WIDE-FIELD H-ALPHA IMAGING WITH A ZWO ASI2600MM

PEDRO RÉ
https://pedroreastrophotography.com/

The ZWO ASI 2600MM Pro[1] uses Sony's latest back-illuminated IMX571 APS-C format native 16-bit ADC sensor. It's one of the most used astronomy cameras (Figure 1). Here is some of the reasons why:

- Ultra-high 14 stops dynamic range.
- Ultra-low 1.0e readout noise.
- Innovative breakthrough design resulting in zero amp-glow.
- 16-bit ADC sensor.

Like the colour version, the ASI2600MM Pro also has a very light weight of just 700 grams.

This 26Mb camera features a small pixel size (3.76 µm) and a large well depth (50 Ke).

The sensor length and width are 23.5 mm x 15.7 mm. The diagonal is 28.3 mm.

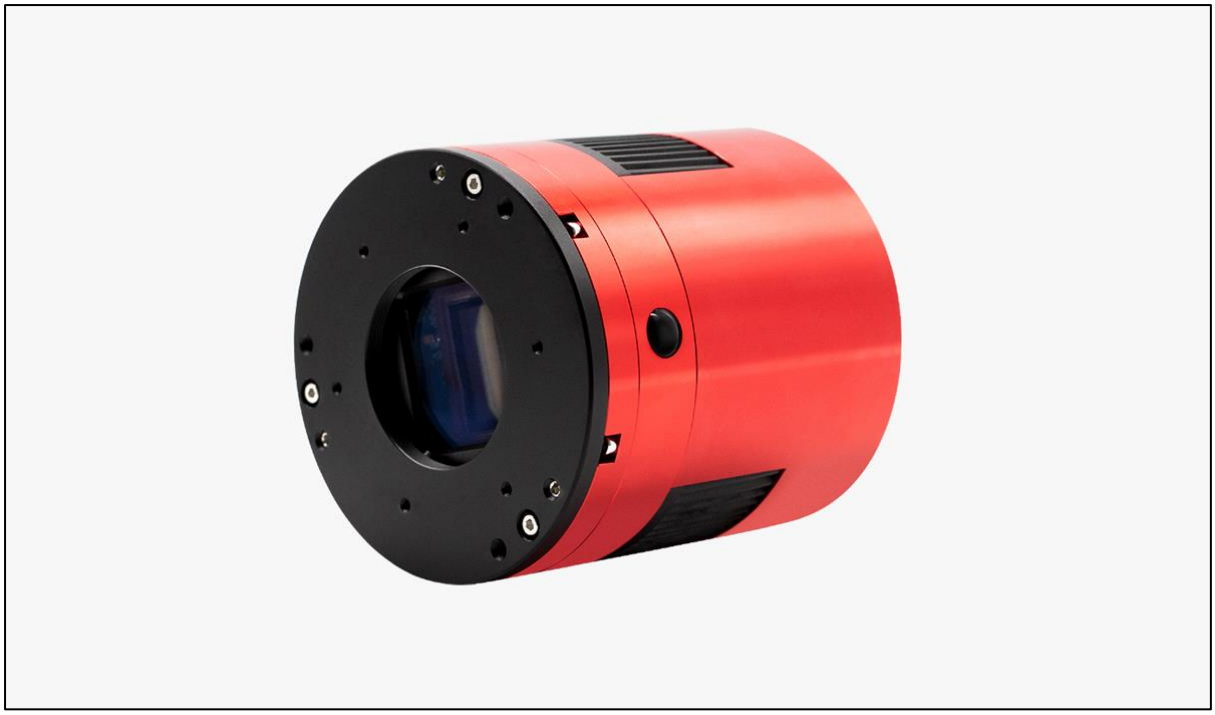
The ASI2600MM Pro was conceived having in mind the optimal characteristics for astrophotography. This 16bit ADC is not a CCD 16bit ADC. It can really achieve a dynamic range output of 14 stop, which will significantly improve the image sharpness and contrast, and create smoother and more natural contrast transitions (as well as colour gradients when using different types of filters).

Sony's back-illuminated CMOS image sensor (Figure 2) improves the sensitivity and noise reduction – the key factors to enhancing image quality. It does this by radically realigning the fundamental pixel structure from front-illumination to back-illumination, while still retaining the advantages of CMOS image sensors such as low power consumption and high-speed operation.

With a conventional front-illumination structure, the metal wiring, and transistors on the surface of the silicon substrate that form the sensor's light-sensitive area (photodiode), impede photon-gathering carried out by the on-chip lens. A back-illuminated structure minimizes the degradation of sensitivity to the optical angle response, while also increasing the amount of light that enters each pixel due to the lack of obstacles such as metal wiring and transistors. These components have been moved to the backside of the silicon substrate.

Traditional CMOS sensors produce a weak infrared light source during operation quite often seen in the corner of uncalibrated images. It is the tell-tale signs of 'amp glow'. As the ASI2600MM Pro uses zero-amp glow circuitry, you won't have to worry about amp glow even when using high gain, long exposure imaging.

[1] https://astronomy-imaging-camera.com/product/asi2600mm-pro-mono/



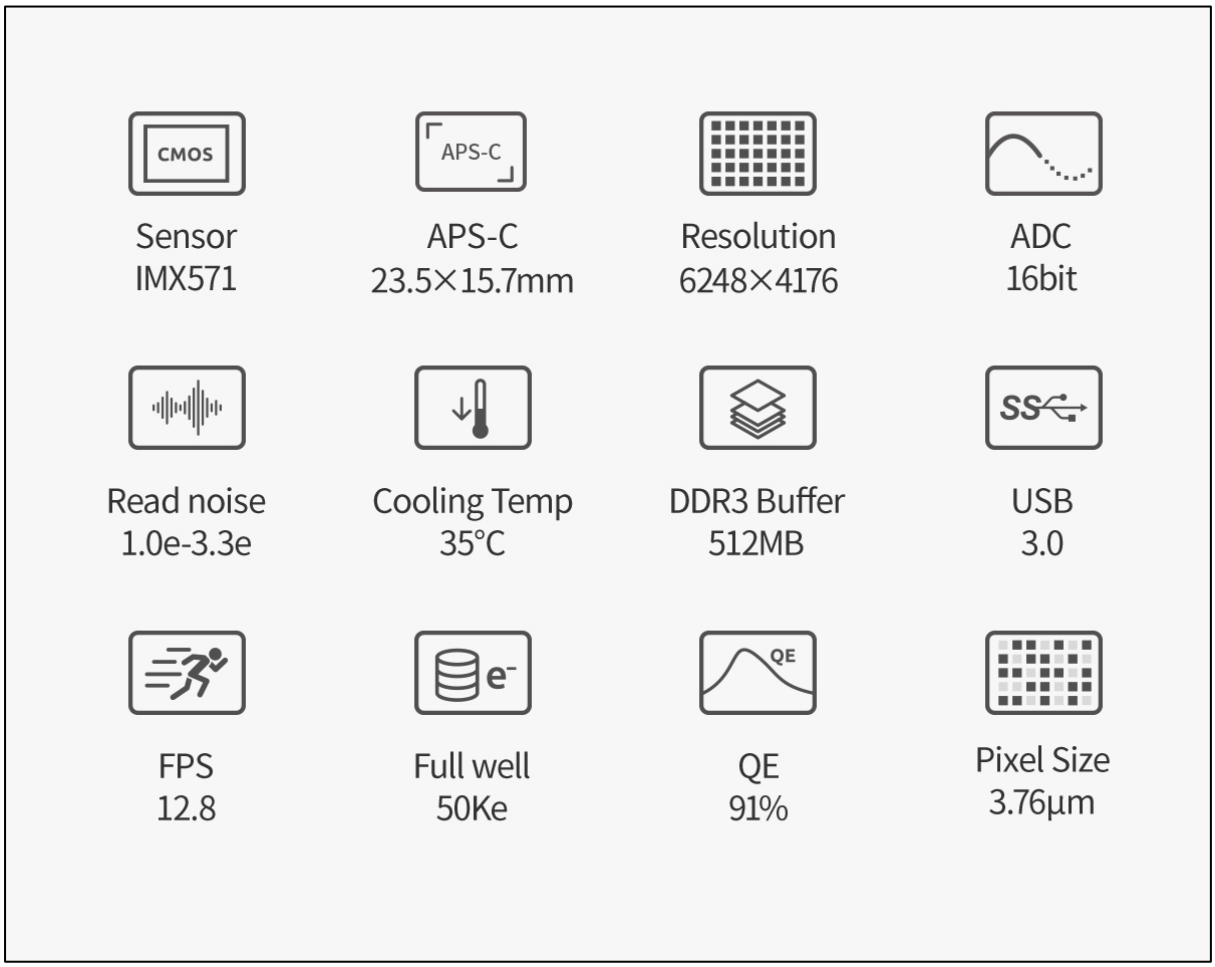


Figure 1 – ZWO ASI2600mm Specs.

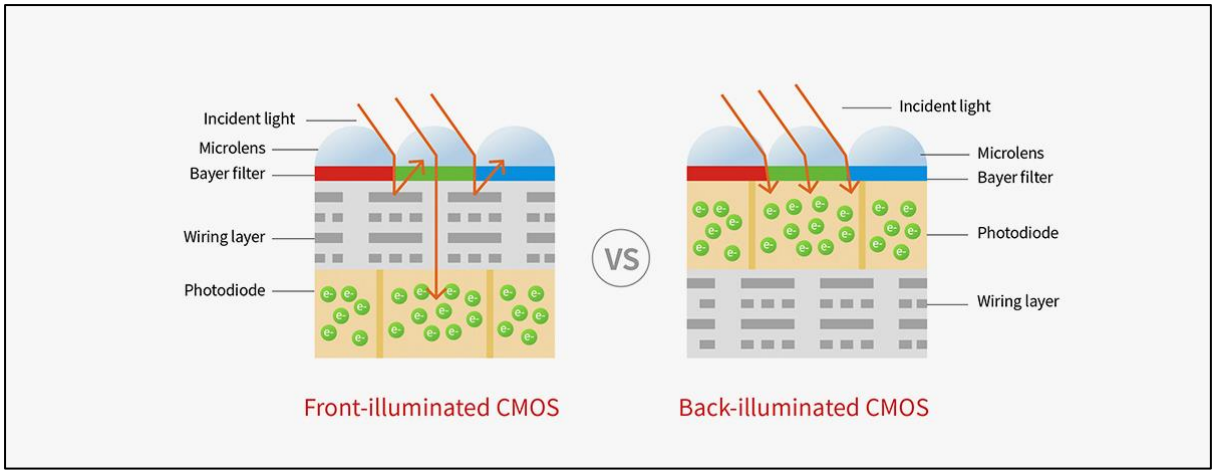


Figure 2- Sony's back-illuminated CMOS image sensor.

The ASI2600MM Pro boasts excellent performance with a dynamic range of up to 14 stops. When the gain value is set to 100, the HCG high gain mode is turned on. With the HCG-mode turned on, the readout noise is greatly reduced, and the dynamic range is basically unchanged. To improve the data quality, it is recommended to set the gain to 0 or gain 100 during deep-sky imaging (Figure 3).

Traditional CMOS sensors produce a weak infrared light source during operation quite often seen in the corner of uncalibrated images. It is the tell-tale signs of 'amp glow'. As the ASI2600MM Pro uses zero-amp glow circuitry, you won't have to worry about amp glow even when using high gain, long exposure imaging (Figure 4).

There is a polyimide heater completely fitting the protective window in the ASI2600MM Pro camera. It can help avoid any potential annoying dew or icing issues depending on the environment in which you capture images (Figure 5).

The power of the heater is around 5W. You are free to turn it off anytime in your photography software if you want to save power.

the QE peak value of the ASI2600MM Pro is 91% (Figure 6).

With a two stage TEC cooling, ASI2600MM Pro can lower the CMOS sensor temperature to more than 35 ° Celsius below ambient temperature, which can significantly reduce dark current generation and sensor noise even during extended exposure times[2].

The unique dark current suppression technology can further reduce dark current noise. At a cooling temperature of 0 °C, the dark current noise is only 0.0022e/s/pixel. This means a 300s exposure will only cause 0.7e dark current noise, which is less than the readout noise. While at a cooling temperature of -20 °, the dark current can even reduce to 0.00012e/s/pixel, which is completely negligible!

The ASI2600MM Pro is equipped with a USB 3.0 transmission interface and a built-in 512MB DDR3 cache to ensure stable and secure data transmission (Figure 7)

[2] The Delta T 35 ℃ is tested at 30 ℃ ambient temperature. It might get down when the cooling system is working for a long time. Also, as the ambient temperature falls, the Delta T would also decrease.

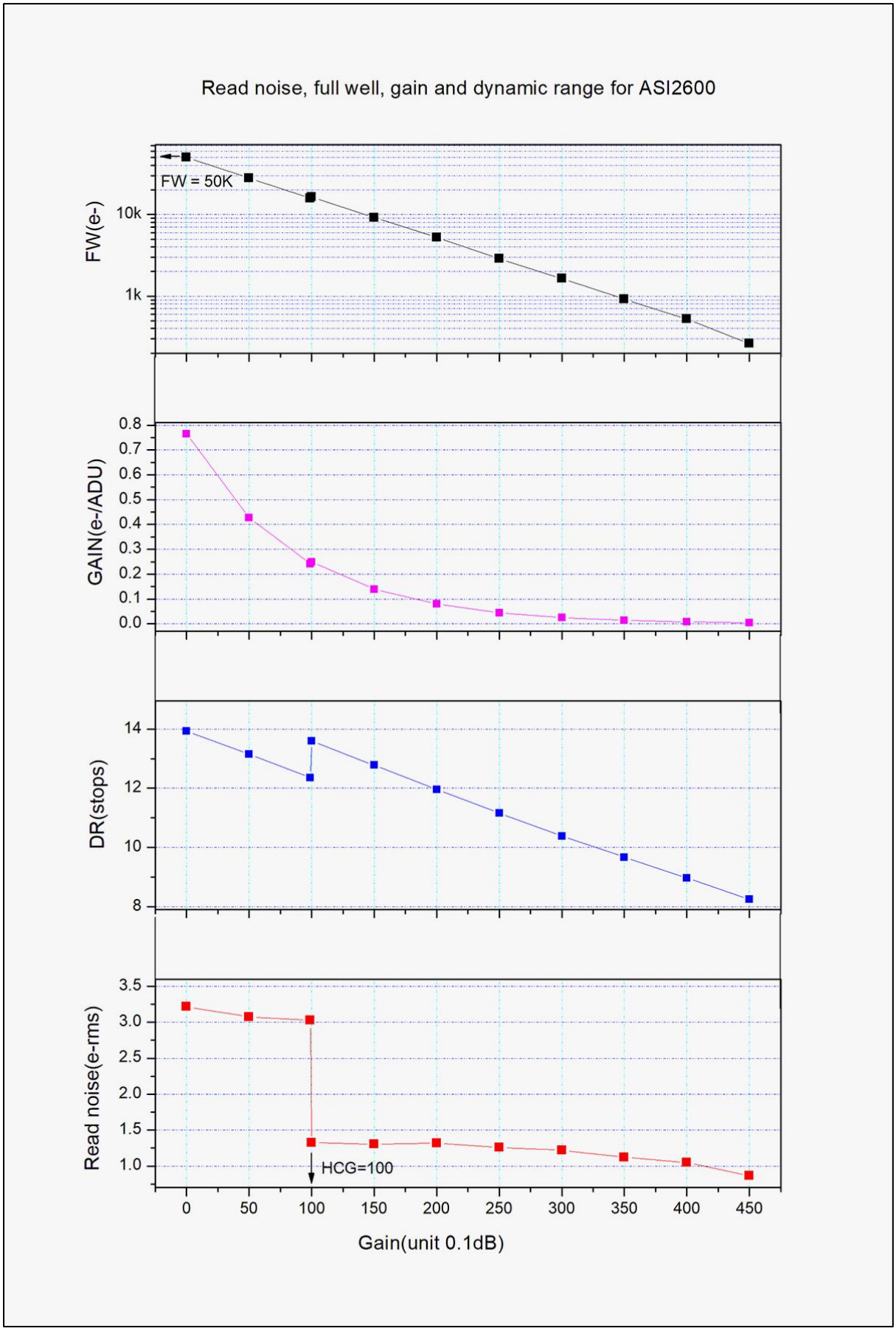


Figure 3- Read noise, full ell, gain and dynamic range of the ZWO ASI2600MM.

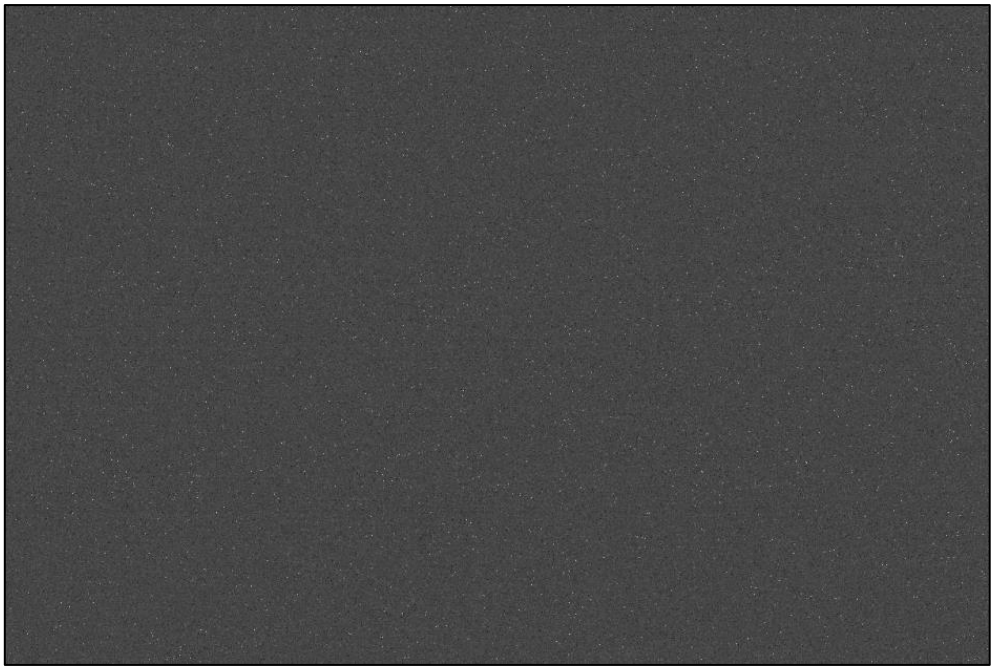


Figure 4- Dark frame from ASI2600 without any amp glow (300 s exposure).

Figure 5- Polyimide heater completely fitting the protective window
in the ASI2600MM Pro camera.

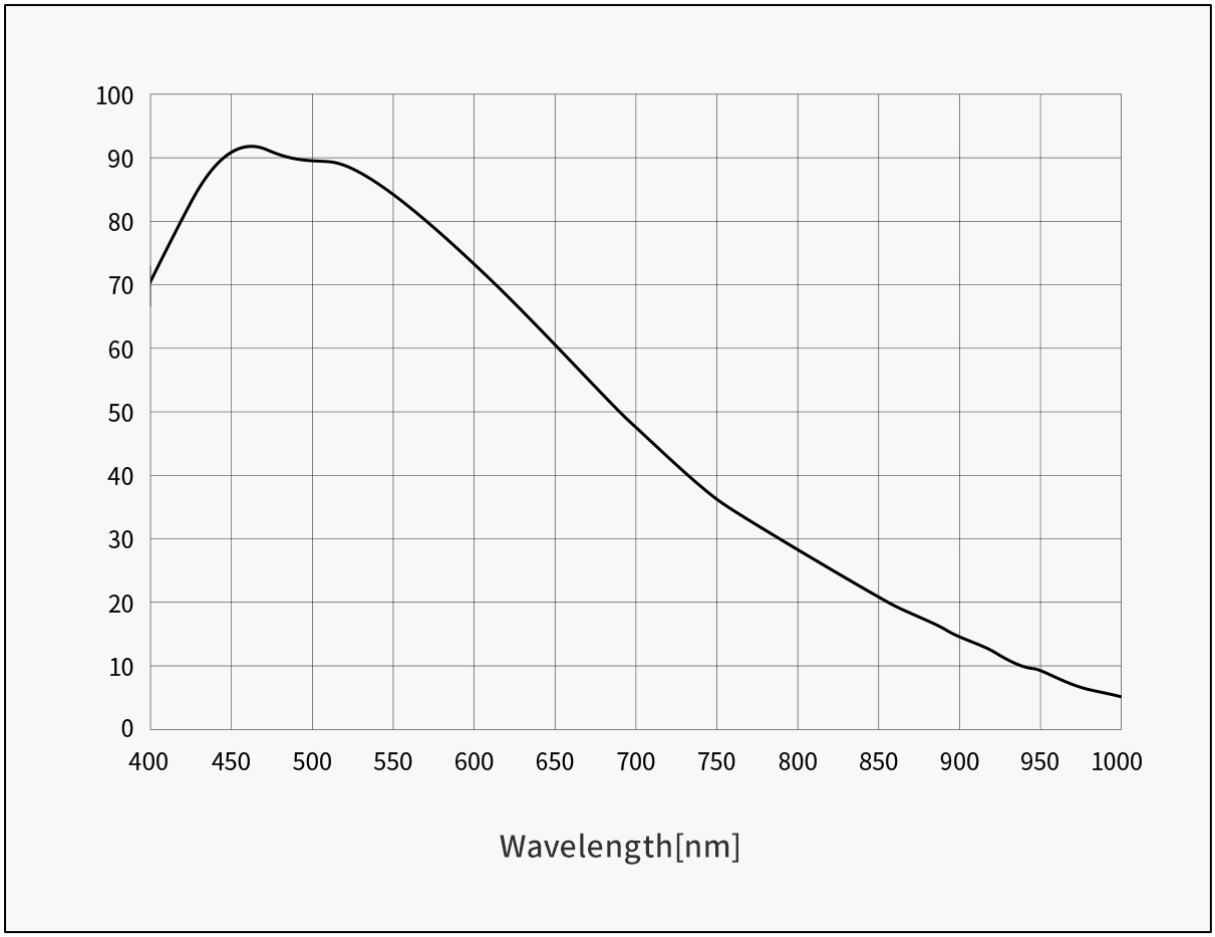


Figure 6- Quantum Efficiency of the ZWO ASI2600MM.

Figure 7- Built-in 512MB DDR3.

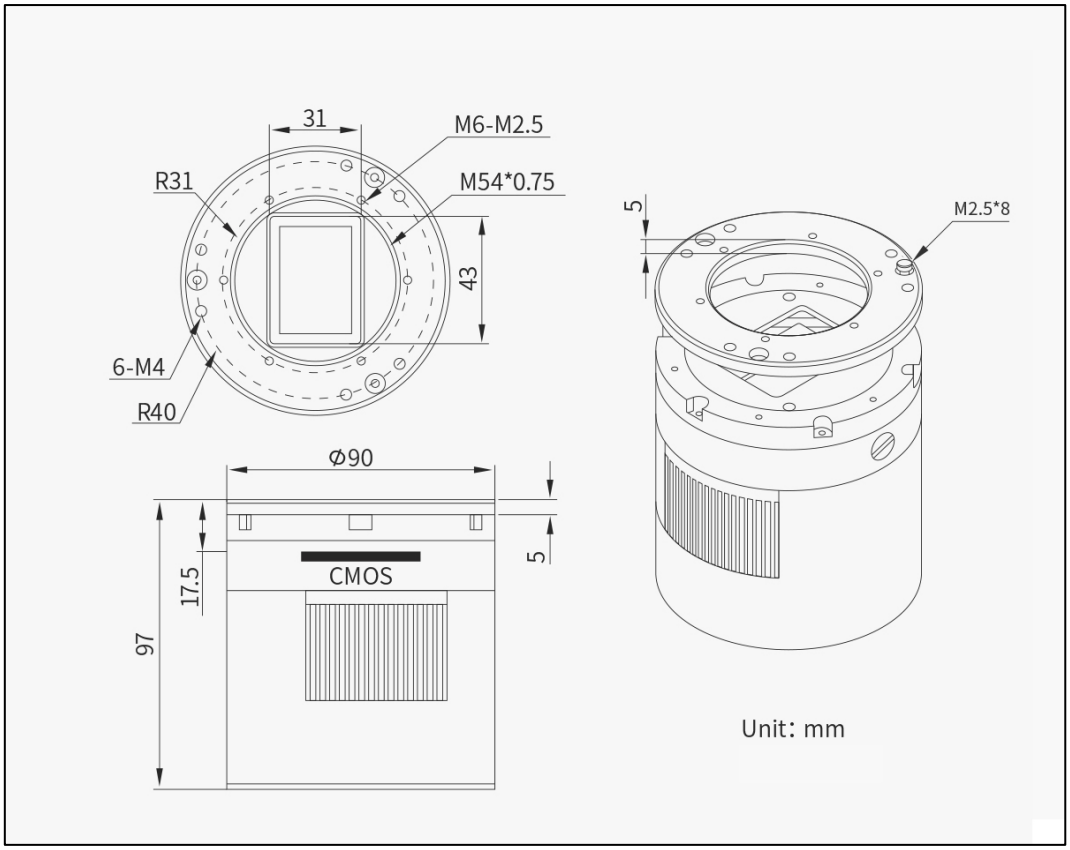


Figure 8- Mechanical diagram.

Figure 9- In the Box.

For Wide-Field imaging the ZWO 2600Mm can be adapted to several objectives (Figure 10).

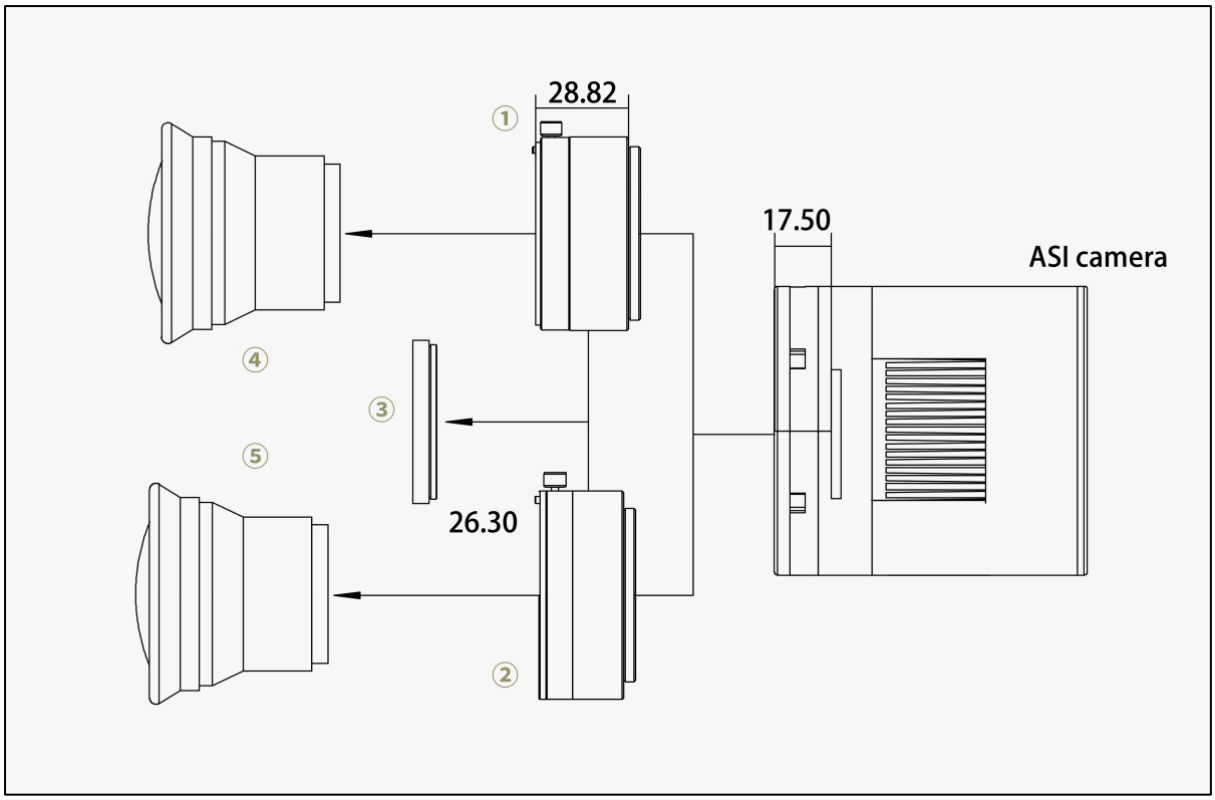


Figure 10- Connection diagram. 1- Nikon T2 adapter, Canon EOS T2 adapter, 3- filter (*e.g.* H-alpha), 4- Nikon lens, 5- Canon Lens.

The ZWO 2600MM should be connected to an external DC 12V @3A~5A power supply adapter for use (connector 5.5 x 2.1mm, centre pole positive) for deep-sky imaging (long integration times).

The Samyang/Rokinon 135mm f/2 is a great lens for wide-field deep sky imaging (Figure 11, 12). This lens features:

- Full frame compatible with an 18.8 ° angle of view on full frame cameras and a 12.4 ° angle of view on APS-C cameras.
- Ultra Multi-Coated (UMC) Optics. Compatible with both full frame and APS-C format mirrorless E mount cameras.
- Minimum Focusing Distance of 2.6 ft. with fast apertures of f/2.0 – f/22.
- 9 diaphragm blades and includes a removable lens hood. One extra-low dispersion (ED) lens element reduces chromatic aberrations.

This objective lens delivers images with incredible clarity, even at its widest aperture (f2). It is a manual focus lens. It delivers images with excellent contrast and sharpness on a high resolution, even with the aperture opened to f2.0[3].

The Samyang 135mm f2 ED UMC is a medium telephoto lens with a large aperture for full-frame bodies. The relatively low-price tag (about 500 €) makes it relatively affordable especially compared to the similarly spec Zeiss Apo Sonnar.

[3] https://www.cameralabs.com/samyang-rokinon-135mm-f2-ed-umc-review/2/

The Samyang is available for Canon EF, Nikon F (AE), Sony E and A mounts, Fujifilm X, and MFT. The Nikon version is the only one with a chip and an automatic aperture. With the other versions you have to stop down manually before shooting and no EXIF data will be transferred to the camera. The Samyang is also available under the Rokinon and Walimex brands in other regions.

Figure 11- ZWO 2600MM & Samyamg 135 mm f/2.

1. *Size* (diameter x length): 82 x 120 mm. The lens-hood adds another 44 mm to the length of the lens.
2. *Weight*: 815 g. The plastic lens hood adds another 60 g to the Samyang.
3. *Optics*: 11 elements in 7 groups. 7 groups have 14 glass/air surfaces which is low for a modern design and reduces the risk of reflections inside the lens. The lens contains one special dispersion elements, hence the “ED” moniker. The Samyang has no aspheric elements.
4. *Closest focus distance* is 0.80 m which gives you a maximum magnification of 1:4.7.
5. *Filter-thread*: 77 mm, the professional standard.
6. *Auto focus*: Manual-focus only.
7. Covers full frame/FX or smaller.
8. *Price*: around 500 EUR new.

Figure 12- ZWO 2600MM & Samyamg 135 mm f/2.

Figure 13- Imaging setup. First light with the ZWO ASI2600MM & Samyang 135 mm f/2 (20231004).

Figure 14- NGC7000. 205min (41x5 min). Samyang 135 mm F/2 (@F/2.8), ZWO ASI 2600MM PRO, Baader 7 nm H-alpha filter, Median, Paramount ME (protrack enabled). Processed with PixInsigth.

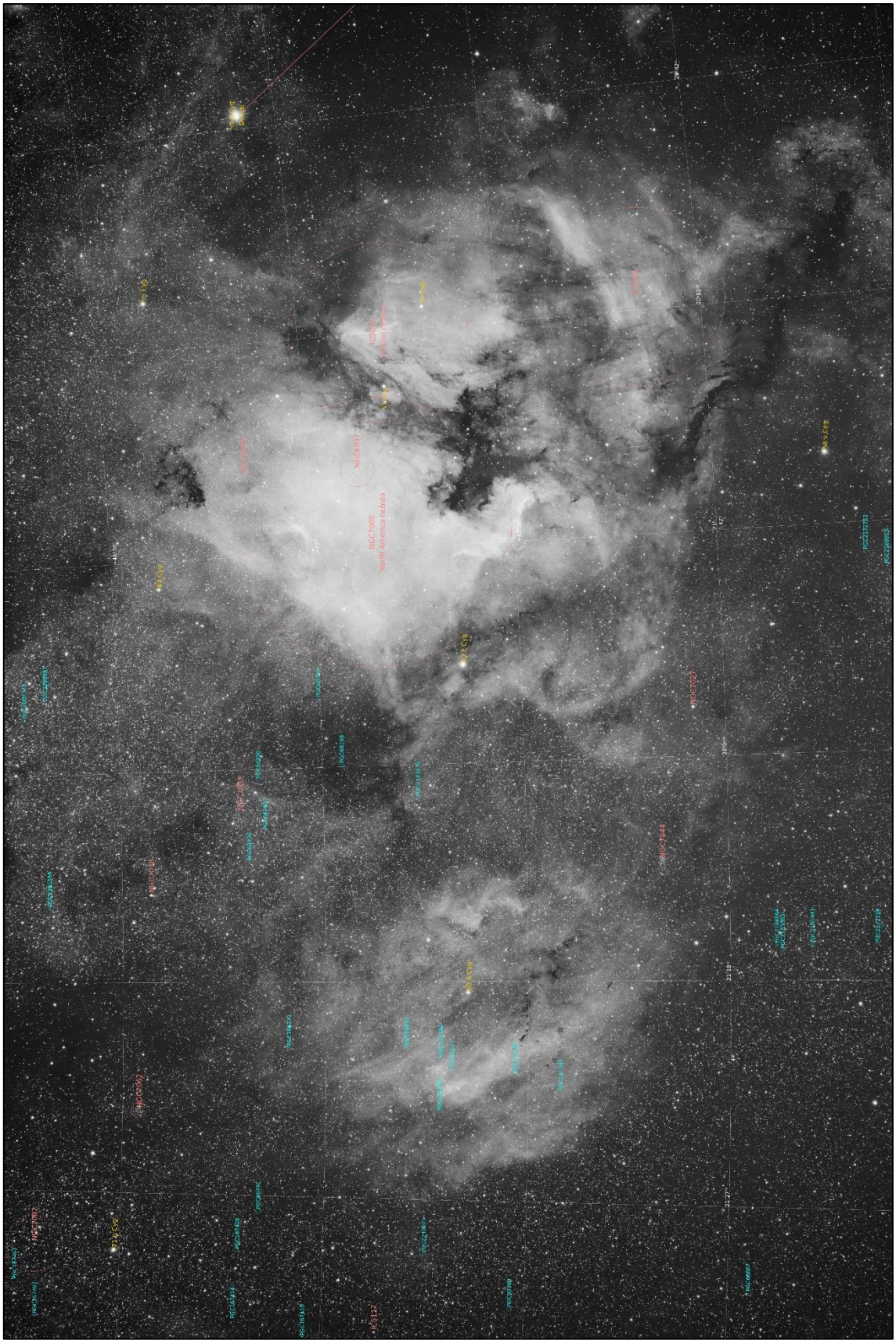


Figure 15- NGC7000. 205 min (41x5 min). Samyang 135 mm F/2 (@F/2.8), ZWO ASI 2600MM PRO, Baader 7 nm H-alpha filter, Median, Paramount ME (protrack enabled). Processed with PixInsigth (annotated).

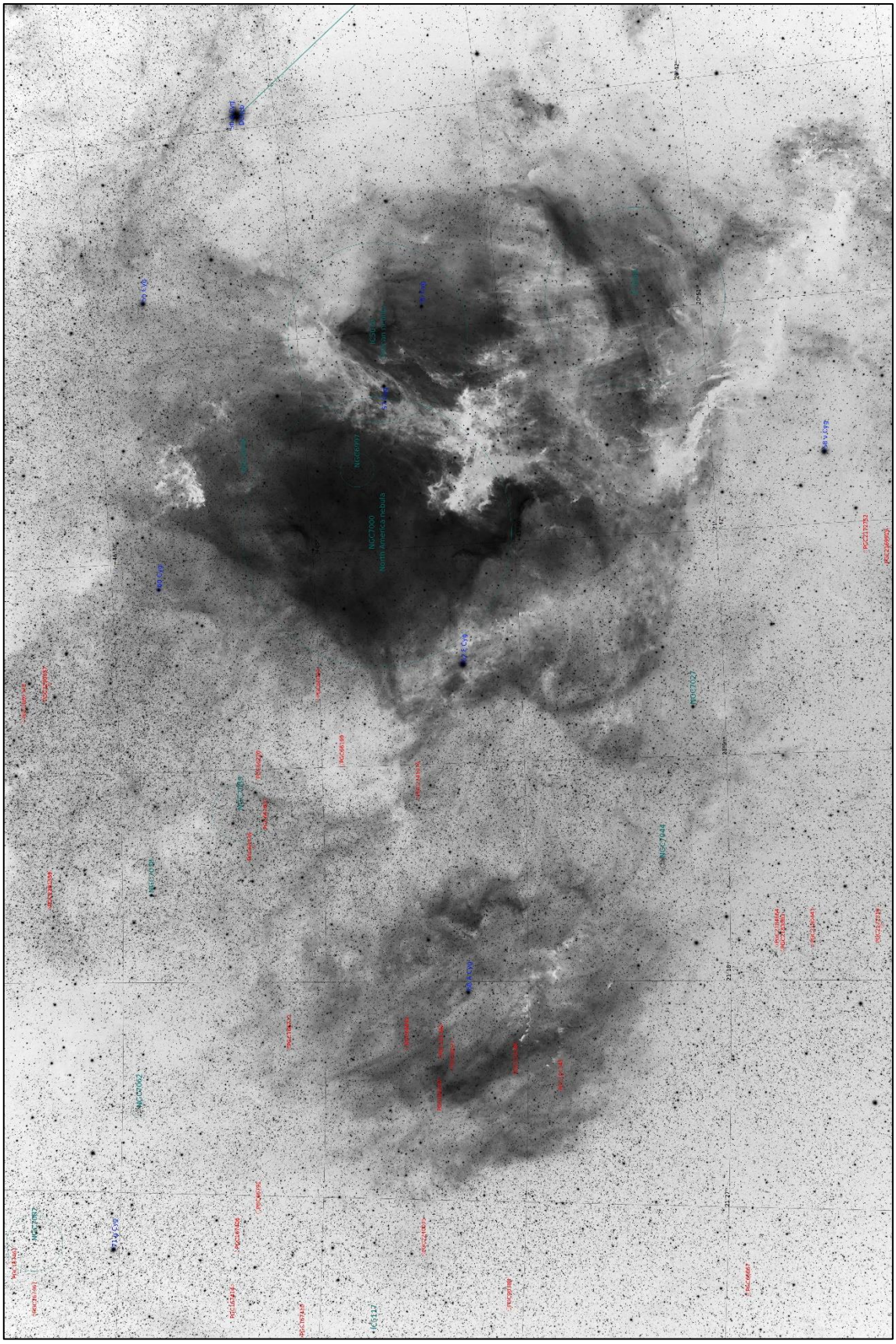
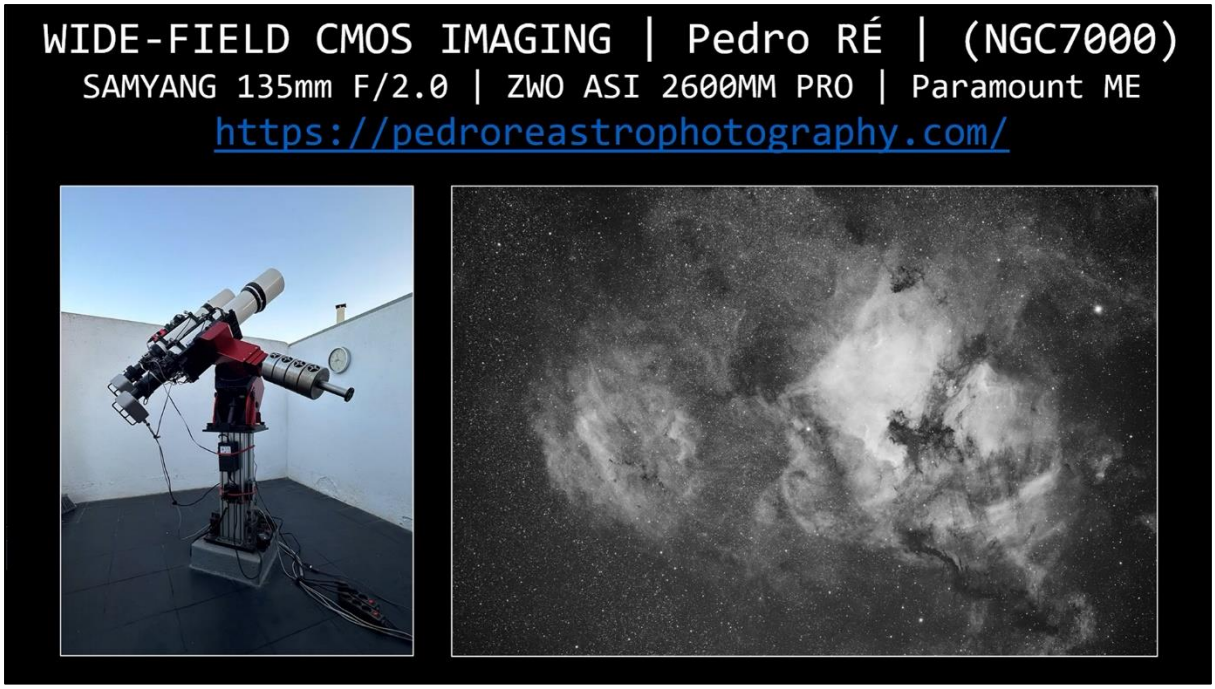


Figure 16- NGC7000. 205 min (41x5 min). Samyang 135 mm F/2 (@F/2.8), ZWO ASI 2600MM PRO, Baader 7 nm H-alpha filter, Median, Paramount ME (protrack enabled). Processed with PixInsigth (negative annotated).



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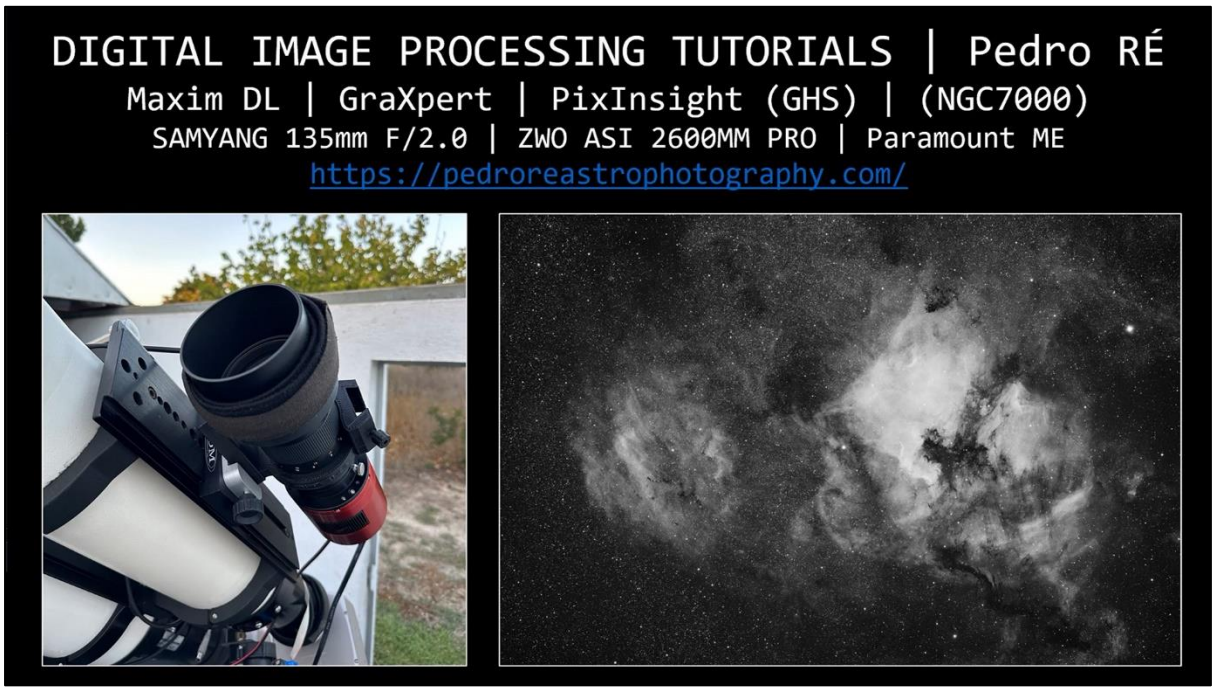

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Maxim DL | GraXpert | PixInsight (GHS) | (NGC7000)
SAMYANG 135mm F/2.0 | ZWO ASI 2600MM PRO | Paramount ME
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