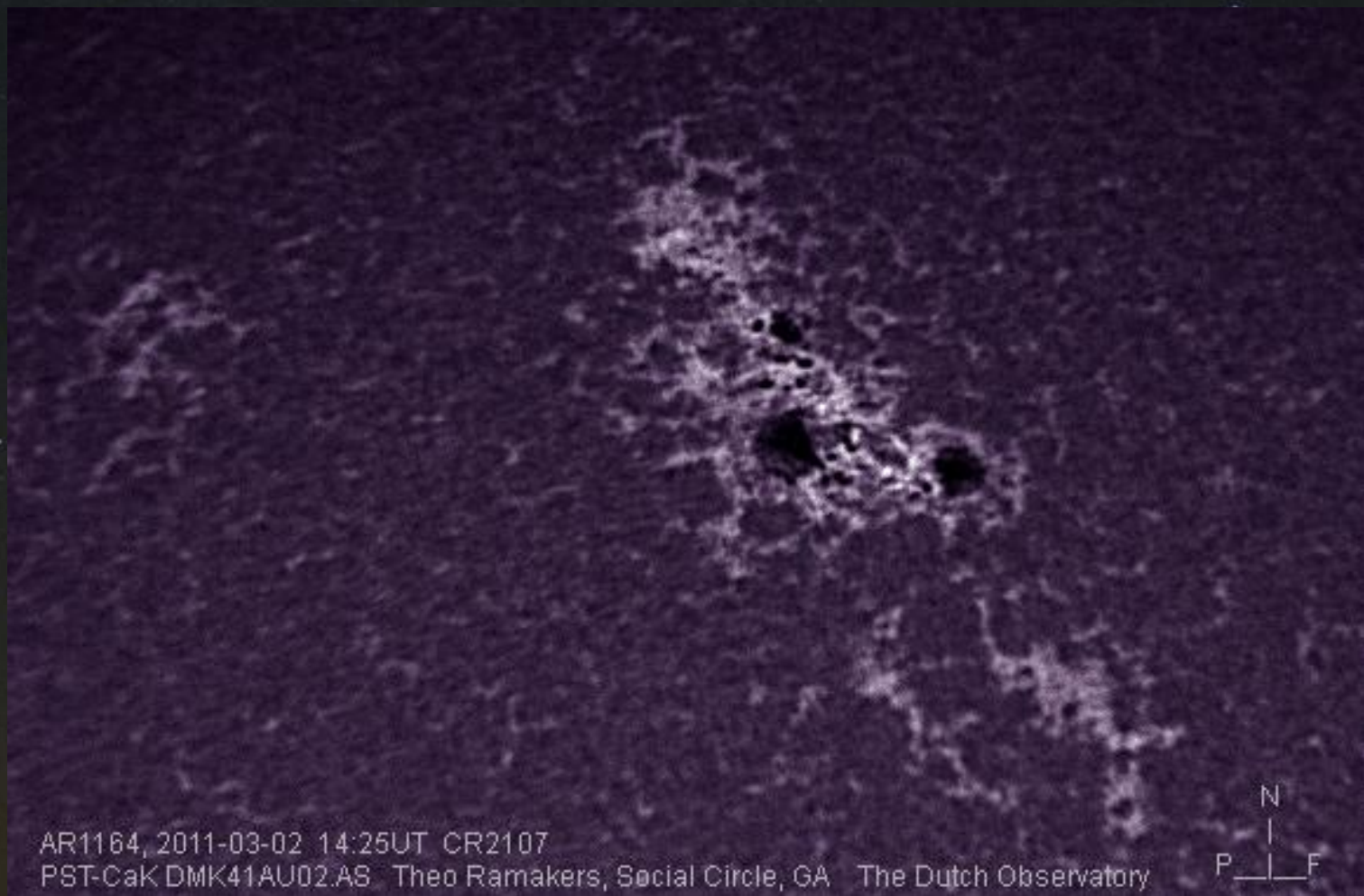
of the Atlanta Astronomy Club



Sun, AR1176, 83, 84 2011-04-04 14:52UT CR2108 PST-CaK, DMK41AU02.AS Theo Ramakers, Social Circle GA

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AR1164, 2011-03-02 14:25UT CR2107

PST-CaK DMK41AU02.AS Theo Ramakers, Social Circle, GA The Dutch Observatory





What about imaging?



What about imaging?

I image using the DMK21AU04.AS and DMK41AU02.AS monochrome cameras without any filters.

Use the loss-less codec Y800 in both fields.

Save the videos as AVI.

For the sun I capture between 300-500 frames.

I include camera settings in the file name



What about imaging?





What about imaging?

My standard camera settings for a whole disk image are:

Gamma: 046 Exposure: 625 Gain: 260

For a Prominence image:

Gamma: 158 Exposure: 625 Gain: 260

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Gain:260

Gamma: 046

Exp. Time: 1/625

IC Capture 2.0 - DMx 41AU02.AS (2010291) [50%] [live]

File Device Capture View Window Help

Device DMx 41AU02.AS (2010291) PAL NTSC - NA - Y800 (1280x960) Input - NA - FPS 15.00

Format AVI Codec Y800 Video File C:\...\Sun-N-Ha-158-625-260-0003 11-09-08 <TIME>.avi

Gain 260 Exposure 1/625 sec Gamma 46

DMx 41AU02.AS (2010291) [50%] [live]

Record Video File

Codec AVI Y800

Filename ...Sun-N-Ha-158-625-260-0003 11-09-08

Information Recorded: 0:00:00.0 Frames: 0 Limit: 500

Scale Linear Logarithmic Clip at 1000

Histogram

712858 844 0 127 255

Ready

10:00 AM

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Gain:260

Gamma: 158

Exp. Time: 1/625

IC Capture 2.0 - DMx 41AU02.AS (2010291) [50%] [live]

File Device Capture View Window Help

Device: DMx 41AU02.AS (2010291) PAL NTSC Input: - NA - FPS: 15.00

Format: AVI Codec: Y800 Video File: C:\...\Sun-N-Ha-158-625-260-0003 11-09-08 <TIME>.avi

Gain: 260 Exposure: 1/625 sec Gamma: 158

DMx 41AU02.AS (2010291) [50%] [live]

Record Video File

Codec: AVI Y800

Filename: ...Sun-N-Ha-158-625-260-0003 11-09-08

Information: Recorded: 0:00:00.0 Frames: 0 Limit: 500

Histogram

Scale: Linear Logarithmic Clip at: 1000

Ready

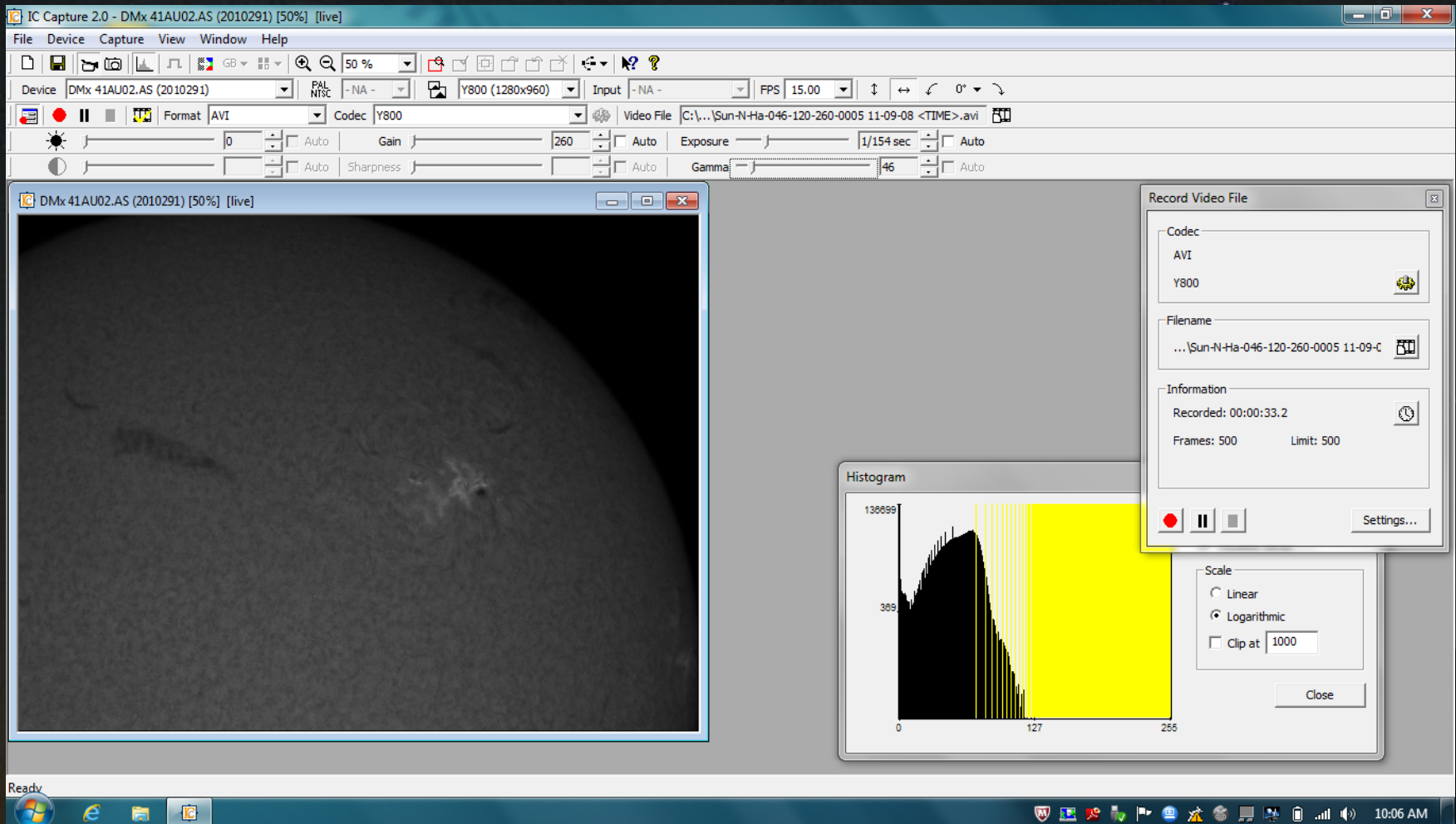
10:00 AM



Gain:260

Gamma: 046

Exp. Time: 1/158



Exposure time 1/154 sec

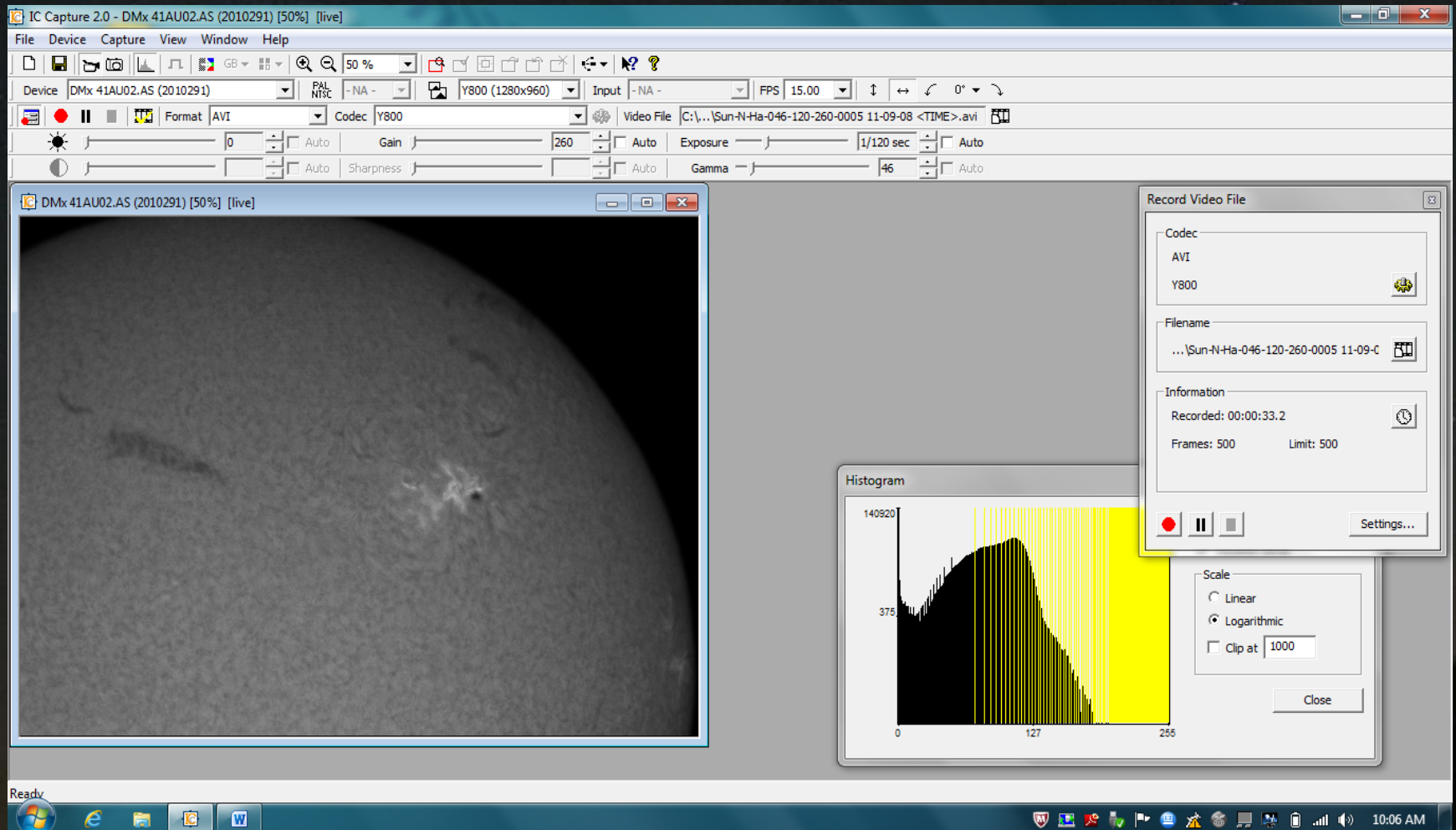
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Gain:260

Gamma: 046

Exp. Time: 1/120



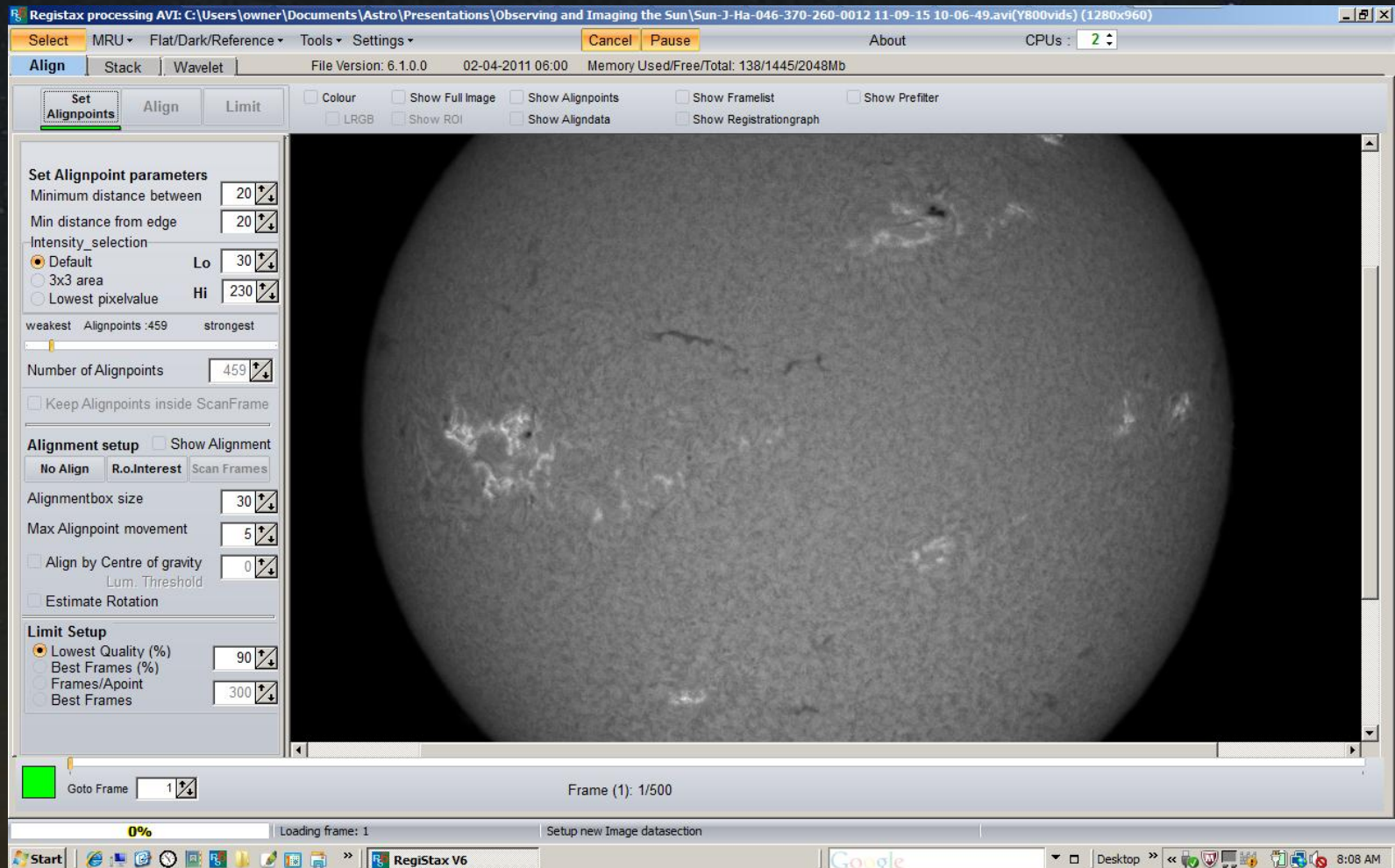
Exposure Time 1/120 sec.



