

Zero Gain vs 100% Gain Test

Meade DSI Pro II

Overview

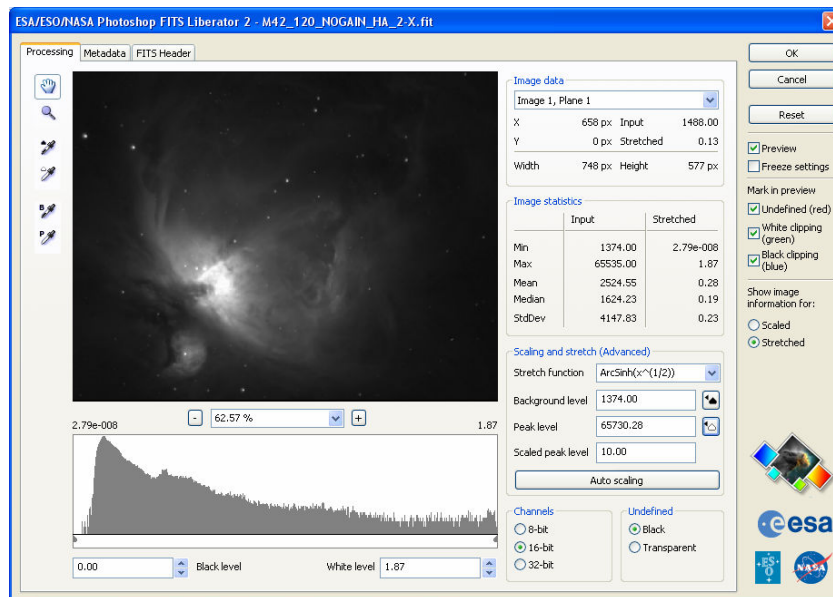
I wanted test the effects on imaging of using the standard of 100% gain and using 0% gain against each other. I was convinced, based on something that I remembered from years ago using my SAC 8 camera, that using no gain might provide an answer to a couple of problems that appear in many DSI images. The first problem is bloated stars. These seem to appear virtually regardless of the exposure time and while various filters will lower the bloating, it still appears very high at times. Secondly, especially when shooting a target such as M42, some parts of the image will tend to saturate very early on and the user is forced to take exposures of various durations to compensate.

Test

To conduct this test, I used the DSI Pro II thru my Meade 80mm ED APO scope with a Schuler 10nm HA filter. For this test I took a series of images at both 100% gain and at 0% gain with each set composed of 10 2 minute exposures. Transparency for this test was very good while seeing was about 5 out of 10, low humidity and no cloud cover. Winds were light and variable out of the west causing some issues with guiding and hence, some stars that were not quite round in the end.

No dark frames were used for either of these images as I ran into another issue to be discussed later regarding the use of dark frames with images shot at less than 100% gain. However, active cooling was used on the camera and the temperature was regulated to -10 degrees Celsius. With the two minute exposures, there was virtually no noise from heat which needed to be removed later.

After each set of images were captured, they were combined in MaximDL using the Sigma Clip function and saved as FITS files with full screen stretch (no manual stretching or clipping). The resultant images were then opened in Photoshop CS 2.0 using the FITS Liberator plug-in, ArcSinH($X^{1/2}$) max screen stretch (both with a black point of 0 and White point of 1.87) as seen below:



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The Images below show the results of the two images once opened in Photoshop with no stretching:



