DMK CAMERA REVIEW

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INTRODUCTION

The following information is intended to be a consumer review for the Imaging Source DMK Monochrome USB line of cameras. I am a novice solar imaging enthusiast with a few years experience in Solar Astrophotography and a lifetime of interest and experience dealing with astronomy and cosmology. I am currently an Air Traffic Controller in Atlanta. I am not an employee of any astronomy related company nor was I paid for this review.

The Imaging Source out of Bremen, Germany with offices in Charlotte, NC (US) recently sent me a selection of their line of monochrome USB cameras and allowed me to do a complete review of their usability and imaging potential for Solar Astrophotography. I have been a big fan of the DMK31 and DMK41 for years now as they have been my main imaging cameras. I thought it might be useful if I wrote this review of my impressions of the cameras for other people in the market for a solar imaging camera. I have not used any expensive night time imaging equipment other than the Meade series of DSI's. I am no expert for sure but I hope you find my review informational and helpful.

The 4 cameras that I evaluated were :

DMK 21AUC03

Lens not included

DMK 31AU03

Lens not included

DMK 21AU04

Lens not included

DMK 41AU02

Lens not included

The manufacturers specifications and sample photos from each camera are located at the end of the review.

REVIEW

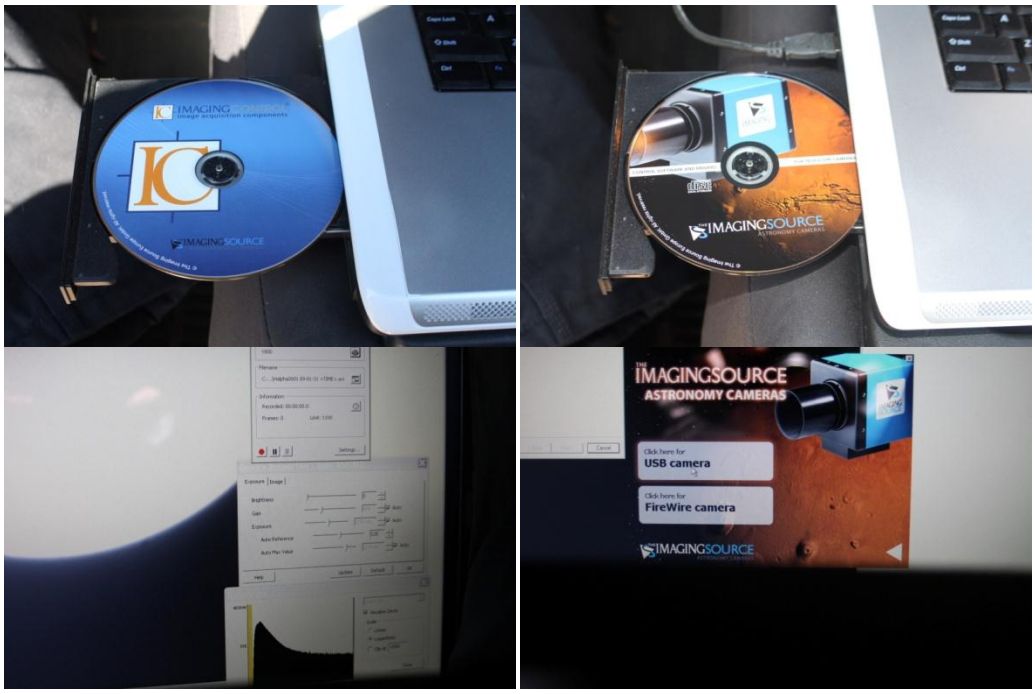
On January 31st, 2009 my friend Theo and I went out to the Charlie Elliott Wildlife Management area with my solar setup to take some images using the aforementioned cameras. All cameras where used with the following equipment:

- Lunt 60mm/B1800 Cak solar telescope
- Meade 80mm ED triplet/ Orion Type II Glass solar filter
- Coronado 90mm Double stacked Halpha solar telescope
- Celestron CGE mount on a PWTech Pinnacle portable pier with ADM accessories


The DMK cameras had many similarities. They are all of very rugged construction with a blue painted metal body. The cameras each had a mounting bar on the bottom for industrial applications.




The cameras come as pictured with no lens. Inside the box is the camera body, a 1 ¼ nosepiece for inserting into a telescope, a 6ft USB connecting cable and a CD containing the camera drivers and the software to obtain the images. The software is called IC capture. It is very well designed and simple to use. There are adjustments for exposure, gain, gamma and many different codecs available for recording images. It works exceptionally well and does not cause headaches to the user. It is very intuitive also so there is not a lot to learn with it.

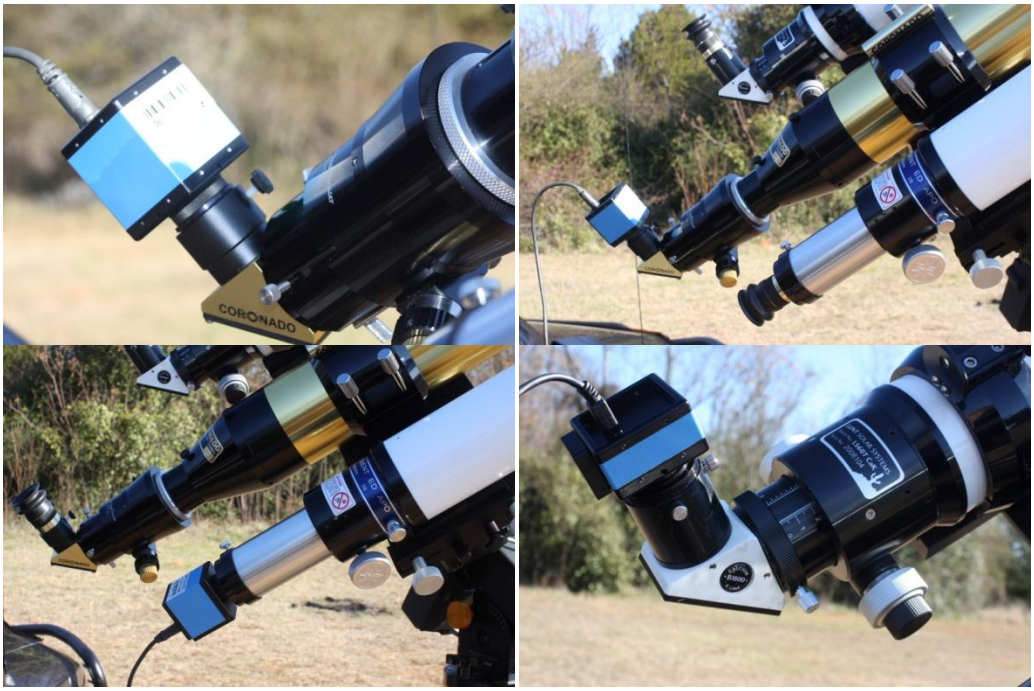


For those of you that might not be aware of what the fuss is about with these cameras; they are used to capture several hundred or several thousand frames of an image in the telescope in rapid succession and store them in an .avi or other popular video format. The images are then fed into a stacking application such as Registax or AviStack and out pops a simulated long exposure of the image without the tracking errors and or any blurs from shaking or wind. The reason that all of the cameras chosen for solar use are monochrome is because the telescopes commonly used for solar imaging are narrowband in design and only show one particular frequency of light. The images that you see on the internet and in magazines are almost always generated in monochrome and then colorized in Adobe or a similar program for the finished result. I also own a DMK 31 USB color camera but it has had mixed results with the Sun due to its confusion with an over or under exposed monochrome (red/no red, blue/no blue) signal.

The main difference in the cameras is chip size. The 21 has a 1/4 inch CCD or CMOS chip. The 31 has a 1/3 inch CCD chip. The 41 has a 1/2 inch CCD chip. The larger the chip of course, the higher the resolution and larger field of view of the image but the slower the frame rate..

The DMK21's have the smallest field of view and least resolution. The DMK21 can take 60 frames per second while the DMK31 is capable of 30fps and the DMK41 does 15fps. All of these speeds may sound like a lot to nighttime astrophotographers but solar is a different animal. Ideally 60fps at the 1/2 inch chip size would be best but that one is not offered yet.

These cameras fit very easily into anything that you can insert a 1 ¼ inch eyepiece into.



They are attached to the computer via the supplied 6 ft USB cable but in order to be usable by most imagers you have to go out and buy a longer cable. The CMOS camera used an A male to mini USB cable but all of the others used a standard A male to B male USB cable. Pictured throughout this review is a 15ft USB 2.0 cable that I added after market at a cost of $29 US.

The table is divided by the type of telescope used and then by each cameras results. The first part will show Halpha in all four cameras , the next part Calcium K line and finally white light results with all four cameras. Each entry then has the actual image from the camera and then the processed image after it.

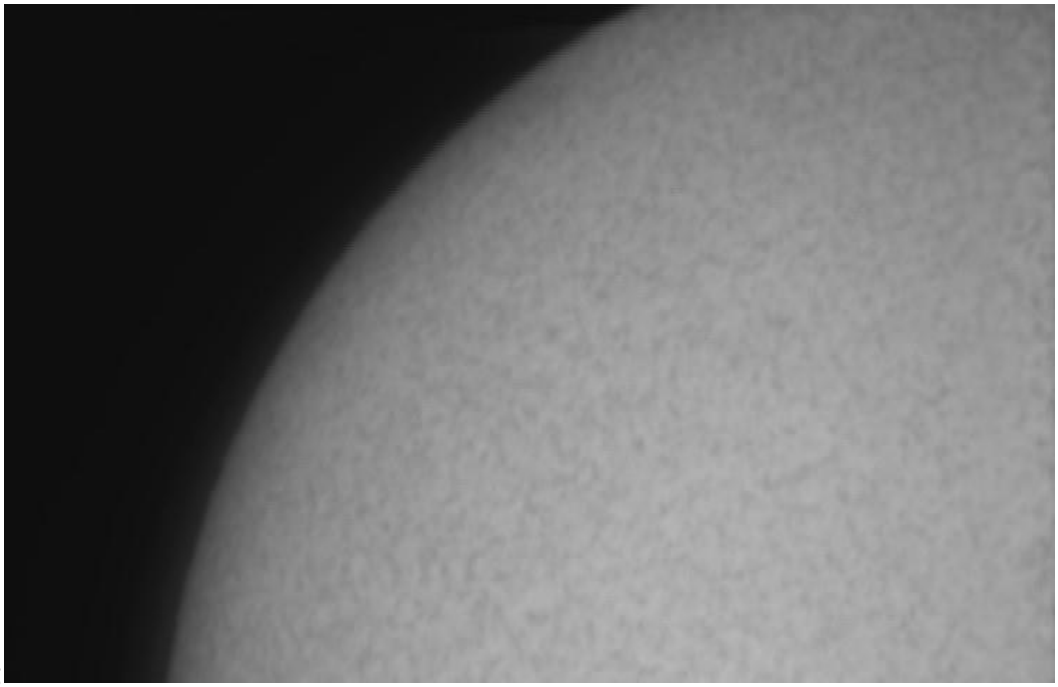
I should note that each camera chip was cleaned with a cotton swab and eyepiece cleaner before each use. They do tend to accumulate dust and debris like any other camera and will have to be cleaned often before use.

There are plusses and minuses to each camera and I hope that the following table of images shows them clearly.

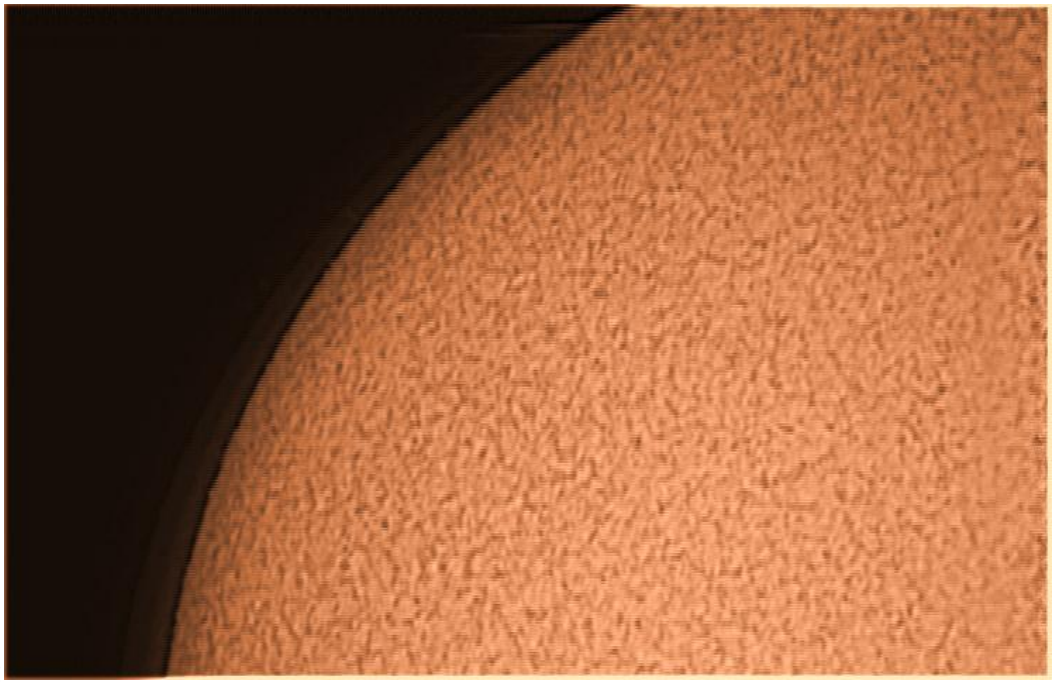
The Halpha images show a set for the prominences and a set for the surface detail for each camera.

After the images I have written my laymen's opinion of the results and then published the specifications from The Imaging Source for all cameras.

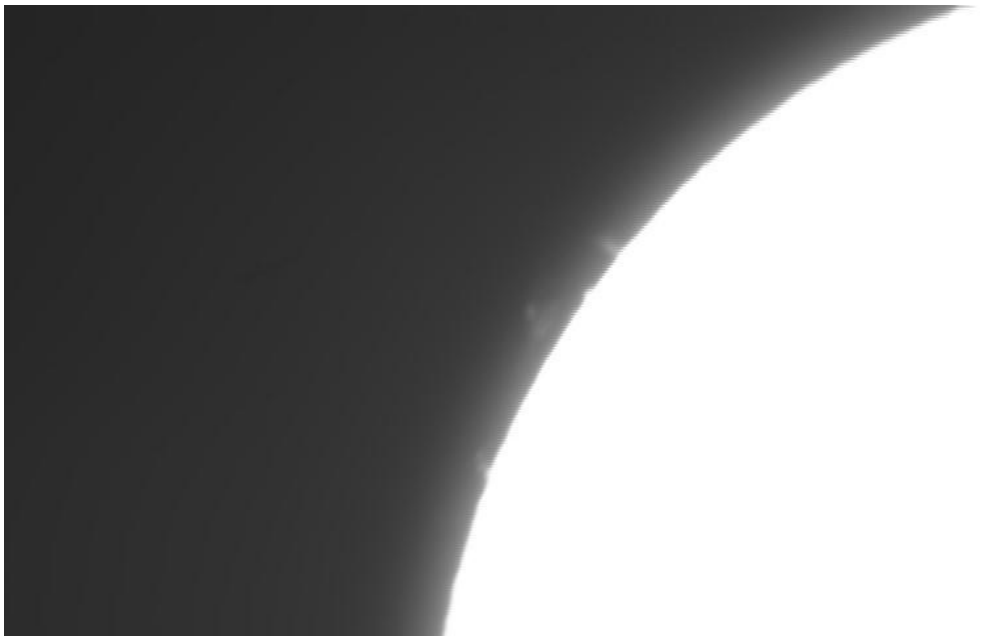
Halpha IMAGES:



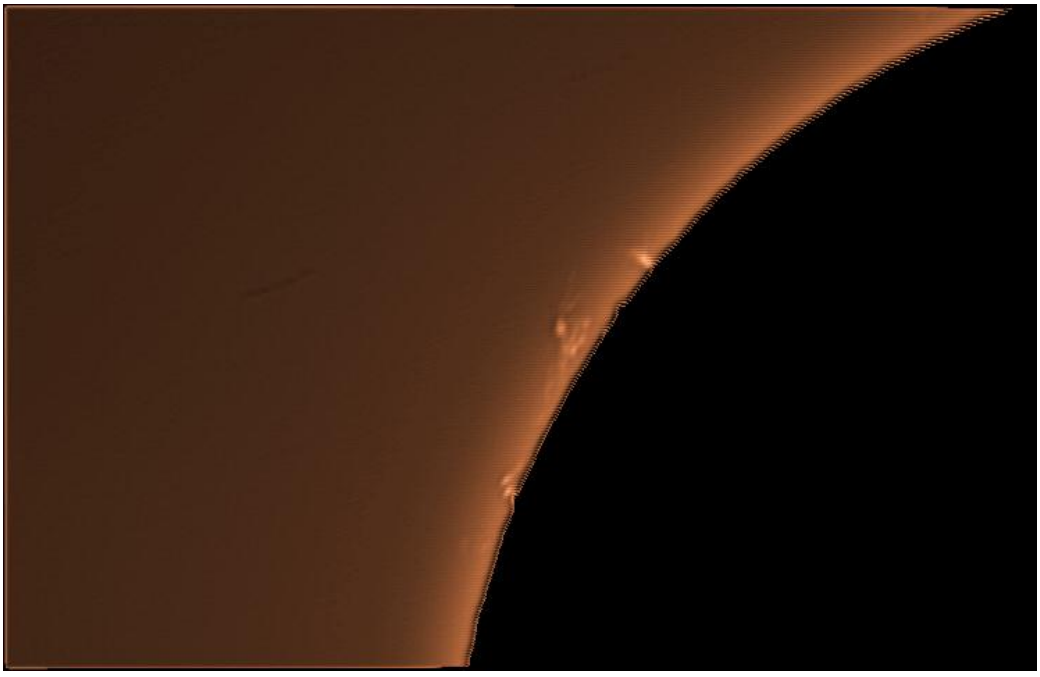
DMK21 CMOS Pre processing



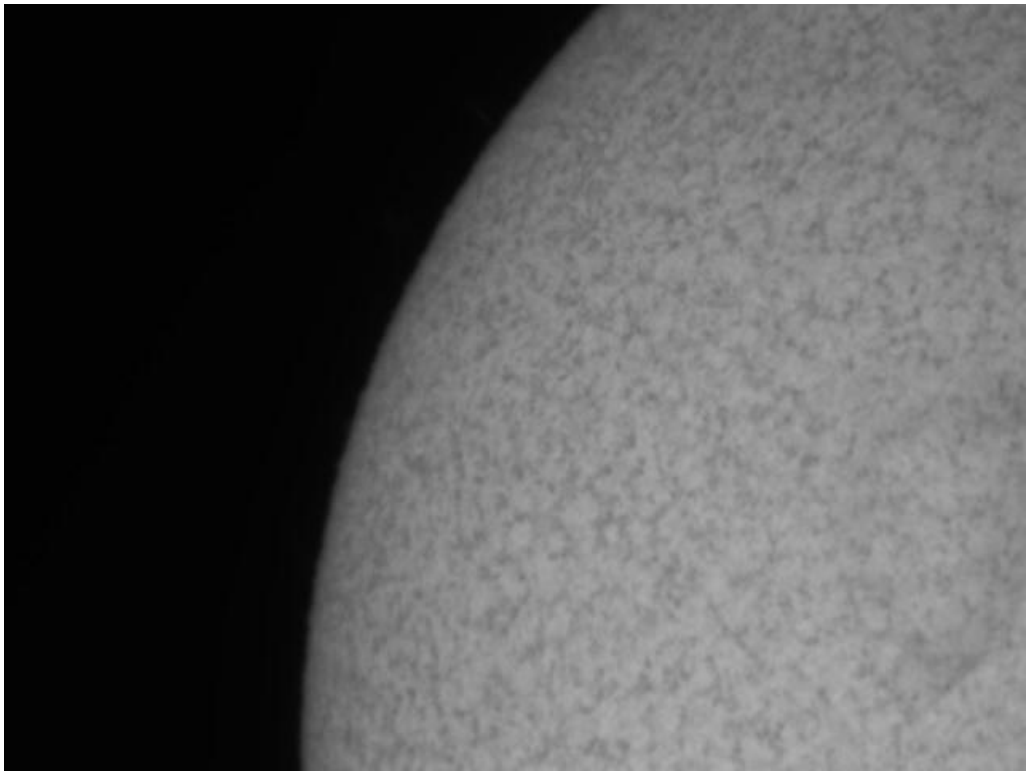
DMK21 CMOS Post processing



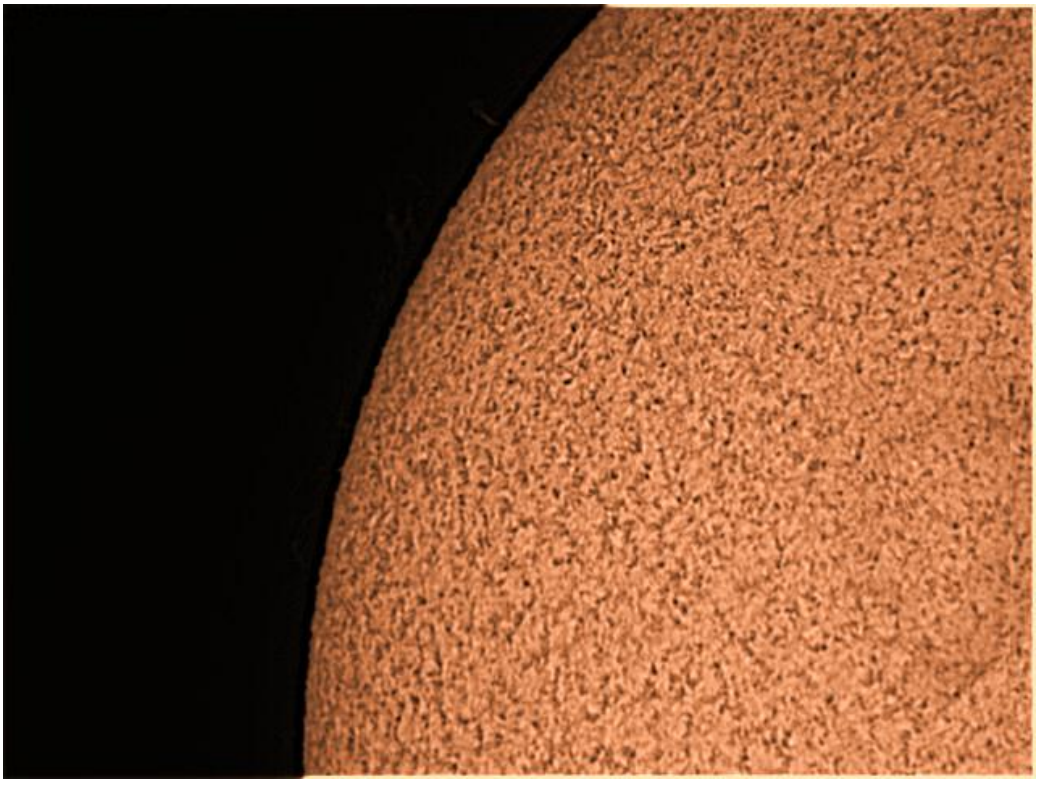
DMK21 CMOS Pre processing



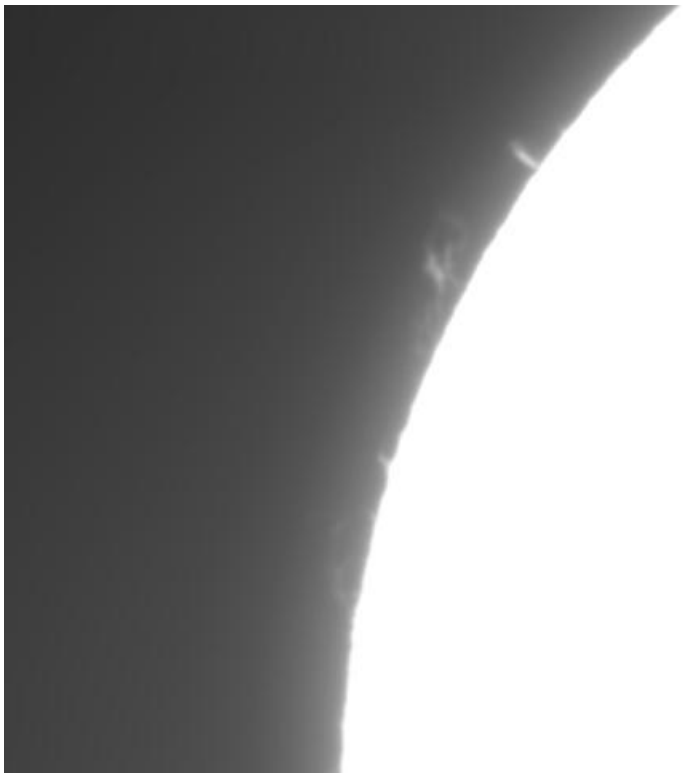
DMK21 CMOS post processing



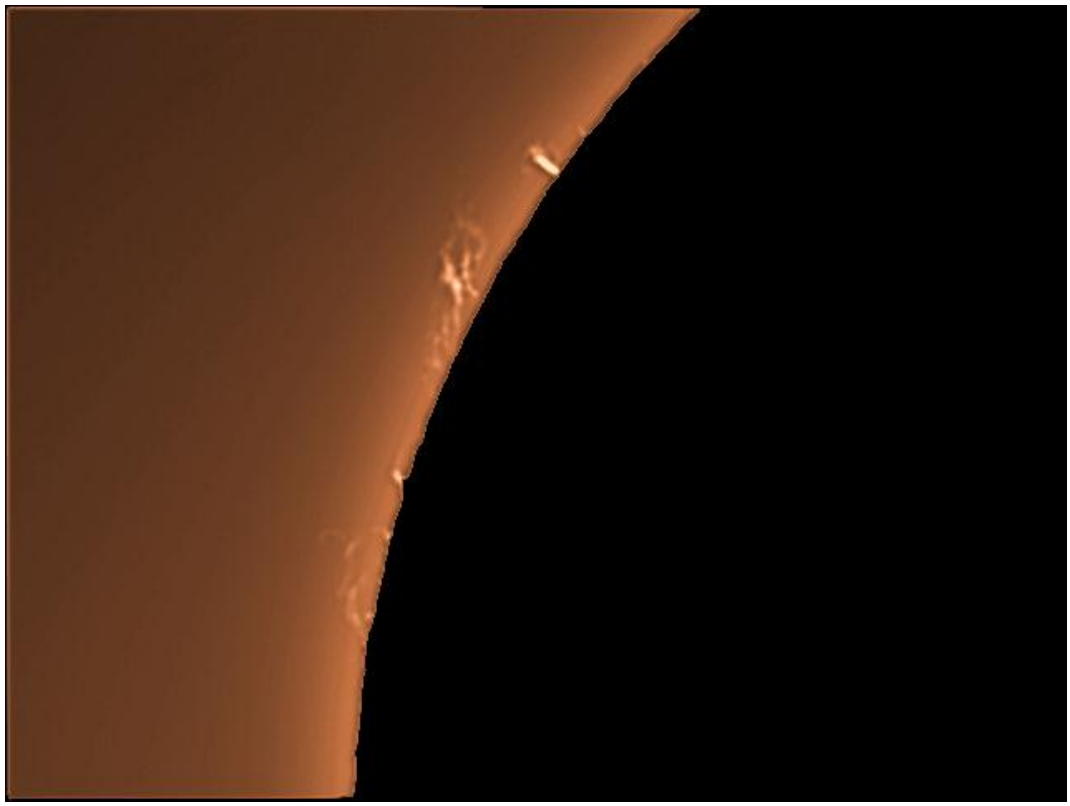
DMK21 CCD pre processing



DMK21 CCD post processing



DMK21 CCD pre processing



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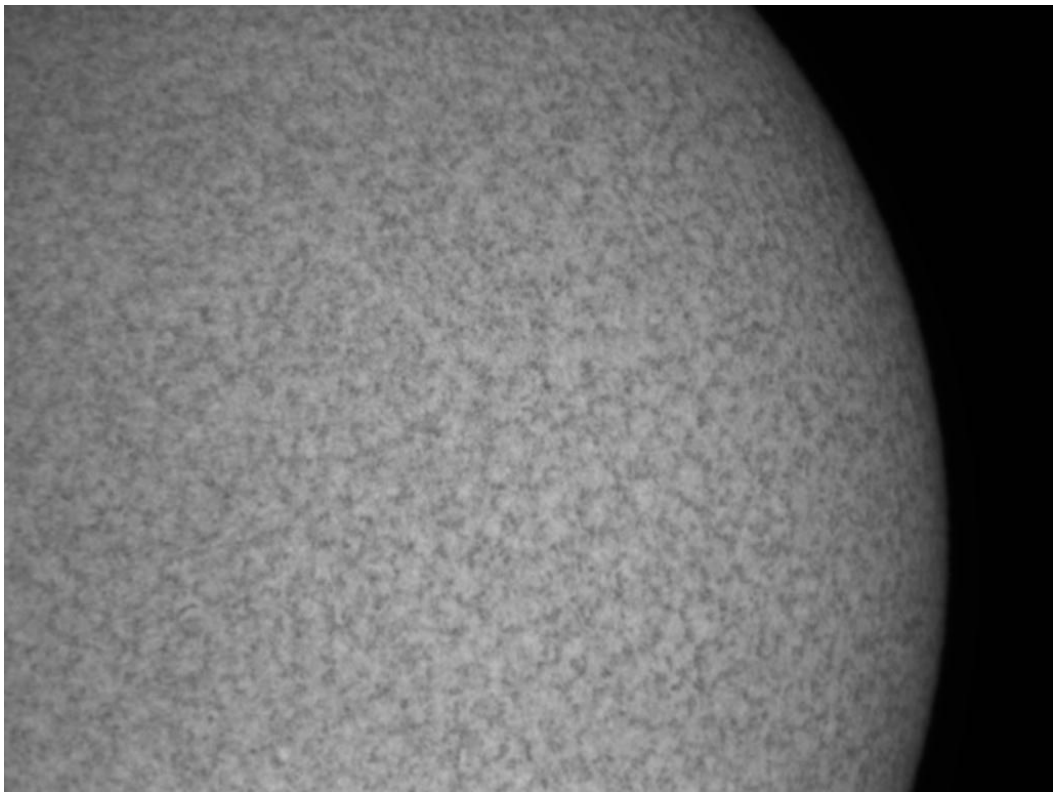
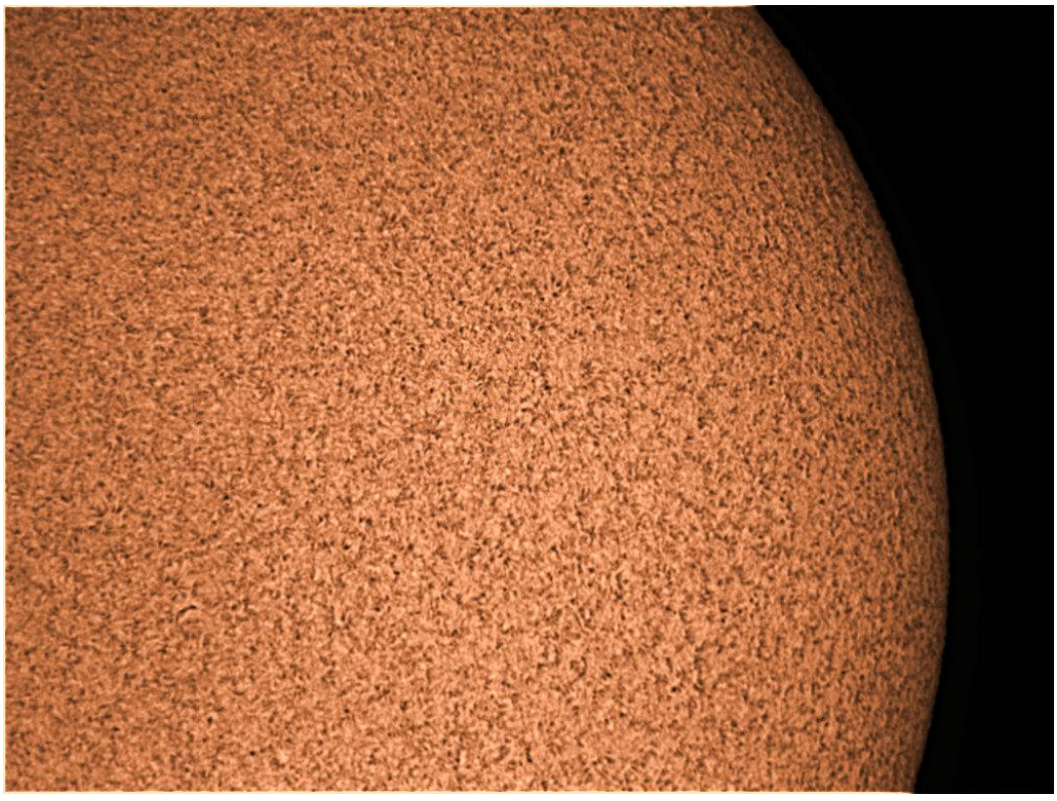
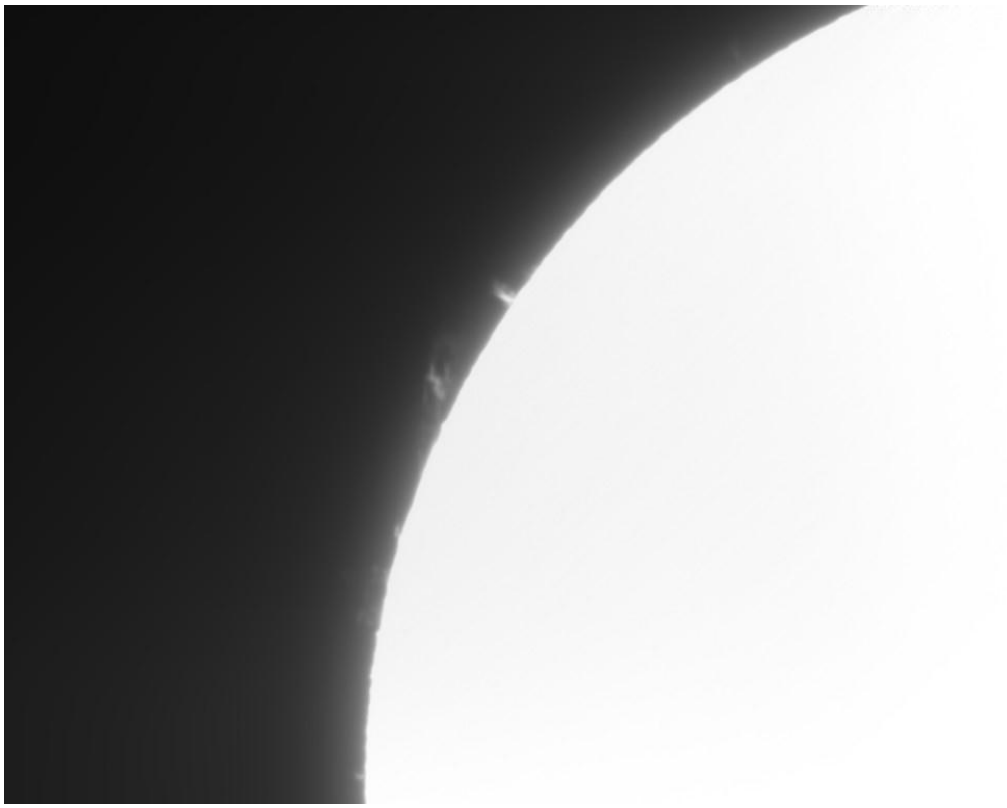


DMK31 CCD pre processing



DMK31 CCD post processing



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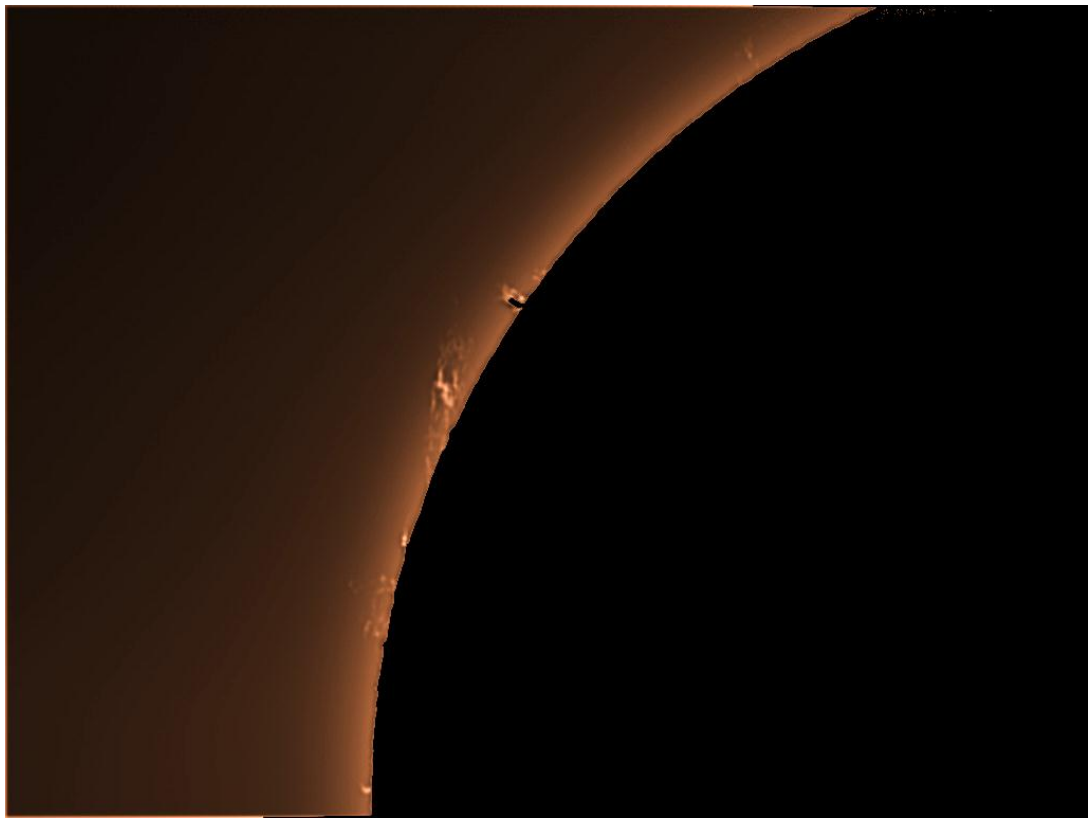
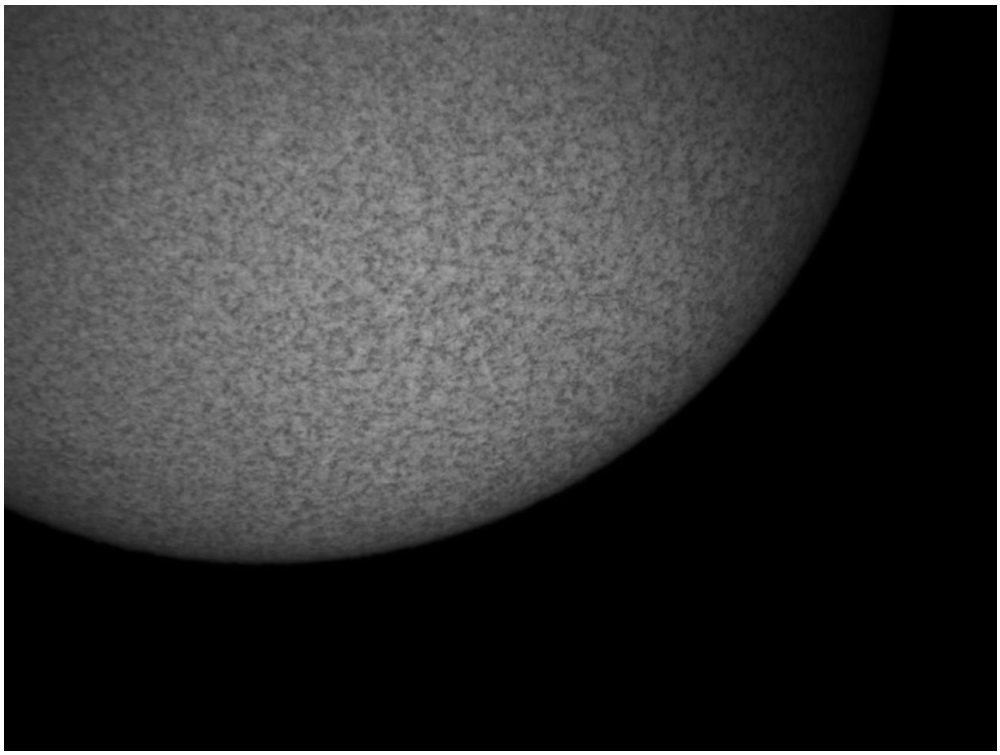
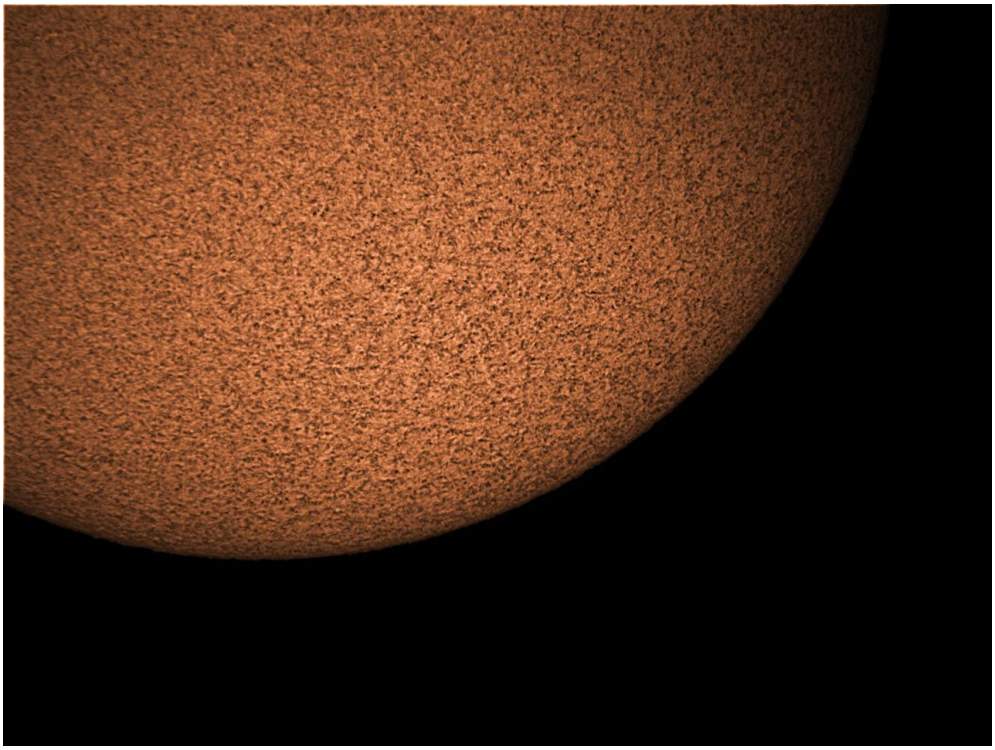


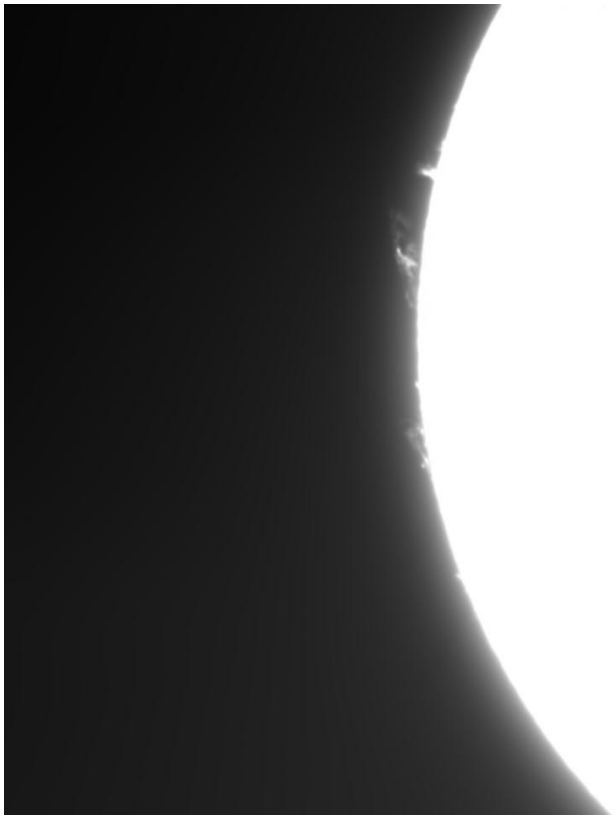
DMK31 CCD post processing



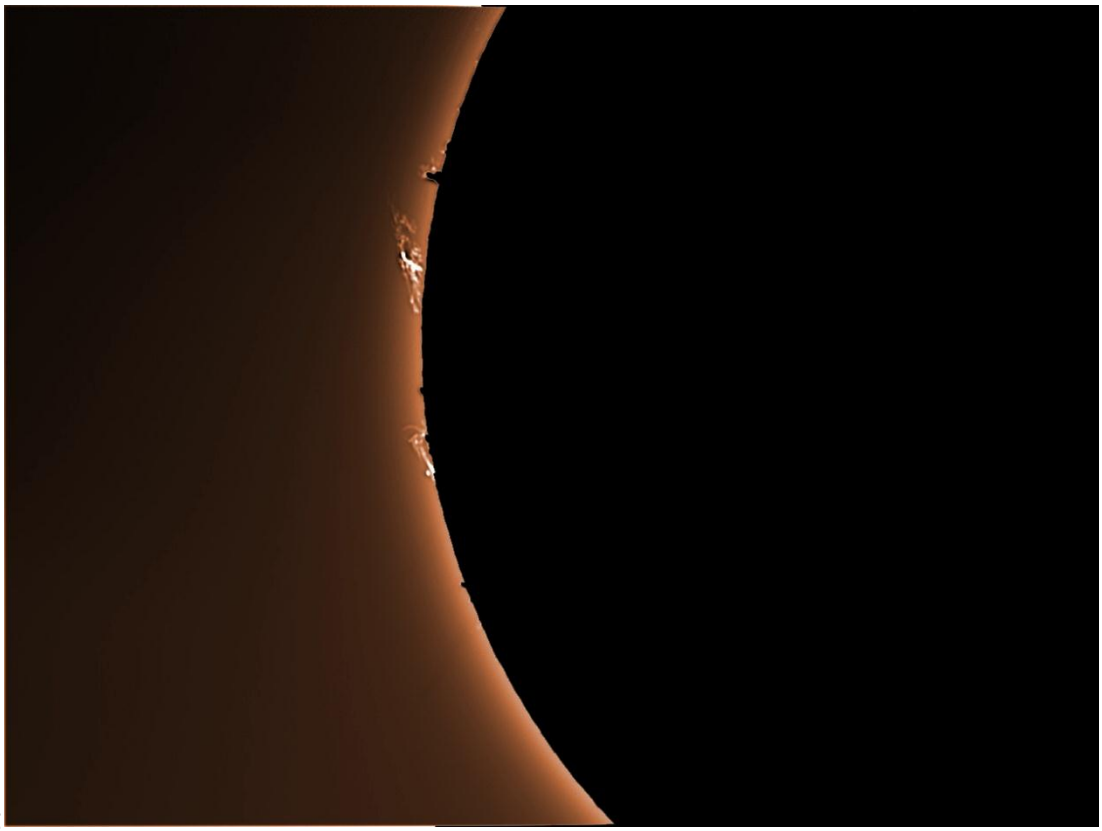
DMK41 CCD pre processing



DMK41 CCD post processing

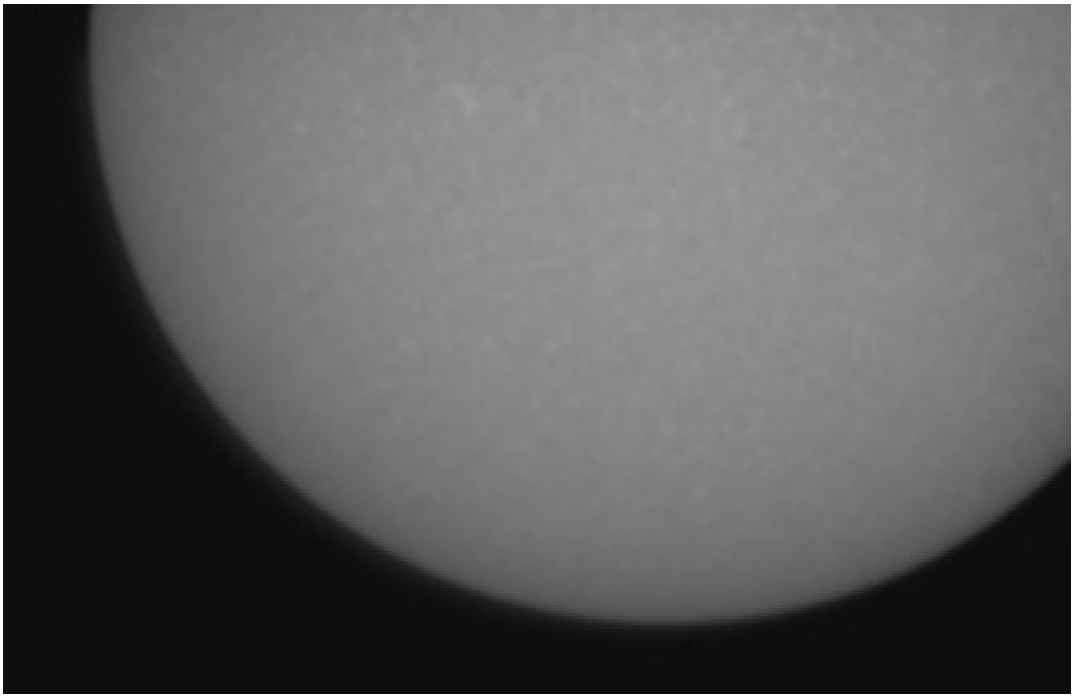


DMK41 CCD pre processing

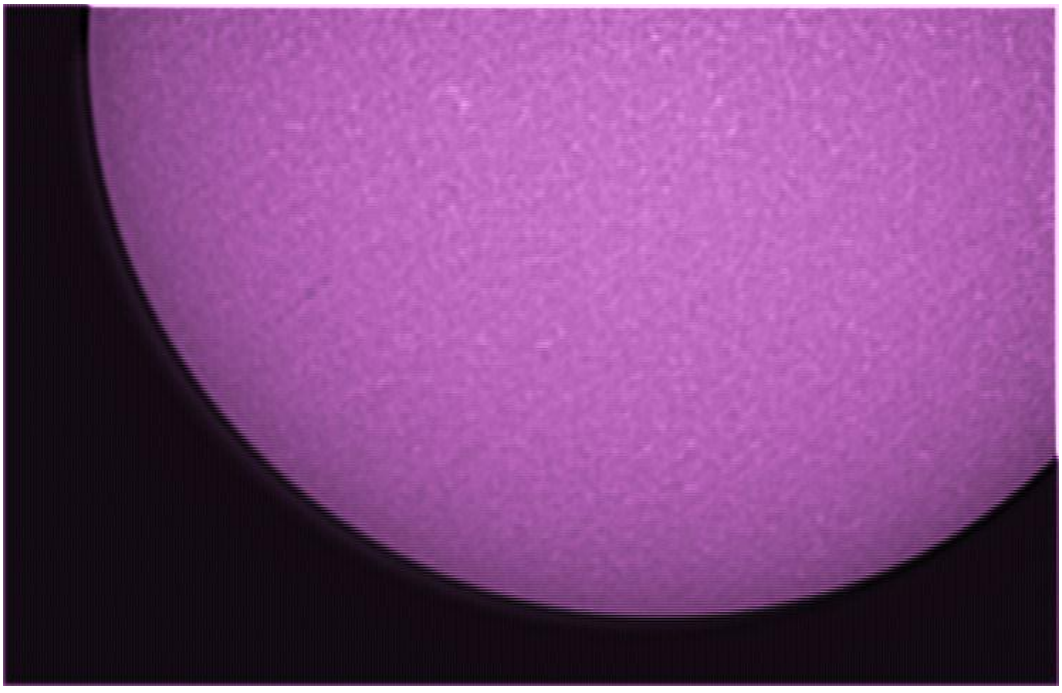


DMK41 CCD post processing

CaK IMAGES:

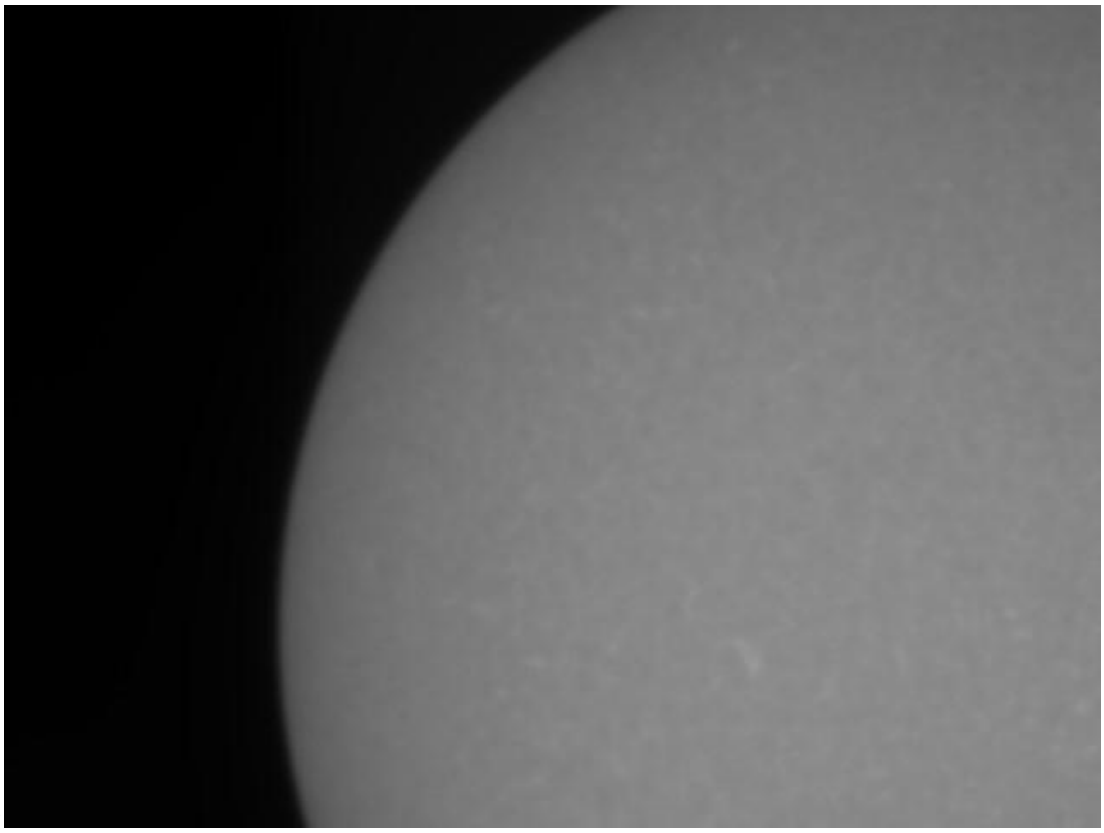


DMK21 CMOS pre processing



DMK21 CMOS post processing

DMK21 CCD pre processing



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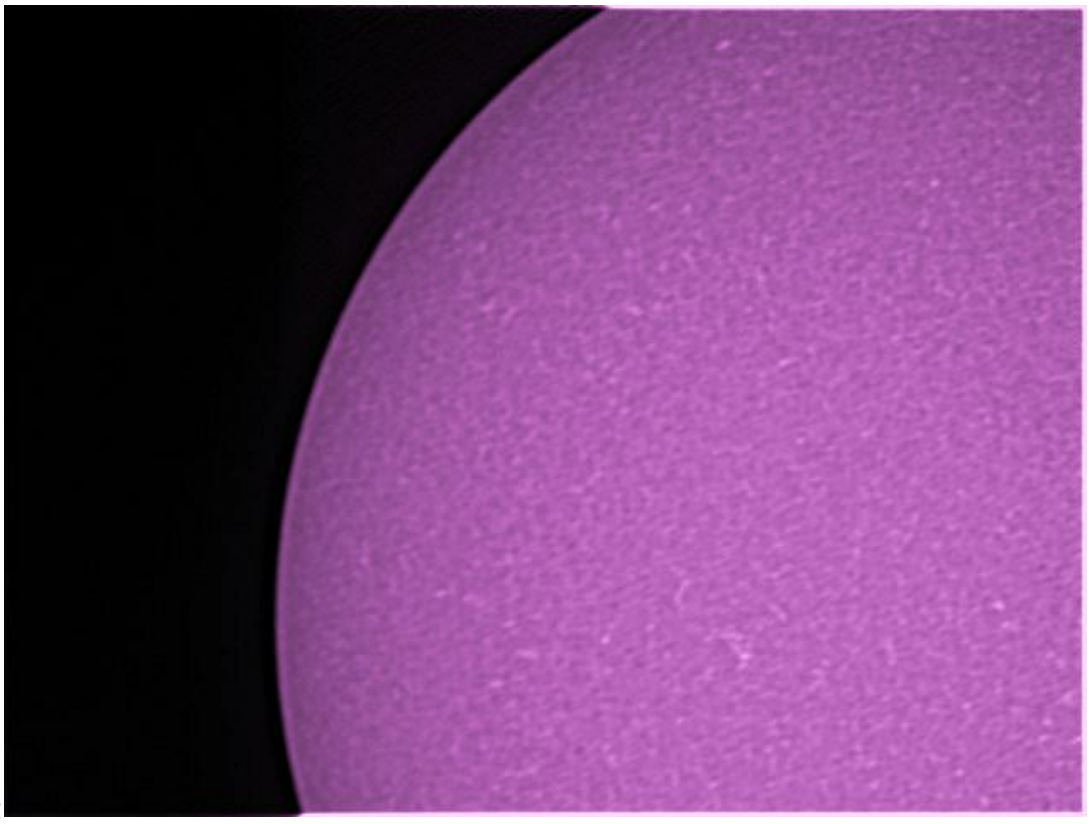
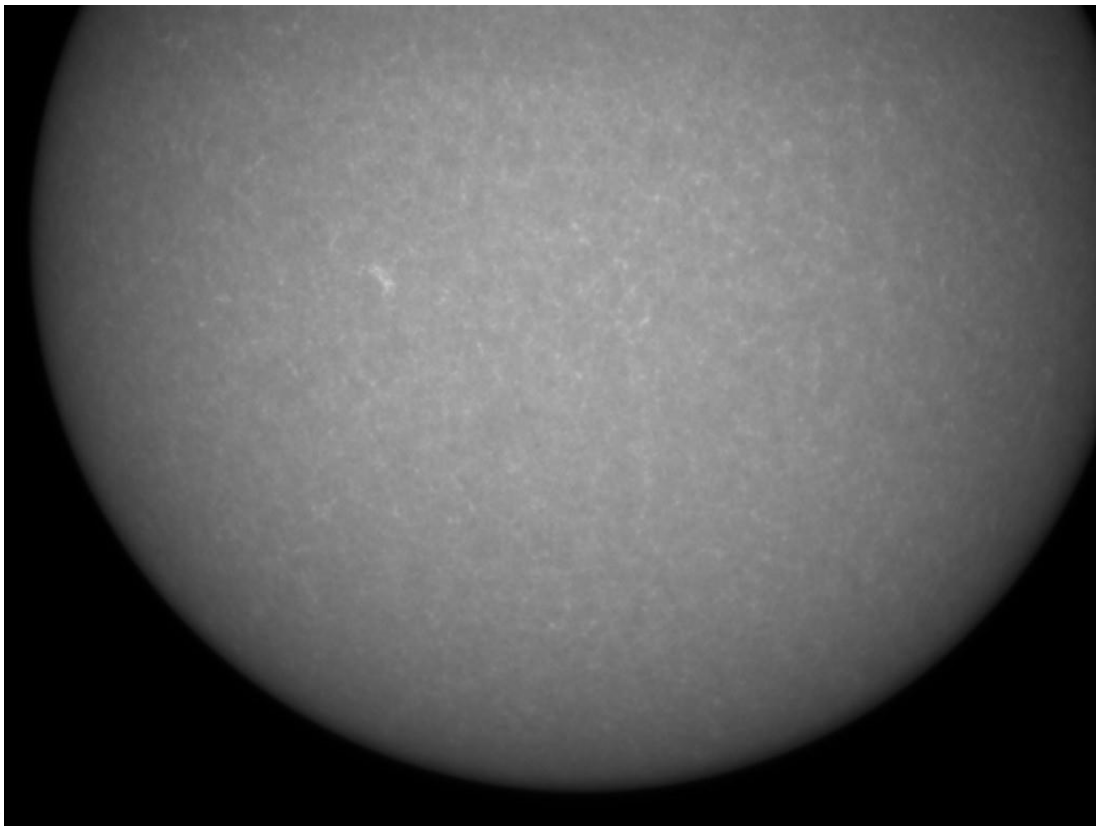
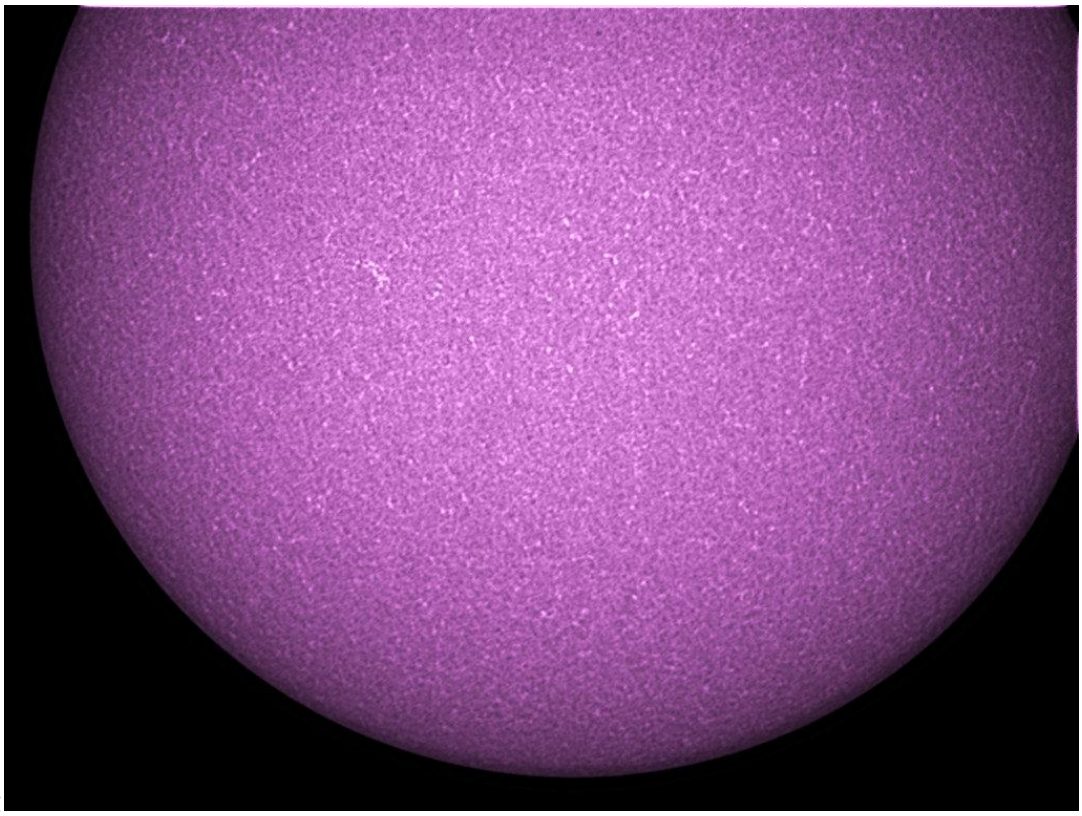


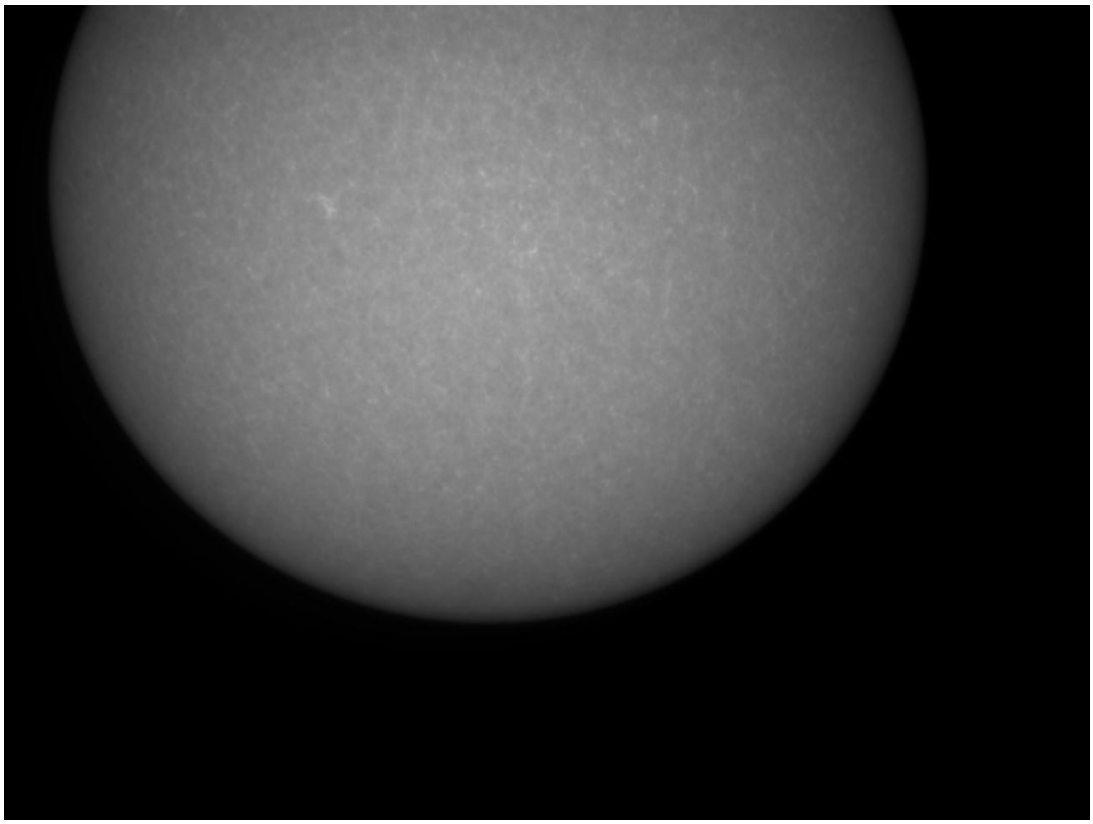
DMK31 CCD pre processing



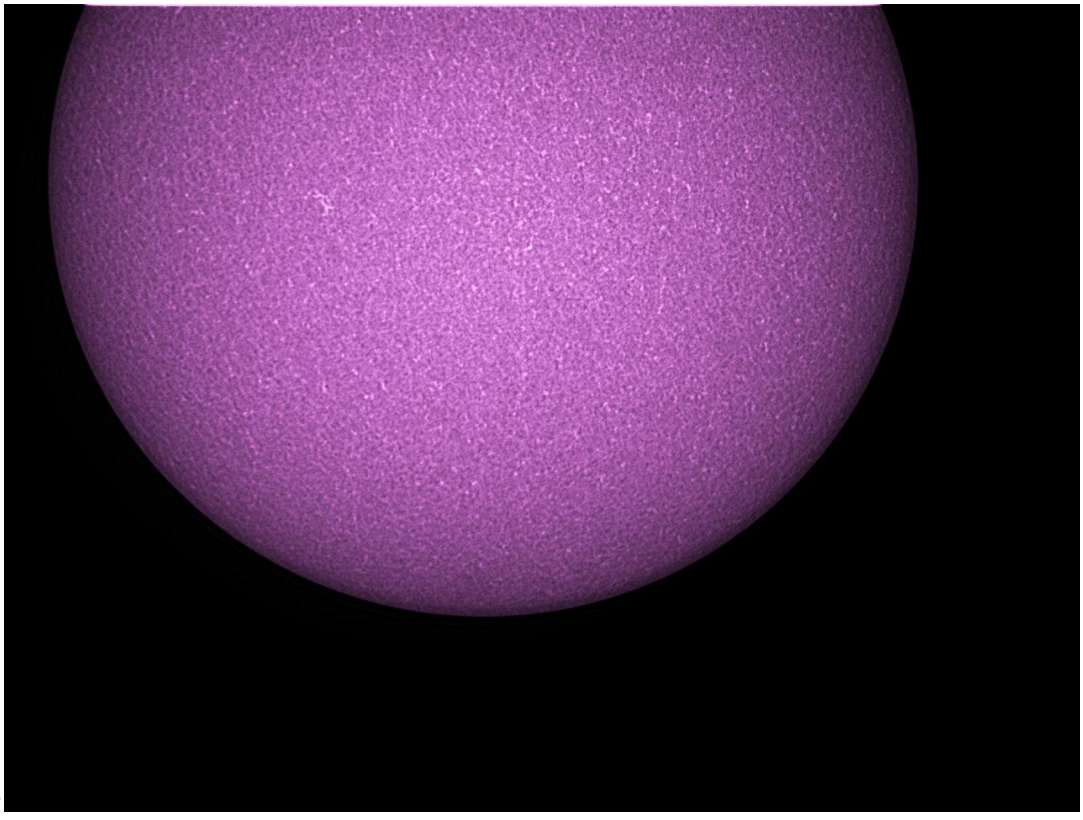
DMK31 CCD post processing



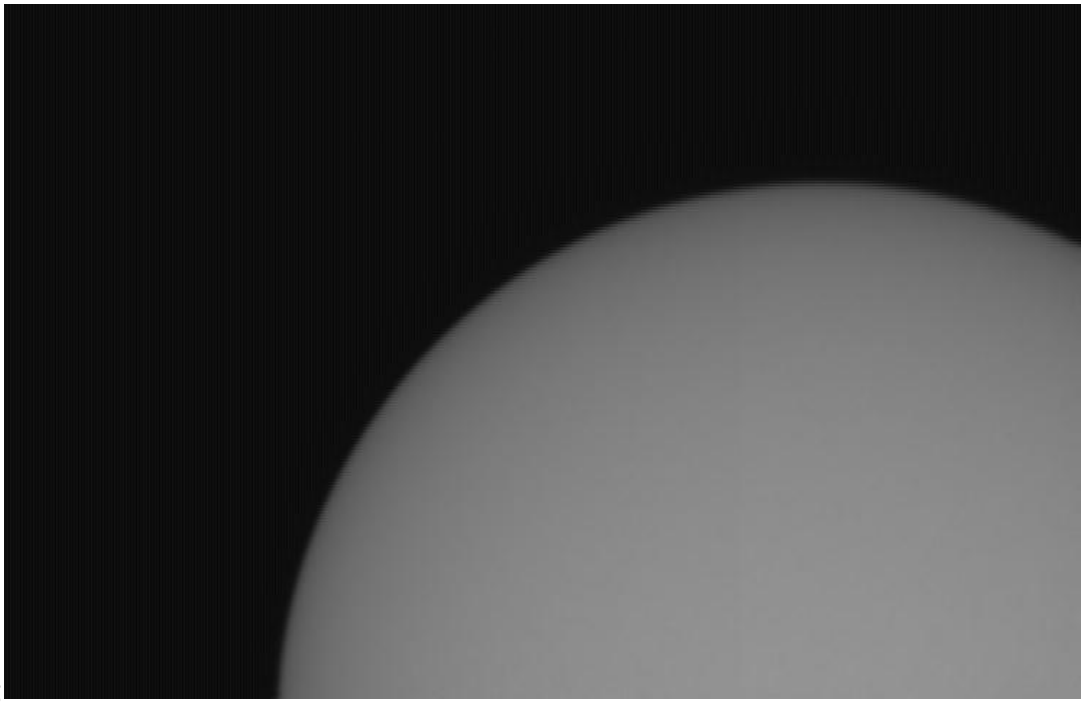
DMK41 CCD pre processing



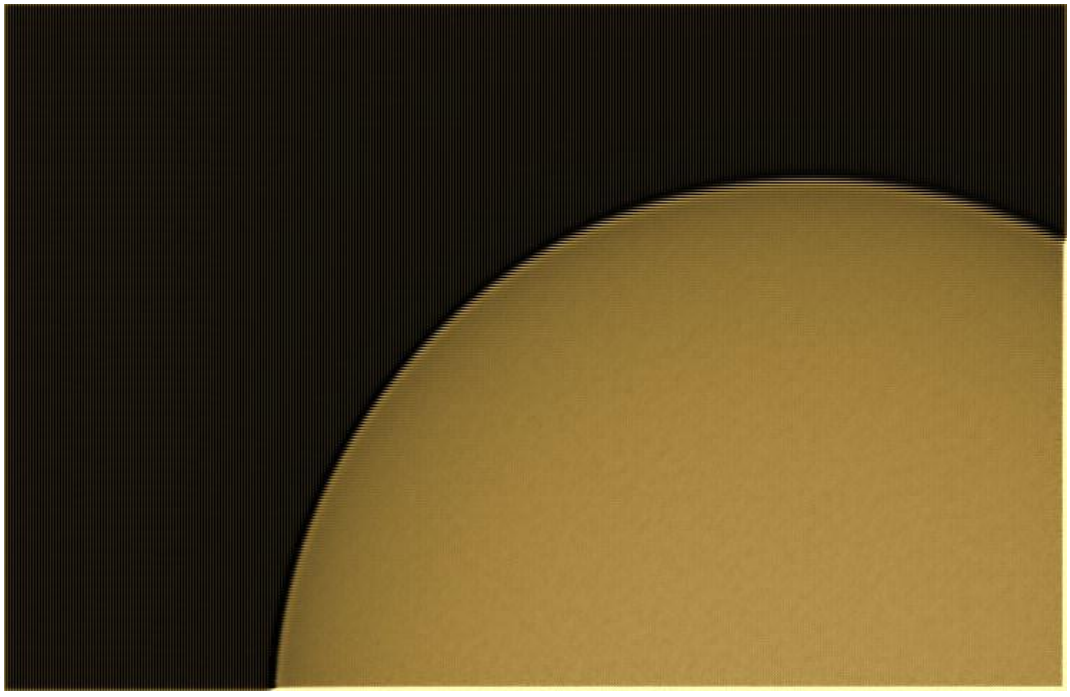
DMK41 CCD post processing



WHITE LIGHT IMAGES:

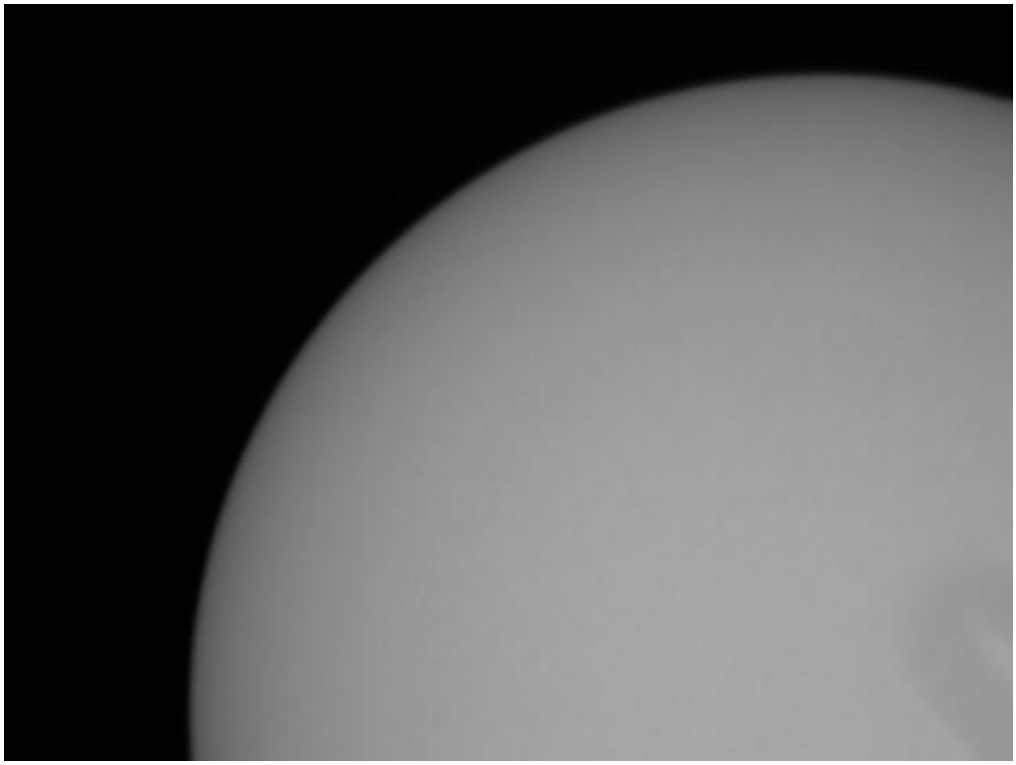


DMK21 CMOS pre processing

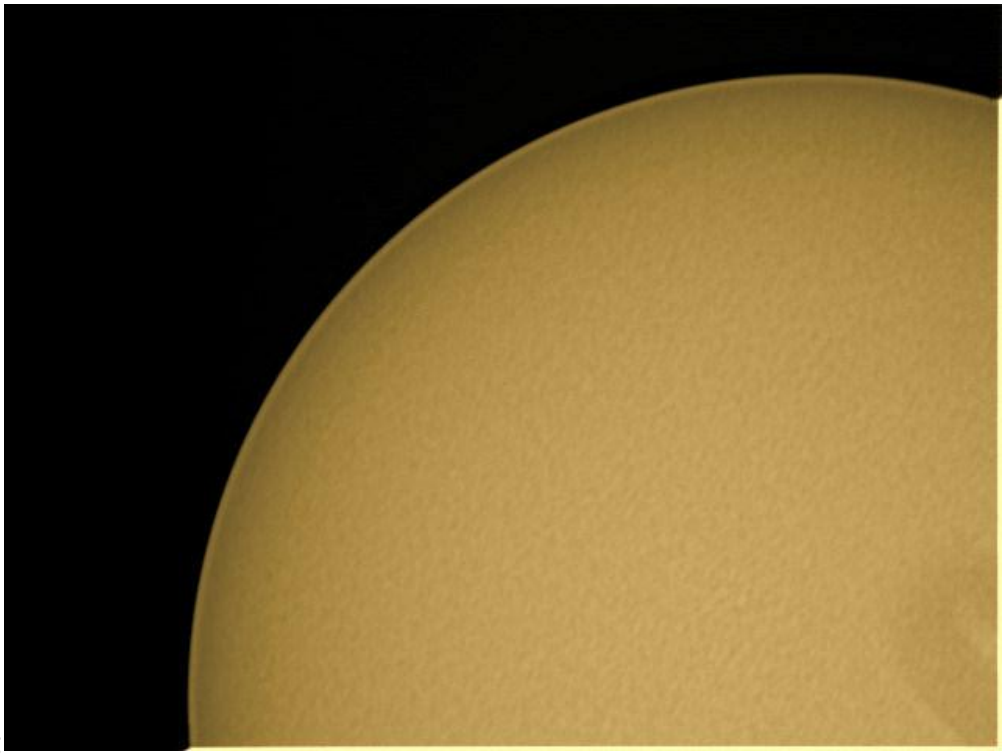


DMK21 CMOS post processing

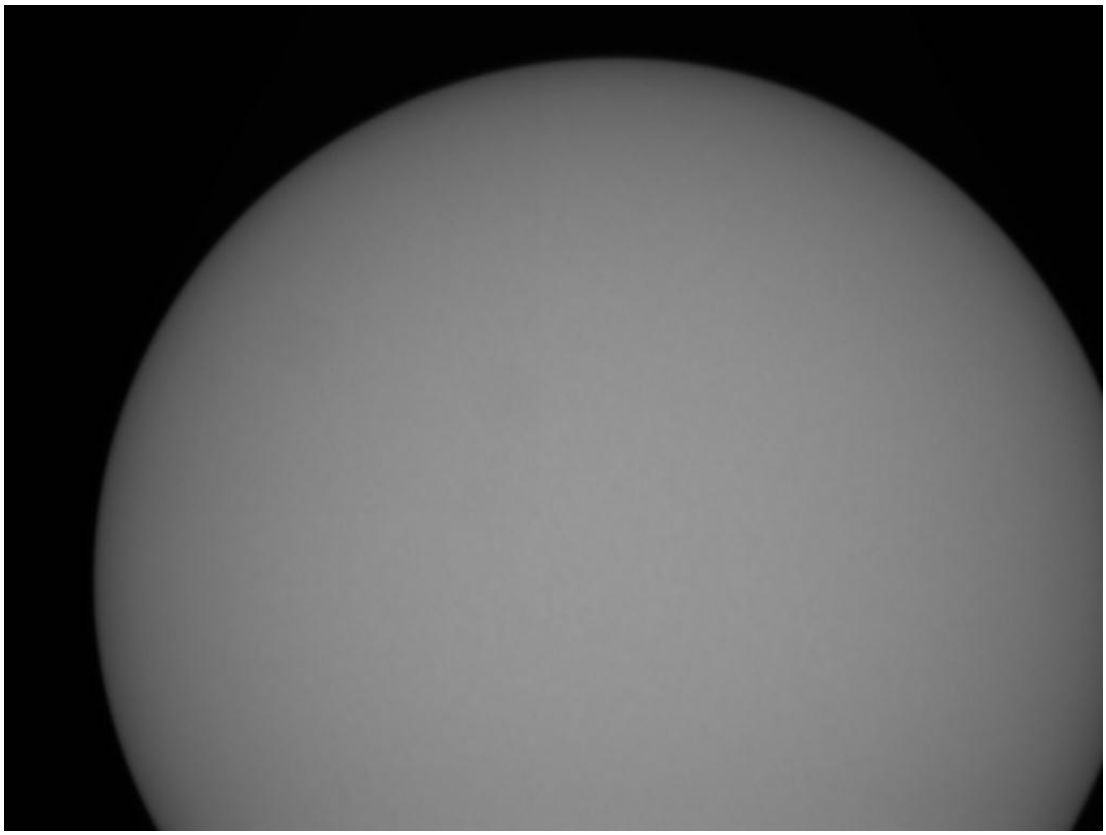
DMK21 CCD pre processing



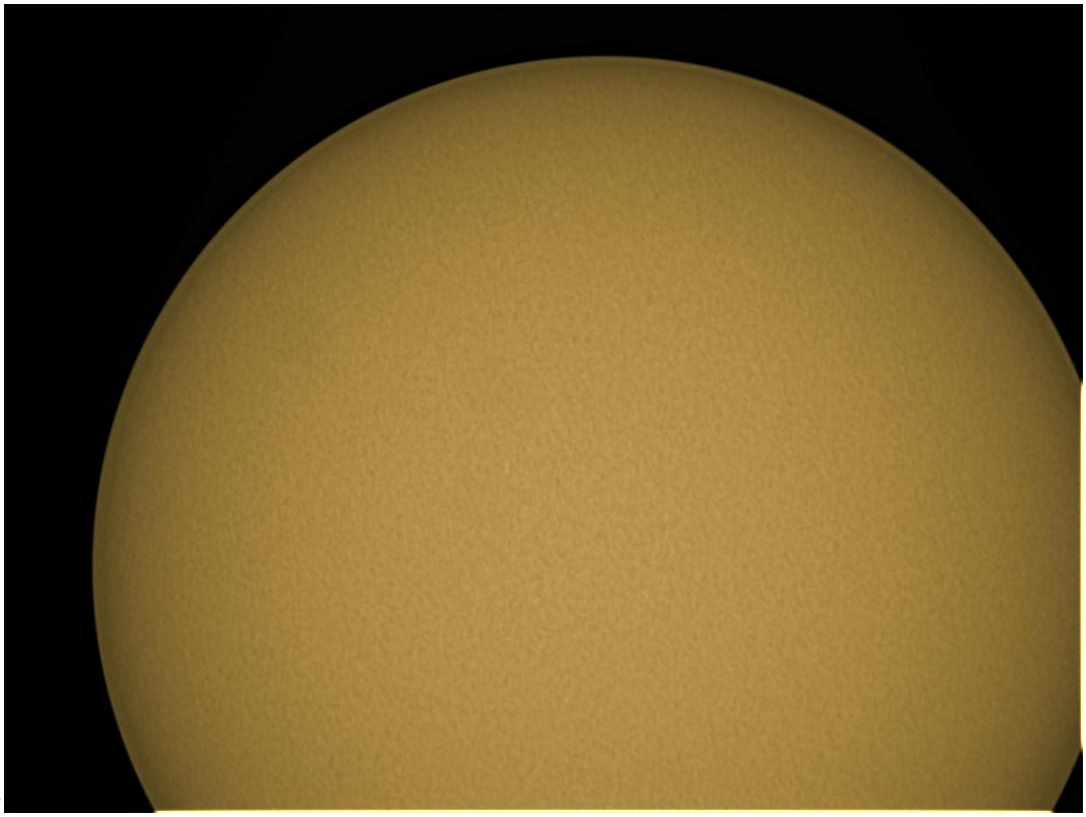
DMK21 CCD post processing



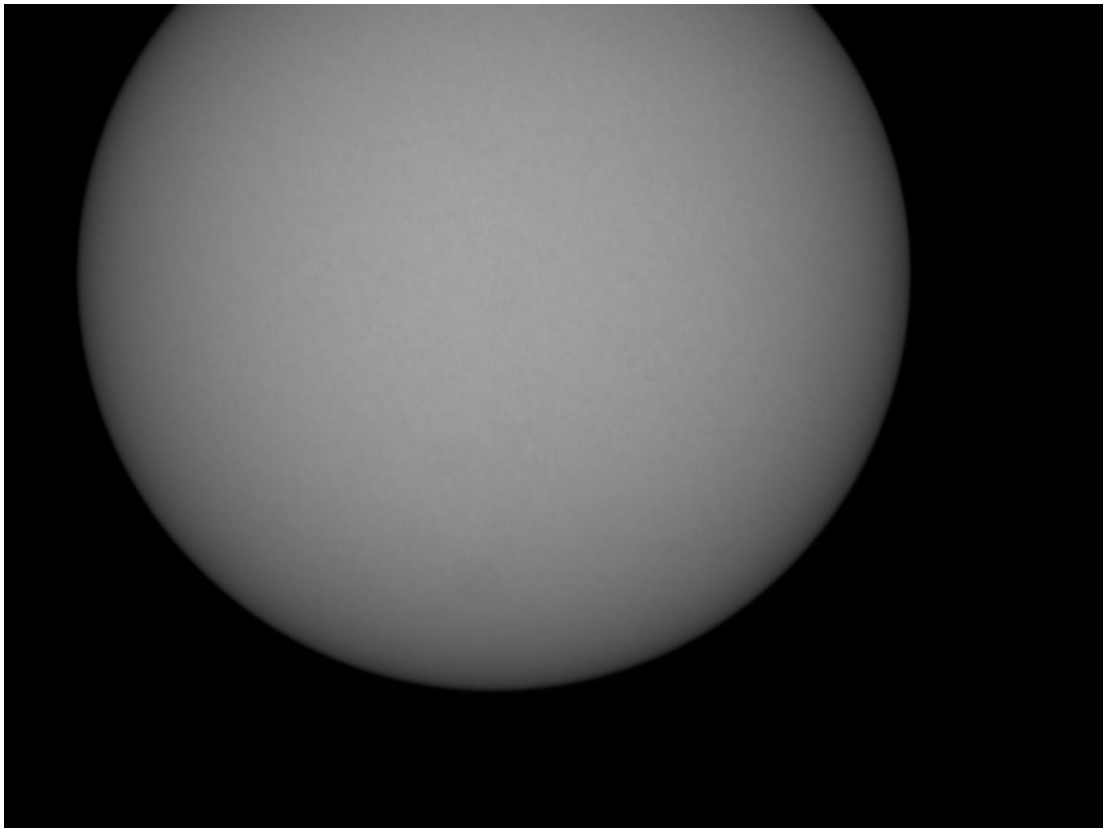
DMK31 CCD pre processing



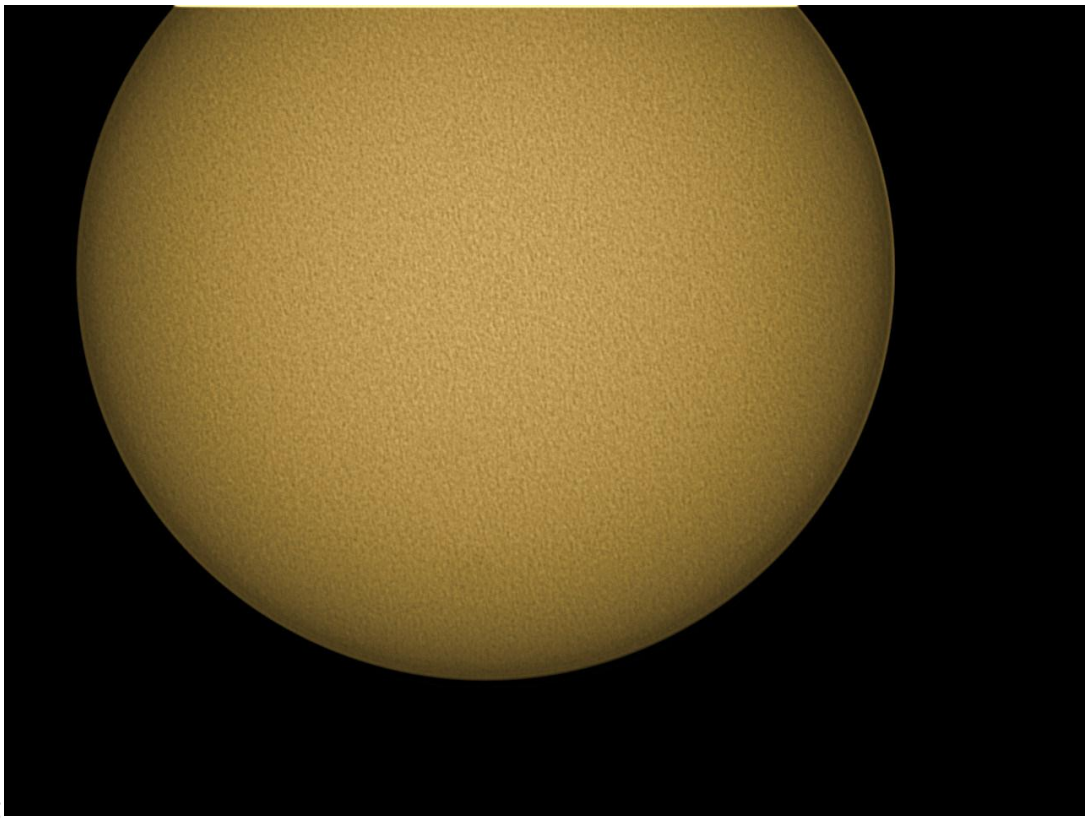
DMK31 CCD post processing



DMK41 CCD pre processing



DMK41 CCD post processing



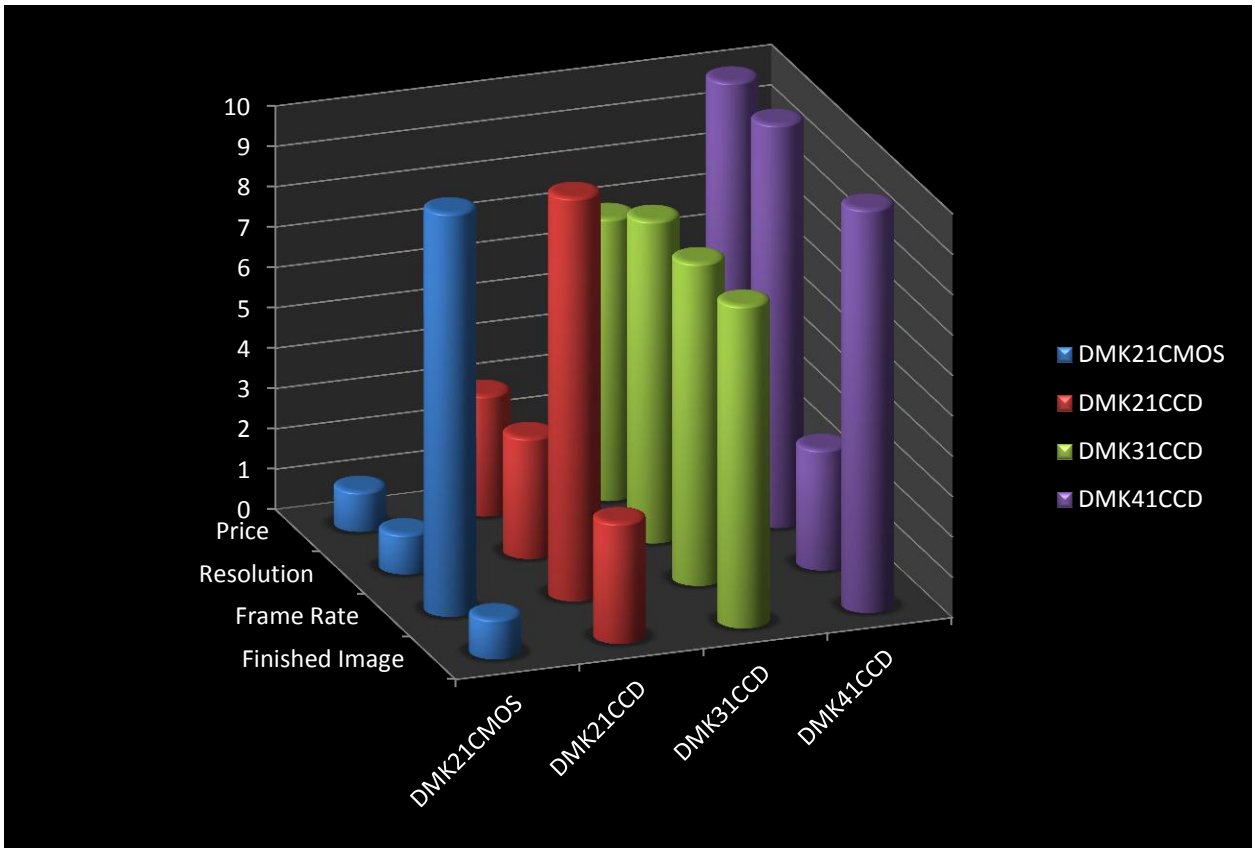
You will notice that as the chip sizes get bigger the resolution improves and the overall raw image gets better and better. The old adage "garbage in, garbage out" applies in that the better single frames you start with of course the better final image after processing. All final images were 800 stacked and aligned frames using Registax and then they were colorized and saved in Corel Photo Paint 10.0. I have seen others in the hobby do a much better job at processing these images with Adobe Photoshop but I wanted to show what a novice result would be with each camera.

BOTTOM LINE:

The CMOS version of the 21 was the smallest and cheapest of the set and it showed in its performance. I would say that it is only a small step above the results you would get from a decent webcam from any computer store. John at DMK wanted me to check out the performance of the CMOS chip I think for his own knowledge more than anything else. I would say that it should only be purchased for solar astrophotography if you are on the tightest of budgets.

I would however strongly recommend any of the CCD versions of these cameras as they all produced a usable image with very little effort or adjustment required.

The following table represents my impressions of some important aspects of the cameras:



In my opinion, the DMK41 Monochrome camera is the one to purchase as it has the highest resolution. The frame rate is a little slow at 15fps but it certainly makes up for it in resolution and field of view for taking full disk images. Since it is currently the same price as the DMK31 I believe that this is the best choice.

Thank you for reading my review. I may be contacted at sramsden@solarastronomy.org for more info on this or any of my reviews.

Below are the actual specifications for these cameras from the manufacturer for those number crunchers out there.

MANUFACTURERS INFORMATION

DMK 21AUC03


Lens not included

- **USB CMOS Monochrome Camera**
- 1/3 " Micron CMOS, progressive scan
- 744x480 pixel
- Up to 60 images/s
- Software included

$ 290.00

GET QUOTATION

or call Sales Department

+1 704-370-0110

- **SPECIFICATION**
- **DOCUMENTATION**
- **DRIVERS & SOFTWARE**

Subject to change	
GENERAL BEHAVIOR	
Video formats @ Frame rate	744x480 Y800 @ 60 fps 640x480 Y800 @ 60 fps
Sensitivity	0.1 lx at 1/30s, gain 20 dB
Dynamic range	ADC: 10 bit, output: 8 bit
SNR	ADC: 8 bit at 25°C, gain 0 dB
INTERFACE (OPTICAL)	
Sensor specification	MT9V023 [192.72 KB]

Type	progressive scan
Format	1/3 "
Resolution	H: 752, V: 480
Pixel size	H: 6.0 µm, V: 6.0 µm
Lens mount	C/CS
INTERFACE (ELECTRICAL)	
Supply voltage	4.5 to 5.5 VDC
Current consumption	approx 250 mA at 5 VDC
INTERFACE (MECHANICAL)	
Dimensions	H: 50.6 mm, W: 50.6 mm, L: 29 mm
Mass	140 g
ADJUSTMENTS (MAN)	
Shutter	1/10000 to 1/4 s
Gain	0 to 12 dB
ADJUSTMENTS (AUTO)	
Shutter	1/10000 to 1/4 s
Gain	0 to 12 dB
ENVIRONMENTAL	
Max. temperature (operation)	-5 °C to 45 °C
Max. temperature (storage)	-20 °C to 60 °C
Max. humidity (operation)	20 % to 80 % non-condensing
Max. humidity (storage)	20 % to 95 % non-condensing

DMK 21AU04

Lens not included

- **USB CCD Monochrome Camera**
- 1/4 " Sony CCD, progressive scan
- 640x480 pixel
- Up to 60 images/s
- Software included

$ 390.00

GET QUOTATION

or call Sales Department

+1 704-370-0110

- **SPECIFICATION**
- **DOCUMENTATION**
- **DRIVERS & SOFTWARE**

Subject to change	
GENERAL BEHAVIOR	
Video formats @ Frame rate	640x480 Y800 @ 60, 30, 15, 7.5, 3.75 fps
Sensitivity	0.5 lx at 1/30s, gain 20 dB
Dynamic range	ADC: 10 bit, output: 8 bit
SNR	ADC: 9 bit at 25°C, gain 0 dB
INTERFACE (OPTICAL)	
Sensor specification	ICX098BL [321.55 KB]
Type	progressive scan
Format	1/4 "

Resolution	H: 640, V: 480
Pixel size	H: 5.6 µm, V: 5.6 µm
Lens mount	C/CS
INTERFACE (ELECTRICAL)	
Supply voltage	4.5 to 5.5 VDC
Current consumption	approx 500 mA at 5 VDC
INTERFACE (MECHANICAL)	
Dimensions	H: 50.6 mm, W: 50.6 mm, L: 50 mm
Mass	265 g
ADJUSTMENTS (MAN)	
Shutter	1/10000 to 30 s
Gain	0 to 36 dB
Offset	0 to 511
ADJUSTMENTS (AUTO)	
Shutter	1/10000 to 30 s
Gain	0 to 36 dB
Offset	0 to 511
ENVIRONMENTAL	
Max. temperature (operation)	-5 °C to 45 °C
Max. temperature (storage)	-20 °C to 60 °C
Max. humidity (operation)	20 % to 80 % non-condensing
Max. humidity (storage)	20 % to 95 % non-condensing

DMK 31AU03

Lens not included

- **USB CCD Monochrome Camera**
- 1/3 " Sony CCD, progressive scan
- 1024x768 pixel
- Up to 30 images/s
- Software included

$ 630.00

GET QUOTATION

or call Sales Department

+1 704-370-0110

- **SPECIFICATION**
- **DOCUMENTATION**
- **DRIVERS & SOFTWARE**

Subject to change	
GENERAL BEHAVIOR	
Video formats @ Frame rate	1024x768 Y800 @ 30, 15, 7.5, 3.75 fps
Sensitivity	0.5 lx at 1/15s, gain 20 dB
Dynamic range	ADC: 10 bit, output: 8 bit
SNR	ADC: 9 bit at 25°C, gain 0 dB
INTERFACE (OPTICAL)	
Sensor specification	ICX204AL [267.38 KB]
Type	progressive scan
Format	1/3 "

Resolution	H: 1024, V: 768
Pixel size	H: 4.65 µm, V: 4.65 µm
Lens mount	C/CS
INTERFACE (ELECTRICAL)	
Supply voltage	4.5 to 5.5 VDC
Current consumption	approx 500 mA at 5 VDC
INTERFACE (MECHANICAL)	
Dimensions	H: 50.6 mm, W: 50.6 mm, L: 50 mm
Mass	265 g
ADJUSTMENTS (MAN)	
Shutter	1/10000 to 30 s
Gain	0 to 36 dB
Offset	0 to 511
Saturation	0 to 200 %
White balance	-2 dB to +6 dB
ADJUSTMENTS (AUTO)	
Shutter	1/10000 to 30 s
Gain	0 to 36 dB
Offset	0 to 511
White balance	-2 dB to +6 dB
ENVIRONMENTAL	
Max. temperature (operation)	-5 °C to 45 °C
Max. temperature (storage)	-20 °C to 60 °C
Max. humidity (operation)	20 % to 80 % non-condensing
Max. humidity (storage)	20 % to 95 % non-condensing

DMK 41AU02

Lens not included

- **USB CCD Monochrome Camera**
- 1/2 " Sony CCD, progressive scan
- 1280x960 pixel
- Up to 15 images/s
- Software included

$ 870.00

GET QUOTATION

or call Sales Department

+1 704-370-0110

- **SPECIFICATION**
- **DOCUMENTATION**
- **DRIVERS & SOFTWARE**

Subject to change	
GENERAL BEHAVIOR	
Video formats @ Frame rate	1280x960 Y800 @ 15, 7.5, 3.75 fps
Sensitivity	0.5 lx at 1/7.5s, gain 20 dB
Dynamic range	ADC: 10 bit, output: 8 bit
SNR	ADC: 9 bit at 25°C, gain 0 dB
INTERFACE (OPTICAL)	
Sensor specification	ICX205AL [271.91 KB]
Type	progressive scan
Format	1/2 "

Resolution	H: 1360, V: 1024
Pixel size	H: 4.65 µm, V: 4.65 µm
Lens mount	C/CS
INTERFACE (ELECTRICAL)	
Supply voltage	4.5 to 5.5 VDC
Current consumption	approx 500 mA at 5 VDC
INTERFACE (MECHANICAL)	
Dimensions	H: 50.6 mm, W: 50.6 mm, L: 50 mm
Mass	265 g
ADJUSTMENTS (MAN)	
Shutter	1/10000 to 30 s
Gain	0 to 36 dB
Offset	0 to 511
Saturation	0 to 200 %
White balance	-2 dB to +6 dB
ADJUSTMENTS (AUTO)	
Shutter	1/10000 to 30 s
Gain	0 to 36 dB
Offset	0 to 511
White balance	-2 dB to +6 dB
ENVIRONMENTAL	
Max. temperature (operation)	-5 °C to 45 °C
Max. temperature (storage)	-20 °C to 60 °C
Max. humidity (operation)	20 % to 80 % non-condensing
Max. humidity (storage)	20 % to 95 % non-condensing