Now I process the videos in Registax Version 6

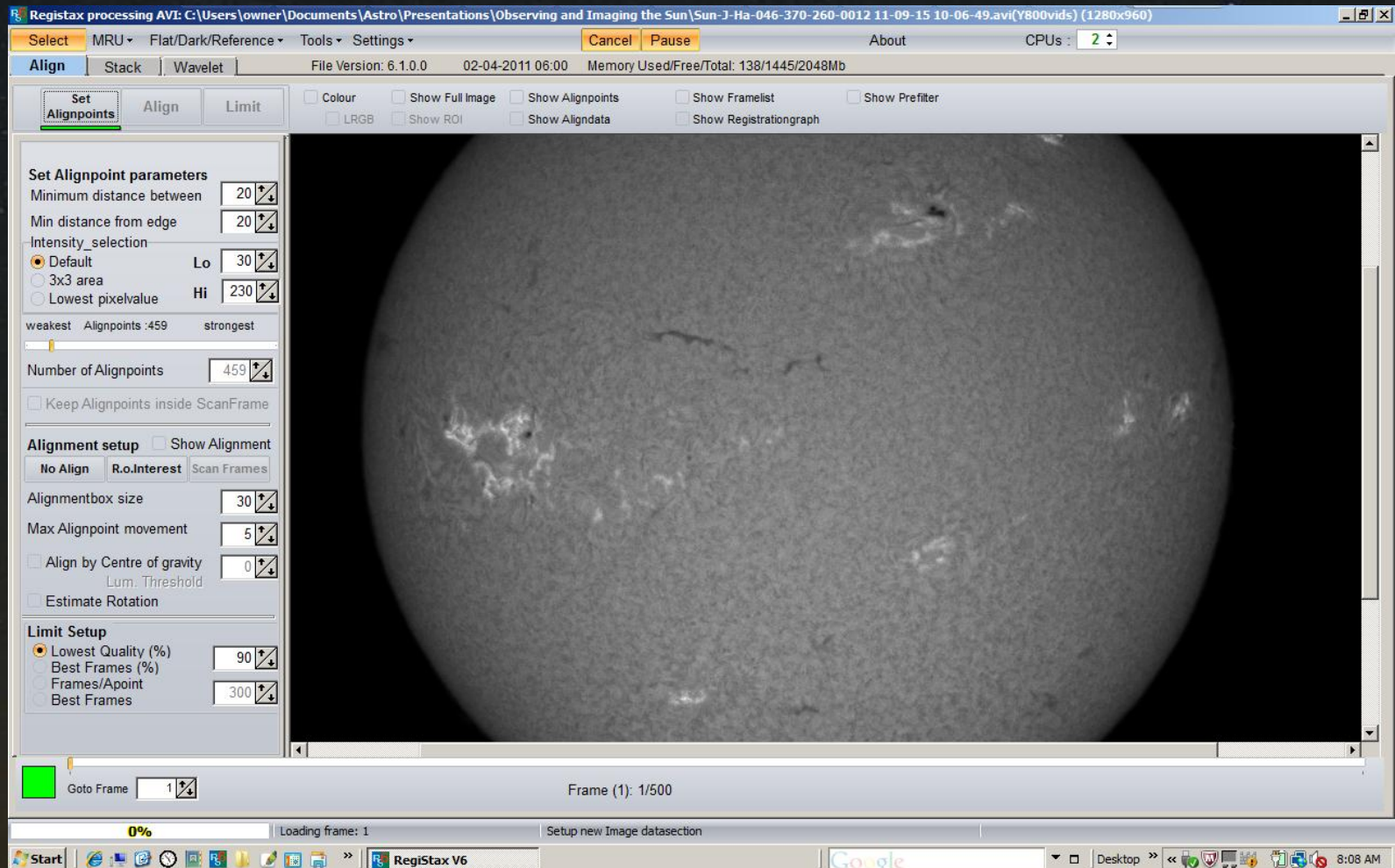


Load the AVI you want to process



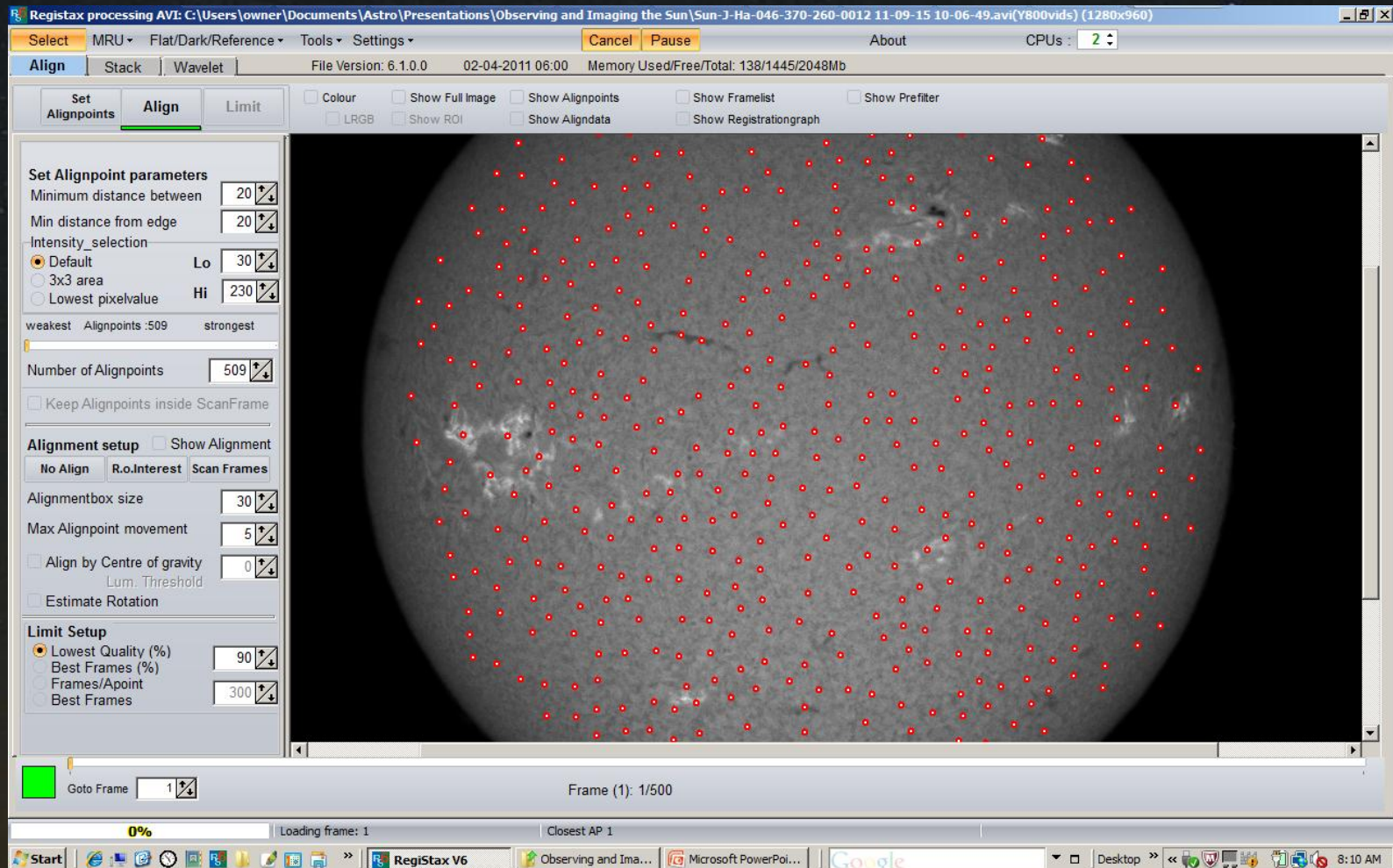
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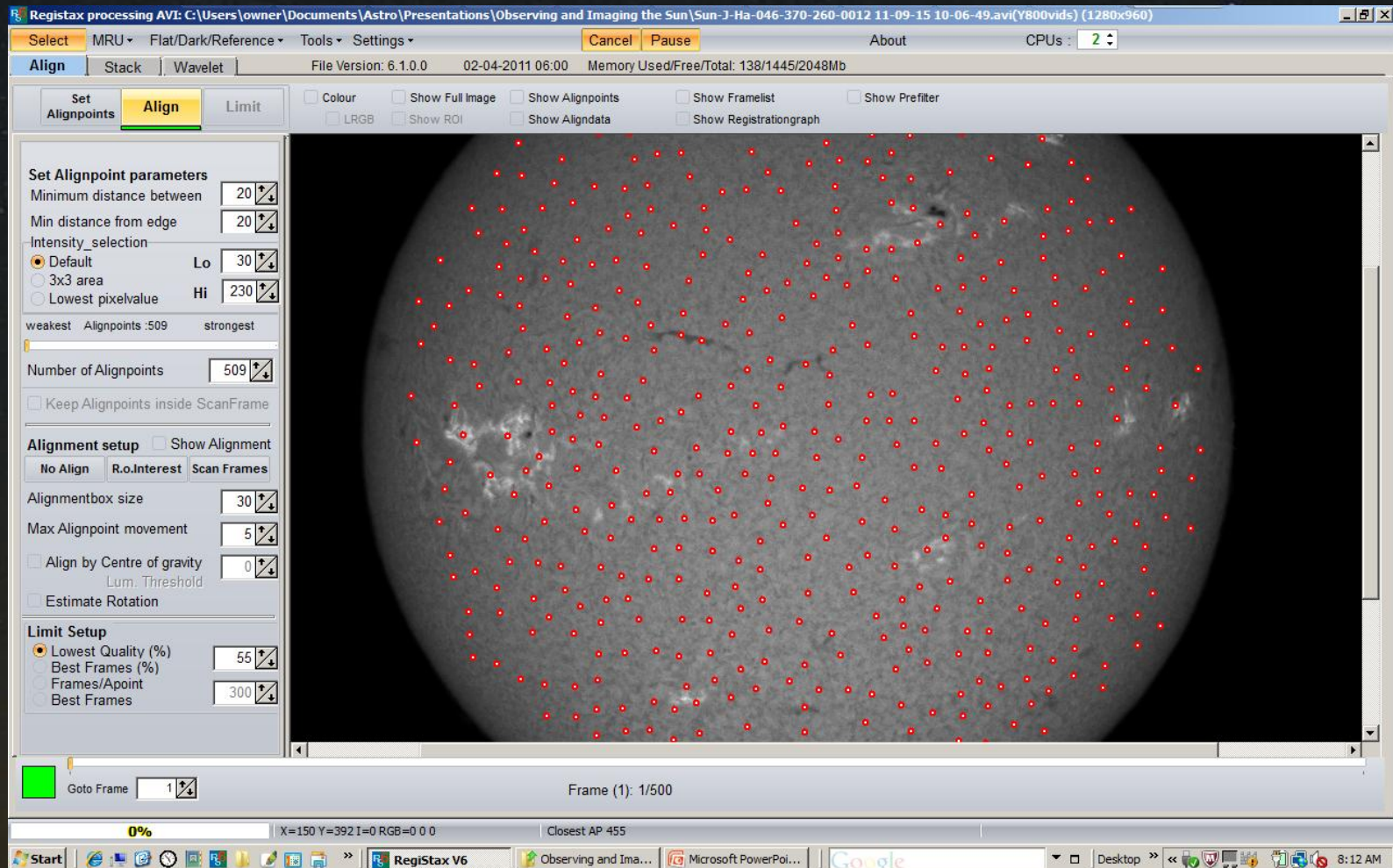


Set the quality to a low value, and select at least 500 – 600 alignment points





If required, change alignment point settings. Hit "Align"



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Registax processing AVI: C:\Users\owner\Documents\Astro\Ppresentations\Observing and Imaging the Sun\Sun-J-Ha-046-370-260-0012 11-09-15 10-06-49.avi(Y800vids) (1280x960)

Select MRU Flat/Dark/Reference Tools Settings Cancel Pause About CPUs: 2

Align Stack Wavelet File Version: 6.1.0.0 02-04-2011 06:00 Memory Used/Free/Total: 159/1422/2048Mb

Set Alignpoints Align Limit

☐ Colour ☐ Show Full Image ☐ Show Alignpoints ☐ Show Framelist ☐ Show Prefilter
☐ LRGB ☐ Show ROI ☐ Show Aligndata ☐ Show Registrationgraph

Set Alignpoint parameters

Minimum distance between 20

Min distance from edge 20

Intensity selection

☒ Default Lo 30

☐ 3x3 area Hi 230

☐ Lowest pixelvalue

weakest Alignpoints: 509 strongest

Number of Alignpoints 509

☐ Keep Alignpoints inside ScanFrame

Alignment setup ☐ Show Alignment

No Align R.o.Interest Scan Frames

Alignmentbox size 30

Max Alignpoint movement 5

☐ Align by Centre of gravity Lum. Threshold 0

☐ Estimate Rotation

Limit Setup

☒ Lowest Quality (%) 55

☐ Best Frames (%)

☐ Frames/Apoint 300

☐ Best Frames

Goto Frame 1

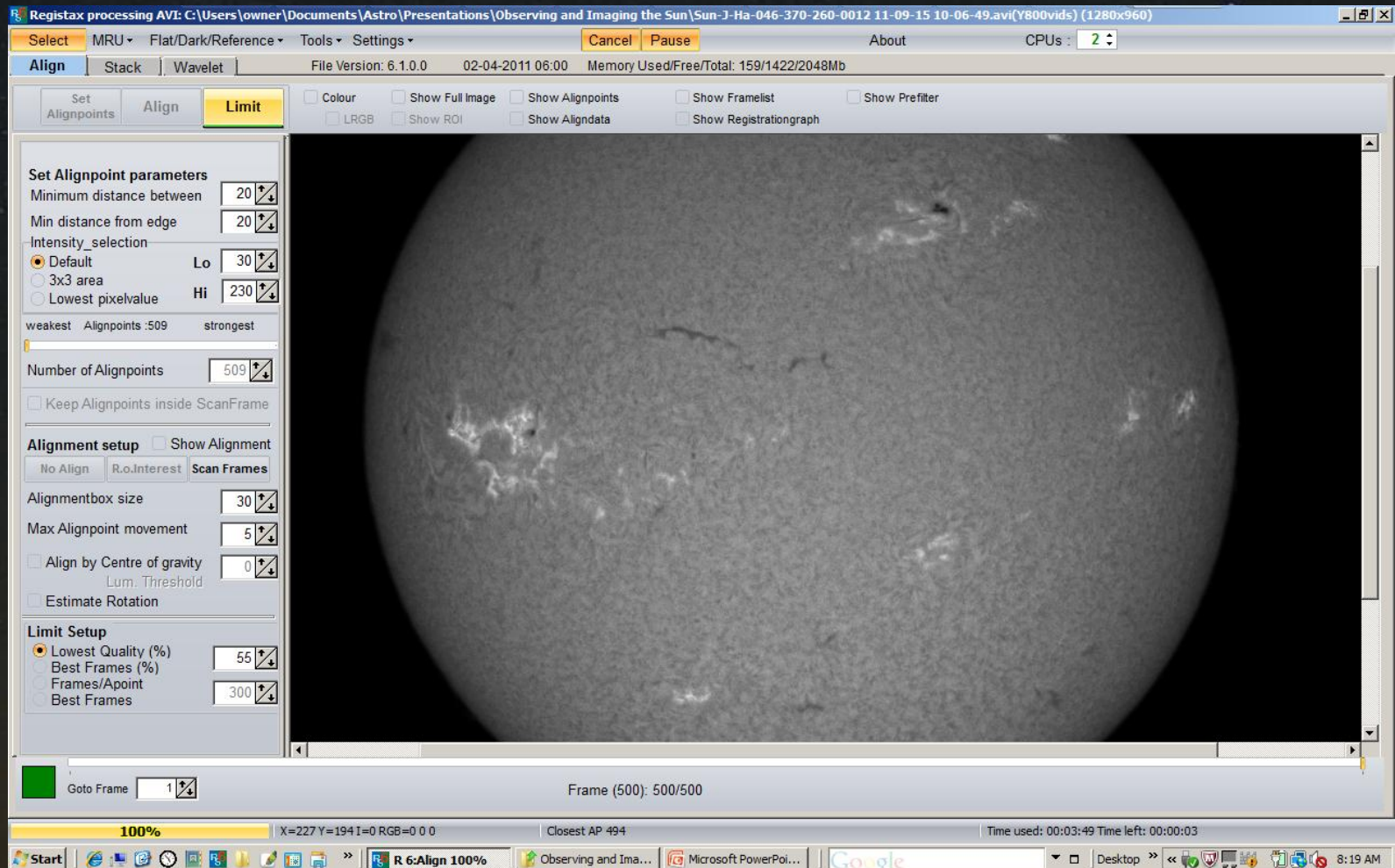
Frame (500): 500/500

100% X=220 Y=740 I=0 RGB=0 0 0 R 6:Align 100% Closest AP 427 Time used: 00:03:49 Time left: 00:00:03

Start R 6:Align 100% Observing and Ima... Microsoft PowerPo... Google Desktop 8:18 AM



When finished select “Limit”. Then activate the “Show Stack graph checkbox”

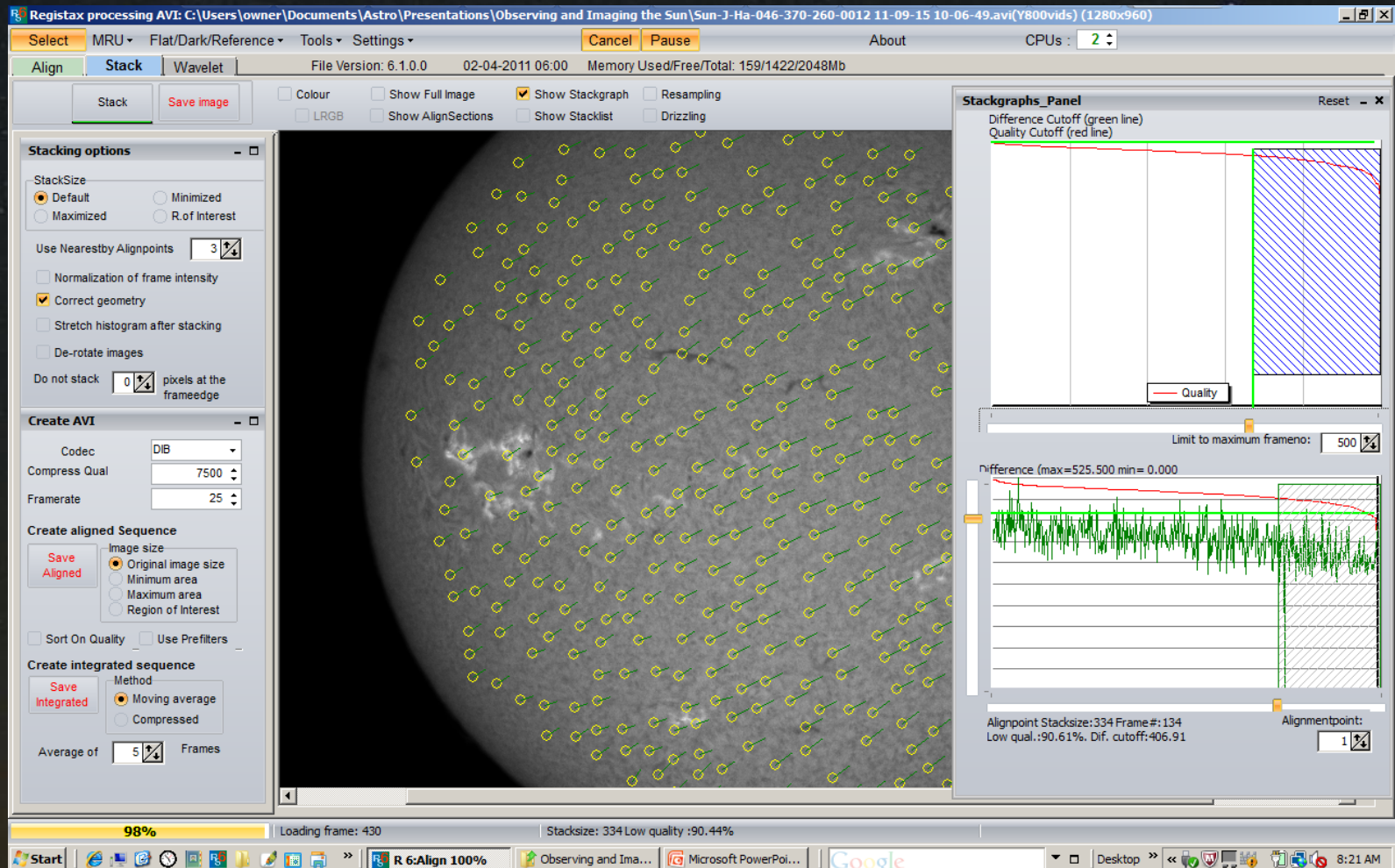


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Move the levers for Quality and Difference to the desired level



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I stack 250-300 frames (approx 60%) Depress the “Stack” Button

Registax processing AVI: C:\Users\owner\Documents\Astro\Presentations\Observing and Imaging the Sun\Sun-J-Ha-046-370-260-0012 11-09-15 10-06-49.avi(Y800vids) (1280x960)

Select MRU Flat/Dark/Reference Tools Settings Cancel Pause About CPUs: 2

Align Stack Wavelet File Version: 6.1.0.0 02-04-2011 06:00 Memory Used/Free/Total: 159/1422/2048Mb

Stack Save image Colour Show Full Image Show Stackgraph Resampling LRGB Show AlignSections Show Stacklist Drizzling

Stacking options

StackSize
☒ Default ☐ Minimized
☐ Maximized ☐ R.o.f Interest

Use Nearestby Alignpoints 3

☐ Normalization of frame intensity
☒ Correct geometry
☐ Stretch histogram after stacking
☐ De-rotate images

Do not stack 0 pixels at the frameedge

Create AVI

Codec DIB
Compress Qual 7500
Framerate 25

Create aligned Sequence

Save Aligned
Image size
☒ Original image size
☐ Minimum area
☐ Maximum area
☐ Region of Interest

☐ Sort On Quality ☐ Use Prefilters

Create integrated sequence

Save Integrated
Method
☒ Moving average
☐ Compressed

Average of 5 Frames

Stackgraphs_Panel Reset

Difference Cutoff (green line)
Quality Cutoff (red line)

Limit to maximum frameno: 500

Difference (max=525.500 min= 0.000)

Alignpoint Stacksiz:334 Frame#:134
Low qual.:90.61% Dif. cutoff:406.91

Alignmentpoint: 1

98% Loading frame: 430 Stacksize: 334 Low quality :90.44%

Start R6:Align 100% Observing and Ima... Microsoft PowerPo... Google Desktop 8:21 AM

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When Stacking is finished select “Save Image” and save as TIFF file

Registax processing AVI: C:\Users\owner\Documents\Astro\Presentations\Observing and Imaging the Sun\Sun-J-Ha-046-370-260-0012 11-09-15 10-06-49.avi(Y800vids) (1280x960)

Select MRU Flat/Dark/Reference Tools Settings Cancel Pause About CPUs: 2

Align Stack Wavelet File Version: 6.1.0.0 02-04-2011 06:00 Memory Used/Free/Total: 208/1373/2048Mb

Stack Save image Colour Show Full Image Show Stackgraph Resampling LRGB Show AlignSections Show Stacklist Drizzling

Stacking options

StackSize

☒ Default ☐ Minimized ☐ Maximized ☐ R.o.f Interest

Use Nearestby Alignpoints 3/4

☐ Normalization of frame intensity

☒ Correct geometry

☐ Stretch histogram after stacking

☐ De-rotate images

Do not stack 0/4 pixels at the frameedge

Create AVI

Codec DIB

Compress Qual 7500

Framerate 25

Create aligned Sequence

Save Aligned

Image size

☒ Original image size ☐ Minimum area ☐ Maximum area ☐ Region of Interest

☐ Sort On Quality ☐ Use Prefilters

Create integrated sequence

Save Integrated

Method

☒ Moving average ☐ Compressed

Average of 5/4 Frames

Stack size (n=487) - (1280x960)

Stacksize: 334 Low quality :90.44%

Time used: 00:02:50 Time left: 00:00:11

Stackgraphs_Panel

Reset

Difference Cutoff (green line)

Quality Cutoff (red line)

Limit to maximum frameno: 500

Difference (max=525.500 min= 0.000)

Alignpoint Stacksizes:334 Frame#:134

Low qual.:90.61% Dif. cutoff:406.91

Alignmentpoint: 1/4

100%

Start R 6:Stack ... Observing a... AutoPlay Microsoft Po... Google Desktop 8:27 AM

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Click Wavelet button and adjust wavelettes according to your taste

Registax processing TIFs: C:\Users\owner\Documents\Astro\Presentations\Observing and Imaging the Sun\Sun-J-Ha-046-455-260-0014 11-09-15 10-09-13.tif

Select MRU Flat/Dark/Reference Tools Settings Cancel Pause About CPUs: 2

Align Stack Wavelet File Version: 6.1.0.0 02-04-2011 06:00 Memory Used/Free/Total: 146/1454/2048Mb

Process Do All Save image Realign_with Processed Stack Again Show Full Image Show Processing Area Show AlignPoints

Wavelets Reset Wavelets

☐ Automatic
☐ Hold Wavelet Setting

Waveletscheme
☐ Dyadic (2^n) ☒ Linear

Initial Layer: 1 Step Increment: 0

Wavelet filter
☐ Default ☒ Gaussian

☐ Use Linked Wavelets

Denoise Sharpen Preview

Layer	Denoise	Sharpen	Preview
1	0.00	0.100	12.8
2	0.00	0.100	37.4
3	0.00	0.100	17.1
4	0.00	0.100	1.00
5	0.00	0.100	1.00
6	0.00	0.100	1.00

Available schemes

Load Scheme Save Scheme

Functions

Histogram	Gamma	Colour Mxing
View Zoomed	View Compare	View Stacksize
Flip and Rotate	RGB Align	RGB Balance
Resize Image	Denoise/ Deringing	Wavelet Filter
Masking	Show Linegraph	Cropping Area

Contrast/Brightness Hold Reset

Contrast: 100 Brightness: 0

Copy To Load to Difference

Toggle
☒ Current Image
☐ Clipboard Image

100% layer setting changed X=220 Y=483 Stack=1 RGB=raw(0 0 0)

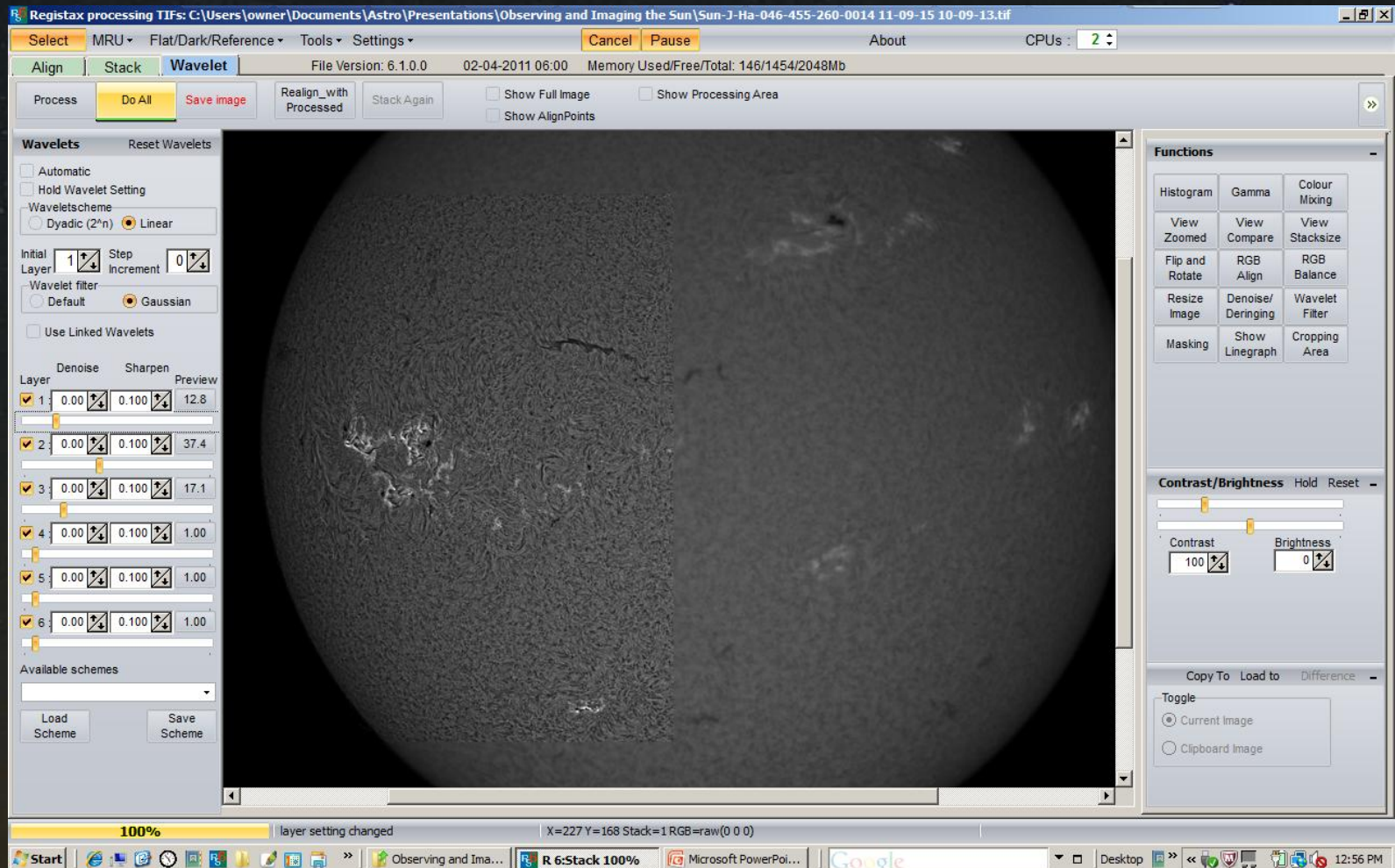
Start CaptureAVI R 6:Stack 100% Google Desktop 12:53 PM

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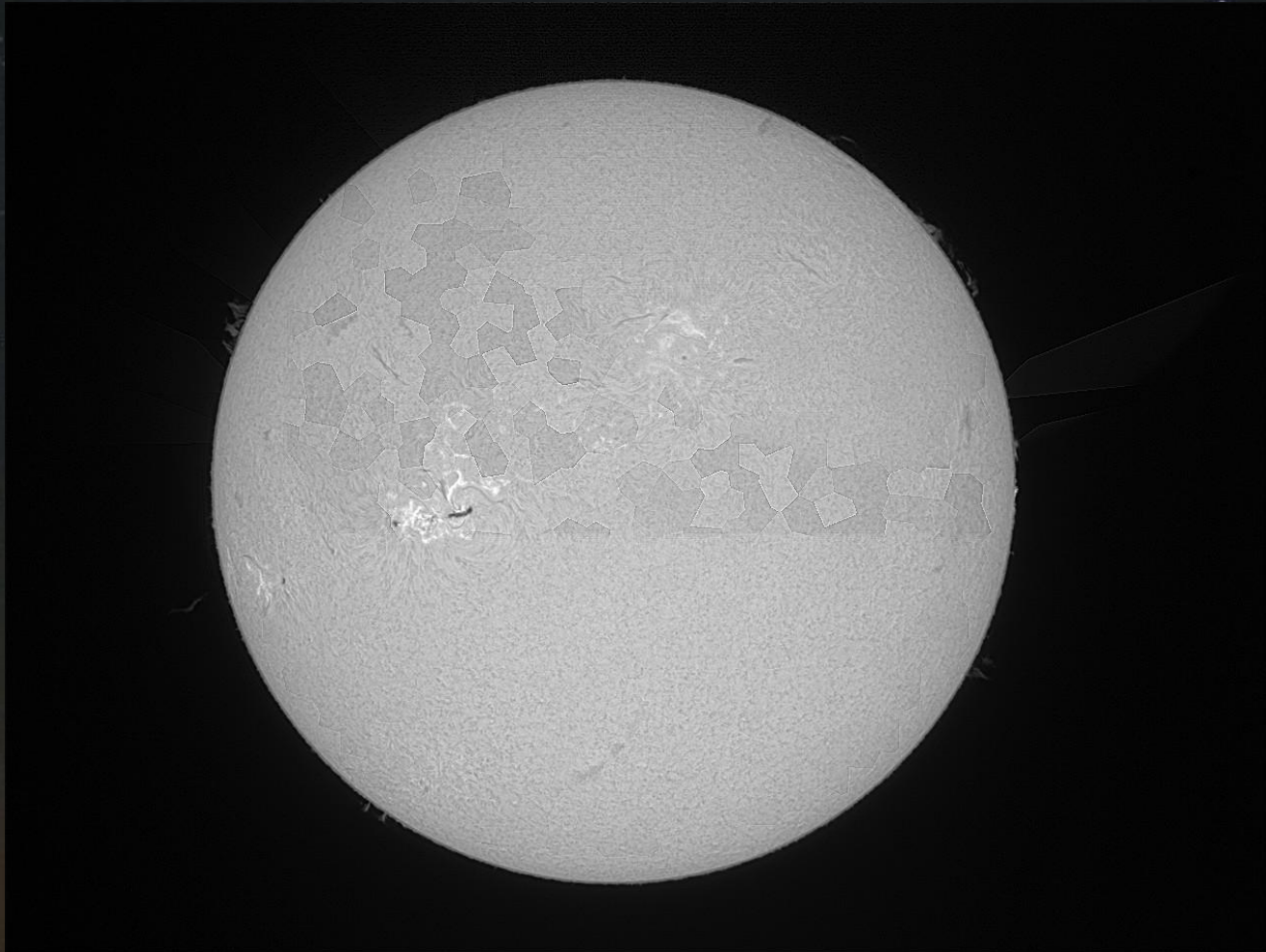


Click Do All and Save the image as a .jpg or .png once completed



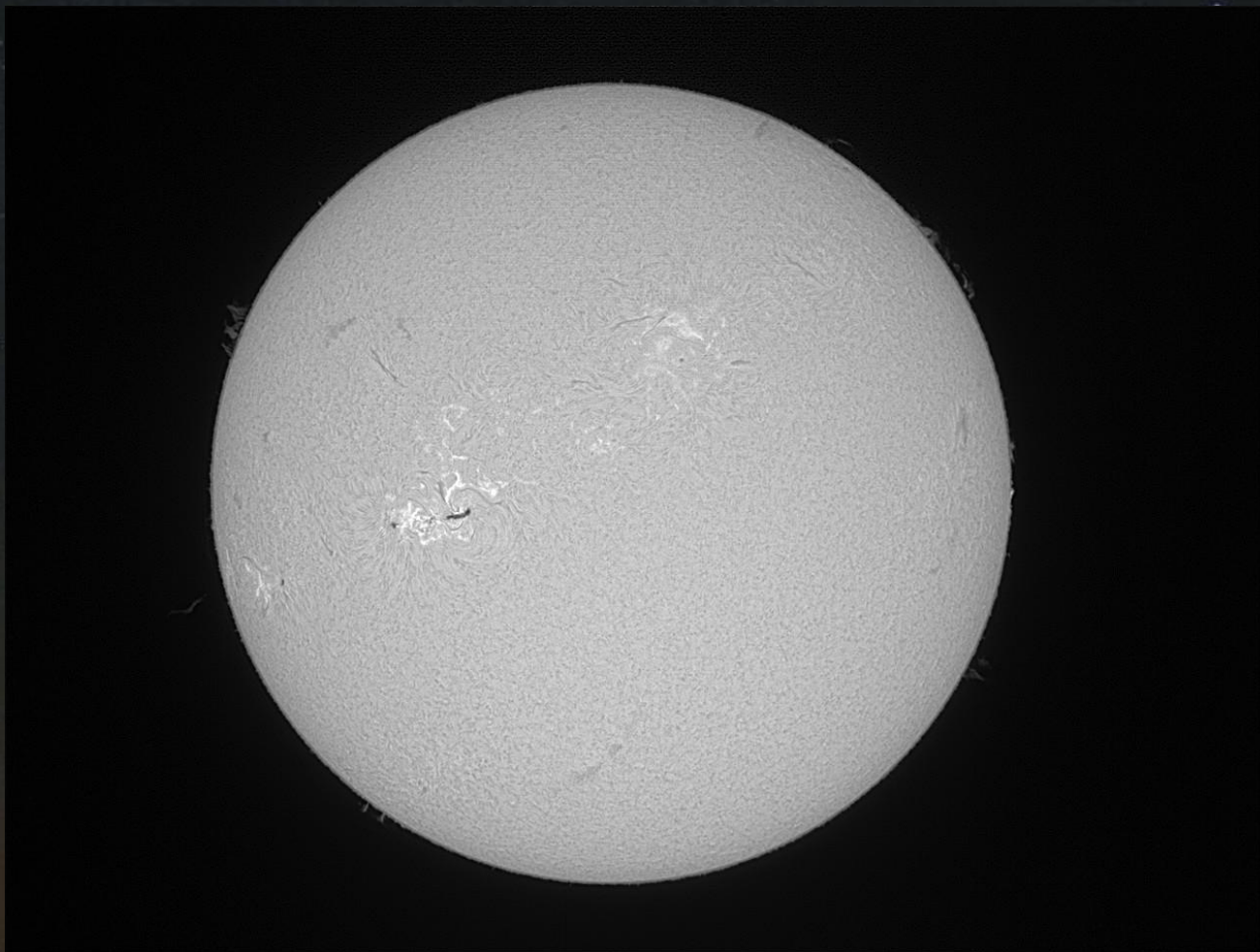


When clouds passed through the image Registax 6 does not work right



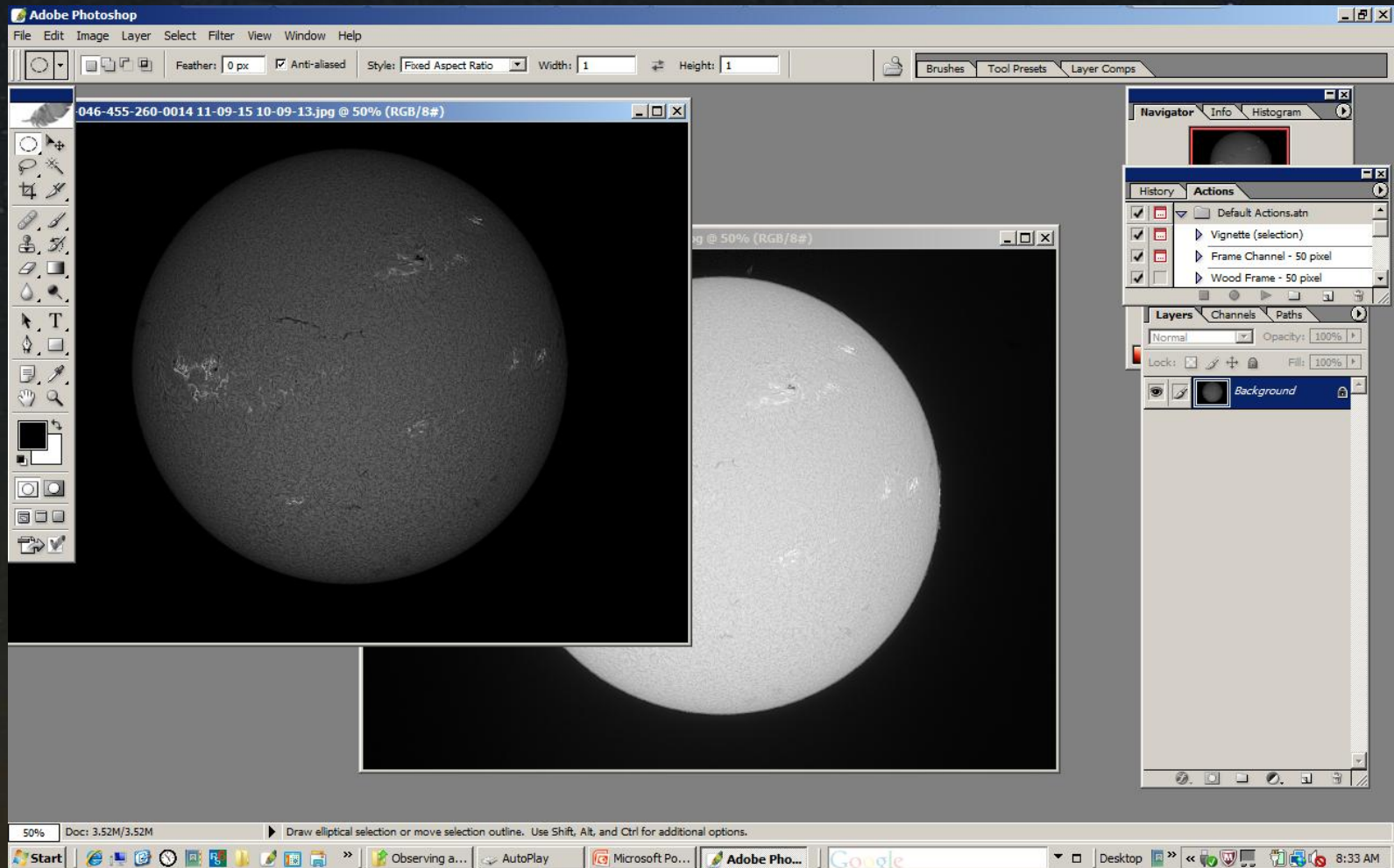


Use Registax Version 5 instead



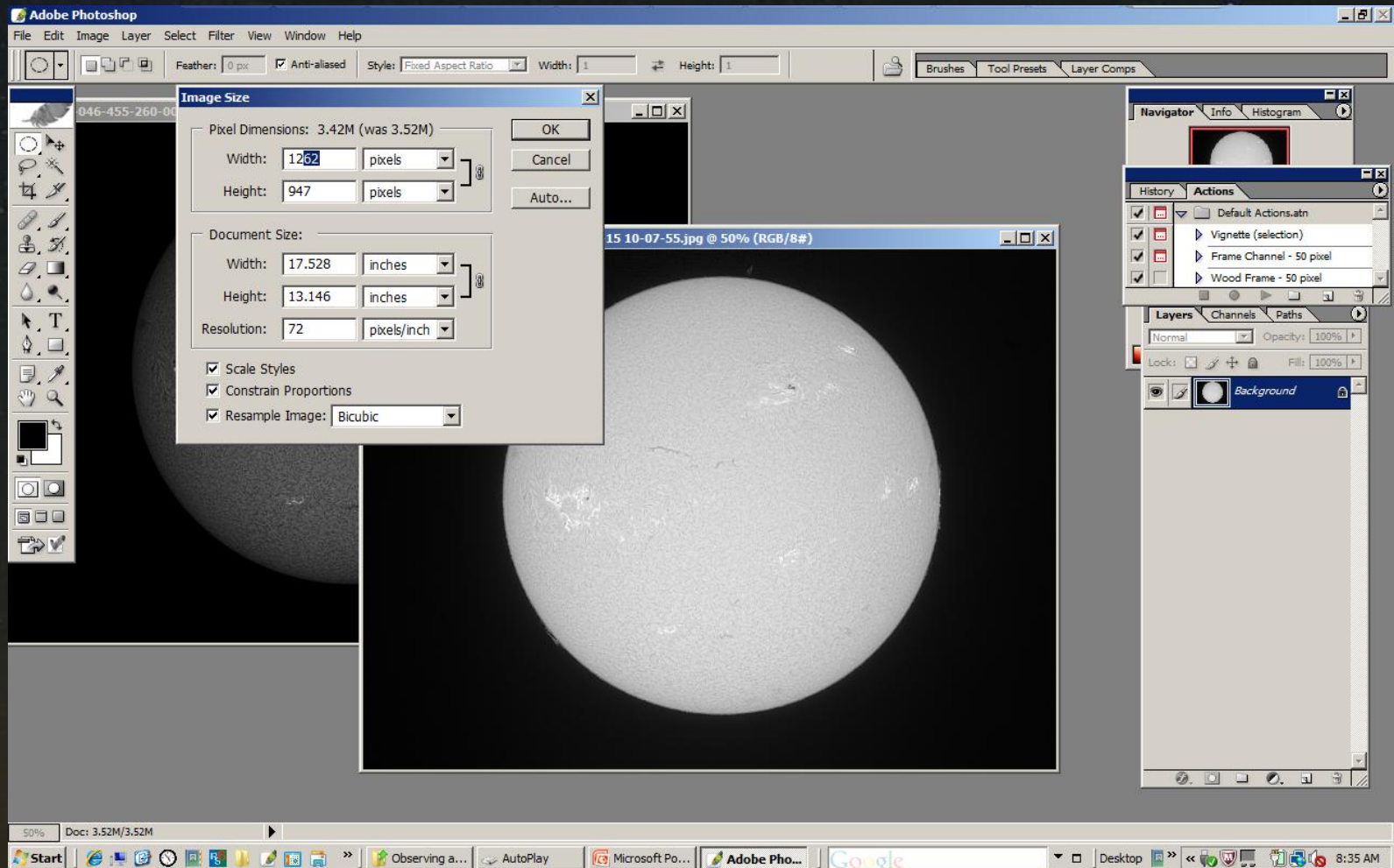


In Photoshop load the solar disk as well as the image showing the limb details





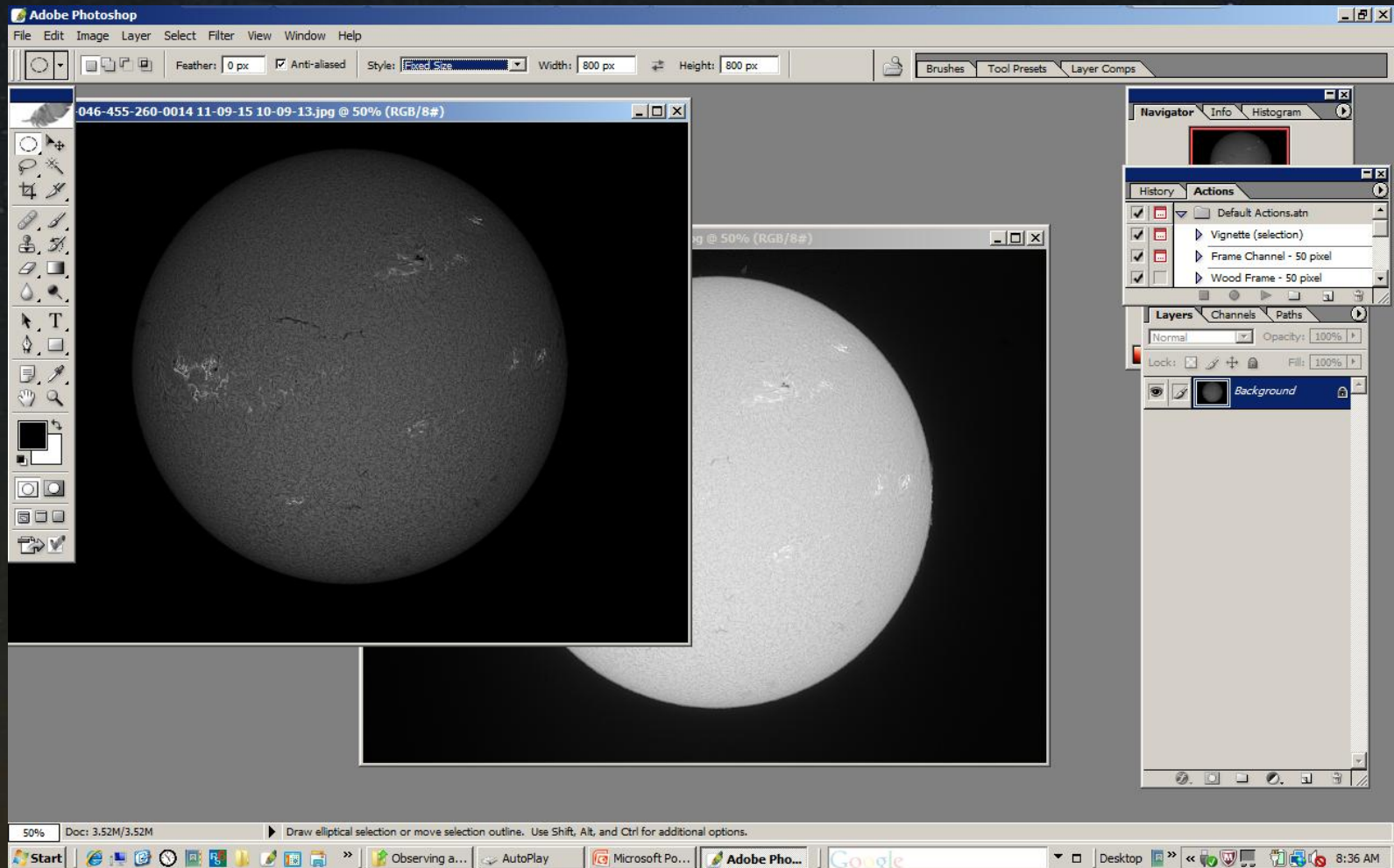
Because the capture program “Bloats” the overexposed image, reduce its size



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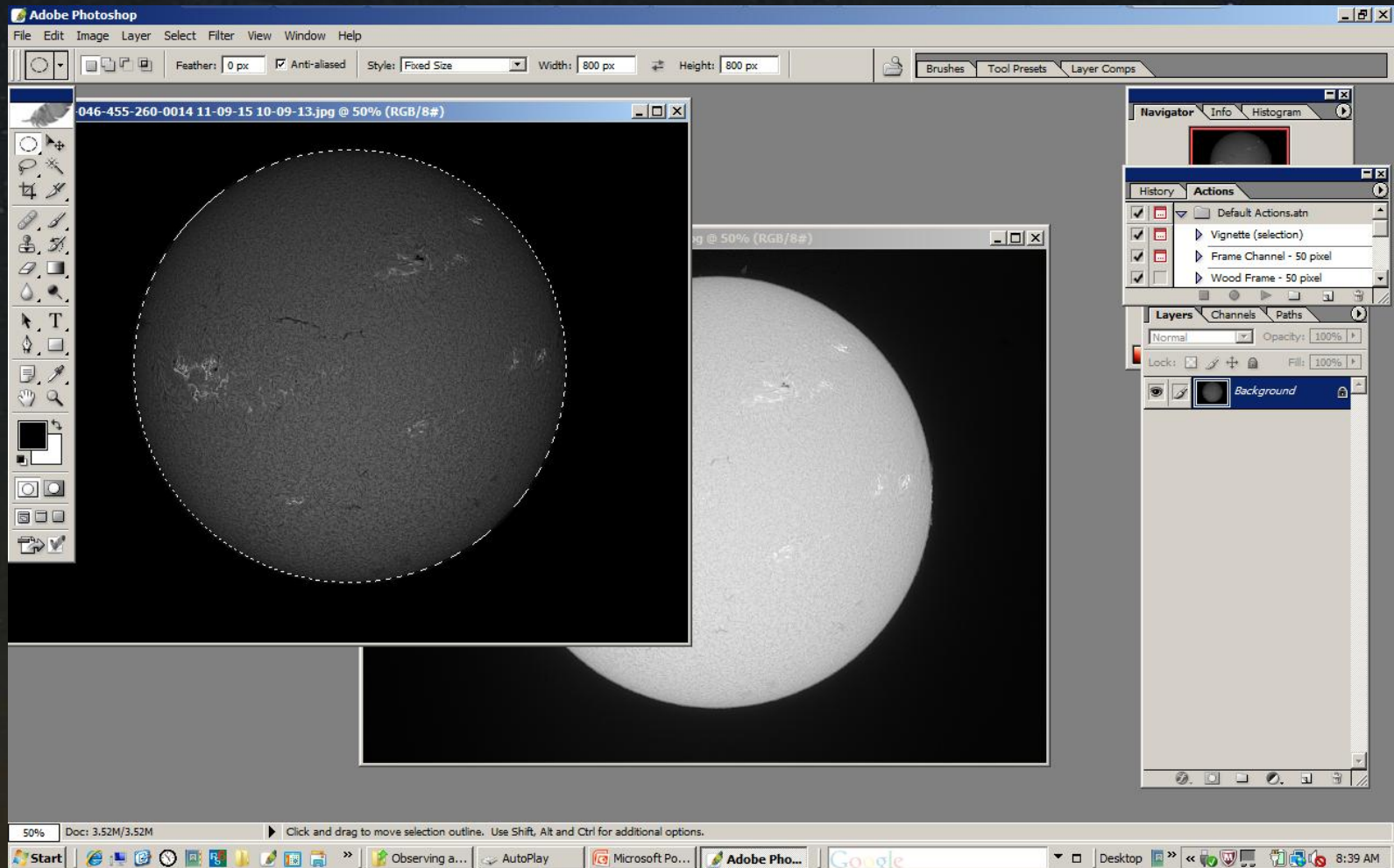
Select the fixed size circle tool and outline exactly the solar disk



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Select the fixed size circle tool and outline exactly the solar disk

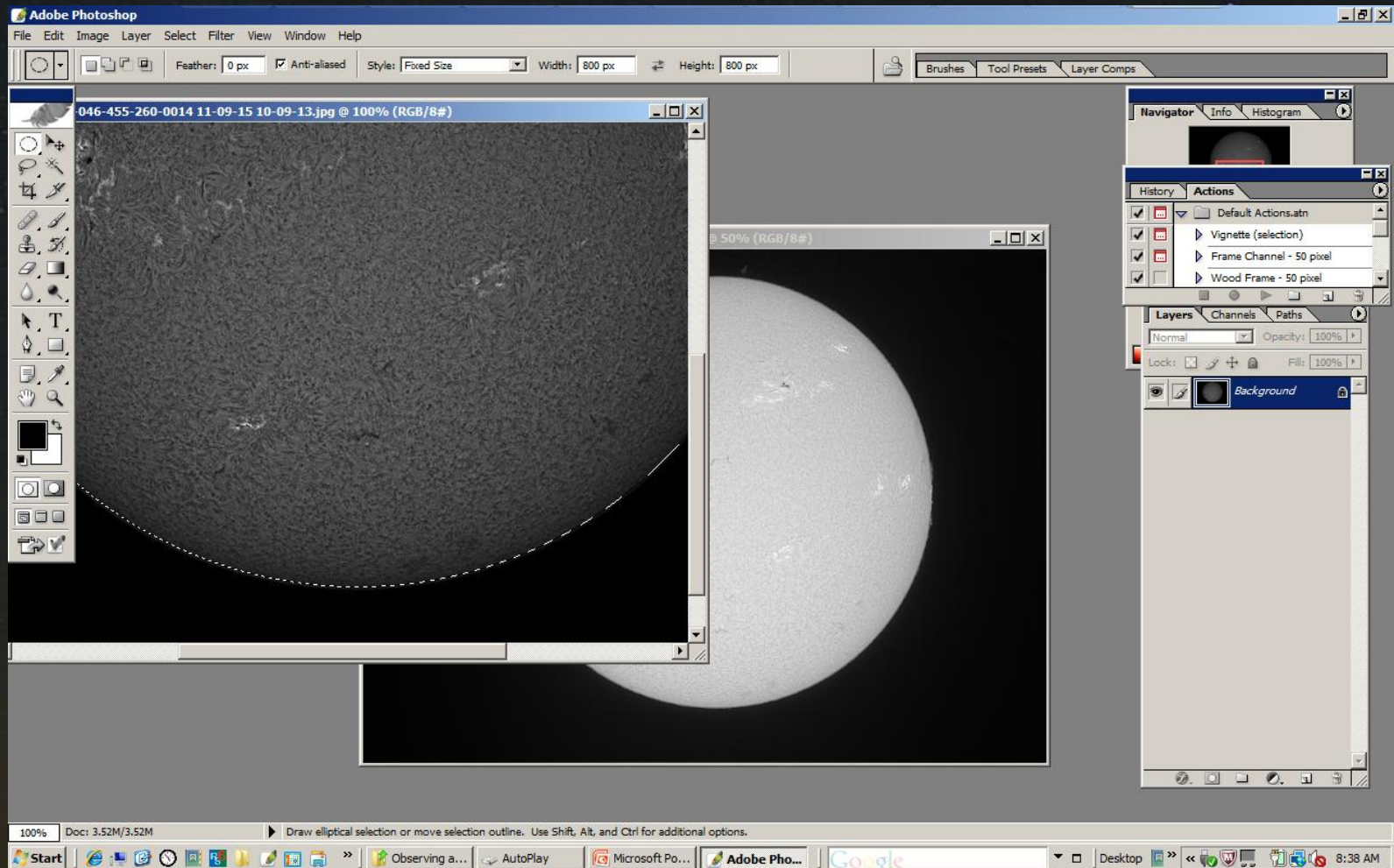


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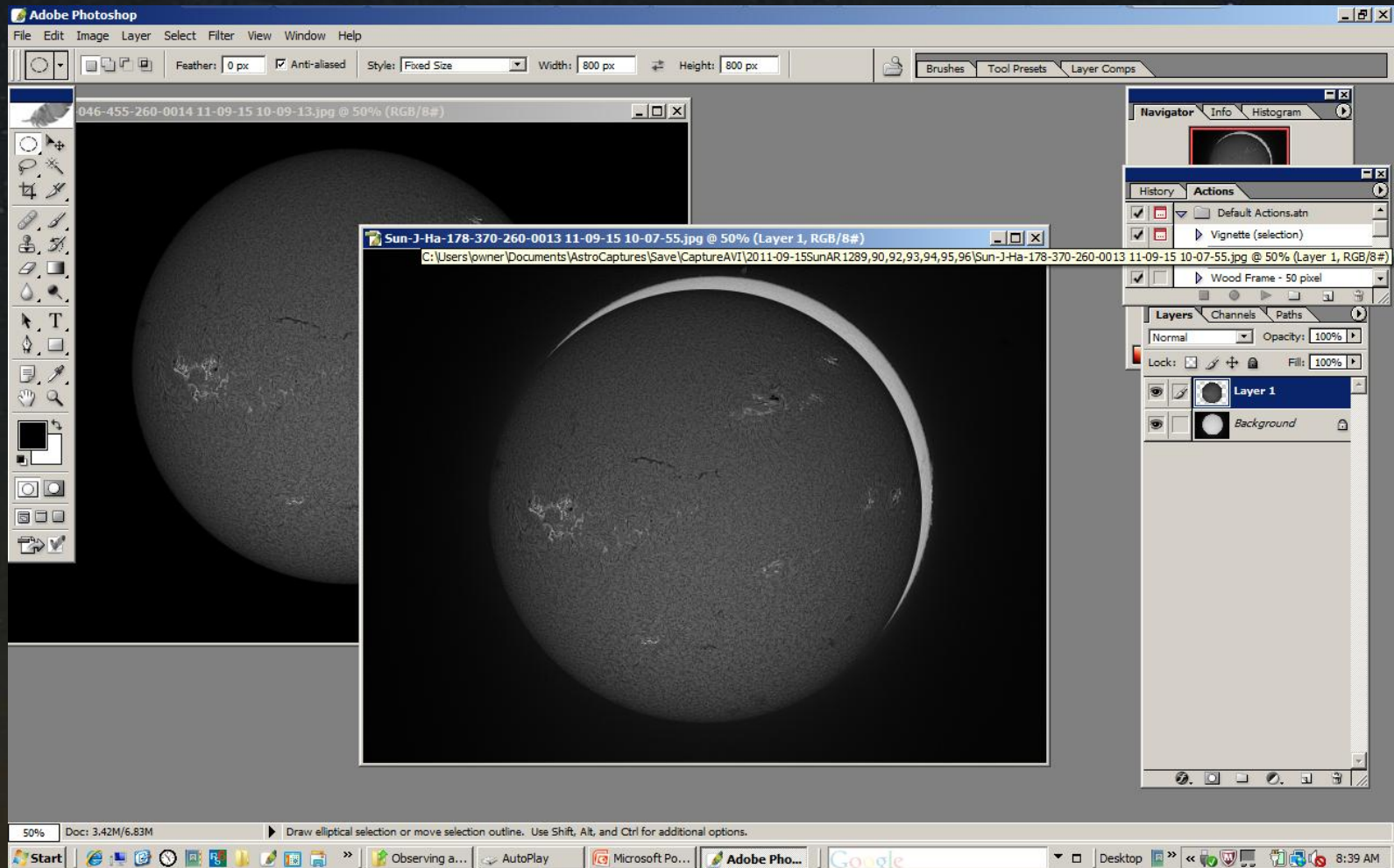


Double check the exact alignment by going to full sized image





When location of the circle is OK, copy image and paste it in the “Limb” image

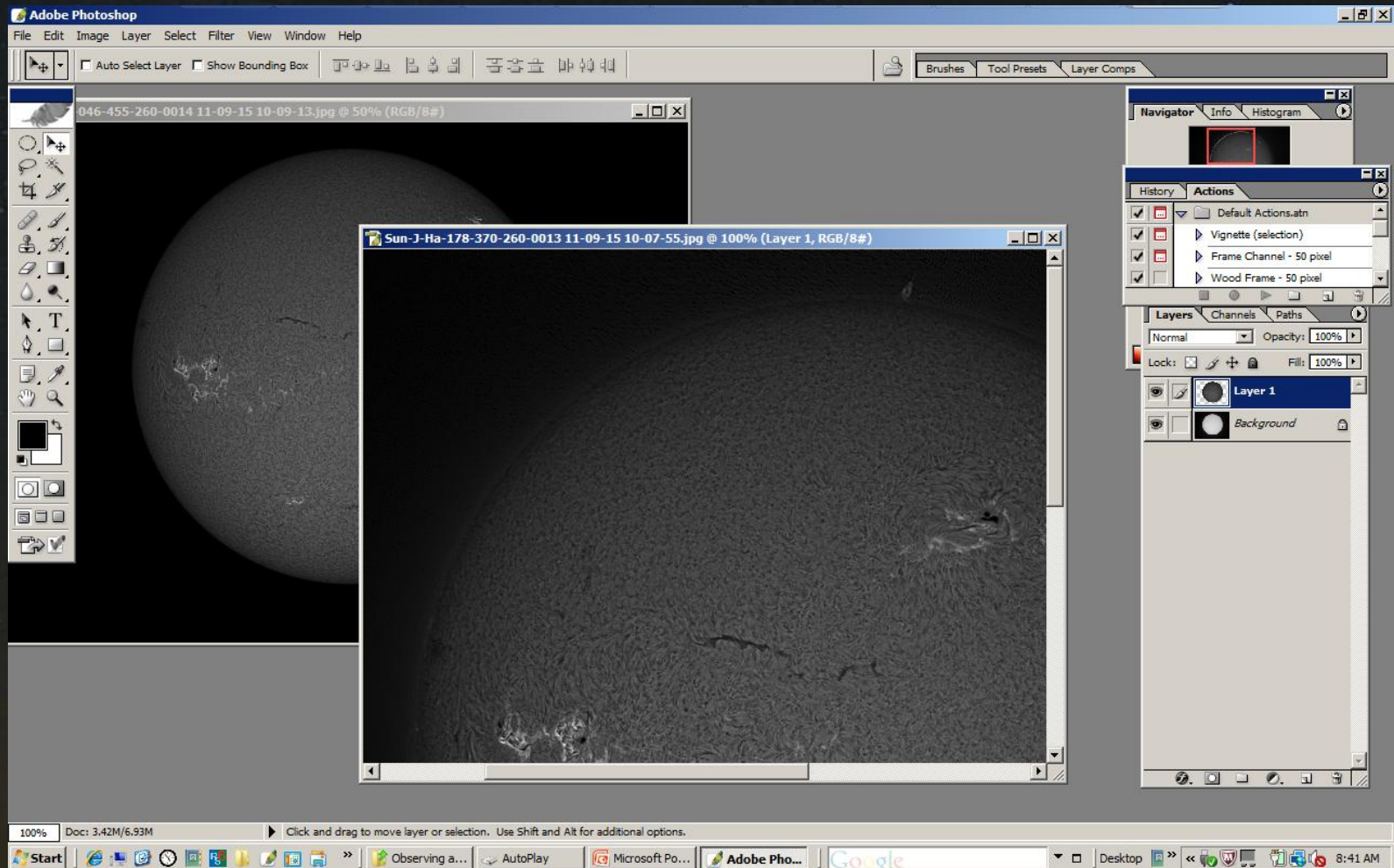


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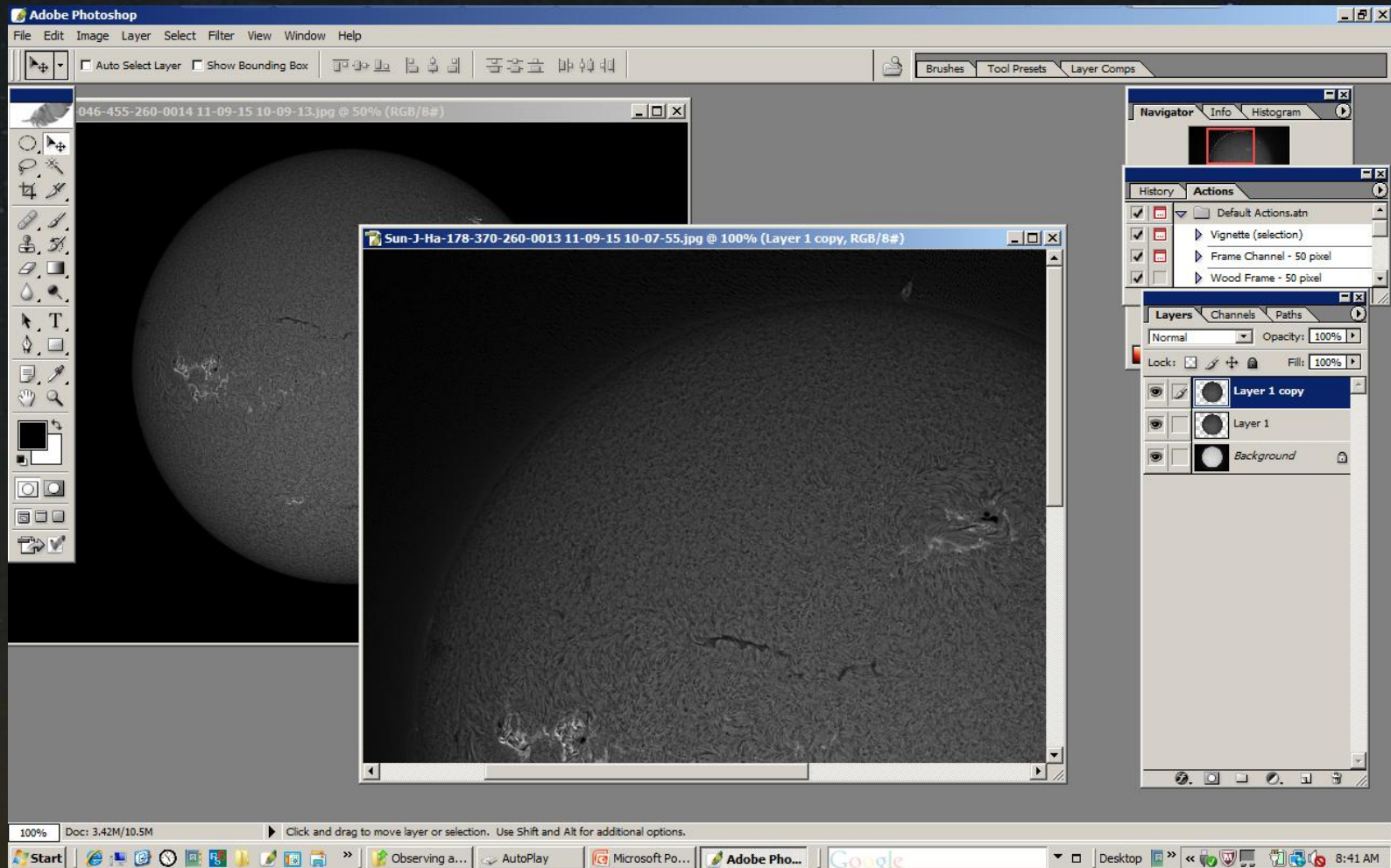
Make sure again that the image fits exactly (Check full size)



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Now make a copy of the disk you just copied on the “Limb” image





Now I generate a Levels and Color Balance clipping layer
For each of the three images.

Adjust the Levels and Color Balance settings according
To your preference.

I use the following color settings:

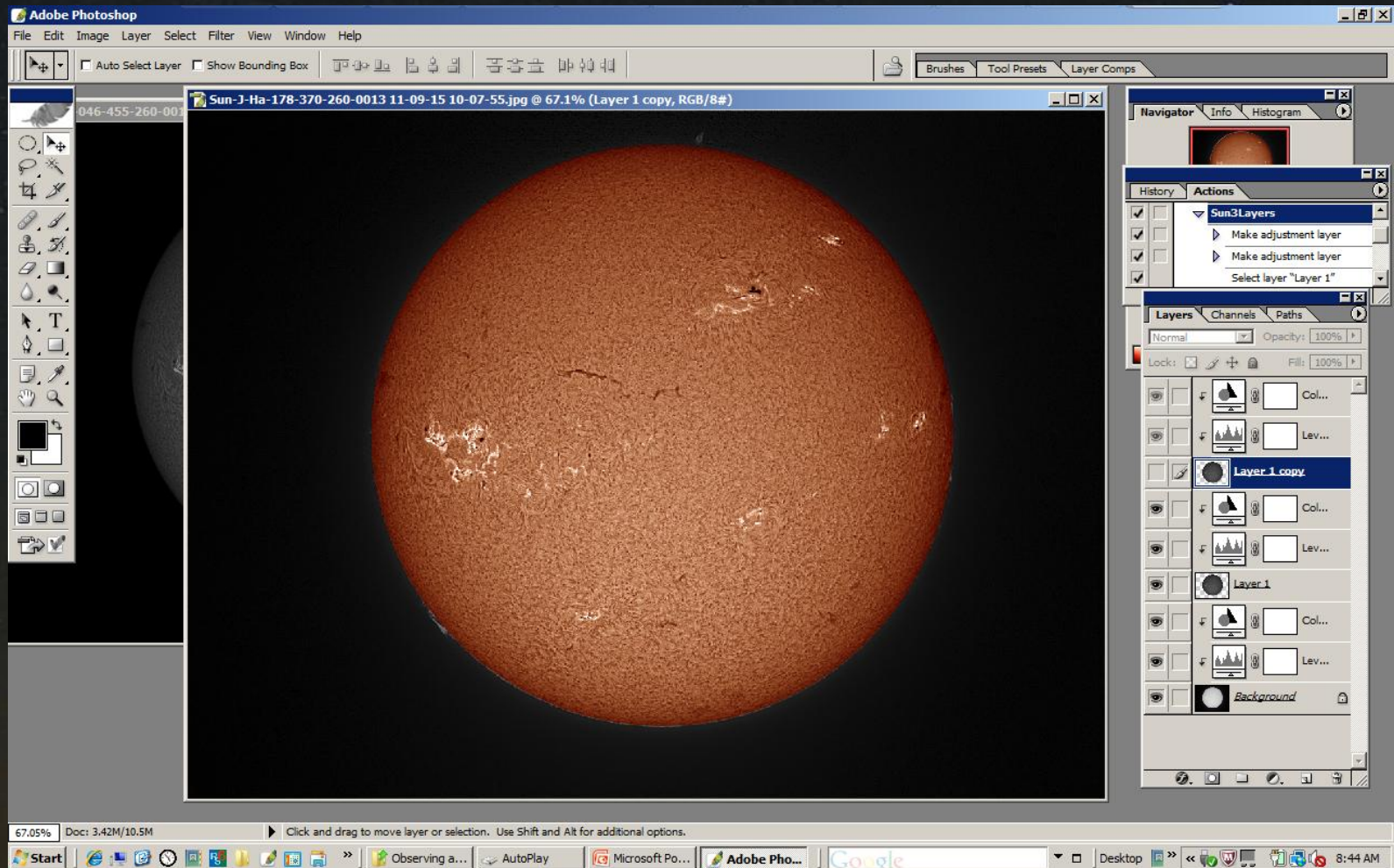
Medium: Red: 61% Blue: -61%

High: Red: 20-25%

Dark: Red: 15-25%



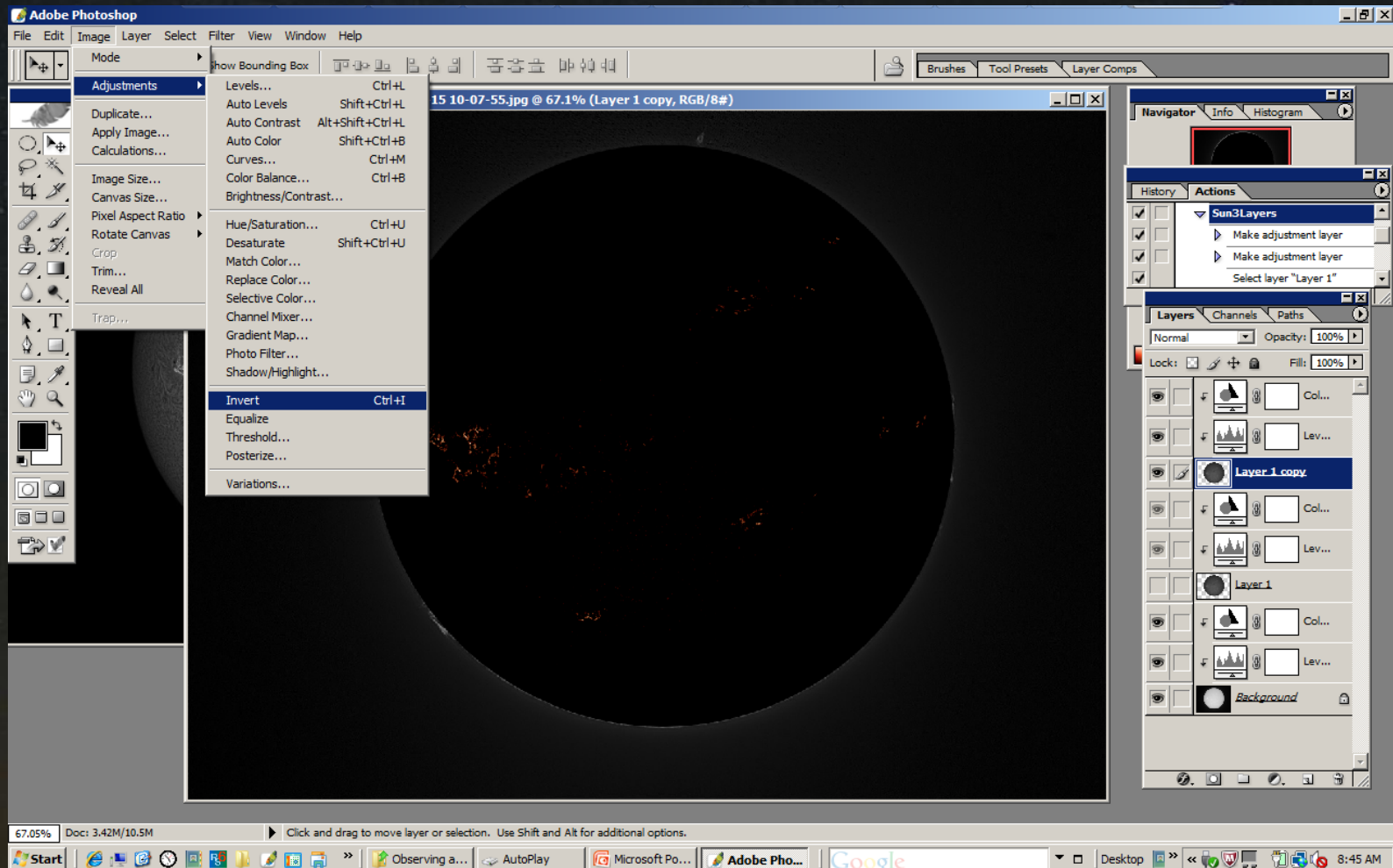
I activate a set of actions to generate the control layers for all three images



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To include an inverted disk image, select the top image in the stack and invert

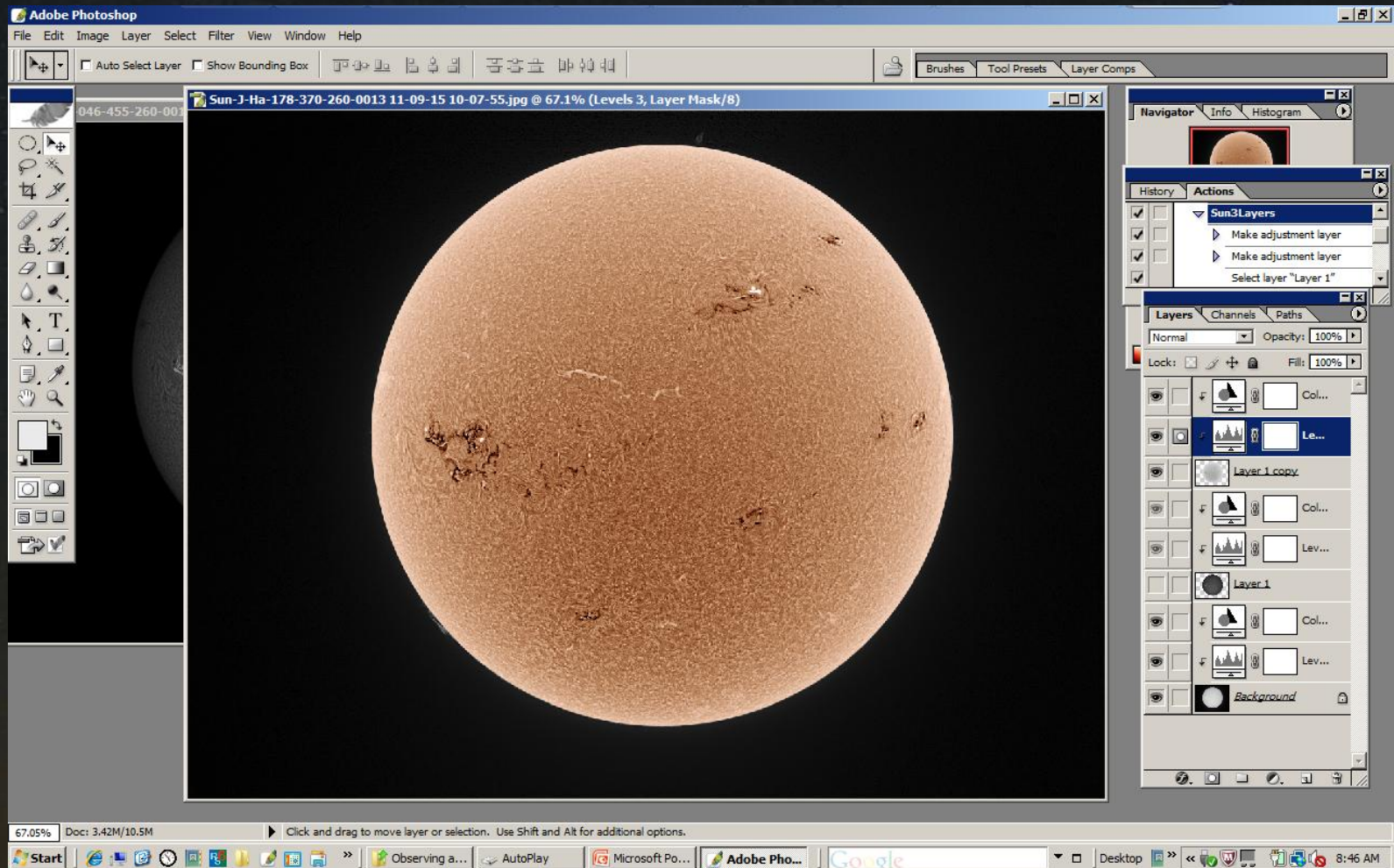


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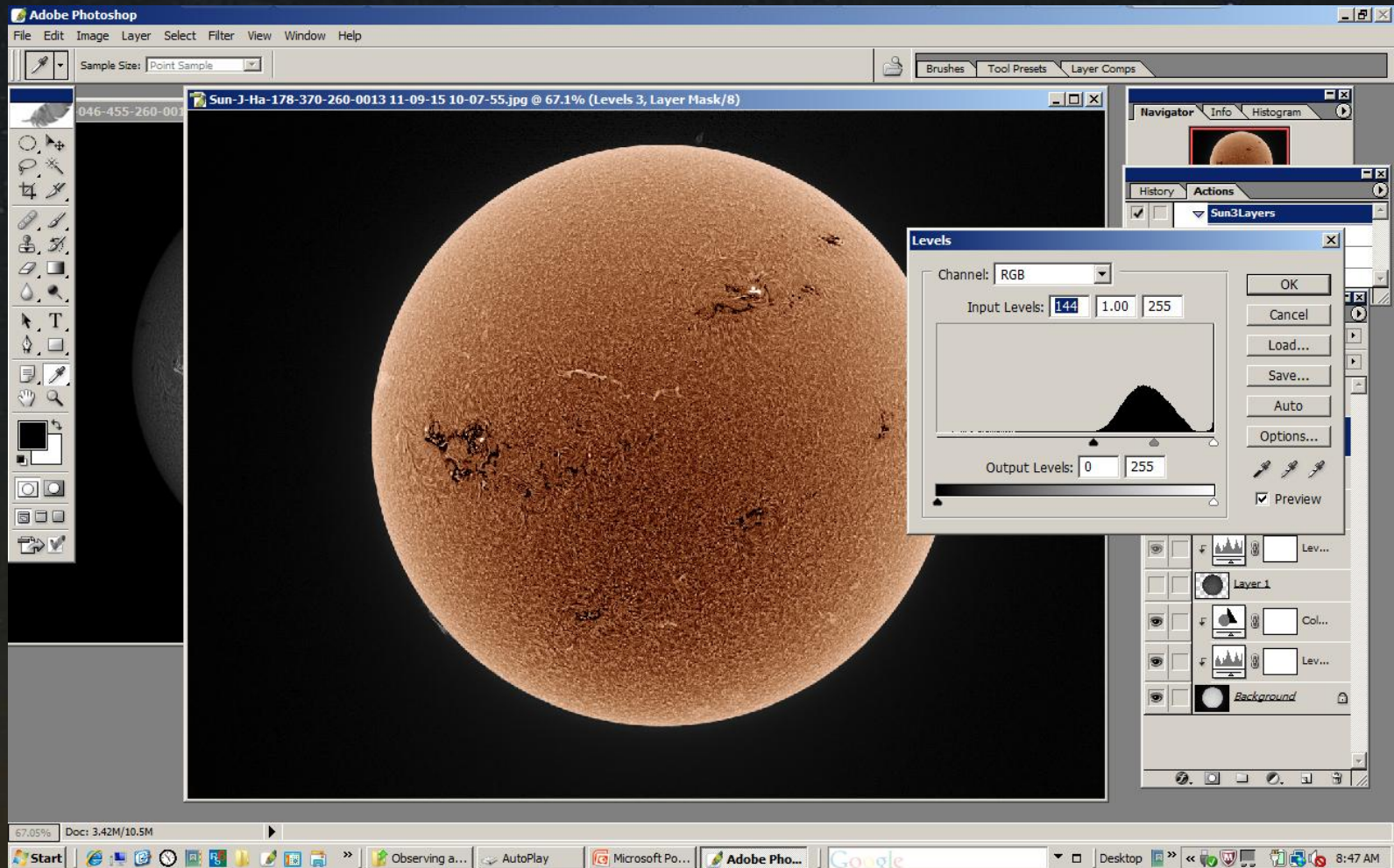


This is my defaulted result



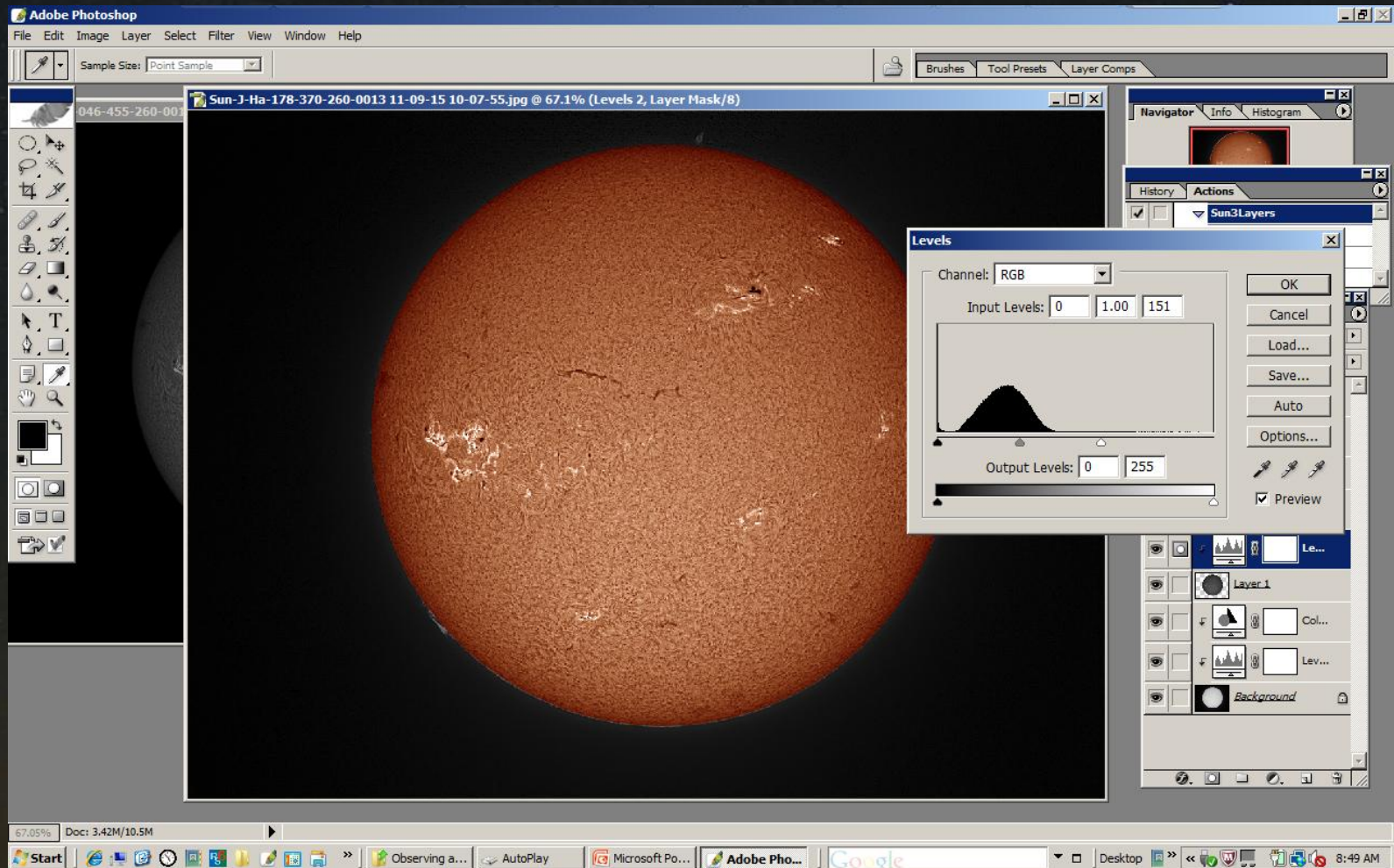


Than fine tune the Levels and Color Balance to the desired result





Do the same for the normal image

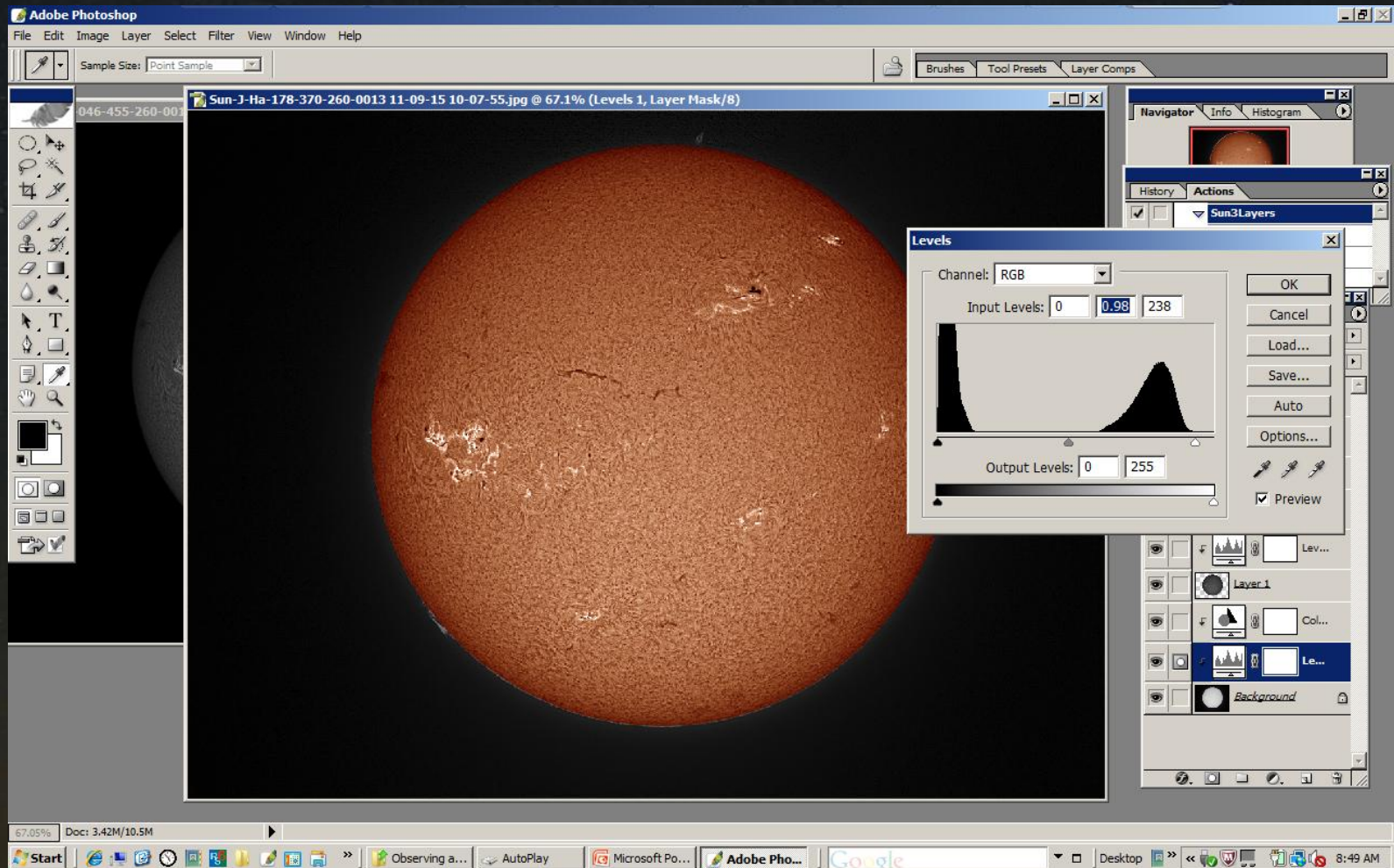


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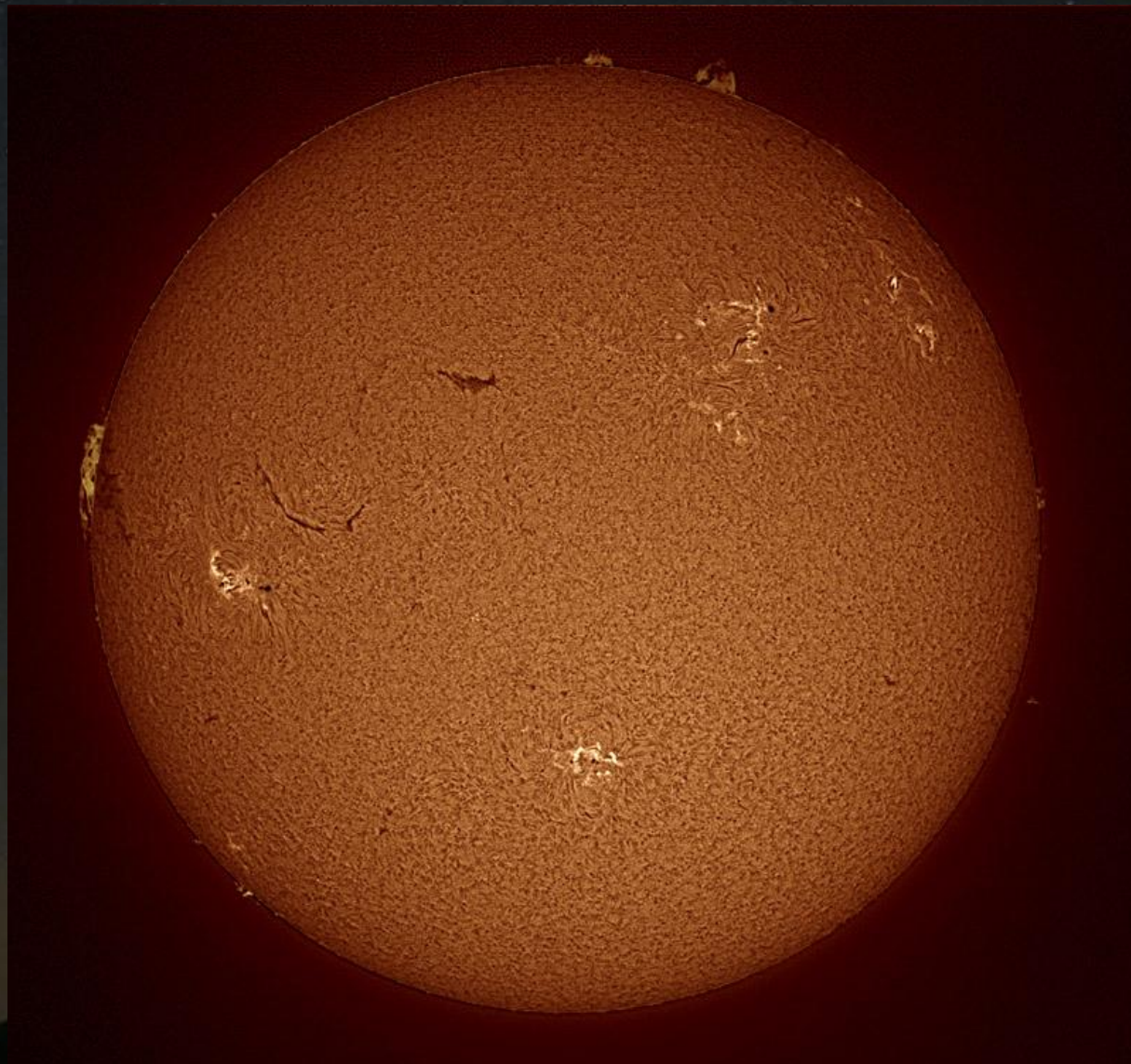


And the image with the details on the limb.



Charlie Elliott Chapter

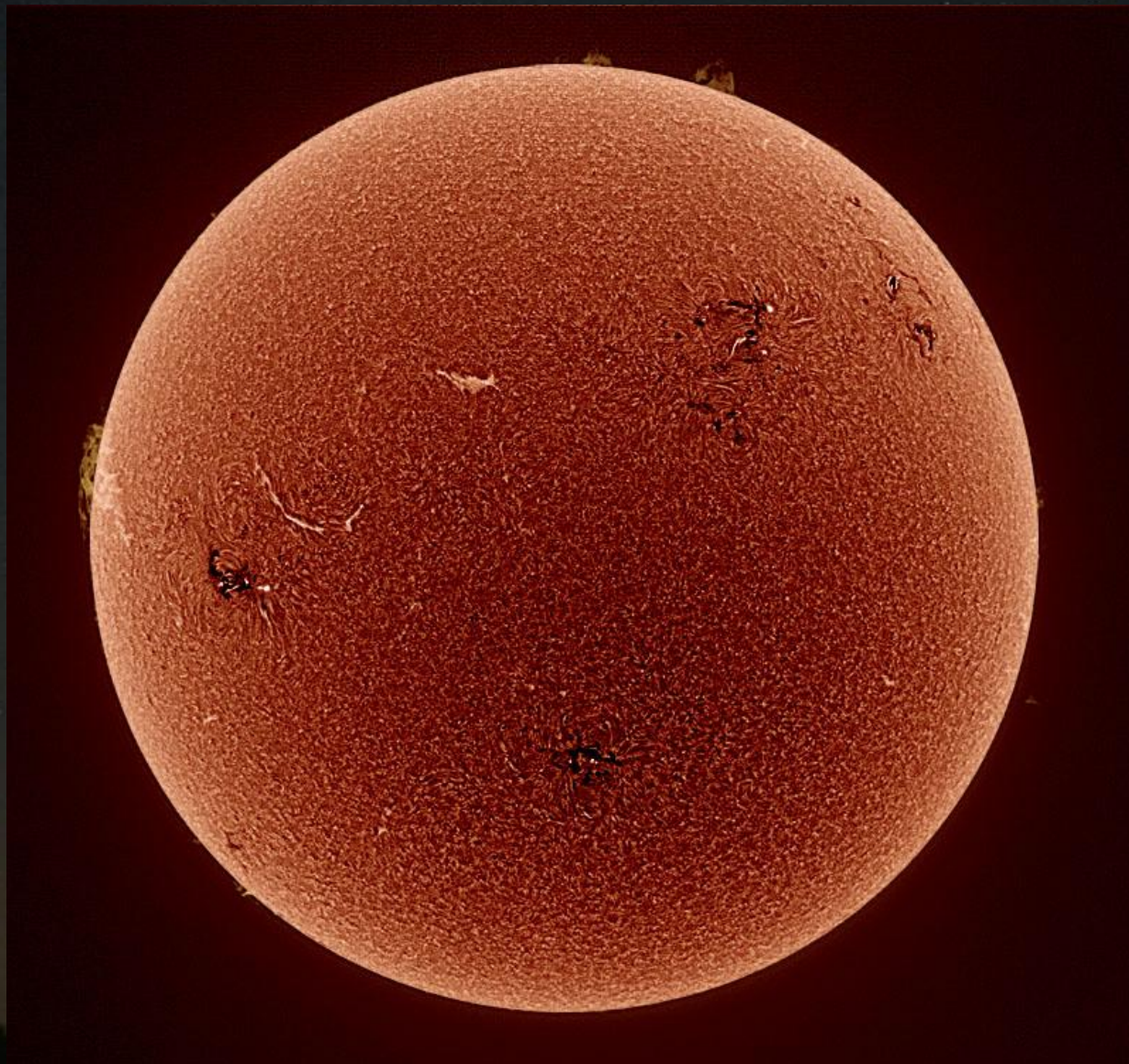
of the Atlanta Astronomy Club



Sun AR1277,79,80,81,82,83 2011-09-02 14:26 UT CR2114 SM40 DMK41AU02.AS Theo Ramakers Social Circle

Charlie Elliott Chapter

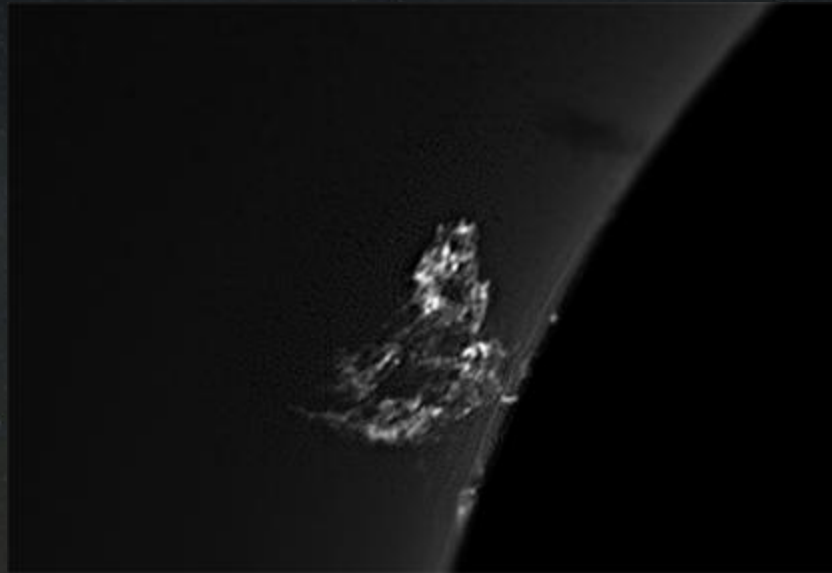
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Sun AR1277,79,80,81,82,83 2011-09-02 14:26 UT CR2114 SM40 DMK41AU02.AS Theo Ramakers Social Circle

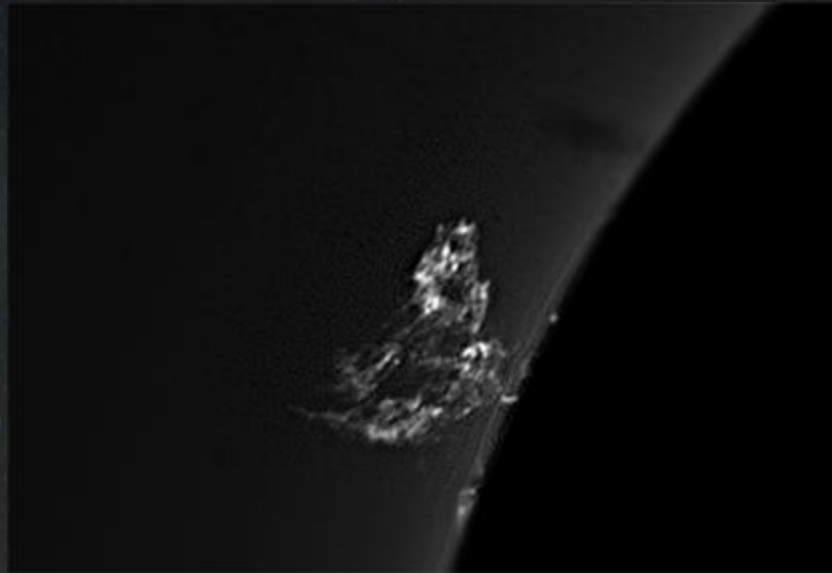


A few images and Animations:



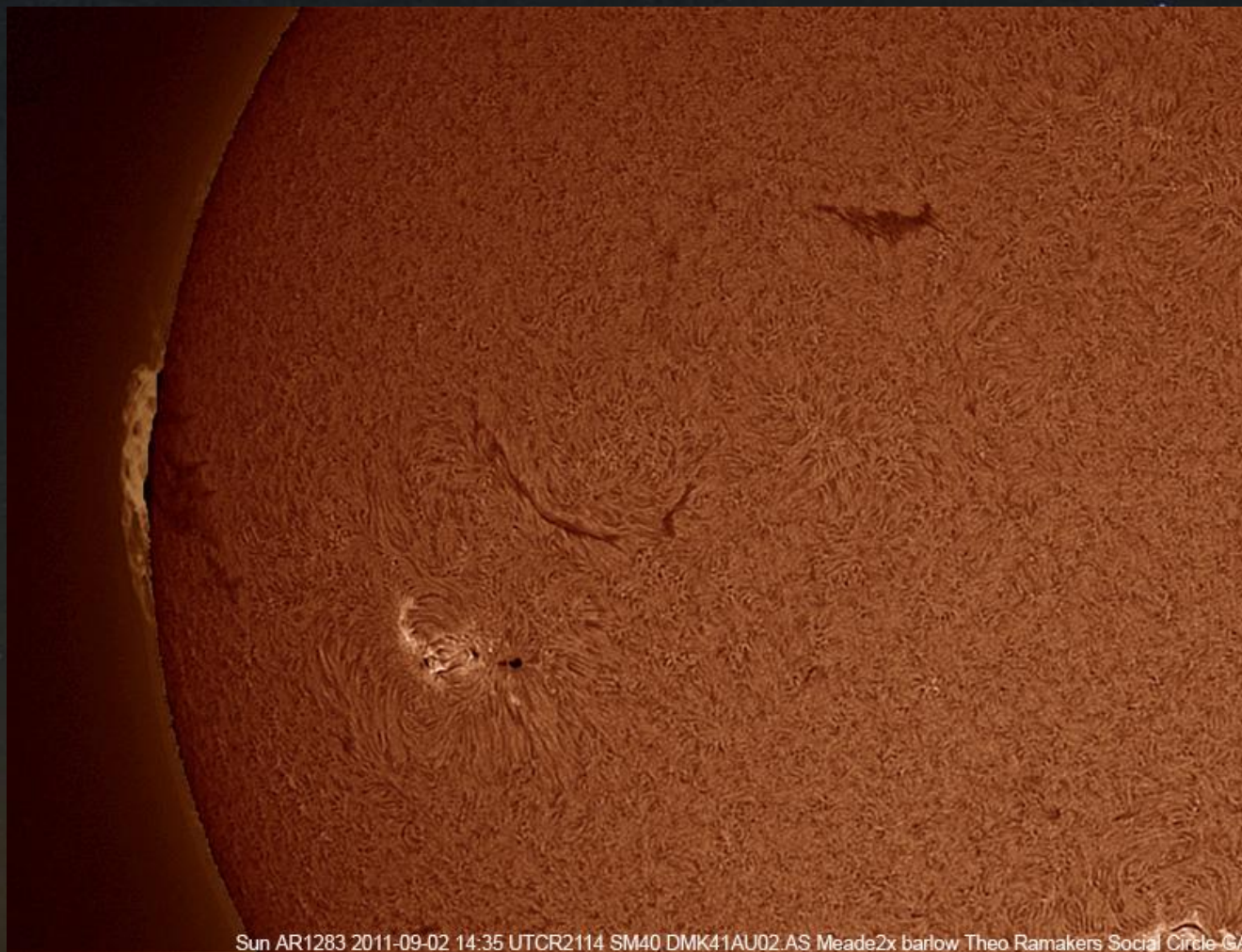


A few images and Animations:



Charlie Elliott Chapter

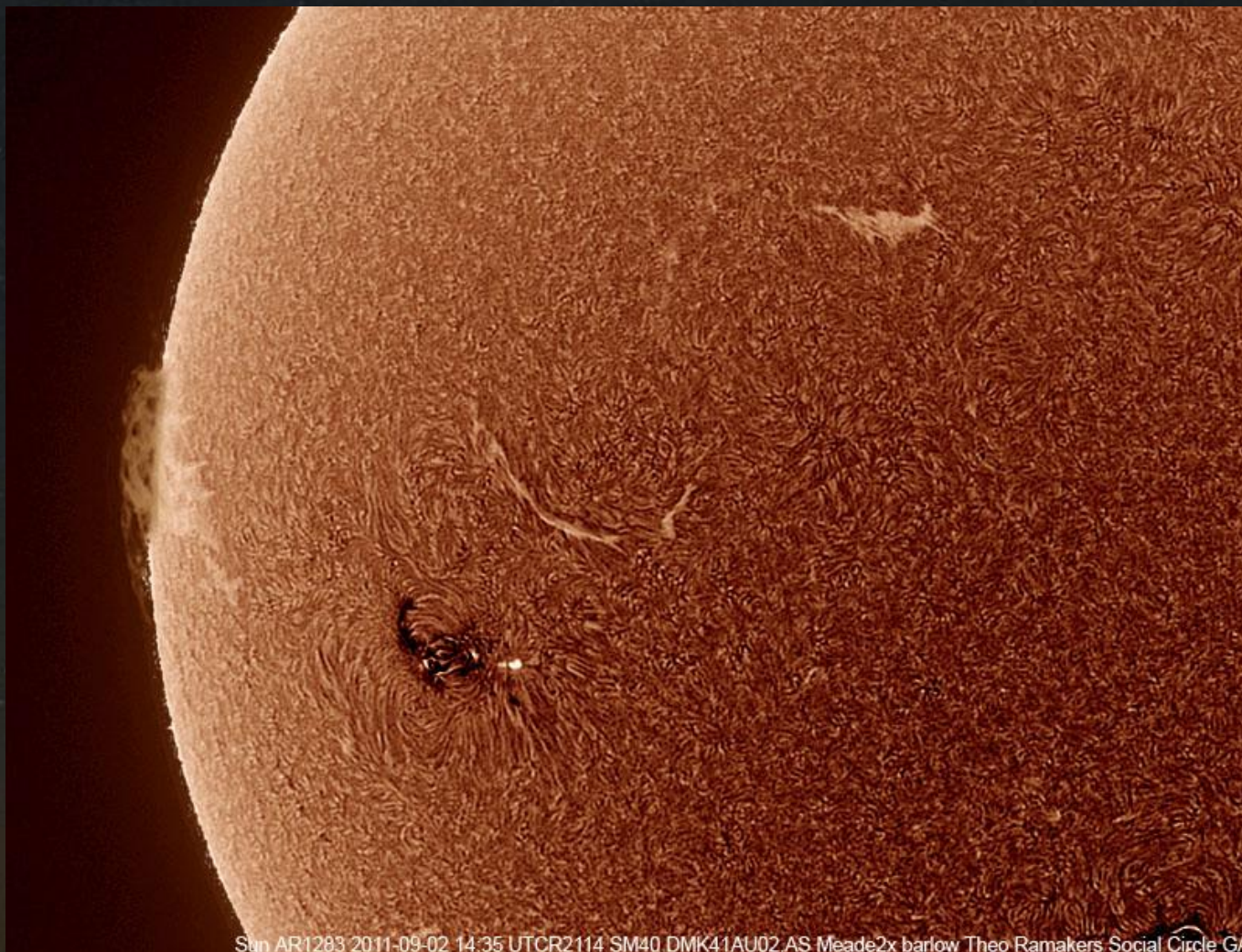
of the Atlanta Astronomy Club



Sun AR1283 2011-09-02 14:35 UTC R2114 SM40 DMK41AU02.AS Meade2x barlow Theo Ramakers Social Circle GA

Charlie Elliott Chapter

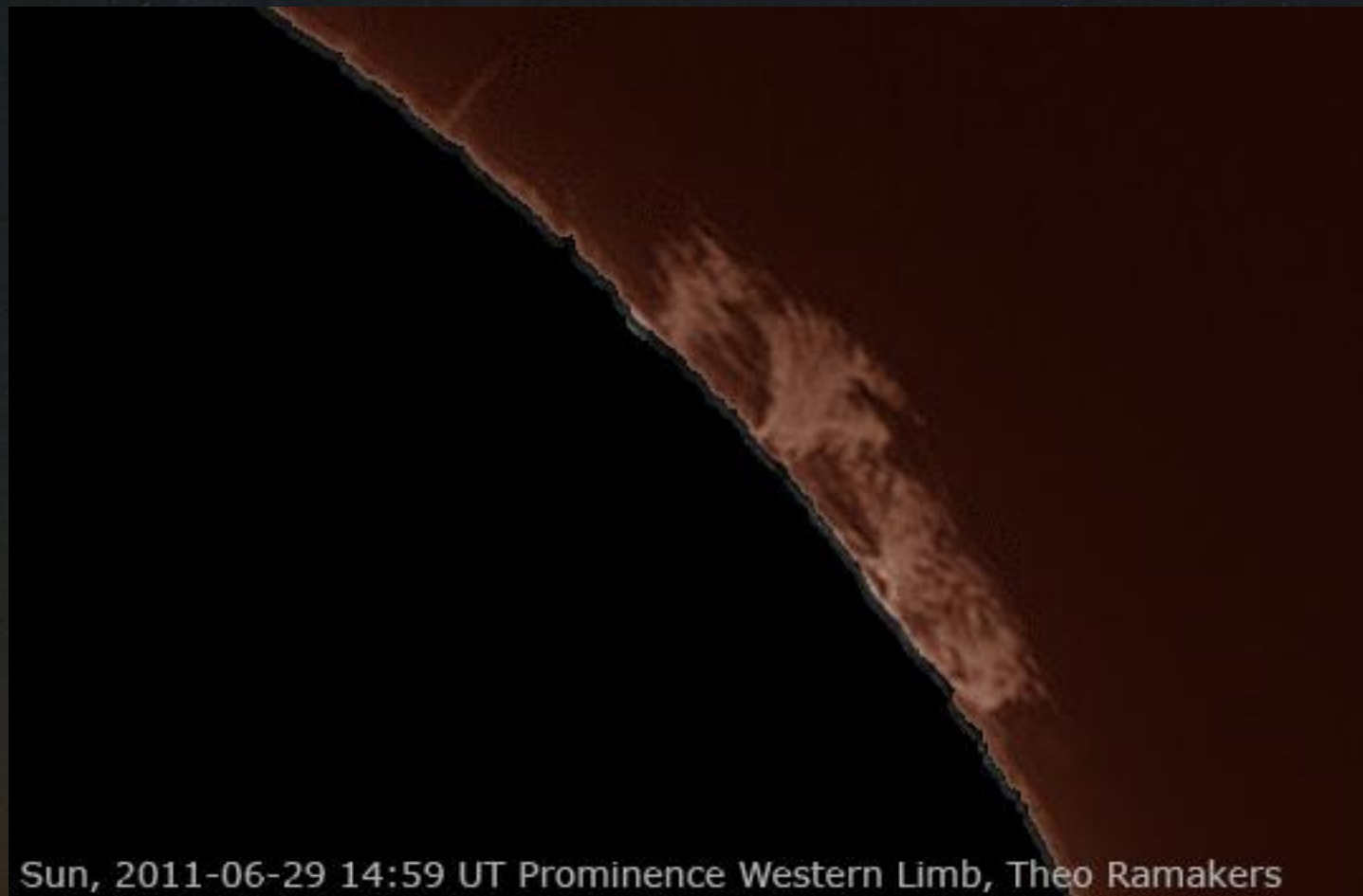
of the Atlanta Astronomy Club



Sun AR1283 2011-09-02 14:35 UTC R2114 SM40 DMK41AU02 AS Meade2x barlow Theo Ramakers Social Circle GA

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Sun, 2011-06-29 14:59 UT Prominence Western Limb, Theo Ramakers

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Sun, AR1242,43 2011-06-29 14:43 UT CR2111 SolarMax40 DMK41AU02.AS Theo Ramakers Social Circle

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Sun, AR1242,43 2011-06-29 14:43 UT CR2111 SolarMax40 DMK41AU02.AS Theo Ramakers Social Circle



Thanks for your attention and....

Clear Skies!!

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