10 x 2 Minute Exposures, 0% Gain, Unstretched

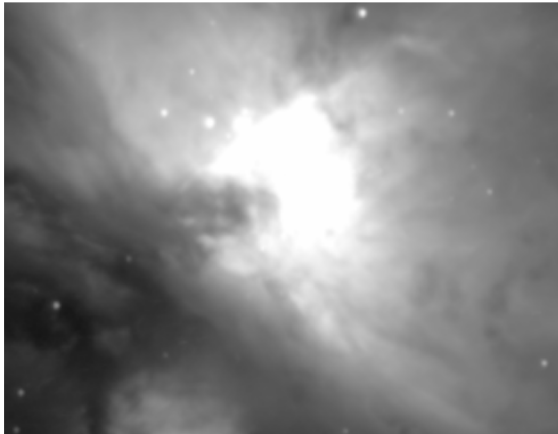


10 x 2 Minute Exposures, 100% Gain, unstretched

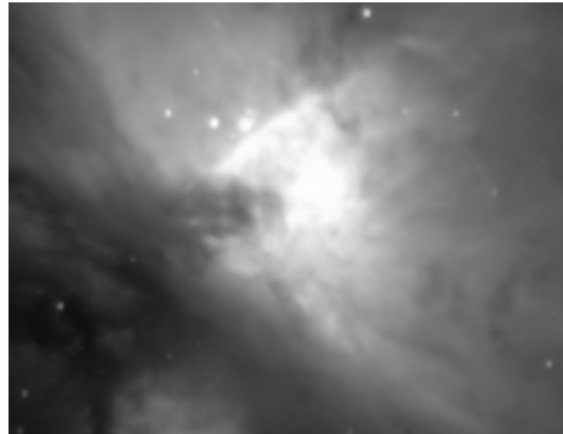
As can be seen, there is very little in the way of additional detail provided by the image shot at 100% gain but the core of M42 is completely blown out in the 100% gain image while it is still fairly well resolved in the image shot at 0% gain.

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This image shows the Trapezium zoomed in to 200%. This shows clearly that not only is the Trapezium itself blown out but it has started to reach into the adjacent stars in the 100% Gain image:



100% Gain

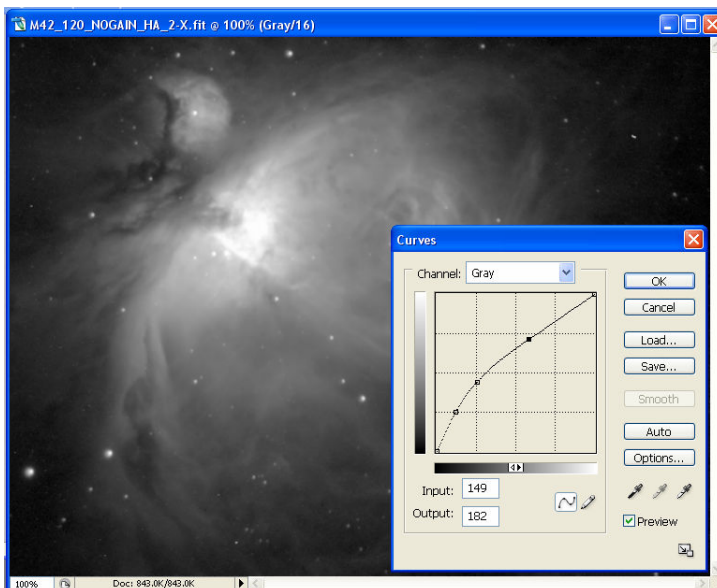


0% Gain

Although I had expected the stars in the 100% image to be bloated more than they are, they are actually in line with what might be expected from a slightly higher white point. While it is expected that at some point, the center of this nebula will be considerably brighter than the surrounding area to the point that it will blow out the white point, it can clearly be seen here that by imaging at zero gain, you are able to take exposures that will bring out the finer details while.

Stretched Images

Since we rarely work with images at full screen stretch and generally stretch them again after opening, I also decide to see what the impact would be on these images once stretched. For this, I used the standard curve as described by Ron Wodaski in his Zone Image Processing book. This is a three point Curve as seen below.



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This same curve was applied to both images with the results seen below:



Zero Gain Stretched



100% Gain Stretched

As can be see, there is till relatively little difference in the nebulosity that is visible and the core of the nebula was still able to be controlled.

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What do We Get?

So, does this work in practice or does the photographer need to still need to capture images at 100% Gain. For fun, I went ahead and captured (along with the HA), 10 images in SII and 13 images in OIII and mapped them in Photoshop to R=SII, G=HA, and B=OIII. The resultant image below has had very little done to it after mapping the channels other then stretches to bring up the intensity.



Conclusion

Although the use of gain may allow for shorter exposures of some objects and may be a preferable setting for unguided or Alt/Az imaging, I believe these tests have shown that not only is it possible to get the same detail with zero gain but also to retain detail and small stars that may have been blown out otherwise: