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Associação Portuguesa de Astrónomos Amadores

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APAA

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Fotografia da capa - TOTAL SOLAR ECLIPSE OF 2006 MARCH 29.
Takahashi FS60C F/5.9, Canon 350D. Pedro Ré, El Saloum (Egypt).

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A APAA faz 50 anos

Pedro Ré, Carlos Saraiva & Rui Lourenço

Em 2026 a APAA completa 50 anos[1]. A nossa Associação foi fundada em 25 de junho de 1976. A escritura pública foi efectuada na Secretaria Notarial de Sintra tendo comparecido como outorgantes: Rui Fernando Morna; Joaquim Soares Garcia; José da Cruz Madaleno; Maria Aliete Garcia e Miguel Augusto Tavares.

A APAA teve inicialmente como sede provisória a residência de um dos outorgantes na Rua de S. Bruno nº 25 em Caxias. Pouco tempo depois a sede seria transferida para a Rua Alexandre Herculano, nº 57, 4º Dto, 1250 Lisboa.

O principal objectivo da APAA, constante do artigo primeiro dos estatutos, é o de reunir todas as pessoas interessadas teórica ou praticamente pela Astronomia e promover a sua expansão e divulgação.

Este objectivo mantém-se inalterado passados 50 anos. A APAA tem contribuído muito significativamente para o desenvolvimento da **Astronomia da Amadores em Portugal** através de um conjunto de factividades muito diversificadas.

No ano em que a APAA completa 50 anos iremos assistir a um eclipse total em 12 de agosto de 2026 visível no Norte de Portugal (Parque Natural de Montesinho).

A Península Ibérica poderá assistir a três eclipses solares: dois totais (em 2026 e 2027) e um anular (em 2028). Uma sequência de três eclipses solares numa área geográfica tão restrita é um fenómeno extremamente raro. É uma oportunidade única de observar dois eclipses totais e um anular.

O eclipse total de 12 de agosto de 2026 terá lugar ao final da tarde. A faixa de totalidade começa nas regiões árticas, atravessa a Gronelândia e a Islândia, desce pelo Atlântico Norte e entra na Península Ibérica pela Galiza. Cruza diversas regiões da metade norte da Península, incluindo Astúrias, Cantábria, Castela e Leão, Aragão e parte da Catalunha, passa pelas ilhas Baleares.

Apesar de varrer uma parte considerável do território espanhol, a faixa de totalidade apenas toca marginalmente o nosso país, numa pequena porção situada no extremo nordeste (parque Natural de Montesinho), mais concretamente na zona de Rio de Onor e Guadramil, concelho de Bragança. Isto significa que quem pretender observar a totalidade em Portugal só o poderá fazer nesta pequena área. Trata-se de uma oportunidade única para observar um eclipse total do sol em território português e assim comemorar os 50 anos da nossa associação[2].

[1] Ré, P & C. Saraiva (2001). A APAA faz 25 anos. Revista Astronomia de Amadores, n.º 12 outubro/dezembro 2001. http://www.astrosurf.com/re/apaa25anos.pdf

[2] Os últimos eclipses solares totais ou anulares foram observados na península ibérica nas seguintes datas: 28 de maio de 1900 (eclipse total); 30 de agosto de 1905 (eclipse total); 17 de abril de 1912 (eclipse híbrido); 3 de outubro de 2005 (eclipse anular).

Heliostar 76mm H-alpha Telescope

Pedro Ré, Carlos Alberto Rodrigues & João Gregório
https://pedroreastrophotography.com/

The **Heliostar 76mm H-alpha Solar Telescope** by Sky-Watcher was officially released around March or April 2025. Its launch was strategically timed to align with the lead-up to the solar maximum anticipated that year, making it especially relevant for solar observers and educators.

Heliostar 76mm specs

Feature	Specification
Aperture	**76 mm**
Focal Length	**630 mm**
Focal Ratio	**f/8.3**
Filter Type	**Solis Etalon H-alpha filter** (native <0.5 Å bandwidth)
Blocking Filter	11.5 mm integrated in diagonal
Eyepiece Included	20 mm (1.25") eyepiece with 70° apparent field of view
Magnification	32x with included eyepiece
Mount Compatibility	Often paired with SolarQuest motorized alt-azimuth mount (HelioFind tracking)
Safety Certification	ISO 12312-2 compliant for safe solar viewing
Smartphone Adapter	Included for solar imaging and sharing
Use Case	Visual observation and imaging of prominences, filaments, sunspots, granulation

Figure 1 – Sky-Watcher **Heliostar 76mm** H-alpha Telescope.

The **Heliostar 76mm** stands out for offering **double-stack performance** without requiring a second etalon (<0.5 Å). That makes it ideal for capturing fine solar surface details and dynamic features like prominences and active regions.

Solis etalon specs

Attribute	Description
Type	**Solid-state etalon** (non-air-spaced)
Central Wavelength	656.3 nm (Hydrogen-alpha line)
Bandpass Width	<0.50 Å (single-stack performance approaching **double-stack quality**)
Tuning System	**Trifid tuner –** allows precise adjustment of the etalon's passband
Contrast Performance	**High contrast for prominences, filaments and surface details**
Thermal Stability	Solid etalon design offers improved stability over air-spaced systems
Integration	Built into the OTA; no need for external double-stacking
Safety Compliance	ISO 12312-2 certified for safe solar viewing

Performance or the Solis etalon

- **Double-stack-like contrast:** Despite being a single etalon, its narrow bandpass delivers exceptional detail and contrast, rivalling more complex systems.
- **Trifid tuning:** Enables dynamic adjustment to optimize visibility of different solar features depending on conditions.
- **Uniformity:** Solid etalon design ensures consistent performance across the field of view, minimizing bandpass drift.

The **Solis etalon** is a standout feature of the **Heliostar 76**, making it ideal for both outreach and documentation of solar phenomena—especially during solar maximum.

Operating the **Solis Etalon** on the **Sky-Watcher Heliostar 76mm H-alpha Solar Telescope** involves a few precise steps to optimize contrast and detail in solar features.

1. Initial Setup

- Mount the telescope securely using a compatible solar tracking mount (*e.g.,* **SolarQuest**).
- Attach the **solar zenith prism** and **eyepiece**.
- Ensure the **blocking filter** and **etalon chamber** are clean and properly aligned.

2. Solar Alignment

- Use the **solar guider** (built-in projection system) to centre the Sun.
- Confirm alignment visually through the eyepiece before tuning.

3. Etalon Tuning via Trifid Knob

- Locate the **Trifid tuning knob** near the etalon chamber.
- Slowly rotate the knob while observing the solar disc:
    - **Clockwise** or **counterclockwise** adjustments shift the passband slightly.
    - Fine-tune until **maximum contrast** is achieved—filaments, prominences and surface details should appear sharp and well-defined.

4. Environmental Considerations

- Allow the telescope to **thermally stabilize** for **~15-30 minutes** if moving between environments.
- The solid etalon is less sensitive to temperature drift than air-spaced designs, but ambient heat can still affect contrast.

5. Observation Tips

- Re-tune periodically as solar features evolve or seeing conditions change.
- For imaging, tune for **maximum limb contrast** if capturing prominences, or **surface detail** for filaments and sunspots.

Heliostar 76mm vs Lunt LS60THa Pressure-Tuned – Comparison Table

Feature	Heliostar 76mm	Lunt LS60THa (Pressure-Tuned)
Aperture	76 mm	60 mm
Focal Length	630 mm	500 mm
Focal Ratio	f/8.3	f/8.3
Etalon Type	Solid-state Solis Etalon	Air-spaced Etalon with Pressure Tuning
Tuning Mechanism	**Trifid tuner (rotational)**	**Pressure tuning** (internal air pressure adjustment)
Bandpass Width	**<0.5 Å (single stack)**	**~0.7 Å** (single-stack); narrower with double-stack
Contrast Performance	High; comparable to double stack	Excellent; enhanced with optional double-stack
Blocking Filter	**Integrated 11.5 mm diagonal**	**B600 or B1200 options** (external)
Mount Compatibility	SolarQuest or manual alt-az	Manual or motorized mounts
Thermal Stability	**Good; requires ~30 min warm-up**	Excellent; pressure tuning minimizes drift
Imaging Suitability	Strong for close-ups and full disc (with mosaics)	Strong for full disc and close-up imaging
Visual Use	Optimized for outreach and detail	Excellent for visual and imaging
Price Range (2025)	~€2600	~€4000 (with B1200)

1. The **Heliostar 76mm** offers excellent contrast in a single-stack configuration, but some users report variability across the solar disc unless mosaics are used.

2. The **Lunt LS60THa** is more expensive but provides consistent performance and easier full-disc imaging due to pressure tuning and field uniformity.

3. For outreach and educational documentation, the Heliostar may offer better value, while the Lunt excels in precision and modularity.

Figure 2 – Sky-Watcher **Heliostar 76mm** H-alpha Telescope.

Figure 3 – Sky-Watcher **Heliostar 76mm** H-alpha Telescope.

Figure 4 – **Solis Etalon**, Heliostar 76mm H-alpha Telescope.

Figure 5 – **Solar finder**, Heliostar 76mm H-alpha Telescope.

Figure 6 – Sky-Watcher Heliostar 76mm H-alpha Telescope.

Figure 7 – Sky-Watcher Heliostar 76mm H-alpha Telescope **(first light).**

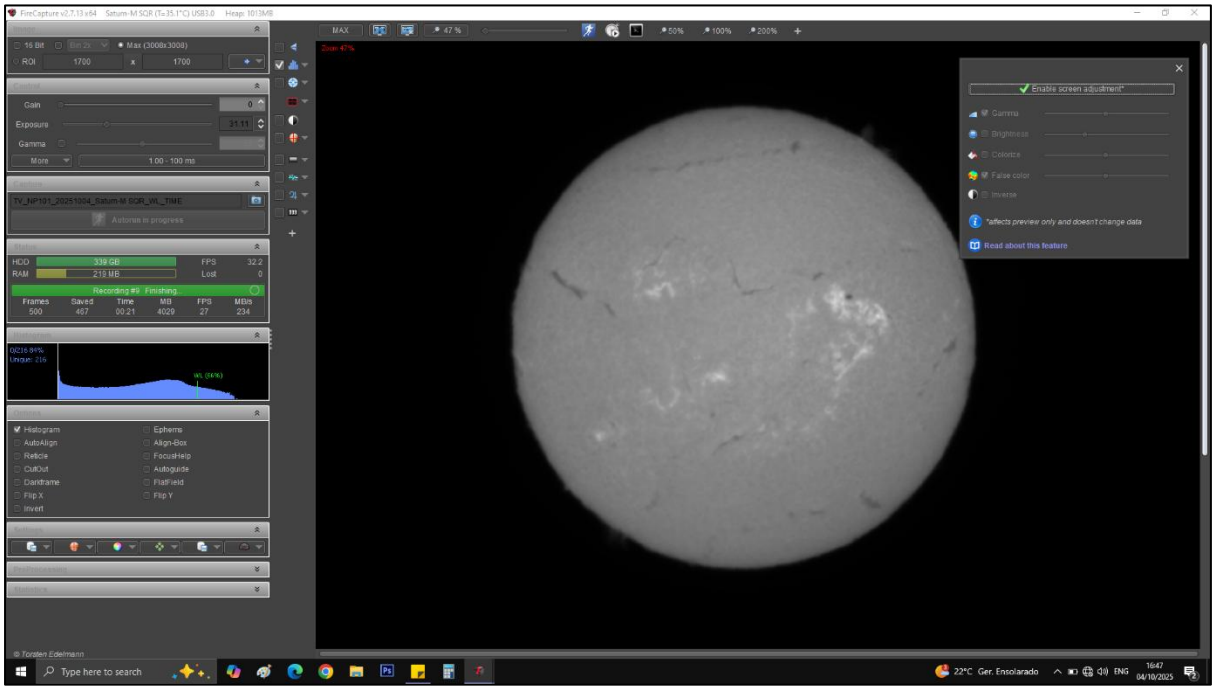

Figure 8 – Sky-Watcher Heliostar 76mm H-alpha Telescope **(first light)**
Player One Saturn-M SQR (20251005).

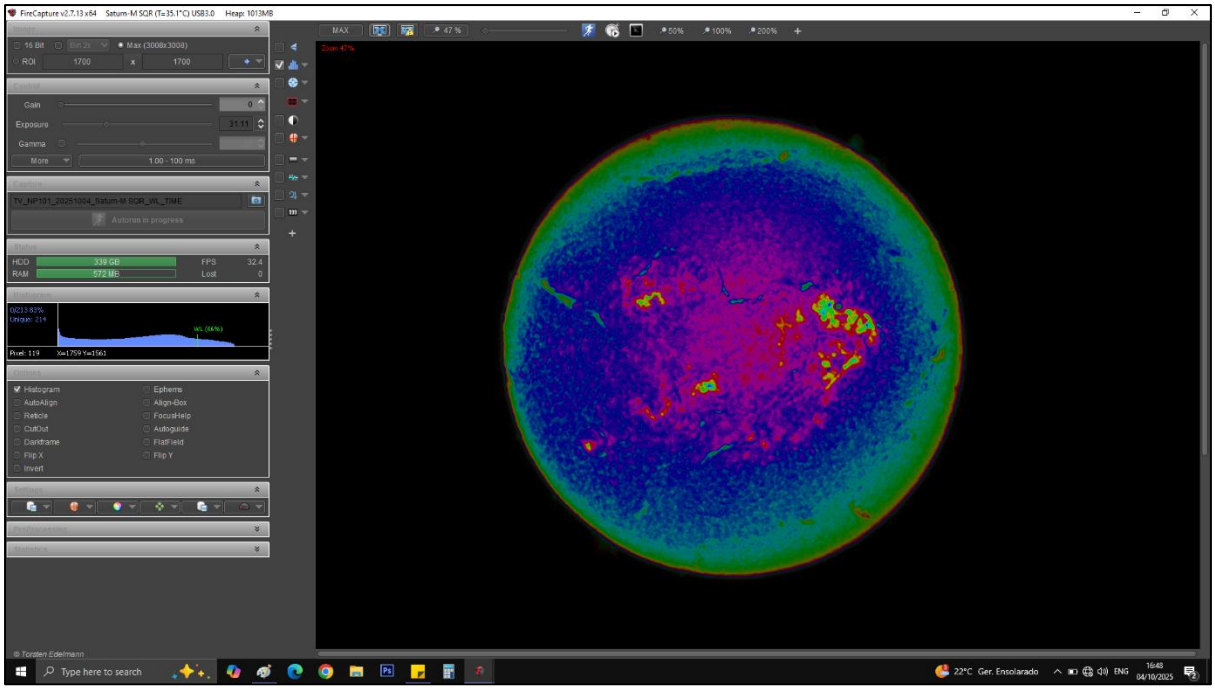

Figure 9 – Sky-Watcher Heliostar 76mm H-alpha Telescope **(first light)**
Player One Saturn-M SQR (20251005).

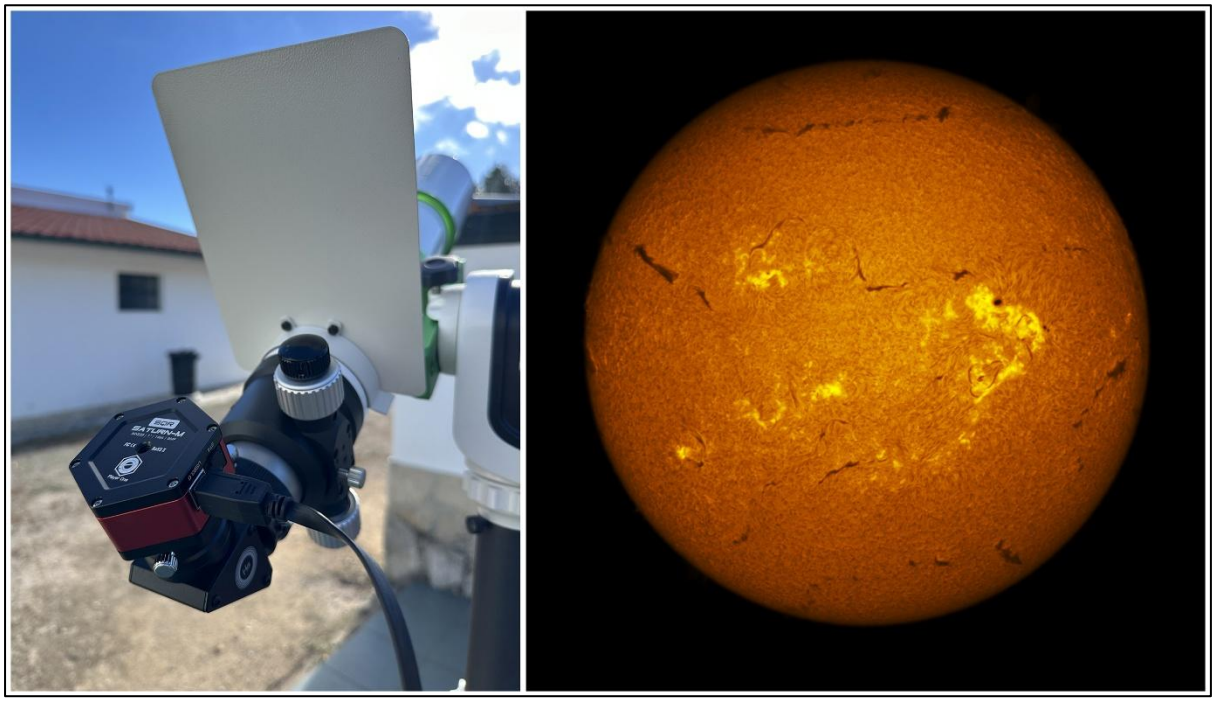

Figure 10 – Sky-Watcher Heliostar 76mm H-alpha Telescope **(first light)**
Player One Saturn-M SQR (20251005).

Solarigraphy: step-by-step Tutorial

Pedro RÉ
https://pedroreastrophotography.com/

Invented around 2000, **Solarigraphy** (also known as **solargraphy**) uses photographic paper without chemical processing, a **pinhole camera** and a scanner to create images that catch **the daily journey of the sun along the sky with very long exposure times**, from several hours to several years.
Solarigraphy is a concept and a photographic practice based on the observation of the **Sun path in the sky** (different in each place on the Earth) and its effect on the landscape, captured by a specific procedure that combines **pinhole photography and digital processing**.
Unlike conventional photography, Solarigraphy doesn't freeze a moment—it **accumulates moments**, layering them into a single image. It uses a pinhole camera loaded with **black-and-white photographic paper** to record the sun's movement. The camera remains in place for an extended period, allowing the sun's light to directly darken the paper and create ghostly arcs that trace its daily journey

- **No chemical development**: "The paper is scanned after exposure rather than developed traditionally.
- **Sun arcs**: Each line in the final image represents a day's solar path. Gaps indicate cloudy days.
- **Landscape memory**: The background often appears faint or surreal, as it's slowly imprinted over time.

Step-by-Step: How to do Solarigraphy
1. Build a Pinhole Camera
You'll need:

- An aluminium can (beer or soda)
- Black-and-white photographic paper (semi-matte). The photographic paper should be loaded in dim red light
- A needle (for the pinhole)
- Electrical tape (to seal and create a shutter)

2. Set Up for Exposure

- Choose a location with a clear view of the sky.
- Mount the camera securely facing south in the northern hemisphere for optimal sun paths.
- Leave it undisturbed for weeks or months or even years[3].

3. Retrieve and Process the Image

- Carefully open the can in a dim room.
- Scan the photographic paper (do not develop it chemically).
- Use photo editing software to enhance contrast and colour.

[3] The longest exposure ever recorded with a pinhole camera is approximately 2,953 days, or eight years and one month, achieved using a beer can pinhole camera. https://www.livescience.com/longest-exposure-photo-discovered-beer-can.html

Solargraph Processing walks through digital editing techniques, including cropping, curves adjustment, and inspection using Photoshop or other image processing software.
You can easily build a Pinhole Camera or buy one[4].

I used a LataCam (Figure 1) to record the sun's daily journey across the sky on two occasions—once for 367 days and once for 221 days. The LataCam was securely fixed facing south (Figure 2).

Figure 1 – LataCam.

[4] Solarcan Solarcan – Ready to use solargraphy camera – LataCam Cámara estenopeica, analógica y recargable LataCam Estrella Galicia | Foticos Collection

Figure 2 – LataCam.

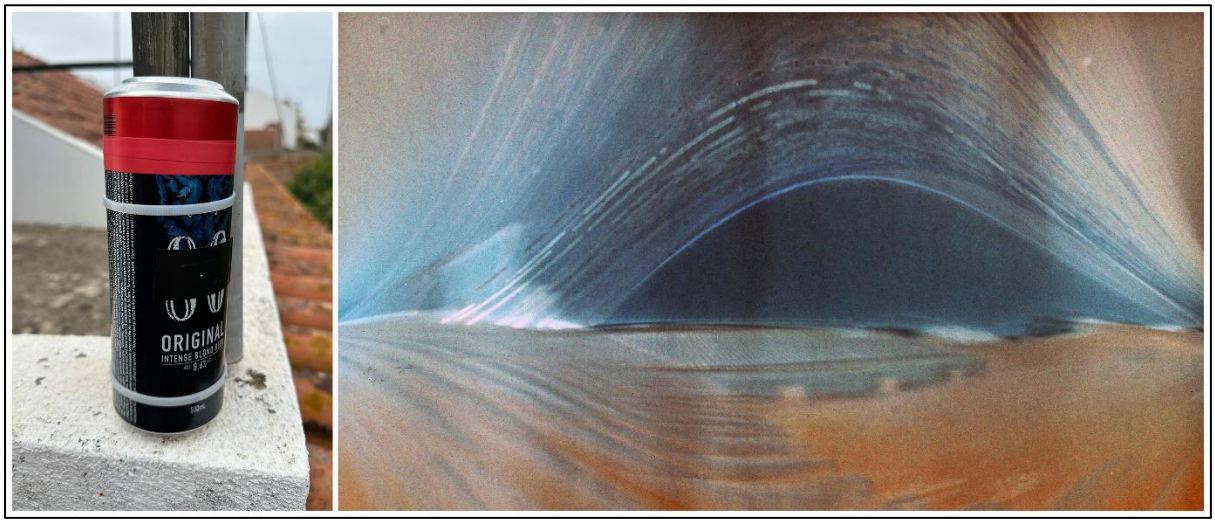

Figure 3- LataCam image 367 days (20231115/20241116). Pedro RÉ.

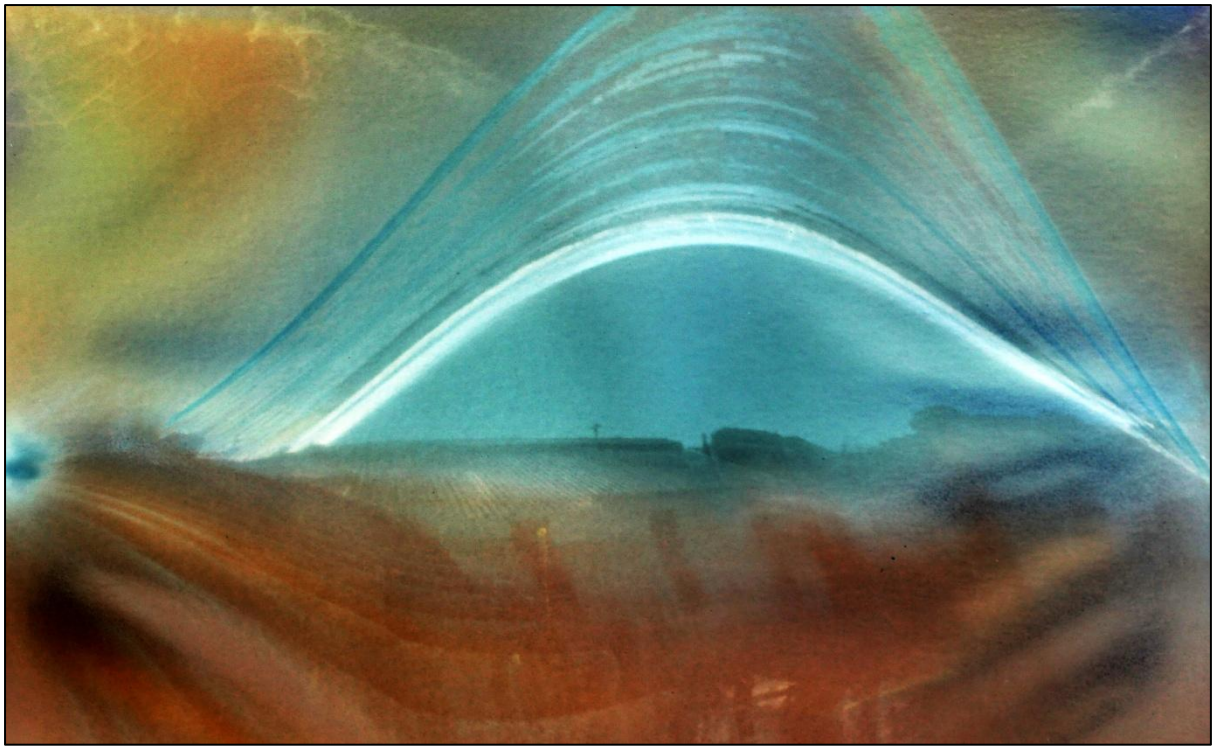

Figure 4 – LataCam image 221 days (20241116/20250625). Pedro RÉ.

Step-by-Step: How to Process Solarigraphy Images

1. Retrieve the Paper Negative

- Carefully open your pinhole camera (*e.g.*, LataCam) in **dim red light** to avoid further exposure (Figure 5 and 6).
- Remove the **black-and-white photographic paper**—it will already contain the image due to direct sunlight darkening the emulsion.

2. Scan the Image

- Use a **flatbed scanner** at high resolution (600–1200 dpi) or photograph the paper using a digital camera.
- Scan in **colour mode**, even though the paper is black and white—this helps capture subtle tonal variations.
- Avoid auto-enhancements during scanning.

3. Open in Editing Software

- Use **Photoshop**, **GIMP**, **Affinity Photo** or other digital imaging software.

4. Adjust Image Settings

- **Invert the image** if needed (some solarigraphs appear as negatives).
- Use **Curves or Levels** to enhance contrast and bring out solar arcs.
- Apply **colour balance** and/or **false colour** to highlight the surreal hues often present in solarigraphy.

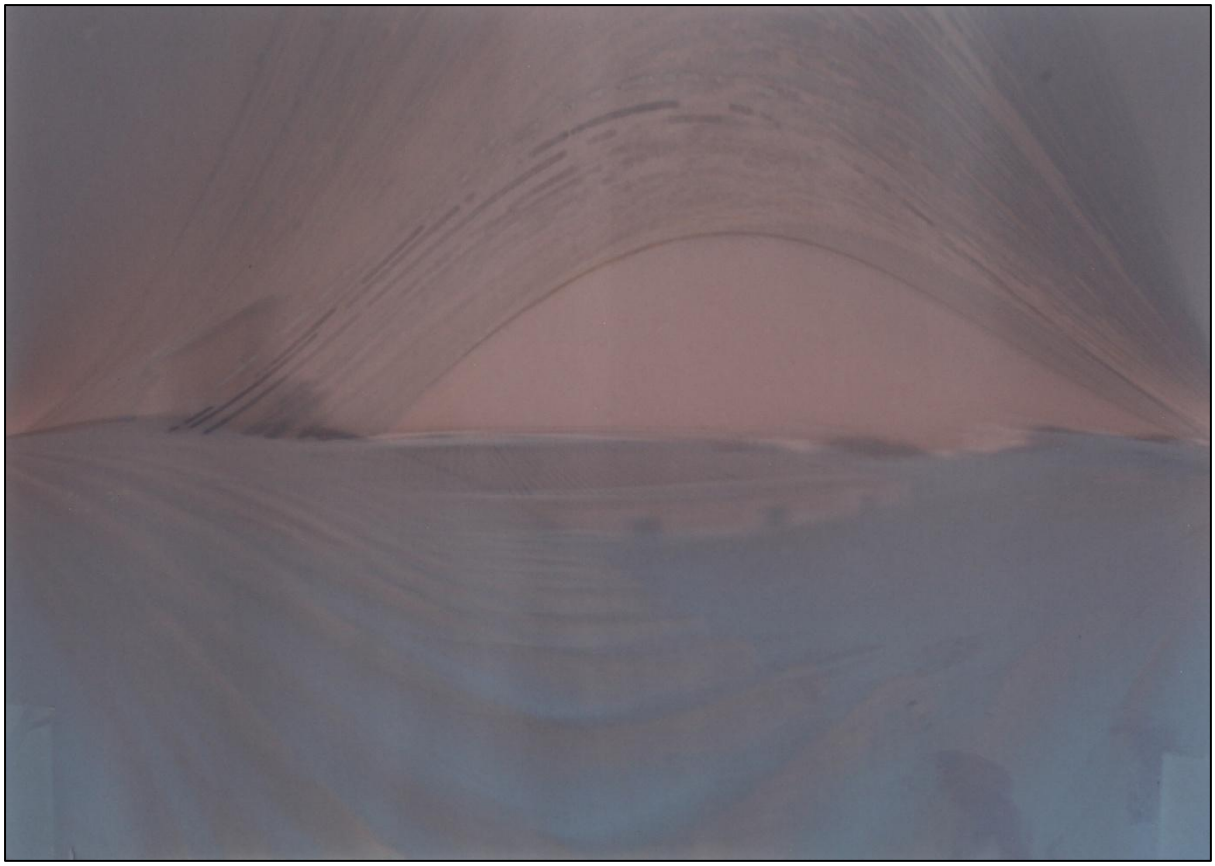

Figure 5- Unprocessed LataCam image (367 days).

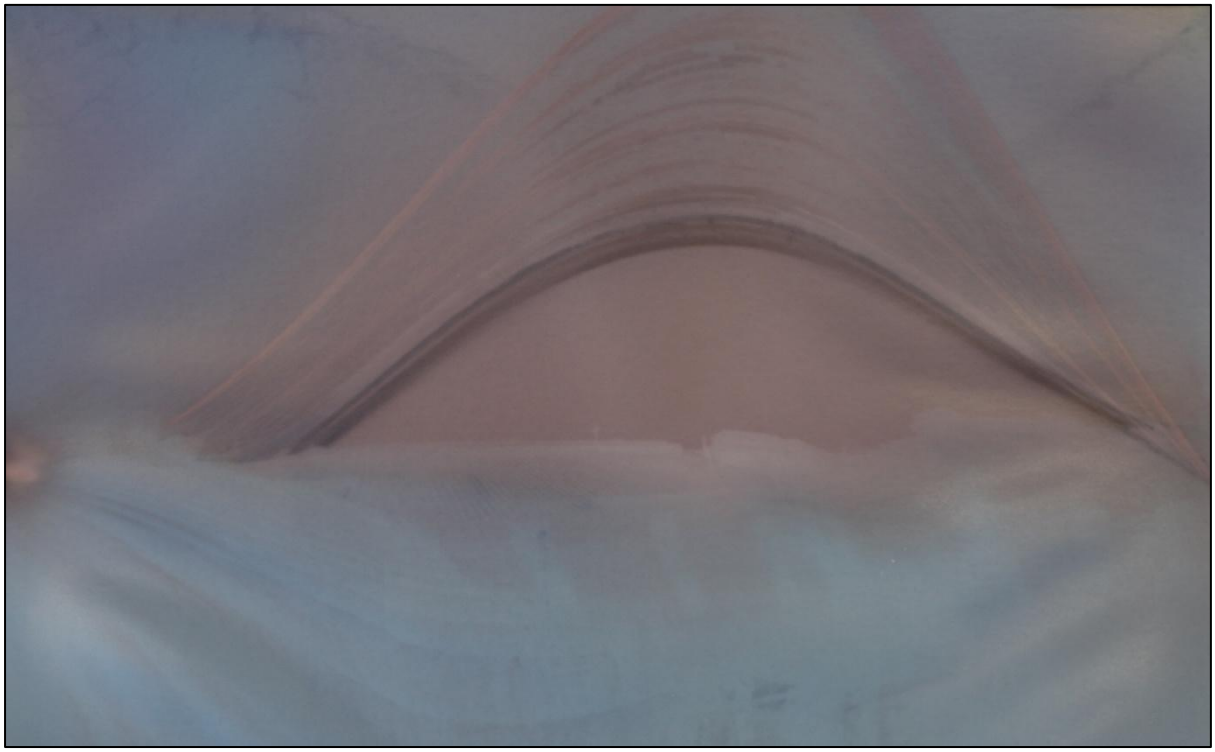

Figure 6- Unprocessed LataCam image (221 days).

Sources:

- SOLARIGRAFIA_SOLARIGRAPHY_English.pdf
- Gallery: Solargraphs show half a year of Sun | New Scientist
- https://www.iac.es/system/files/documents/2019-02/paralajes_luces_interactive.pdf
- La solarigrafía, qué es y cómo se hace. Una técnica al alcance de todos

Youtube Videos (Pedro RÉ):

https://youtu.be/7Ct16pWUUqQ
Solarigraphy | LataCam | Pedro RE'
https://pedroreastrophotography.com/

https://youtu.be/CcpoWcUHMM0
Solarigraphy | LataCam | Pedro RE'
https://pedroreastrophotography.com/

The Bortle Scale

Pedro RÉ
https://pedroreastrophotography.com/

The **Bortle Scale** (Figure 1) is a **nine-level classification system** used in astronomy to **assess the darkness of the night sky** at a specific location, particularly in relation to **light pollution**. Developed by amateur astronomer John E. Bortle in 2001, it helps observers and astrophotographers evaluate how clearly celestial objects can be seen from a given site.

Overview of the Bortle Scale Classes

Class	Sky Quality	Description
1	*Excellent Dark Sky*	Milky Way casts shadows; zodiacal light and airglow visible; no light pollution
2	*Dark Sky*	Milky Way very prominent; minimal light pollution near horizon
3	*Rural Sky*	Some light pollution: Milky Way still shows structure
4	*Rural/Suburban*	Light domes visible; Milky Way less detailed
5	*Suburban Sky*	Milky Way faint or invisible; skyglow dominates
6	*Bright Suburban*	Milky Way only overhead; sky appears greyish-white
7	*Suburban/Urban*	Milky Way invisible; only brightest stars visible
8	*City Sky*	Sky glows orange/white; few stars visible
9	*Inner City Sky*	Only brightest constellations visible; sky glow reaches zenith

The Bortle Scale can be used to:

1. Choose observing sites with low or no Light pollution
2. Plan astrophotography sessions in a given location
3. Advocate dark-sky preservation

The Bortle scale can be estimated by:

1. Observing which celestial objects are visible (*e.g.,* Milky Way, Messier objects…)
2. Using apps like Dark Sky Finder or a Light Pollution Map
3. Measuring sky brightness with a Sky Quality Meter (SQM)

The original publication of the Bortle Scale appeared in the **February 2001 issue of Sky & Telescope magazine**. The article was authored by John E. Bortle and titled: "**Introducing the Bortle Dark-Sky Scale**" (Figure 2).

John Bortle's goal was to provide a practical and intuitive tool for stargazers to assess sky quality—particularly as light pollution increasingly obscures celestial views. The scale quickly gained traction among both amateur and professional astronomers and continues to be widely used today.

Figure 1 – Bortle Scale, a nine-level classification system used in astronomy to measure the darkness of the night sky.

The Bortle Scale and the Sky Quality Meter (SQM)[5] are two complementary tools used to assess night sky brightness and light pollution levels.

Sky Quality Meters (SQMs) (Figure 3) vary based on field of view, connectivity, and data logging capabilities. All are designed to measure **night sky brightness** in magnitudes per square arcsecond (mag/arcsec^2), but they serve different needs—from casual stargazing to professional monitoring.

Main Models by Unihedron[6]

Model	Field of View	Features	Best For
SQM	~84° (wide)	Basic handheld model	General sky brightness checks
SQM-L	~20° (narrow)	Integrated lens for zenith-only readings	Precision measurements at zenith
SQM-LU	~20°	USB connection for real-time data logging	Research, automated setups
SQM-LE	~20°	Ethernet-enabled for remote monitoring	Permanent observatories, networks
SQM-DL	~20°	Data logger with internal memory	Long-term field campaigns

[5] The **Sky Quality Meter (SQM)** is a handheld or mountable device used to **quantify the brightness of the night sky**, especially for assessing **light pollution**. It's widely used by amateur astronomers, astrophotographers, researchers, and dark-sky advocates to measure how dark the sky is at a specific location.
[6] https://unihedron.com/

Introducing the Bortle Dark-Sky Scale

Excellent? Typical? Urban? Use this nine-step scale to rate the sky conditions at any observing site. | **By John E. Bortle**

ILLUSTRATIONS BY JOHN BIANCHI (FROM "EXPLORING THE NIGHT SKY" BY TERENCE DICKINSON)

How dark is your sky? A precise answer to this question is useful for comparing observing sites and, more important, for determining whether a site is dark enough to let you push your eyes, telescope, or camera to their theoretical limits. Likewise, you need accurate criteria for judging sky conditions when documenting unusual or borderline observations, such as an extremely long comet tail, a faint aurora, or subtle features in galaxies.

On Internet bulletin boards and newsgroups I see many postings from beginners (and sometimes more experienced observers) wondering how to evaluate the quality of their skies. Unfortunately, most of today's stargazers have never observed under a truly dark sky, so they lack a frame of reference for gauging local conditions. Many describe observations made at "very dark" sites, but from the descriptions it's clear that the sky must have been only moderately dark. Most amateurs today cannot get to a truly dark location within reasonable driving distance. Thus, upon finding a semirural observing site where stars of magnitude 6.0 to 6.3 are marginally apparent to the unaided eye, they believe they have located an observing Nirvana!

Thirty years ago one could find truly dark skies within an hour's drive of major population centers. Today you often need to travel 150 miles or more. In my own observing career I have watched the extent to which ever-growing light pollution has sullied the heavens. In years long past I witnessed nearly pristine skies from parts of the highly urbanized northeastern United States. This is no longer possible.

Limiting Magnitude Isn't Enough

Amateur astronomers usually judge their skies by noting the magnitude of the faintest star visible to the naked eye. However, naked-eye limiting magnitude is a poor criterion. It depends too much on a person's visual acuity (sharpness of eyesight), as well as on the time and effort expended to see the faintest possible stars. One person's "5.5-magnitude sky" is another's "6.3-magnitude sky." Moreover, deep-sky observers need to assess the visibility of both stellar and nonstellar objects. A modest amount of light pollution degrades diffuse objects such as comets, nebulae, and galaxies far more than stars.

To help observers judge the true darkness of a site, I have created a nine-level scale. It is based on nearly 50 years of observing experience. I hope it will prove both enlightening and useful to observers — though it may stun or even horrify some! Should it come into wide use, it would provide a consistent standard for comparing observations. Researchers would also be better able to assess the plausibility of an unusual or marginal observation. All around, it could be a boon to those of us who regularly scan the heavens.

Rate Your Skies

Class 1: Excellent dark-sky site. The zodiacal light, gegenschein, and zodiacal band (*S&T:* October 2000, page 116) are all visible — the zodiacal light to a striking degree, and the zodiacal band spanning the entire sky. Even with direct vision, the galaxy M33 is an obvious naked-eye object. The Scorpius and Sagittarius region of the Milky Way casts obvious diffuse shadows on the ground. To the unaided eye the limiting magnitude is 7.6 to 8.0 (with effort); the presence of Jupiter or Venus in the sky seems to degrade dark adaptation. Airglow (a very faint, naturally occurring glow most evident within about 15 of the horizon) is readily apparent. With a 32-centimeter (12½-inch) scope, stars to magnitude 17.5 can be detected with effort, while a 50-cm (20-inch) instrument used with moderate magnification will reach 19th magnitude. If you are observing on a grass-covered field bordered by trees, your telescope, companions, and vehicle are almost total-

Figure 2 - Introducing the Bortle Dark-Sky Scale, by John Bortle, published in the February issue of Sky & Telescope magazine.

The Bortle Scale and the SQM

Bortle Class	SQM Reading (mag/arcsec²)	Limiting Magnitude	Sky Description
1	21.7–22.0+	7.6–8.0+	Milky Way casts shadows; airglow visible
3	21.3–21.5	6.6–7.0	Milky Way prominent; some light pollution
5	20.0–20.5	5.6–6.0	Milky Way faint; skyglow dominates
7	18.0–19.0	~5.0	Milky Way invisible; only bright stars seen
9	<15.5	<4.0	Sky brightly lit; only planets visible

Figure 3 – Sky quality meters: SQM (left) SQM-L (right).

Bortle Dark Sky Scale Reference

Class 1 - Excellent Dark Sky
SQM: 21.7-22.0+ mag/arcsec²
Limiting Magnitude: 7.6-8.0+
Zodiacal light visible, Milky Way casts shadows, airglow visible on horizon

Class 2 - Typical Dark Sky
SQM: 21.5-21.7 mag/arcsec²
Limiting Magnitude: 7.1-7.5
Milky Way structure visible, zodiacal light evident, M31 visible to naked eye

Class 3 - Rural Sky
SQM: 21.3-21.5 mag/arcsec²
Limiting Magnitude: 6.6-7.0
Milky Way still prominent, some light pollution on horizon

Class 4 - Rural/Suburban Transition
SQM: 20.4-21.3 mag/arcsec²
Limiting Magnitude: 6.1-6.5
Milky Way visible overhead, light domes on horizon

Class 5 - Suburban Sky
SQM: 19.1-20.4 mag/arcsec²
Limiting Magnitude: 5.6-6.0
Milky Way washed out except overhead, clouds brighter than sky

Class 6 - Bright Suburban Sky
SQM: 18.0-19.1 mag/arcsec²
Limiting Magnitude: 5.1-5.5
Milky Way invisible, M31 requires effort, sky grayish

Class 7 - Suburban/Urban Transition
SQM: 16.8-18.0 mag/arcsec²
Limiting Magnitude: 4.6-5.0
Sky noticeably bright, entire sky has grayish cast

Class 8 - City Sky
SQM: 15.5-16.8 mag/arcsec²
Limiting Magnitude: 4.1-4.5
Sky *bright gray/orange, only brightest stars visible*

Class 9 - Inner City Sky
SQM: <15.5 mag/arcsec²
Limiting Magnitude: <4.0
Sky brilliantly lit, only planets and brightest stars visible

Class	Color Key	Naked-eye Limiting Magnitude	Sky Description	Milky Way	Astronomical Objects	Zodiacal Light / Constellations	Airglow and Clouds	Night Time Scene
1		7.6 - 8.0	Excellent, truly dark-skies.	MW shows great detail and light from the Scorpio / Sagittarius region casts obvious shadows on the ground.	M33 (the Pinwheel Galaxy) is a obvious object.	Zodiacal light has an obvious color and can stretch across the entire sky.	Bluish airglow is visible near the horizon and clouds appear as dark blobs againt the backdrop of the stars.	The brightness of Jupiter and Venus is annoying to night vision. Ground objects are barely lit and trees and hills are dark.
2		7.1 - 7.5	Typical, truly dark skies.	Summer MW shouws great detail and has veined appearance.	M33 is visible with direct vision, as are many globular clusters.	Zodiacal light bright enough to cast weak shadows after dusk and has an apparent color.	Airglow may be weakly apparent and clouds still appear as dark blobs.	Ground is mostly dark, but objects projecting into the sky are discernible.
3		6.6 - 7.0	Rural sky.	MW still appears complex, dark voids and bright patches and meandering outline are all visible.	Brightest Globular Clusters are distinct, but M33 is only visible with averted vision. M31 (the Andromeda Galaxy) is obviously visible.	Zodical light is striking in Spring and Autumn, extending 60 degrees above the horizon.	Airglow is not visible and clouds are faintly illuminated, except at the zenith.	Some light pollution eveidnet along the horizon. Ground objects are vaguely apparent.
4		6.1 - 6.5	Rural / suburban transition.	Only well above the horizon does the MW reveal any structure. Fine details are lost.	M33 is a difficult object, even with averted vision. M31 is still readily visible.	Zodiacal light is clearly evident, but extends less than 45 degrees after dusk.	Clouds are faintly illuminated except at the zenith.	Light pollution domes are obviouse in several directions. Sky is noticeably brighter than the terrain.
5		5.6 - 6.0	Suburban sky.	MW appears washed out overhead and is lost completely near the horizon.	The oval of M31 is detectable, as is the glow in the Orion Nebula.	Only nints of zodiacal light in Spring and Autumn.	Clouds are noticibly brighter than the sky, even at the zenith.	Light pollution domes are obviouse to casual observers. Ground objects are partly lit.
6		5.1 - 5.5	Bright, suburban sky.	MW only apparent overhead and appears broken as fianter parts are lost to sky glow.	M31 is detectable only as a faint smudge; Orion Nebula is seldom glimpsed.	Zodiacal light is not visible. Constellations are seen and not lost against a starry sky.	Clouds anywhere in the sky appear fairly bright as they reflect back light.	Sky from horizon to 35 degrees glows with grayish color. Ground is well lit.
7		4.6 - 5.0	Suburban / urban transition.	MW is totally invisible or nearly so.	M31 and the Beehive Cluster are rarely glimpsed.	The brighter constellations are easily recognizable.	Clouds are brilliantly lit.	Entire sky background appears washed out, with a grayish or yellowish color.
8		4.1 - 4.5	City sky.	Not visible at all.	The Pleiades Cluster is visible, but very few other objects can be detected.	Dimmer constellations lack key stars.	Clouds are brilliantly lit.	Entire sky background has an orangish glow and it is bright enough to read at night.
9		4.0 at best	Inner city sky.	Not visible at all.	Only the Pleiades Cluster is visible to all but the most experienced observers.	Only the brightest constellations are discernable and they are missing stars.	Clouds are brilliantly lit.	Entire sky background has a broight glow, even at the zenith.

Figure 5 - Bortle Dark Sky Classification Reference Chart

Sources

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Wide-Field CMOS imaging with a Sky Watcher Star Adventurer Gti and a ZWO ASIAIR Mini

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The **ASIAIR Mini** (Figure 1 and 2) is ZWO's most compact astrophotography controller to date—a wireless, all-in-one smart device that orchestrates your entire imaging setup from a single app. It's designed to simplify and streamline the astrophotography process, especially for mobile or minimalist rigs (*e.g.* Sky Watcher Star Adventurer GTi) (Figure 3).

Despite its small size, the ASIAIR Mini offers nearly all the core features of its larger siblings, including:

- **Camera and Mount Control**: Operates ZWO cameras, auto guiders, filter wheels, and motorized focusers, plus most GoTo mounts.
- **Wireless Operation**: Connects via dual-band Wi-Fi, allowing full control from your smartphone or tablet.
- **Automated Imaging**: Handles polar alignment, plate solving, autoguiding, live stacking, and autorun sequences.
- **Power Distribution**: Includes four 12V DC outputs to power accessories directly.
- **User-Friendly Interface**: The ASIAIR app (iOS/Android) offers intuitive control with real-time previews and adjustments.

It's particularly well-suited for users who value **portability, simplicity, and precision**—making it a strong candidate for solar imaging setups or remote field work.

The ASIAIR Mini has a few limitations as compared to the ASIAIR Pro or ASIAIR Plus, namely:

Hardware Limitations

- **No USB 3.0 Ports** All four USB ports are USB 2.0, which can slow down data transfer—especially with high-resolution cameras or planetary video capture.
- **No Ethernet Port** Unlike the ASIAIR Plus, the Mini lacks wired network connectivity. You're reliant on Wi-Fi, which may be less stable in noisy environments.
- **No Physical Power Switch** It powers on automatically when connected to 12V DC. Shutdown must be done via software.
- **Limited Power Control** The four 12V outputs are always on at 100%—no individual control or monitoring like on the ASIAIR Plus.

Connectivity & Compatibility Constraints

- **Wi-Fi Only** While the external antenna improves range, interference or dense environments can still affect performance. No support for travel routers via Ethernet.
- **Device Support** Only supports ZWO cameras and accessories. DSLR/mirrorless compatibility is limited, and mount support must be verified per model.

Software & Functional Limitations

- **No Video Mode Optimization** May struggle with planetary or lunar video stacking depending on the camera used.
- **Basic Documentation** Initial setup can be confusing—*e.g.,* password location is not clearly explained in the manual.
- **No Telescope Profiles** You can't save multiple telescope configurations for quick swapping between setups

FFigure 1 – ZWO ASIAir Pro (left) and ASIAir Mini (right).

Figure 2 – *What's in the Box* – The ZWO ASIAIR Mini comes with four DC power cables: two 0.5-meter and two 1-meter cables, each with 2.1mm barrel plugs, the type commonly used for 12-volt astronomy gear. A 1.5-meter-long male-to-female extension cable is also supplied.

The **ZWO ASIAIR Mini** and the **Sky-Watcher Star Adventurer GTi** can work together quite effectively, especially for wide-field imaging or solar setups where portability and precision matter.

Figure 3 – Sky Watcher Star Adventurer Gti, ASIAIR Mini, Samyang 135mm f/2, ZWO ASI2600MC Duo. Pedro RÉ (2025).

The **Sky-Watcher Star Adventurer GTi** is a significant evolution of the classic **Star Adventurer**, blending portability with full GoTo functionality. The SW Star Adventurer Gti is designed for **portable deep-sky imaging**, offering advanced features in a compact form factor.

Key Features

- **GoTo Mount**: Full computerized GoTo capability via SynScan app (iOS/Android) or hand controller.
- **Wi-Fi Control**: Integrated Wi-Fi for wireless operation using mobile devices.

- **Tracking Rates**: Sidereal, Solar, Lunar, and custom speeds.
- **Payload Capacity**: Up to **5 kg**, suitable for DSLR/mirrorless cameras with telephoto lenses or small refractors.
- **Integrated Polar Scope**: Illuminated and built into the body for precise polar alignment.
- **Equatorial Wedge**: Built-in with altitude and azimuth adjustments.
- **Autoguider Port**: ST-4 compatible for guiding corrections.
- **Power Options**:
    - Internal battery compartment (8× AA batteries).
    - External 12V DC input for longer sessions.

Connectivity & Control

- **USB Interface**: For DSLR shutter control and firmware updates.
- **SynScan Pro App**: Enables slewing, tracking, and object database access.
- **Vixen-Style Dovetail Clamp**: Compatible with most small telescopes and mounting rails.
- **Tripod Compatibility**: Standard 3/8" thread for universal tripod mounting.

Imaging Applications

- Wide-field Milky Way panoramas
- Long-exposure nebula and galaxy imaging
- Solar/lunar tracking with filters or spectroheliographs
- Time-lapse astrophotography

Sky-Watcher Star Adventurer GTi + ASIAIR Mini: Integration Overview
How They Work Together

- **Mount Control:** The ASIAIR Mini can control the GTi via USB (EQMod cable or SynScan USB), replacing the hand controller entirely.
- **GoTo & Plate Solving:** ASIAIR handles slewing, plate solving, and framing.
- **Autoguiding:** Connect a ZWO guide camera and guidescope to the Mini for precise tracking and dithering.
- **Camera Integration:** DSLR, mirrorless, or ZWO astro cameras can be controlled directly from the ASIAIR app.
- **Power Distribution:** The Mini can power accessories, but not the GTi mount itself—Sky-Watcher warns against this due to current draw risks.

Figure 4 – ASIAIR App. Operates ZWO cameras, auto guiders, filter wheels, and motorized focusers, plus most GoTo mounts.

Figure 5 - Samyang 135mm F/2 (@F/2.8), Sky-Watcher Star Adventurer GTi, ZWO ASIAIR Mini, ZWO ASI294MC, ASI120MM Mini (Guide). Pedro RÉ (2025).

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igure 6 - ASIAIR App. M45.

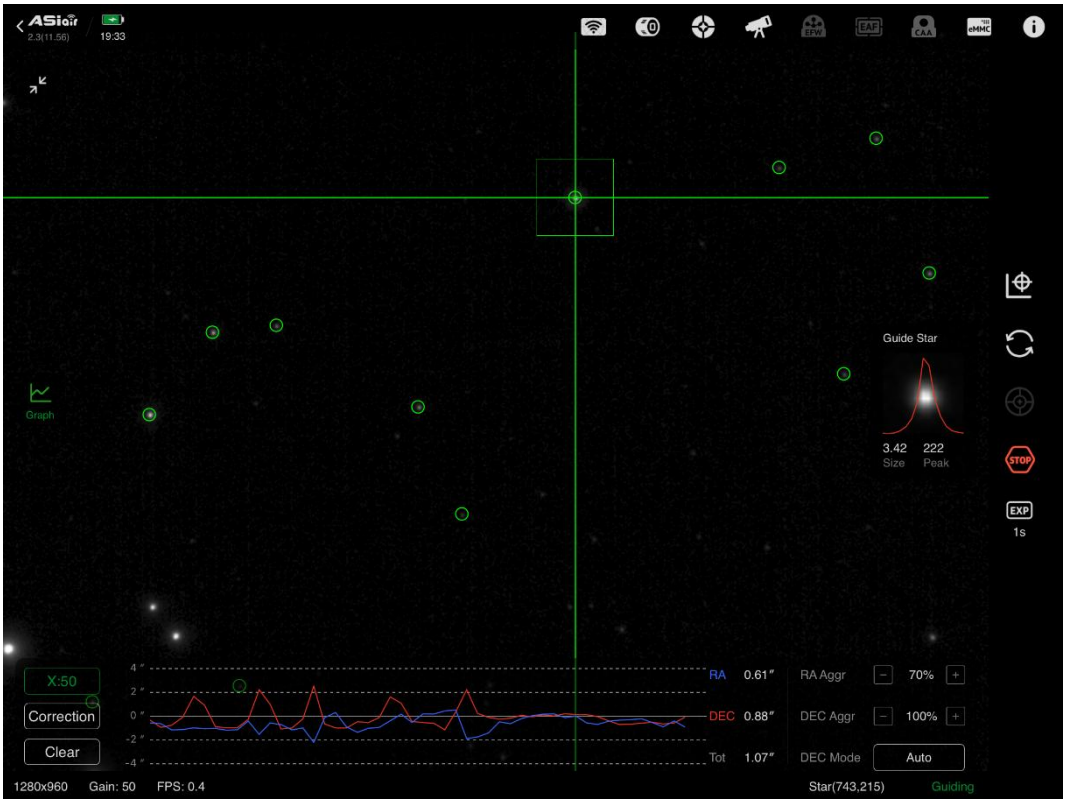

Figure 7 - ASIAIR App. Autoguiding PHD2.

Figure 8 - M045, 230Min (46x5Min), Samyang 135mm F/2 (@F/2.8), Sky-Watcher Star Adventurer GTi, ZWO ASIAIR Mini, ZWO ASI294MC, ASI120MM Mini (Guide), Antlia Triband RGB Ultra filter. Pedro RÉ (2025).

Figure 9 - M081/M082, 125Min (25x5Min), Samyang 135mm F/2 (@F/2.8), Sky-Watcher Star Adventurer GTi, ZWO ASIAIR Mini, ZWO ASI294MC, ASI120MM Mini (Guide), Antlia Triband RGB Ultra filter. Pedro RÉ (2025).

Figure 10 - M042, 200Min (40x5Min), Samyang 135mm F/2 (@F/2.8), Sky-Watcher Star Adventurer GTi, ZWO ASIAIR Mini, ZWO ASI294MC, ASI120MM Mini (Guide), Antlia Triband RGB Ultra filter. Pedro RÉ (2025).

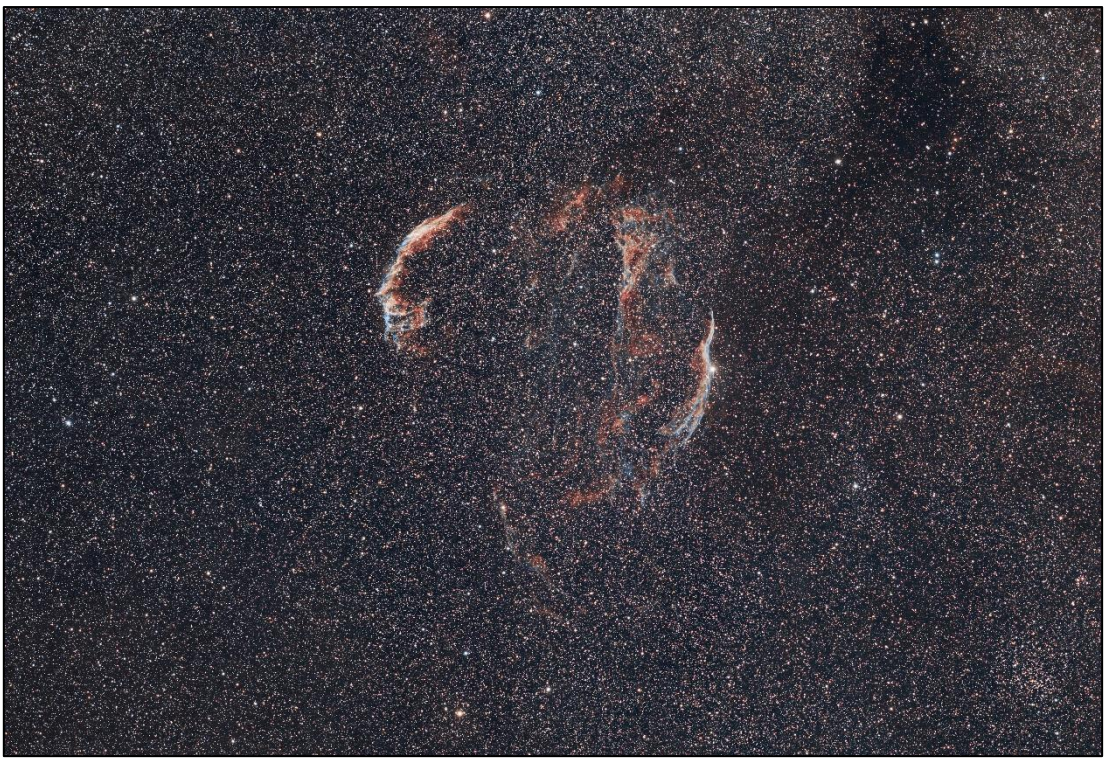

Figure 11 - NGC6960, 315Min (63x5Min), Samyang 135mm F/2 (@F/2.8), Sky-Watcher Star Adventurer GTi, ZWO ASIAIR Mini, ZWO ASI294MC, ASI120MM Mini (Guide), Altair QuadBand CMOS Optimised Filte. Pedro RÉ (2025).

Figure 12 - NGC700/IC5070, 500Min (100x5Min), Samyang 135mm F/2 (@F/2.8), Sky-Watcher Star Adventurer GTi, ZWO ASIAIR Mini, ZWO ASI294MC, ASI120MM Mini (Guide), Altair QuadBand CMOS Optimised Filter. Pedro RÉ (2025).

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- https://pedroreastrophotography.com/samyang_135_f2_widefield.html Pedro RÉ's Web site

Youtube Videos (Pedro RÉ):

https://youtu.be/L7_B79svj7o
WIDEFIELD CMOS IMAGING | Pedro RE'
SAMYANG 135mm F/2.0 | ZWO ASI 294MC PRO | SW Star Adventurer Gti | ASIAIR mini
Finding Chart (PixInsight)

https://youtu.be/hcmza7Hs9MQ
WIDEFIELD CMOS IMAGING | Pedro RE'
SAMYANG 135mm F/2.0 | ZWO ASI 294MC PRO | SW Star Adventurer Gti | ASIAIR mini
(NGC7000/NGC6960)

https://youtu.be/LVF_CL1xptU
WIDEFIELD CMOS IMAGING | Pedro RE'
SAMYANG 135mm F/2.0 | ZWO ASI 294MC PRO | SW Star Adventurer GTi | ASIAIR Mini

https://youtu.be/-gBtUZ5XvdI
WIDEFIELD CMOS IMAGING | Pedro RE' (20250117/31)
SAMYANG 135mm F/2.0 | ZWO ASI 294MC PRO | SW Star Adventurer GTi | ASIAIR Mini

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WIDEFIELD CMOS IMAGING | Pedro RE' (20250117)
SAMYANG 135mm F/2.0 | ZWO ASI 294MC PRO | SW Star Adventurer GTi | ASIAIR Mini

Wide-field imaging with a ZWO ASI2600MC Pro Duo & Player One Poseidon-C Pro

Pedro RÉ
https://pedroreastrophotography.com/

The **ASI2600MC/MM Duo** (Figure 1, 2 & 3) combines imaging and guiding sensors in a single compact body. The main sensor is the Sony IMX571, featuring a native 16-bit ADC, 14 stops of dynamic range, and a 3.76µm square pixel array. Readout noise is as low as 1.0 e^-, and the full well capacity reaches an impressive 73 ke. Remarkably, it exhibits no amp glow.

The guide sensor is the Type 1/1.8 SC2210, known for its excellent near-infrared (NIR) sensitivity. The sensor size is 7.68 mm × 4.32 mm, with 4 µm ×4 µm pixels arranged in a 1920 × 1080 array and a full well depth of 8780 e.

Stars at the corners of guide images may appear slightly distorted when affected by the reducer's back focus distance. This is not caused by sensor tilt and does not impact normal use.

Main Imaging Sensor: Sony IMX571

- **Sensor Type**: APS-C format, back-illuminated CMOS
- **Resolution**: 26 megapixels (6252 × 4176)
- **Pixel Size**: 3.76 µm square
- **ADC**: Native 16-bit (not emulated), enabling smooth tonal transitions
- **Dynamic Range**: Up to 14 stops
- **Full Well Capacity**: Up to 73,000 electrons (at gain -25)
- **Read Noise**: As low as 1.0e
- **Quantum Efficiency (QE)**: Peak over 80%
- **Amp Glow**: None — thanks to zero-amp glow circuitry

Integrated Guiding Sensor: SC2210

- **Sensor Type**: 1/1.8" CMOS (same as ASI220MM Mini)
- **Resolution**: 1920 × 1080
- **Pixel Size**: 4 µm
- **Sensor Size**: 7.68 mm × 4.32 mm
- **Full Well Capacity**: 8780e
- **QE Peak**: Up to 92% at 500 nm
- **Read Noise**: As low as 0.6e
- **NIR Sensitivity**: Excellent — ideal for guiding in faint star fields

Cooling & Build

- **Cooling System**: Two-stage TEC cooling
- **Delta T**: 30–35°C below ambient (at 30°C ambient)
- **Anti-Dew**: Built-in dew heater
- **Housing**: Compact design with tilt adjustment via rear screws
- **Connectivity**: Single USB 3.0 cable for both imaging and guiding
- **Buffer**: 512 MB DDR3 for stable data transfer

Performance & Usability

- **Frame Rate**: Up to 15 FPS in RAW8 mode at full resolution
- **STARVIS Technology**: Enhances sensitivity and reduces noise
- **No Need for OAG**: Integrated guider simplifies setup and cabling

- **Ideal For:** Portable rigs, remote setups, and users seeking high sensitivity with minimal complexity

The **Poseidon-C Pro** cooled camera, developed by Player One Astronomy, is designed for advanced deep-sky object (DSO) imaging. It features the Sony IMX571 APS-C format colour sensor with a resolution of 6252 × 4176 pixels (26 MP), a pixel size of 3.76 µm, and a diagonal of 28.3 mm. The sensor supports a full well capacity of 71.7 ke.

Design & Build

- The camera body adopts a polygonal octagonal design with cambered surfaces and rounded chambers. The front piece is circular to minimize diffraction when used with RASA systems.
- The red-and-black colour scheme, enhanced by a fine matte finish, gives the camera a sleek and professional appearance.

Sensor Tilt Plate

- A rear 4-point adjustable sensor tilt plate allows users to correct field curvature more precisely. Each corner can be independently adjusted, and a built-in high-density sponge pad prevents light leakage from side slits.

Cooling System

- Equipped with a dual-stage TEC cooling unit, the camera achieves a ΔT of over 40 °C. The improved structure prevents heat from re-entering the camera chamber.
- Integrated anti-dew heater with adjustable power settings helps combat condensation during imaging sessions.

✅ **Pros of the IMX571 CMOS Sensor**

High Resolution & Pixel Density

- **26 MP APS-C format** (6252 × 4176 pixels) with **3.76 µm pixel size**
- Excellent for capturing fine detail in deep-sky objects

Low Noise Performance

- **Native 16-bit ADC** enables smoother gradients and better dynamic range
- **Read noise as low as 1.0e** at optimal gain settings
- **Zero-amp glow** thanks to advanced circuitry

High Quantum Efficiency

- **Peak QE >80%**, meaning more photons are converted into signal
- Great sensitivity across visible spectrum, especially in Hα and OIII regions

Deep Cooling Compatibility

- Works well with TEC cooling systems, achieving ΔT of 30–35°C below ambient
- Reduces thermal noise for long exposures

STARVIS Technology

- Back-illuminated design improves low-light performance
- Ideal for faint nebulae and galaxies

Versatile Format

- APS-C size offers a good compromise between field of view and resolution
- Compatible with many telescope setups without excessive vignetting

❌ Cons of the IMX571 CMOS Sensor

Cost & Variants

- **Consumer vs. industrial grade**
  - Consumer-grade chips (used in most astro cameras) are rated for ~300 hours/year
  - Industrial-grade chips offer better thermal stability and longevity, but are pricier

Rolling Shutter

- Uses a **rolling shutter**, which can introduce artifacts in fast-moving scenes
- Not a major issue for long-exposure astrophotography, but limits use in high-speed imaging

Backfocus Constraints

- Some camera bodies (e.g., ToupTek) have **fixed backfocus** around 17.5 mm
- Limits flexibility in optical train design compared to ZWO's 6.5 mm backfocus

Dew Risk

- High cooling performance can lead to **dew formation** without proper dew control
- Requires active dew heaters or desiccants

Sensor Packaging

- **Plastic packaging** in consumer-grade chips may be less thermally stable than **ceramic** industrial versions
- Can affect flatness and performance under deep cooling

Figure 1 – ZWO ASI2600MC Duo.

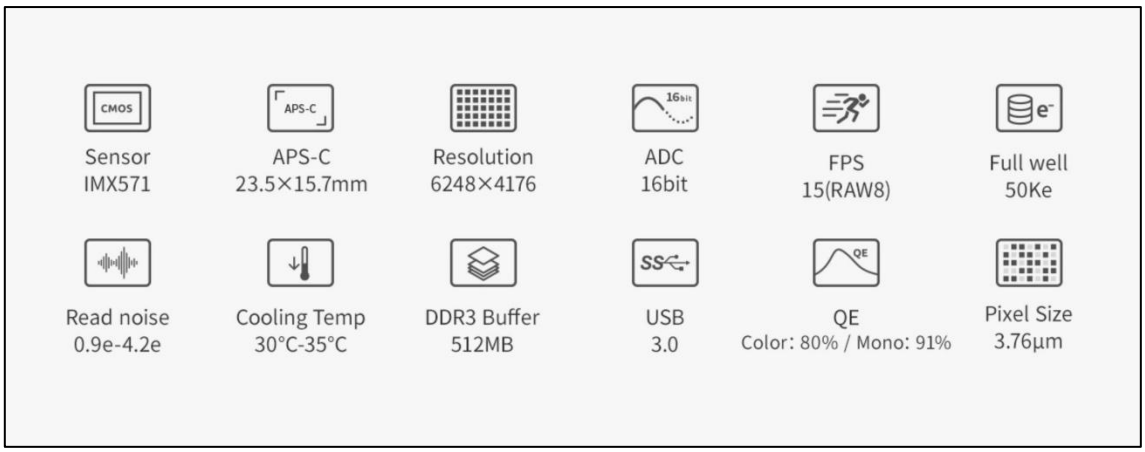

Figure 2 – ZWO ASI2600MC Duo Specs.

Figure 3 - ZWO ASI2600MC Duo, Samyang 135mm f/2, SW Star Adventurer GTi, ASIAIR Mini. Pedro RÉ (2025).

Figure 4 – Player One Poseidon-C Pro. Samyang 135mm f/2. Pedro RÉ (2025).

Figure 5 - Player One Poseidon-C Pro. Samyang 135mm f/2, Paramount ME. Pedro RÉ (2025).

Figure 6 - NGC700/IC5070, 240 Min (48x5Min), Samyang 135mm F/2 (@F/2.8), Sky-Watcher Star Adventurer GTi, ZWO ASIAIR Mini, ZWO ASI2600MC DUO, ASI120MM Mini (Guide), Altair QuadBand CMOS Optimised Filter. Pedro RÉ (2025).

Figure 7 - NGC700/IC5070, 240 Min (48x5Min), Samyang 135mm F/2 (@F/2.8), Sky-Watcher Star Adventurer GTi, ZWO ASIAIR Mini, ZWO ASI2600MC DUO, ASI120MM Mini (Guide), Altair QuadBand CMOS Optimised Filter. Annotated image Pedro RÉ (2025).

Figure 8 - NGC700/IC5070, 200 Min (40x5Min), Samyang 135mm F/2 (@F/2.8), Sky-Watcher Star Adventurer GTi, ZWO ASIAIR Mini, ZWO ASI2600MC DUO, ASI120MM Mini (Guide), Altair QuadBand CMOS Optimised Filter. Pedro RÉ (2025).

Figure 9 - NGC700/IC5070, 200 Min (40x5Min), Samyang 135mm F/2 (@F/2.8), Sky-Watcher Star Adventurer GTi, ZWO ASIAIR Mini, ZWO ASI2600MC DUO, ASI120MM Mini (Guide), Altair QuadBand CMOS Optimised Filter. Annotated image Pedro RÉ (2025).

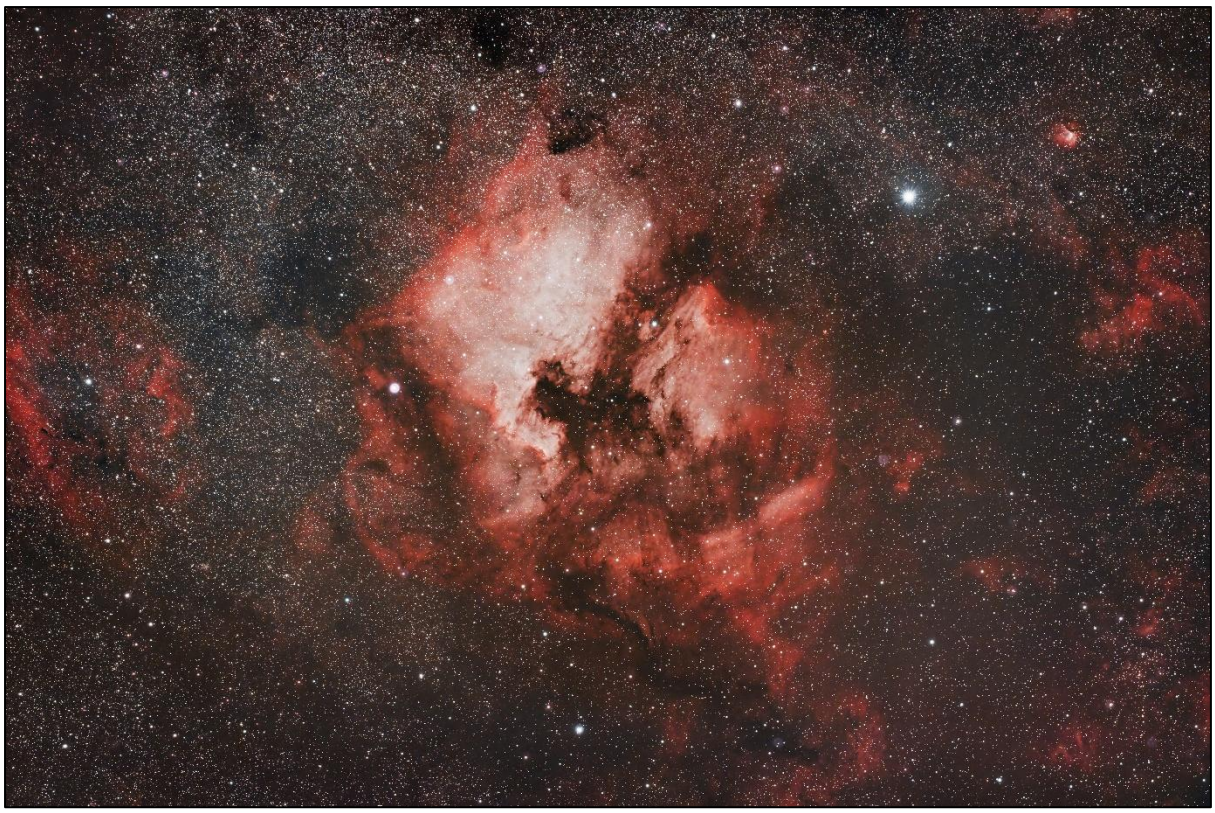

Figure 10 - NGC7000. 180min (36x5min). Samyang 135mm F/2 (@F/2.8), PLAYER ONE POSEIDON-C PRO, Optolong L-eXtreme filter, Paramount ME (protrack enabled). Pedro RÉ (2025).

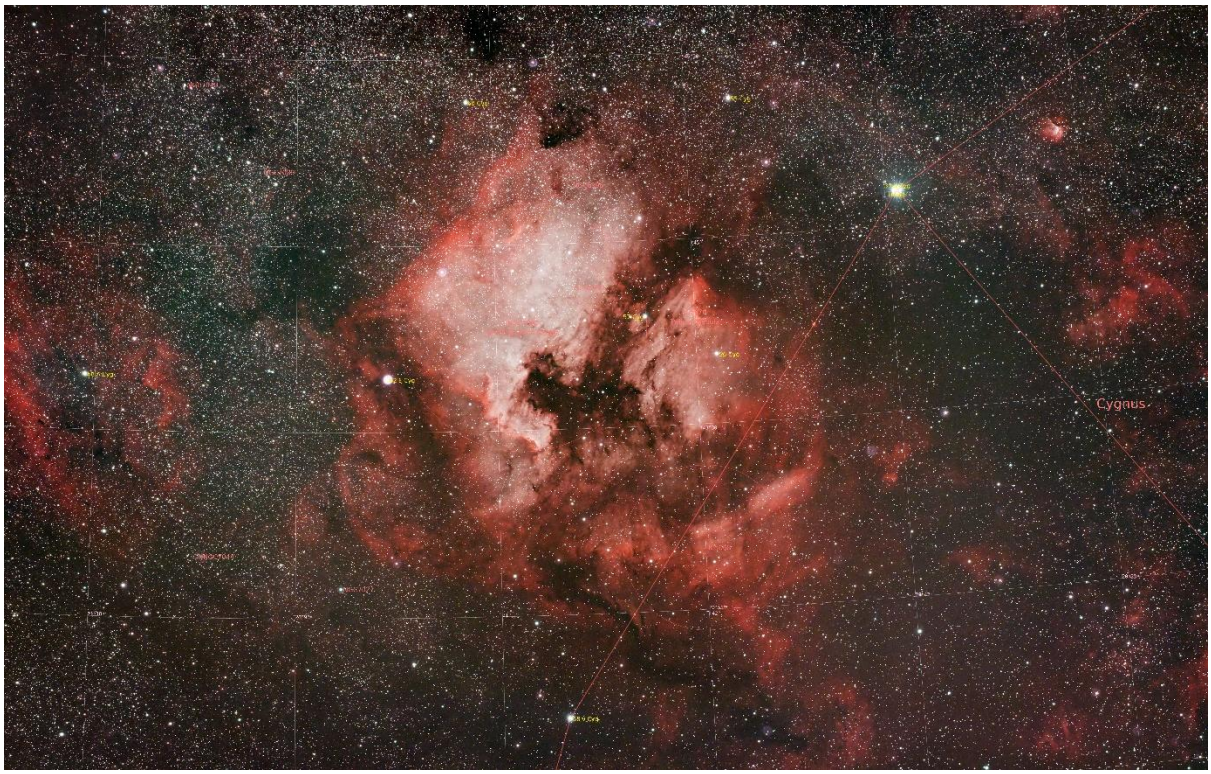

Figure 11 - Figure 10 - NGC7000. 180min (36x5min). Samyang 135mm F/2 (@F/2.8), PLAYER ONE POSEIDON-C PRO, Optolong L-eXtreme filter, Paramount ME (protrack enabled). Annotated image Pedro RÉ (2025).

Figure 12 - VEIL & CIRRUS NEBULAE. 180min (34x5min). Samyang 135mm F/2 (@F/2.8), PLAYER ONE POSEIDON-C PRO, Optolong L-eXtreme filter, Paramount ME (protrack enabled). Pedro RÉ (2025).

Figure 13 - VEIL & CIRRUS NEBULAE. 180min (34x5min). Samyang 135mm F/2 (@F/2.8), PLAYER ONE POSEIDON-C PRO, Optolong L-eXtreme filter, Paramount ME (protrack enabled). Annotated image Pedro RÉ (2025).

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***Youtube Videos* (Pedro RÉ):**

https://youtu.be/ANX2d1rQ4_Y
WIDEFIELD CMOS IMAGING | Pedro RE' SAMYANG 135mm F/2.0 | ZWO ASI 2600MC DUO | SW Star Adventurer Gti | ASIAIR mini (FIRST LIGHT)

https://youtu.be/UoZyEj-UaAc
WIDEFIELD CMOS IMAGING | Pedro RE'
Samyang 135mm f/2 | Player One Poseidon-C Pro

https://youtu.be/KYqz1m4keRg
Image Processing Tutorials | Pedro RE'
ONE SHOT COLOR CAMERA IMAGE PROCESSING WORKFLOW (PixInsight)

ASKAR SQA55 264mm f/4.8 Super Quintuplet Astrograph

Pedro RÉ
https://pedroreastrophotography.com/

The Askar SQA55 is a versatile Petzval refractor that incorporates five optical elements for superior image correction. Uniquely, it features a variable aperture—a rarity among refractors. With an adjustable aperture ranging from f/4.8 to f/22, the SQA55 is ideal for both nighttime astrophotography and daytime photography, functioning seamlessly as a manual focus camera lens.

The Askar SQA55 combines the simplicity of a lens with the power of a telescope. Its Petzval design eliminates backspacing hassles and the need for a field flattener. It features ergonomic touches like dual focus locks, quick-release hardware, and multiple filter threads. Compact and travel-ready, the SQA55 redefines user-friendly performance (Figure 1 to 8).

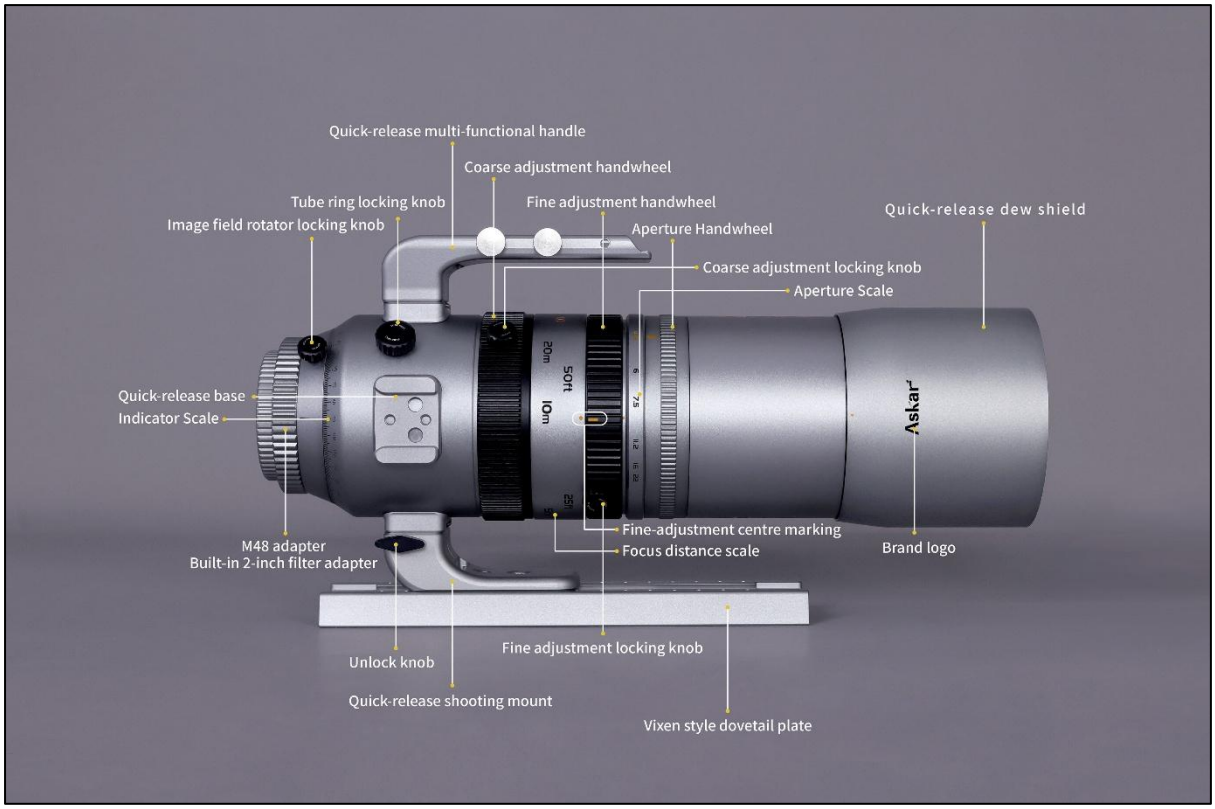


Figure 1 – Askar SQA55 264mm f/4.8 Super Quintuplet Astrograph.

Main Specs:

- Aperture: 55mm
- Focal Length: 264mm
- Focal Ratio: f/4.8 (adjustable up to f/22)
- Optical Design: Quintuplet Petzval APO (includes SD and ED glass elements)
- Closest Focus Distance: 5m
- Focusing Mode: Manual focus
- Filter Diameter: M67 (front) and M48 (rear)
- Total Length: 316mm (including dew shield), 244mm (without dew shield)

- Weight: 1.84kg (OTA), 2.18kg (including handle & dovetail plate)
- Rear-End Connection Distance: Supports 50-60mm range (recommended 55mm)
- Additional Features: Built-in filter thread, quick-release base, reversible lens hood, dual-speed focuser, and compatibility with autofocus kits

Figure 2 – Askar SQA55 264mm f/4.8 Super Quintuplet Astrograph.

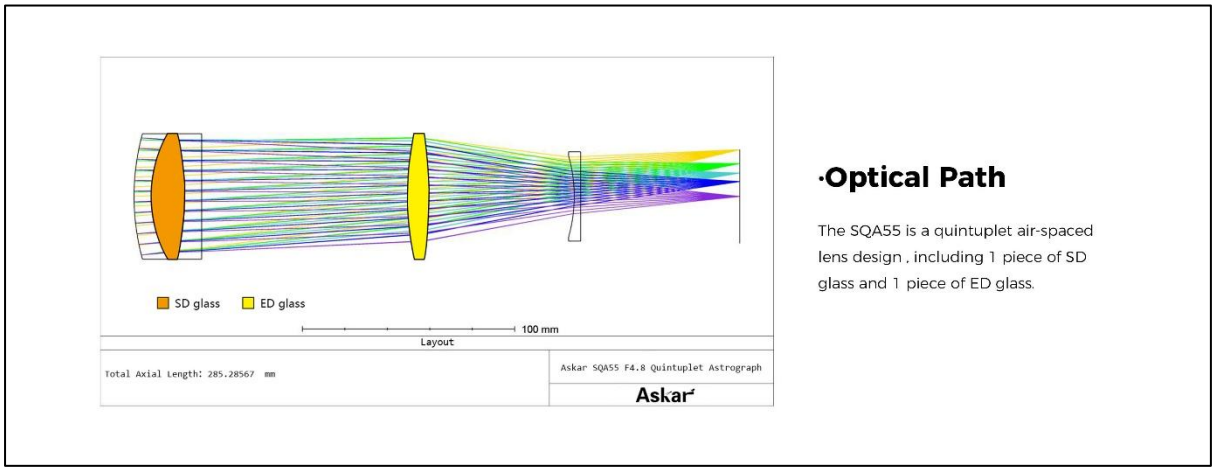


Figure 3 – Askar SQA55 264mm f/4.8 Super Quintuplet Astrograph.

·MTF Chart

The modulation transfer function (MTF) is a quantitative description of the clarity of the image (including resolution and contrast) of an optical lens. The vertical axis is the MTF value, and the horizontal axis is the distance from the center of the frame to the edge. In the two sets of curves corresponding to low and high frequencies, even at the edge of the full frame . the sagittal lines and sagittal lines distance of the SQA55 lens remain very small, and at the low frequency of 10LP/mm, it is higher than 0.9 overall, showing the high resolution and sharpness of the SQA55.

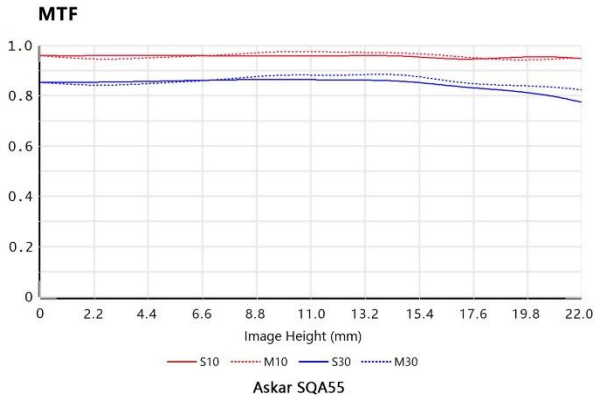
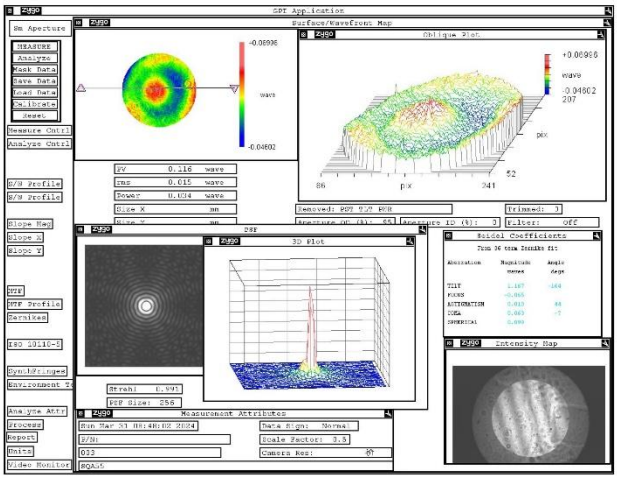


Figure 4 – Askar SQA55 264mm f/4.8 Super Quintuplet Astrograph.



·ZYGO Objective Chart

The ZYGO interferometer is internationally recognized as a more authoritative instrument for testing optical lens quality, and the SQA55 test results show great star quality.

Figure 5 – Askar SQA55 264mm f/4.8 Super Quintuplet Astrograph.

·Spot Diagram

The imaging quality of the optical system can be evaluated by analyzing the distribution of the spots on the spot diagram.
The SQA55 has a central star point with an RMS radius of less than 2.5 μm, and the star point at the corner is less than 4 μm, showing fine star point.

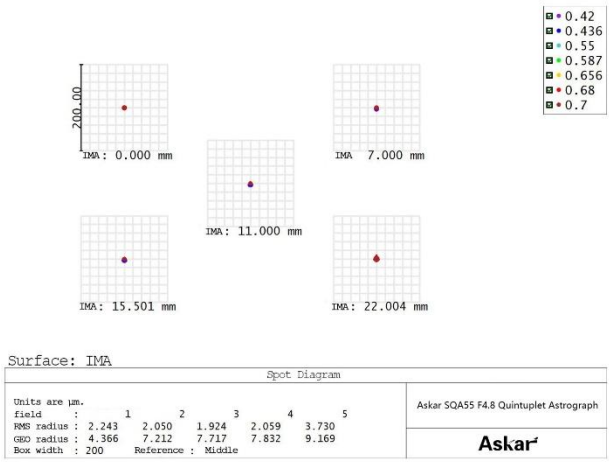


Figure 6 – Askar SQA55 264mm f/4.8 Super Quintuplet Astrograph.

Figure 7 – Askar SQA55 264mm f/4.8 Super Quintuplet Astrograph. Pedro RÉ (2025).

Figure 8 – Askar SQA55 264mm f/4.8 Super Quintuplet Astrograph. Pedro RÉ (2025).

Figure 9 – Askar SQA55 264mm f/4.8 Super Quintuplet Astrograph. LEO TRIPLET (M65, M66, NGC3628), 85Min (17x5Min), ASKAR SQA55, Antlia Triband RGB Ultra filter, ZWO ASI533MC, ASI120MM Mini (Guide), Paramount ME. Aberration Inspector (PixInsight). Pedro RÉ (2025).

Optical Correction Highlights

- ***Five-element lens system:*** This design includes two Super Low Dispersion (SD) glass elements, which significantly reduce chromatic aberration and ensure accurate color reproduction.
- ***Flat field imaging:*** The built-in Petzval configuration eliminates the need for external field flatteners and backfocus calculations. This means sharp stars from center to edge—perfect for full-frame sensors.
- ***Minimal distortion:*** The SQA scopes correct for common issues like coma, field curvature, and vignetting, delivering clean, distortion-free images across the entire field of view.
- *Star sharpness:* Central stars maintain an RMS radius of <1.7 µm, with corners at <2.2 µm, which is exceptional for astrophotography.

- ***Illumination:*** The SQA106, for example, offers 90% illumination at 44mm and supports a 55mm corrected image circle, making it ideal for full-frame and even medium-format cameras.

The Askar SQA series offers high-performance optics in a user-friendly design, making it an attractive choice for astrophotographers seeking simplicity without compromising image quality. Its integrated features eliminate the need for additional accessories or complex setup, streamlining the imaging process. Whether selecting between models or pairing with a specific camera, the SQA line provides versatile solutions for both novice and experienced users (Figure 9).

Pros and Cons

✅ **Pros**

- **Flat Field Imaging**: Petzval design delivers sharp stars across the entire frame—no need for a field flattener or back focus calculations.
- **Full-Frame Friendly**: M54 thread and wide optical path reduce vignetting, making it ideal for full-frame sensors.
- **Compact & Travel-Ready**: Weighs just over 2kg and includes a military-grade carrying case—perfect for mobile setups.
- **Versatile Aperture**: Adjustable from f/4.8 to f/22, allowing use for both astrophotography and daytime terrestrial imaging.
- **Premium Build**: Machined aluminium body, integrated rotator, and dual ring mounting system feel solid and professional.
- **No Coma or Aberration**: Round stars with minimal distortion, even at the edges.

❌ **Cons**

- **Helical Focuser Limitations**: Less precise than dual-speed rack-and-pinion focusers, especially for autofocusing.
- **Dew Shield & Lens Cap Issues**: The lens cap can be tricky to attach when the dew shield is in place, risking scratches.
- **Guide Scope Flex**: Mounting a guide scope on the top handle may introduce flex, affect guiding accuracy unless carefully secure.
- **CAA Locking Difficulty**: The Camera Angle Adjuster (CAA) locking screw is hard to adjust; it can be replaced with a flat hand screw.

Figure 10- M011, 85Min (17x5Min), ASKAR SQA55, Player One Poseidon-C Pro, Antlia Triband Filter, Median, Paramount ME. Pedro RÉ (2005).

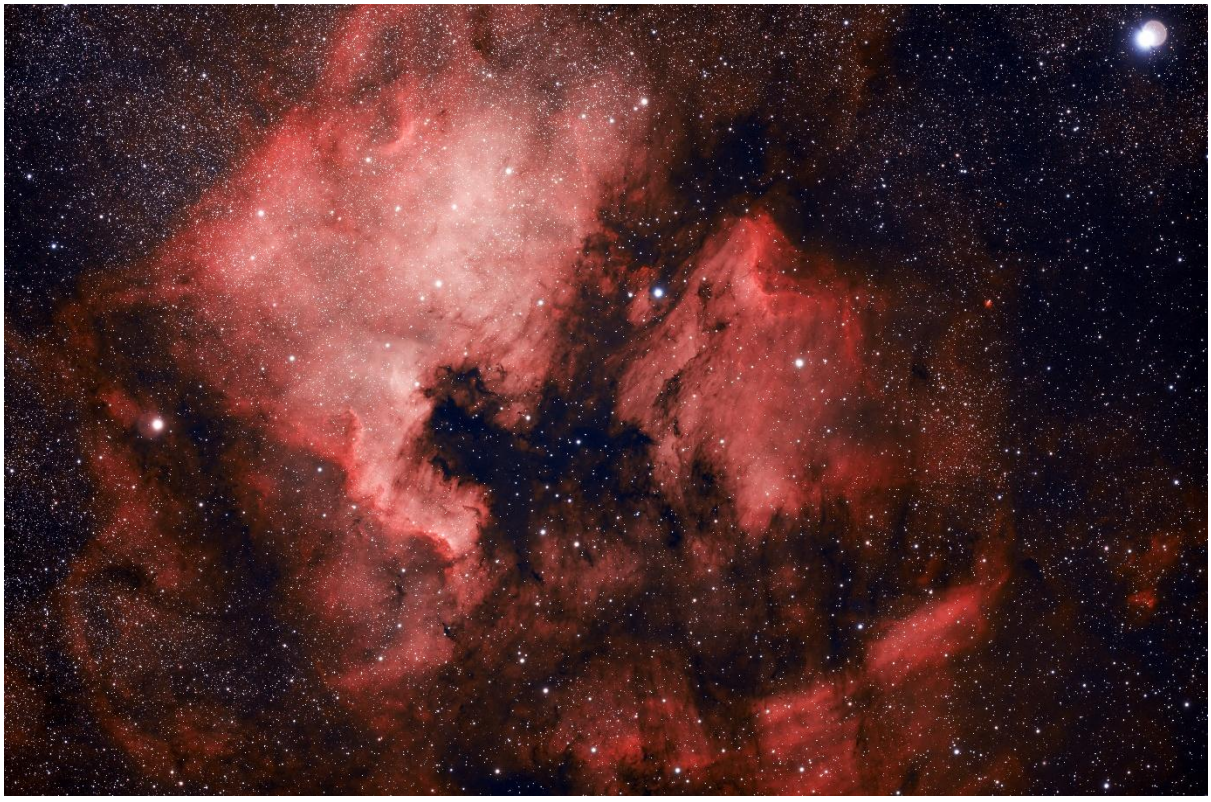


Figure 11 - NGC7000, 450Min (90x5Min), ASKAR SQA55 Player One Poseidon-C Pro, Optolong L-eNhance filter, Median, Paramount ME. Pedro RÉ (2005).

Figure 12- VEIL NEBULA, 145Min (29x5Min), ASKAR SQA55 Player One Poseidon-C Pro, Optolong L-eNhance filter, Median, Paramount ME. Pedro RÉ (2025).

Figure 13- M008/M020, 80Min (16x5Min), ASKAR SQA55, Player One Poseidon-C Pro, Antlia Triband Filter, Median, Paramount ME. Pedro RÉ (2025).

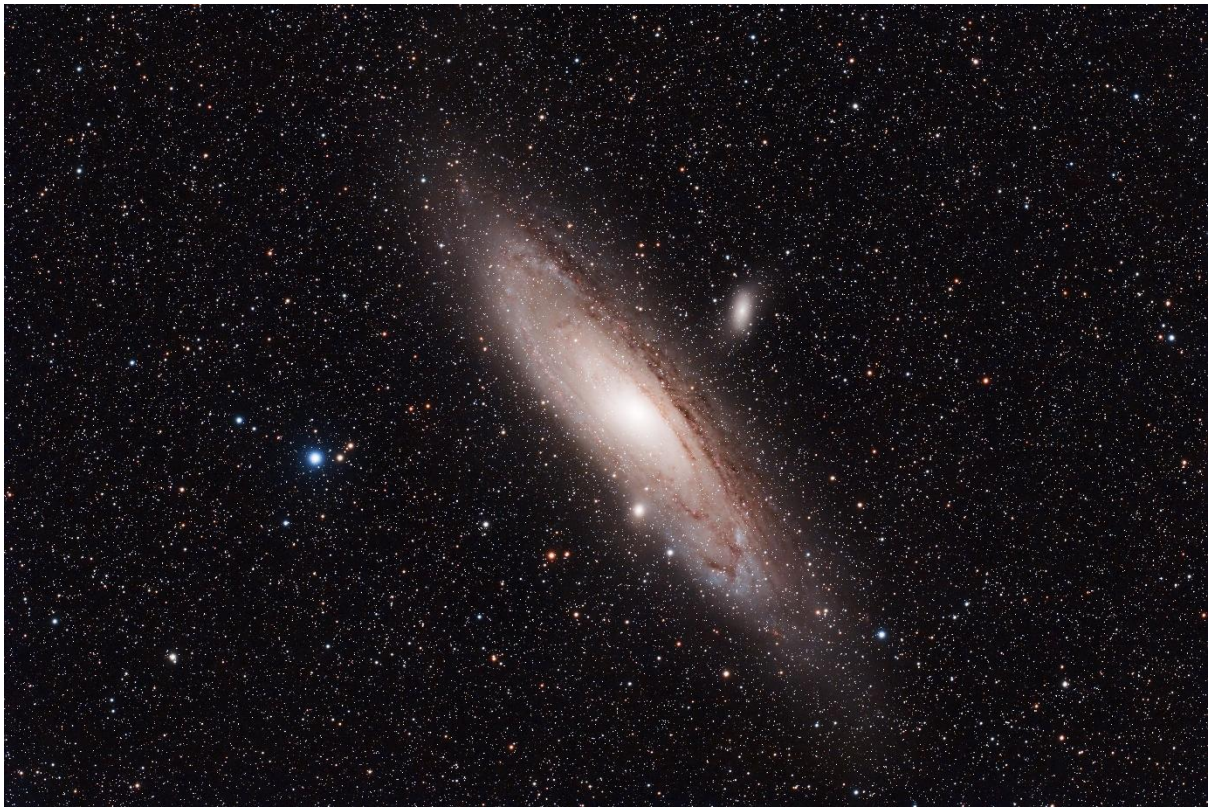


Figure 14- M031/M032, 320Min (64x5Min), ASKAR SQA55, Player One Poseidon-C Pro, Antlia Triband Filter, Median, Paramount ME. Pedro RÉ.

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- https://pedroreastrophotography.com/askar_sqa55.html Pedro RÉ's website

Youtube Videos (Pedro RÉ):

https://youtu.be/UUjy8xjQNDs
ASKAR SQA55 264mm f/4.8 Super Quintuplet Astrograph | Pedro RE'
Player One Poseidon-C Pro | Paramount ME (M31/M16/M17)

https://youtu.be/KKdsObRCMRw
ASKAR SQA55 264mm f/4.8 Super Quintuplet Astrograph

https://youtu.be/tXuo038yXQk
ASKAR SQA55 264mm f/4.8 Super Quintuplet Astrograph | Pedro RE'
Player One Poseidon-C Pro | Paramount ME

https://youtu.be/75FL0a0-6HI
ASKAR SQA55 264mm f/4.8 Super Quintuplet Astrograph | Pedro RE'
Player One Poseidon-C Pro | Paramount ME | (NGC7000

MLAstro SHG700 Spectroheliograph

Pedro RÉ
https://pedroreastrophotography.com/

The **MLAstro SHG 700** is a state-of-the-art, high-resolution solar spectroheliograph engineered for precise solar imaging. Designed with advanced features and intuitive operation, it is designed to serve both novice and seasoned astrophotographers. Unlike traditional etalon-based systems, the SHG 700 offers superior spectral resolution and enhanced flexibility in wavelength selection, enabling detailed monochromatic imaging of solar features such as H-alpha, Calcium K, and Sodium D. Its robust construction, digital integration, and user-friendly interface position it as a compelling instrument for solar observation, particularly within the amateur astronomy community. By merging modern optical technology with accessible design, the MLAstro SHG 700 represents a significant advancement in narrowband solar imaging.

The **SHG700** (Figure 1, 2 & 3) was developed by Nguyen T. Minh (PhD). Mihn runs a website (https://mlastro.com/) and sells not only the SHG700 but also lens kits for the Sol'Ex (https://solex.astrosurf.com/sol-ex-presentation-en.html) and accessories too.

Main Specifications:

Optical Components:

- 2x MLAstro 72mm flat-field compound lenses
- 1x 2400 l/mm holographic grating (25x25x6mm)
- 1x 7mm long, 7-micron wide Quartz slit (optional 10mm quartz slit)

Performance:

- Enables full-disk scans with telescopes up to 730mm focal length in one pass.
- Comes fully assembled and calibrated, ready for immediate use.

Additional Accessories:

- T2 (M42) to 1.25" adapter (for connecting the camera)
- 2" to M42 nosepiece (for attaching to the telescope)

Operational Principles of the MLAstro SHG 700 Spectroheliograph

The MLAstro SHG 700 spectroheliograph enables high-resolution solar imaging by scanning the solar disk line-by-line in narrow spectral bands. Unlike etalon-based systems that provide real-time full-disk views, this instrument utilizes a precision quartz slit to isolate a narrow segment of incoming sunlight. The collimated beam is diffracted through a 2400 lines/mm holographic grating, producing a dispersed spectrum from which a monochrome camera records spectral slices at a selected wavelength. These slices are acquired sequentially—either manually or via motorized right ascension tracking—and subsequently reconstructed into a monochromatic image using dedicated software such as SHG GUI[7] or JSol'Ex[8]. Final image processing involves stacking, sharpening, and contrast enhancement, following workflows similar to planetary imaging. This technique offers superior spectral resolution and wavelength flexibility, making it a valuable tool for detailed solar studies.

[7] https://github.com/thelondonsmiths/Solex_ser_recon_EN
[8] https://melix.github.io/astro4j/1.3.0/en/jsolex.html

Figure 1- MLAstro SHG700 Spectroheliograph.

Figure 2- MLAstro SHG700 Spectroheliograph. Takahashi S60C & Player One Neptune M (IMX178).

✅ Pros of the MLAstro SHG 700

Optical and Spectral Performance

- Ultra-narrowband resolution (~0.3 Å FWHM): Captures fine solar features with exceptional contrast.

- High spectral resolution (~R = 20,000): Suitable for solar imaging

Build Quality and Design

- Preassembled and calibrated: No need for 3D printing or DIY alignment—ready to use out of the box.
- Premium materials: CNC-machined aluminium body, 7µm quartz slit, and flat-field compound lenses ensure durability and optical precision.
- Micrometre-driven focus points: Allows fine control over image sharpness and slit alignment.

Software and Workflow

- Compatible with SHG GUI and JSOLEX for image reconstruction.
- Produces full-disk solar images with rich spectral detail, surpassing typical etalon-based systems.

Versatility

- Can be adapted for stellar spectroscopy with optional kits.
- Works with a wide range of telescopes and monochrome cameras.

Cost Efficiency

- Offers performance comparable to high-end etalon filters (which can cost tens of thousands of dollars) at a fraction of the price.

❌ Cons of the MLAstro SHG 700

Imaging Time and Workflow

- Not real-time: Requires scanning the Sun line-by-line, which takes several minutes depending on setup.
- Post-processing required: Image reconstruction and enhancement are essential, demanding familiarity with stacking and spectral software.

Learning Curve

- Requires technical understanding: Users must grasp slit-based spectroscopy and spectral alignment principles.
- Less intuitive than plug-and-play solar scopes

Hardware Requirements

- Needs a fast computer: Image acquisition and processing demand a modern Windows-based laptop or desktop (Linux support may be limited).
- Camera and telescope not included: Users must supply compatible gear

Availability

- Batch-based production: Units are released in limited batches, so availability may fluctuate.

Step-by-Step Operation of the MLAstro SHG 700

1. Setup and Alignment

- **Mount the SHG 700** securely to your telescope.
- Ensure the telescope is **polar-aligned** and tracking accurately (manual or motorized RA drive).
- Attach a **monochrome camera** to the SHG's output port.
- Connect the camera to your computer and launch your capture software (*e.g.*, SharpCap or Firecapture).

2. Focusing the Optical Train

- Use the **micrometre focus knobs** to adjust:
    - **Slit focus**: Ensures the solar image is sharply defined at the slit (dust on the slit can be used for precise focusing).
    - **Collimator lens focus**: Optimizes the beam entering the grating.

    - **Camera focus**: Sharpens the spectral image on the sensor.
- Look for **scintillating vertical lines** in the preview—these indicate **critical focus**.

3. Targeting the Sun

- Slew the telescope until the Sun is cantered on the slit.
- Use live view to confirm that the solar image is aligned and stable.
- Adjust tilt if necessary to remove vertical light band artifacts.

4. Spectral Scanning

- Begin the scan:
    - **Manual**: Slowly move the telescope across the solar disk.
    - **Automated**: Use a SharpCap script to control mount and camera synchronously.
- Record the scan as a **SER video file** or image sequence at the desired wavelength (*e.g.*, H-alpha, Ca K…).

5. Image Reconstruction

- Load the scan into **JSOLEX** or **SHG GUI**.
- The software stitches thousands of spectral slices into a full monochromatic image.
- Apply **stacking, sharpening, and contrast enhancement** if needed.

6. Post-Processing

- *Optional*: Colorize the image using false-colour palettes.
- Save final images in standard formats (TIFF, PNG) for analysis or publication.

7. Maintenance and Storage

- Clean the quartz slit gently if dust is present.
- Store the SHG 700 in a dry, padded case when not in use.

Essential Accessories for the SHG 700

Accessory	Purpose
T2 (M42) to 1.25" adapter	Connects your monochrome camera to the SHG 700
2" to M42 nosepiece	Attaches the SHG 700 to your telescope's focuser or diagonal
Monochrome camera	Required for capturing spectral slices
Tracking mount	Enables smooth scanning across the solar disk
Windows laptop or PC	For image acquisition and processing with SHG GUI or JSOLEX

Optional Enhancements

- **Solar finder scope**: Helps align the Sun quickly and safely
- **Neutral density or ERF filters**: Protect optics and reduce heat load (especially for larger apertures)
- **Custom mounting plates or dovetails**: For rigid integration with your existing setup

Figure 3- MLAstro SHG700 Spectroheliograph. Takahashi S60C & Player One Neptune M (IMX178).

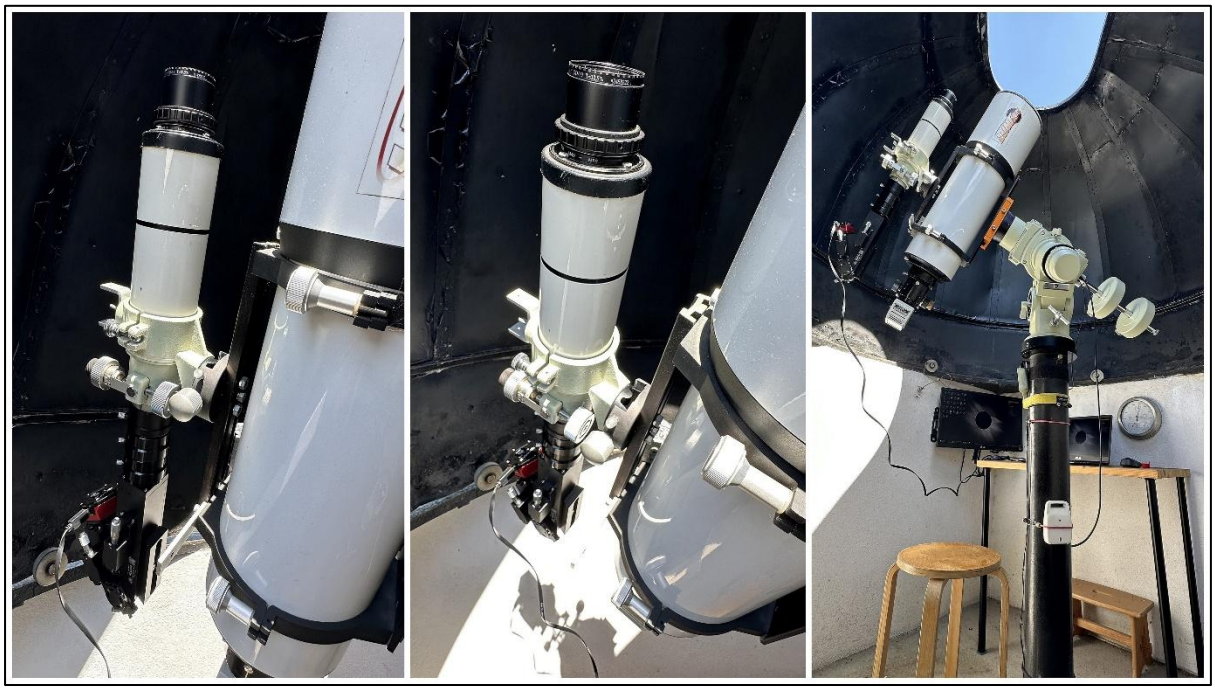


Figure 4 – MLAstro SHG700, Takahashi S60C & Player One Neptune M (IMX178), Takahashi EM-400 equatorial mount. Pedro RÉ (2025).

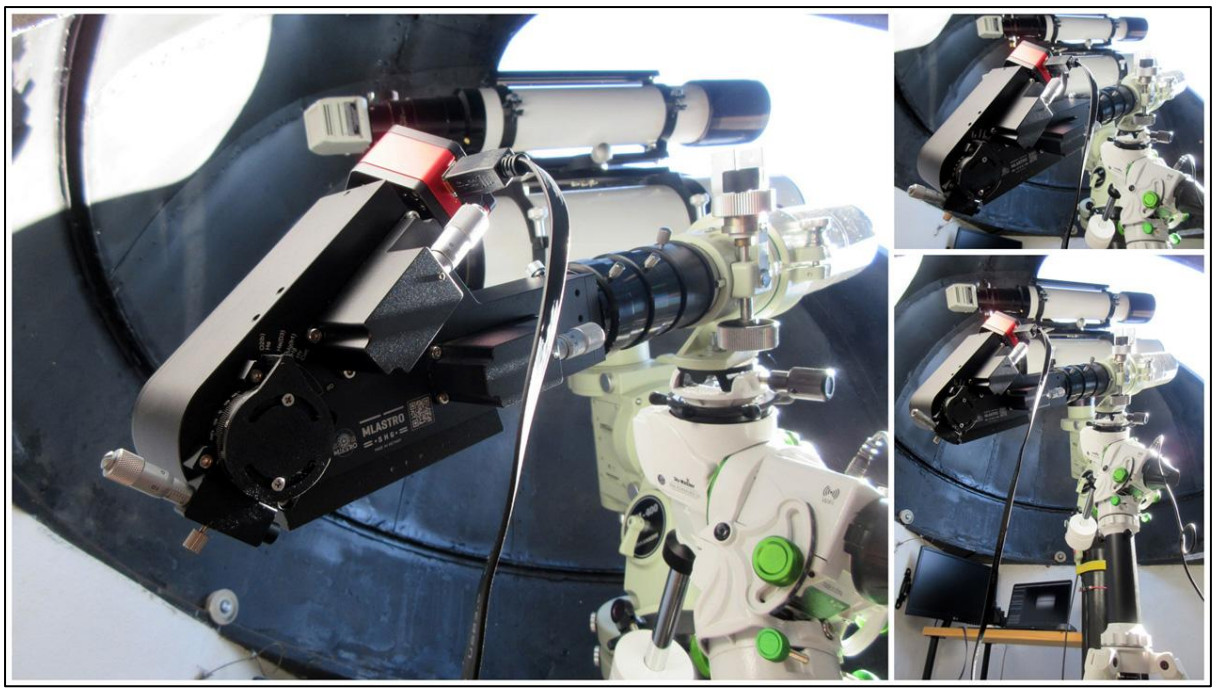


Figure 5 - MLAstro SHG700, Takahashi S60C & Player One Neptune M (IMX178), Sky Watcher star adventurer Gti equatorial mount. Pedro RÉ (2025).

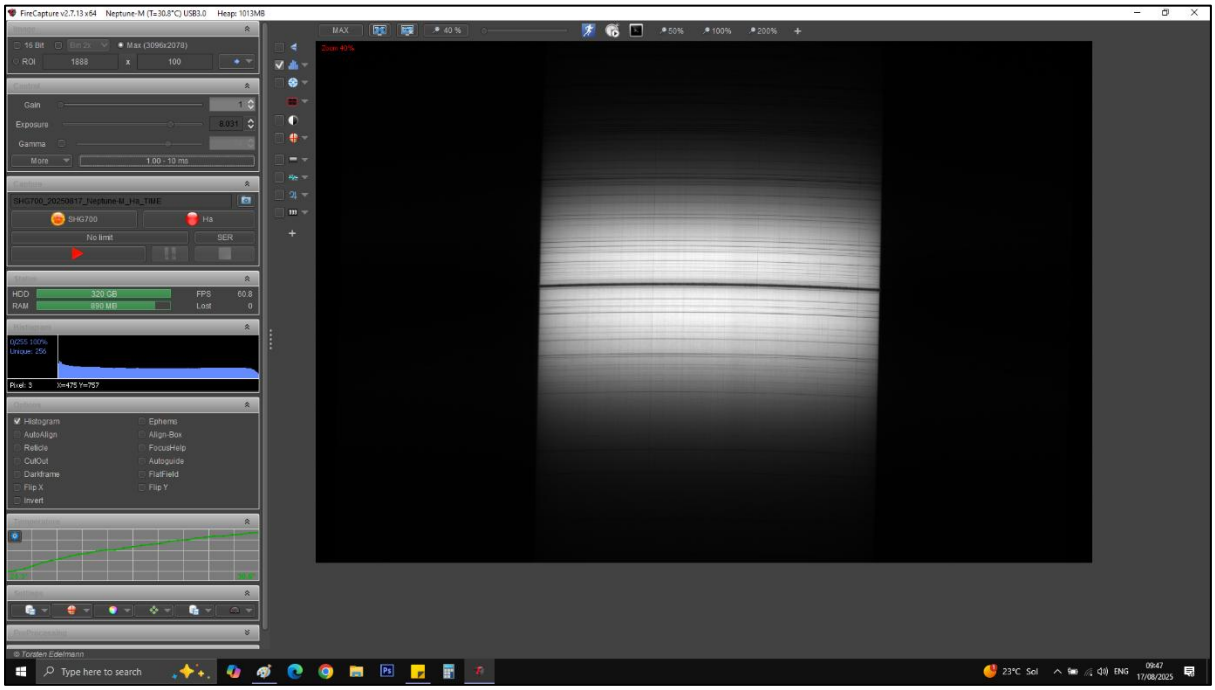


Figure 6 - MLAstro SHG700, Takahashi S60C & Player One Neptune M (IMX178), Sky Watcher star adventurer Gti equatorial mount. Firecapture acquisition software. Pedro RÉ (2025).

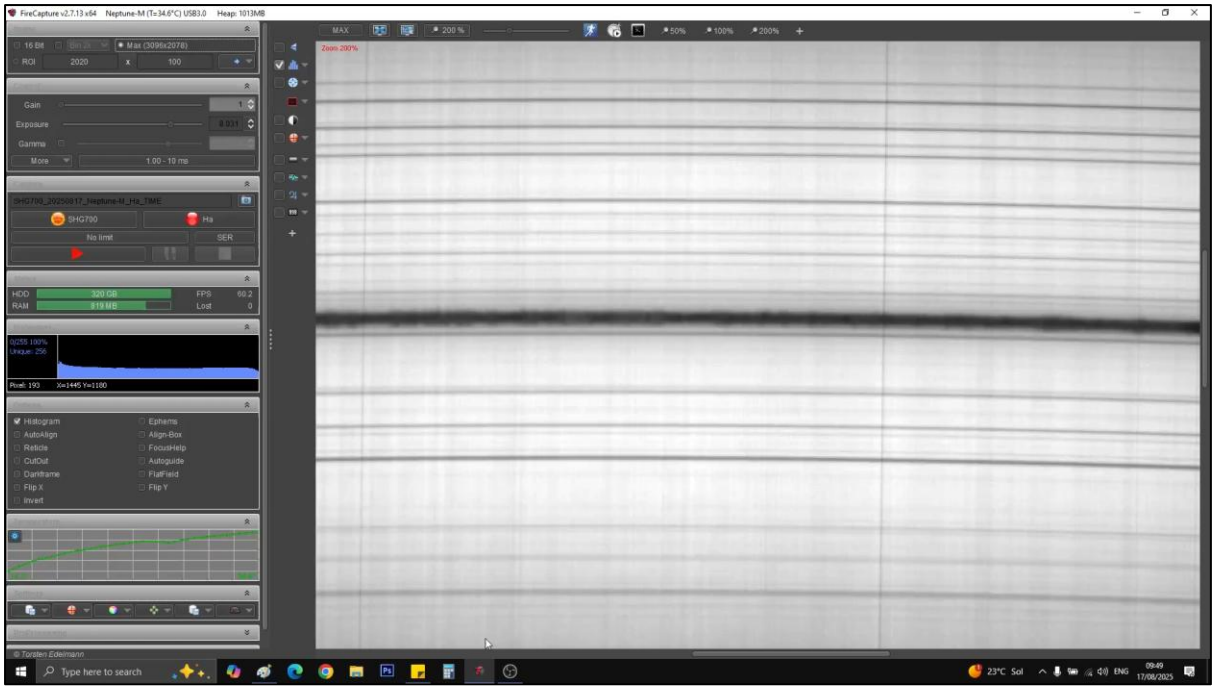
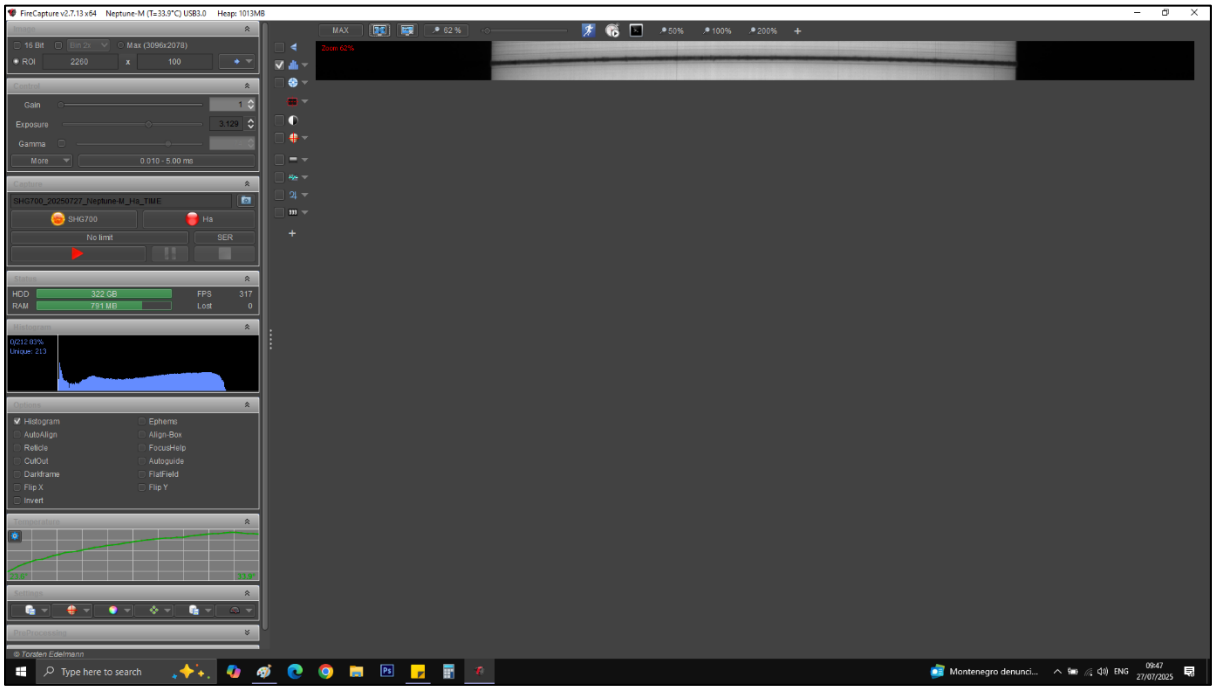


Figure 7 - MLAstro SHG700, Takahashi S60C & Player One Neptune M (IMX178), Sky Watcher star adventurer Gti equatorial mount. Firecapture acquisition software. Pedro RÉ (2025). ***In Focus***



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igure 8 - MLAstro SHG700, Takahashi S60C & Player One Neptune M (IMX178), Sky Watcher star adventurer Gti equatorial mount. Firecapture acquisition software. Pedro RÉ (2025).

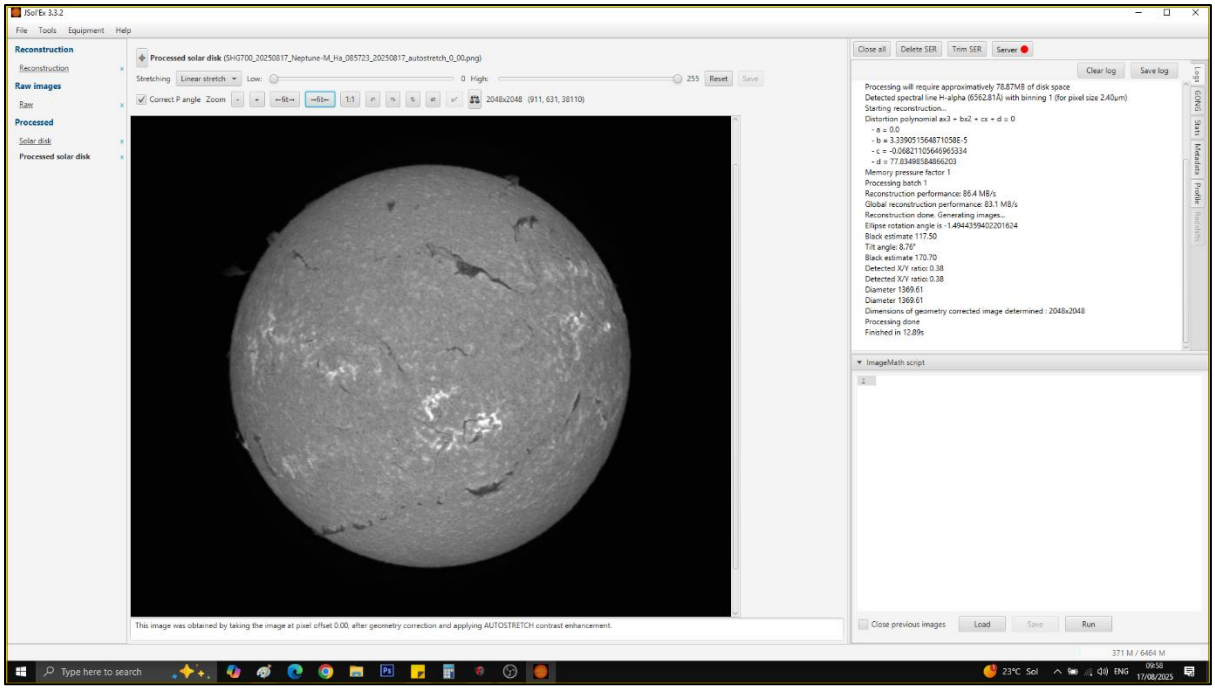

Figure 9 - MLAstro SHG700, Takahashi S60C & Player One Neptune M (IMX178), Sky Watcher star adventurer Gti equatorial mount. Firecapture acquisition software. Pedro RÉ (2025). ***JSOLEX Software***.

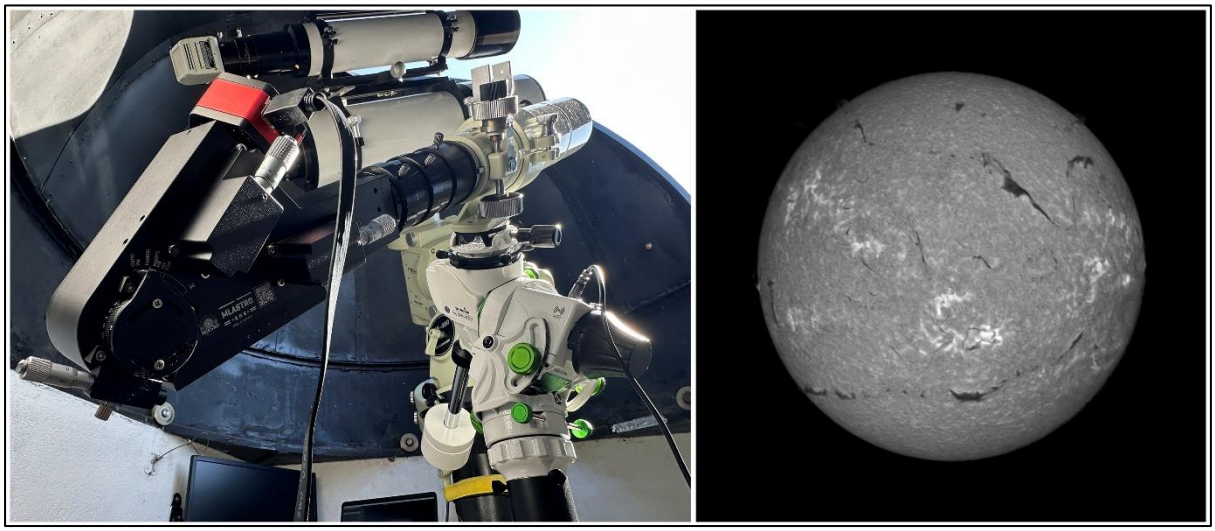

Figure 10 - SUN (20250817) H-alpha. FS60C f/5.9 MLAstro SHG700, Player One Neptune-M SW Star Adventurer Gti (10 stacked images). Pedro RÉ (2025).

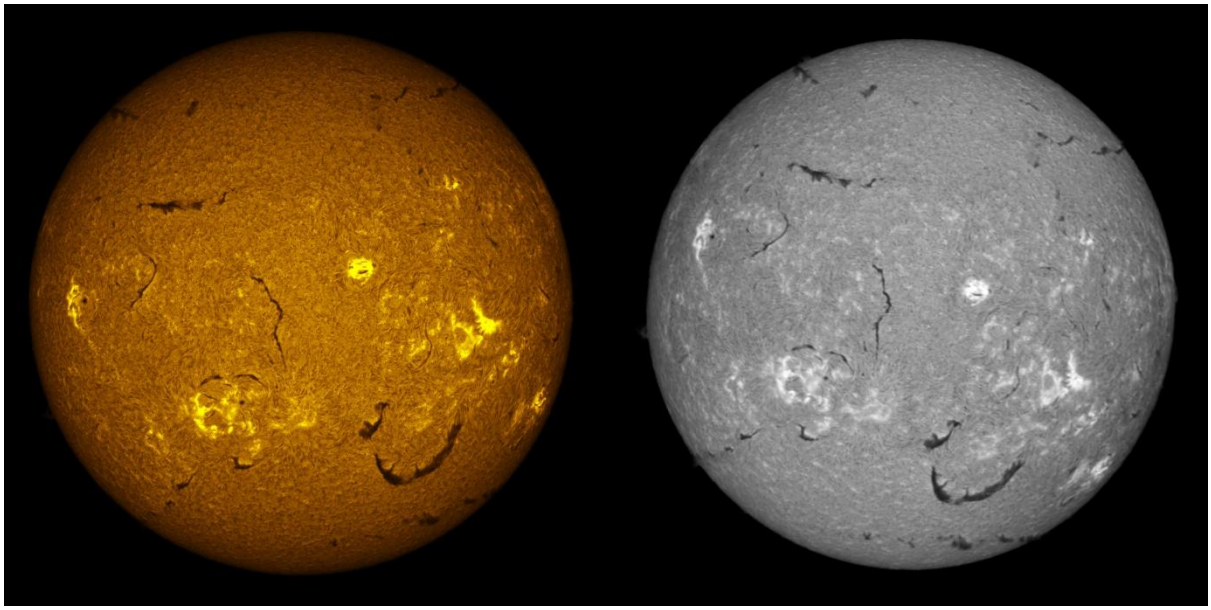

Figure 11 - SUN (20250801) H-alpha. TV NP101 F/5.4, Double Stack SM90II/SM60, FS60C f/5.9, MLAstro SHG700. Pedro RÉ (2025).

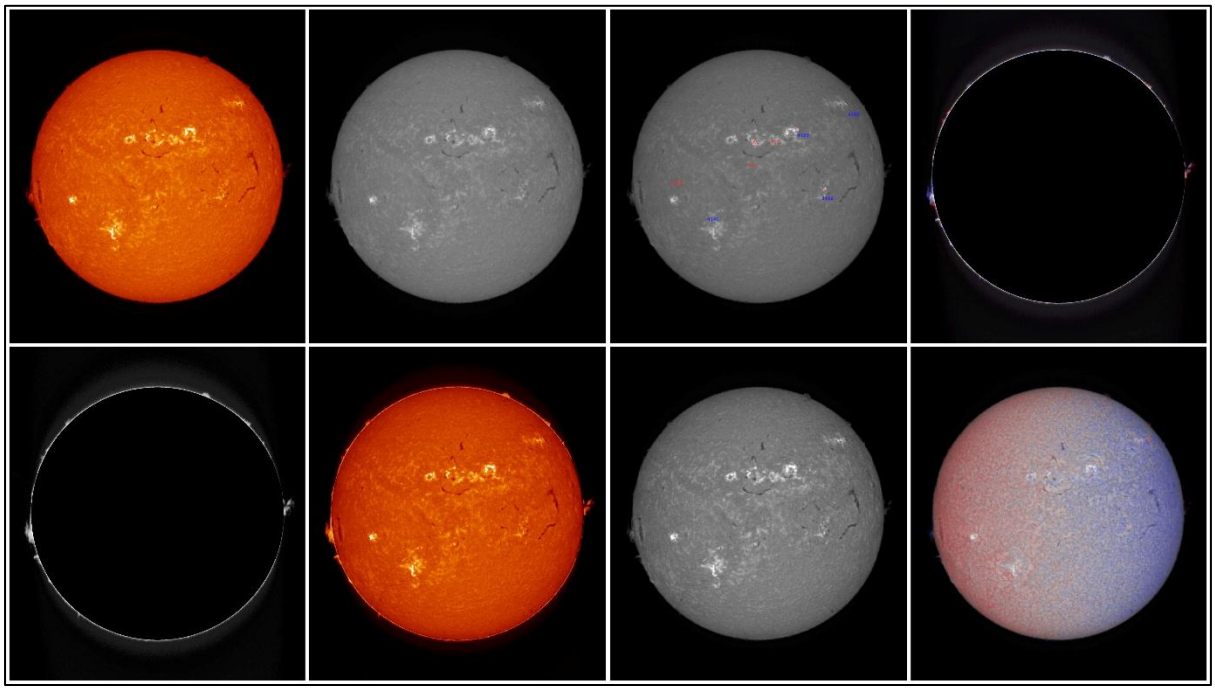

Figure 12 - SUN (20250715) H-alpha. FS60C f/5.9, MLAstro SHG700, Player One Neptune-M, SW Star Adventurer GTi | **JSolEx**. Pedro RÉ 2025).

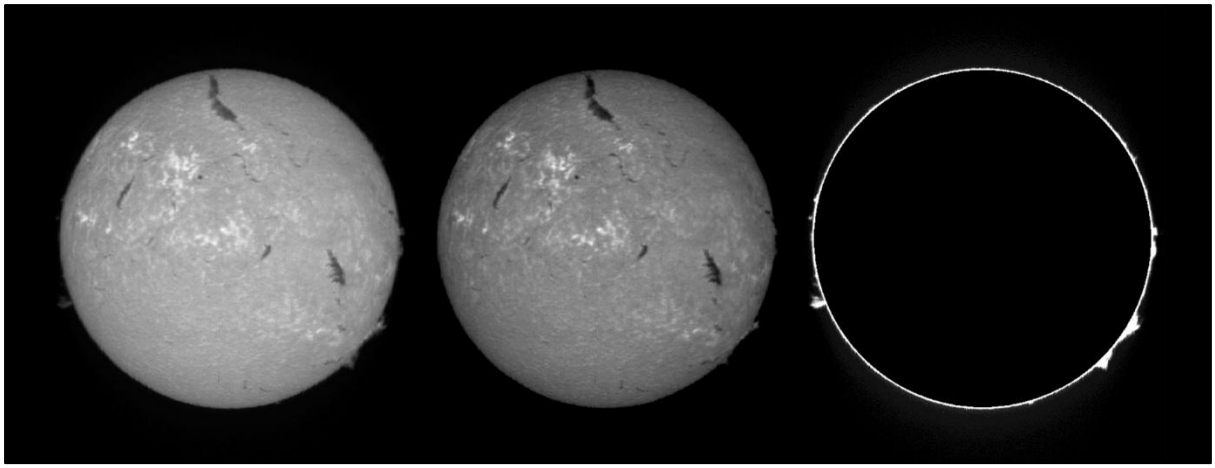

Figure 13 - SUN (20250517) H-alpha. FS60C f/5.9, MLAstro SHG700, Player One Neptune-M. **SHG GUI**. Pedro RÉ (2025).

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https://github.com/thelondonsmiths/Solex_ser_recon_EN thelondonsmiths/Solex_ser_recon_E
https://pedroreastrophotography.com/SHG700_pre.html Pedro RÉ's Web Site

Youtube Videos (Pedro RÉ):

https://youtu.be/0uZavSBNPRo
Solar imaging session (20250517) | Pedro RÉ
MLAstro SHG700 (First Light) | FS60C F/5.9 | Player One Neptune-M | Takahashi EM-400

https://youtu.be/gkbT8e7Qckw
Solar imaging session (20250608) | Pedro RÉ
MLAstro SHG700 (First Light) | FS60C F/5.9 | Player One Neptune-M | SW Star Adventurer GTi

https://youtu.be/AtczYWC1lfE
Solar imaging session (20250622) | Pedro RÉ
MLAstro SHG700 | FS60C F/5.9 | Player One Neptune-M | SW Star Adventurer GTi

https://youtu.be/6O4VpVgddiU
Solar imaging session (20250708) | Pedro RÉ
MLAstro SHG700 | FS60C F/5.9 | Player One Neptune-M | SW Star Adventurer GTi

https://youtu.be/BAlkzvzGpJM
Solar imaging session (20250722) | Pedro RÉ
MLAstro SHG700 | FS60C F/5.9 | Player One Neptune-M | SW Star Adventurer GTi

https://youtu.be/Amqmc9oxXrs
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MLAstro SHG700 | FS60C F/5.9 | Player One Neptune-M | SW Star Adventurer GTi

https://youtu.be/SxtlHoexTDs
Solar imaging session (20250727) | Pedro RÉ
MLAstro SHG700 | FS60C F/5.9 | Player One Neptune-M | SW Star Adventurer GTi

https://youtu.be/GEM8nX858J0
Solar imaging session (20250817) | Pedro RÉ
MLAstro SHG700 | FS60C F/5.9 | Player One Neptune-M | SW Star Adventurer GTi

Acuter Solarus-80 Solar Telescope

Pedro Ré
https://pedroreastrophotography.com/

The Acuter Solarus-80[9] (Figure 1 & 2) is an 80mm solar telescope with a safe, **permanently mounted glass white light solar filter**, which is useful for many different aspects of **white light solar observing**, including the observation of sunspots, solar eclipses, solar surface details & the transit of inner planets across the Sun.

Specifications

- **Objective Lens Diameter**: 80mm (multi-coated)
- **Telescope Focal Length**: 400mm (f/5)
- **Eyepiece Supplied**: Fixed 5-16mm Zoom Eyepiece, adjustable in 5mm, 10mm & 16mm stages
- **Magnifications**: x80, x40 & x25
- **Safe Solar Finder**: Ensures safe viewing of the Sun
- **Universal Smartphone Adaptor**: Allows you to take photos using your smartphone
- **Filter Wheel**: Pre-loaded with Red, Yellow, Blue, Green, Orange & ND (Neutral Density) Filters, with a handy In-Use Filter Indicator
- **90° Diagonal**: For comfortable viewing (non-rotatable)
- **Crayford Focuser**: Non-rotatable
- **45mm Vixen-Type Dovetail Bar**: With 1/4"-20 Tripod Threads (Side Mounted)
- **Telescope Length**: 378mm
- **Telescope Weight**: 1.75kg

Uses

The Acuter Solarus-80 is ideal for various **white light solar observing** applications, including:

- **Observing Sunspots**: View sunspots safely and in detail.
- **Solar Eclipses**: Watch solar eclipses with a clear and safe view.
- **Solar Surface Details**: Observe the intricate details of the solar surface.
- **Transit of Inner Planets**: Watch the transit of inner planets across the Sun.

This telescope is equipped with a built-in rotating filter wheel, allowing you to view the Sun in different colours. It also includes a universal smartphone camera adapter, making it easy to capture your observations.

The Acuter Solarus-80 conforms to and meets the transmission requirements of ISO 12312-2:2015 (Filters for the direct observation of the Sun).

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[9] When observing the Sun, it's crucial to follow safety guidelines to protect your eyes and equipment. **Disclaimer: Solar observation can be dangerous if proper precautions are not taken**. Always use a solar filter that is specifically designed for solar viewing. N**ever look directly at the Sun through a telescope, binoculars, or any optical device without a certified solar filter**. Failure to use appropriate solar filters can result in **permanent eye damage or blindness**. Ensure that all equipment is in good condition and that the solar filter is securely attached before observing the Sun. The use of homemade filters or unverified equipment is strongly discouraged. Always follow the manufacturer's instructions and guidelines for safe solar observation.
Stay safe and enjoy your solar observations!

Figure 1 – Acuter Solarus-80 Solar Telescope.

Figure 2 – Acuter Solarus-80 Solar Telescope.

The Acuter Solarus-80 comes complete with built-in white-light filter, solar finder, diagonal, zoom eyepiece, smartphone adaptor and a filter wheel pre-loaded with colour filters. The OTA can be bought on its own or together with a solar mount like the Sky Watcher SolarQuest mount[10] (Figure 3 & 4).

[10] https://www.skywatcherusa.com/products/solarquest

Figure 3 – Acuter Solar tracking mount.

Figure 4 – Acuter Solar tracking mount.

The Solarus-80 is a pleasure to use. The built-in zoom eyepiece offers three set focal lengths and magnifications: 5mm (80x), 10mm (40x), or 16mm (25x). While the 16mm length presented the Sun at a relatively wide field of view, we found it to be clear, sharp, and in focus, thanks to the Solarus-80's Crayford focuser. The 10mm view is optimal for this setup; the solar disc perfectly fits the field of view, while the sunspots remain clear, sharp, and perfectly focused.

The Solarus-80 It is well suited to beginner and intermediate observers looking to enjoy white light solar observation. The Solarus-80 telescope and mount package includes everything a beginner solar astronomer could want.

The filter wheel comes preloaded with red, yellow, blue, green, orange and neutral-density filters to help boost sunspot contrasts and details according to user preference. An empty slot is also included, should you wish to do solar observing with only the built-in white-light filter. A simple switch allows easy movement between the options.

Figure 5 – Acuter Solarus-80 + Sky-Watcher SolarQuest mount.

Figure 6 – Acuter Solarus-80 + Sky-Watcher SolarQuest mount.

Figure 7 – Acuter Solarus-80.

Figure 8 – Acuter Solarus-80.

Figure 9 – Acuter Solarus-80 permanently mounted glass solar white light filter.

Figure 10 – Acuter Solarus-80 Filter Wheel.

Figure 11- Acuter Solarus-80 + Sky-Watcher SolarQuest mount.

Figure 12 - SUN (20241125) WL (09:30 UTC). Acuter Solarus-80, grasshopper 3 GS3-U3-28S4M (Pedro RÉ).

BeaverLAB Finder TW2 Pro "Smart" Telescope

Pedro Ré
https://pedroreastrophotography.com/

The BeaverLAB Finder TW2 is an AI-enhanced smart telescope designed for astrophotography.
Key Features

- **AI-Enhanced:** The world's first AI-powered planetary camera, the DS1, enhances image quality through color correction, noise reduction, and other image processing technologies.
- **4K Quality:** Captures stunning 4K images and videos of celestial objects.
- **29X Optical Magnification:** Allows for detailed views of the Moon, planets, galaxies, and nebulas.
- **82mm Aperture:** Ensures ample light absorption, enhancing the brightness and clarity of captured images.
- **Touchscreen Interface:** High-resolution touchscreen for adjusting image settings such as saturation, contrast, and exposure directly on the screen.
- **Portability:** Weighs less than 8 pounds, making it easy to transport for both backyard stargazing and remote astrophotography sessions.
- **User-Friendly:** Suitable for users of all experience levels, with an integrated app for additional control and real-time visual editing.

Specifications

- **Optical Length:** 500mm
- **Aperture:** F/6.1
- **Magnification:** 29X optical magnification (plus 4X digital zoom)
- **Weight:** Less than 4 Kg
- **Included Accessories:** Tripod, remote control, carry case, and the DS1 planetary camera.

The Finder TW2 is designed to simplify the complexities of stargazing and astrophotography, making it accessible and enjoyable for everyone.

PROS

- **Lightweight and Portable**: Weighs only 3.8kg (8.38lbs), making it easy to transport.
- **Affordable**: Priced at $499, it's a budget-friendly option for astrophotography.

- **Includes a Planetary Camera**: Comes with the Starlight Camera DS1, which is designed for astrophotography.
- **Solar Filter**: Equipped with a solar filter for safe solar observations.
- **Quick Assembly**: Easy to set up, even without instructions.
- **AI-Enhanced**: The world's first AI-powered planetary camera enhances image quality through colour correction, noise reduction, and other image processing technologies.
- **4K Quality**: Captures stunning 4K images and videos of celestial objects.
- **Touchscreen Interface**: High-resolution touchscreen for adjusting image settings directly on the screen.

CONS

- **No Fine-Tune Tools**: Lacks fine-tuning controls for precise adjustments.
- **Poor Build Quality**: Some users have reported issues with the build quality.
- **Manual Navigation**: Does not have built-in planetarium software or the ability to self-align.
- **Camera and App Issues**: Users have experienced camera and app freezes and crashes.
- **Limited to Moon and Sun Observations**: Best suited for observing the moon and sun, with less effectiveness for deep-sky objects.

The BeaverLAB Finder TW2 is a great option for those looking to get into astrophotography without breaking the bank. However, it does have some limitations that more advanced users might find restrictive.

Figure 1 – BeaverLAB Finder TW2 Pro “Smart” telescope.

BEAVERLAB FINDER TW2: SPECIFICATIONS	
Sensor:	1/1.8-inch CMOS sensor
Aperture:	82 mm/3.2-inch
Focal ratio:	f/6.1
Focal length:	500 mm/19.69-inch
Optics:	85mm/3.4-inch reflector
Storage:	30 GB
Connections:	USB-C
Mount:	Altazimuth
Battery capacity:	6,000 mAh (six hours run-time)
Weight:	3.8kg/8.38lbs
Dimensions:	190x85mm/48x3.4-inches (telescope tube)

Figure 2 – BeaverLAB Finder TW2 Pro “Smart” telescope specs.

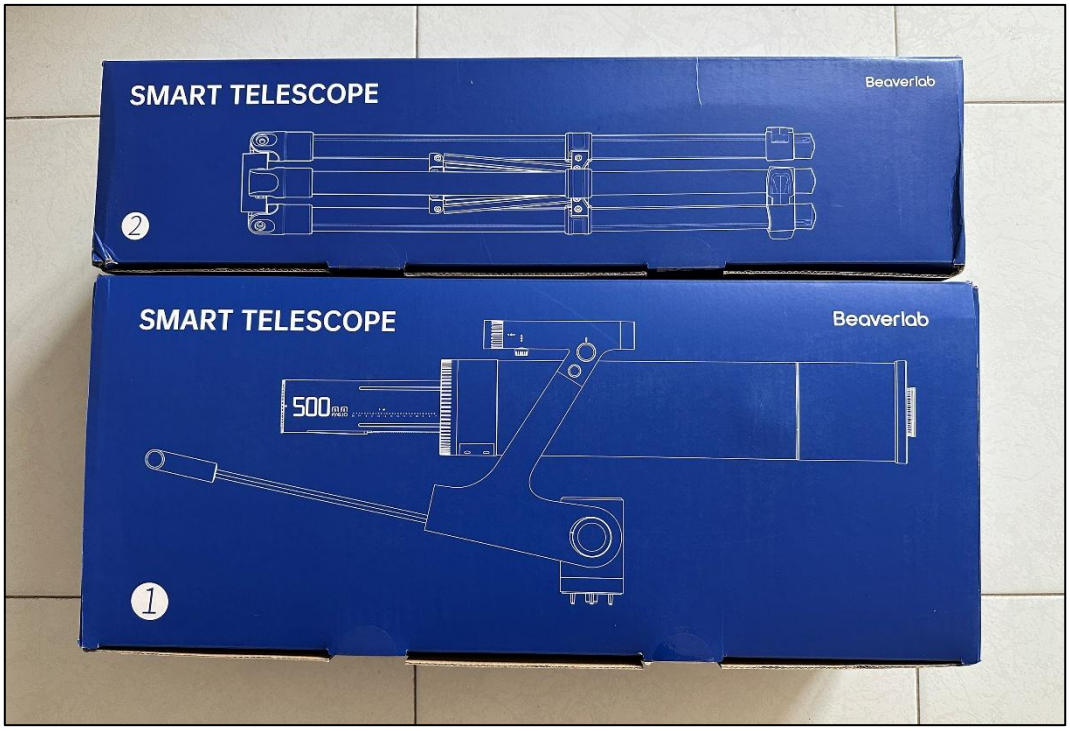


Figure 3 – BeaverLAB Finder TW2 Pro “Smart” telescope.

Figure 4 – BeaverLAB Finder TW2 Pro “Smart” telescope.

Figure 5 – BeaverLAB Finder TW2 Pro “Smart” telescope. **Solar imaging.**

Figure 6 – BeaverLAB Finder TW2 Pro “Smart” telescope. Sun (20241010)

Figure 7 – BeaverLAB Finder TW2 Pro “Smart” telescope. Moon (20241117).

SeeStar S50 um telescópio inteligente

Luís Plantier

O ZWO Seestar S50 não possui uma “história” no sentido tradicional de um percurso longo, mas sim um percurso marcado pela inovação tecnológica que o tornou num dos telescópios mais acessíveis e populares para astrofotografia. Lançado pela marca de equipamentos astronómicos ZWO, o Seestar S50 veio democratizar a prática da astrofotografia ao integrar, num único dispositivo compacto, um telescópio, uma montagem, uma câmara e software, tudo controlado através de uma aplicação para smartphone. Esta abordagem permite que qualquer pessoa — desde principiantes a entusiastas — capte imagens de objetos celestes sem a complexidade habitual dos equipamentos tradicionais.

1. Tecnologia Tudo-em-Um:

O Seestar S50 integra tudo o que um astrofotógrafo precisa num só aparelho: o tubo ótico refrator apocromático, uma montagem automática, uma câmara astronómica (com um sensor IMX462) e um sistema de software inteligente (ASIAIR), eliminando a necessidade de múltiplos acessórios.

2. Controlo Intuitivo por Aplicativo:

O dispositivo é controlado por um aplicativo de smartphone que funciona como um centro de comando, permitindo ao utilizador selecionar objetos celestes do mapa do céu, acionar a fotografia e até participar numa comunidade para partilhar imagens.

3. Automatização Total:

O Seestar S50 realiza o alinhamento automático, o sistema GoTo (para apontar para objetos celestes), o rastreio automático (para manter o objeto no campo de visão), o autofoco e o empilhamento automático (para acumular imagens e criar fotos detalhadas).

4. Design Compacto e Portátil:

Com um peso de cerca de 3 kg e com tripé incluído, o Seestar S50 é fácil de transportar, permitindo levar a astrofotografia para qualquer lugar.

5. Acessibilidade e Democratização da Astrofotografia:

Antes do Seestar S50, a astrofotografia exigia equipamentos dispendiosos, complexos e um conhecimento técnico aprofundado. O Seestar S50 veio tornar a captura de imagens de qualidade de nebulosas, galáxias e outros objetos celestes acessível a um público mais vasto, mesmo sem experiência prévia.

Este dispositivo representa uma evolução significativa na forma como as pessoas interagem com o universo. É um exemplo claro de como a tecnologia inteligente pode simplificar tarefas complexas, permitindo que mais indivíduos se conectem com o cosmos de forma acessível, criativa e envolvente.

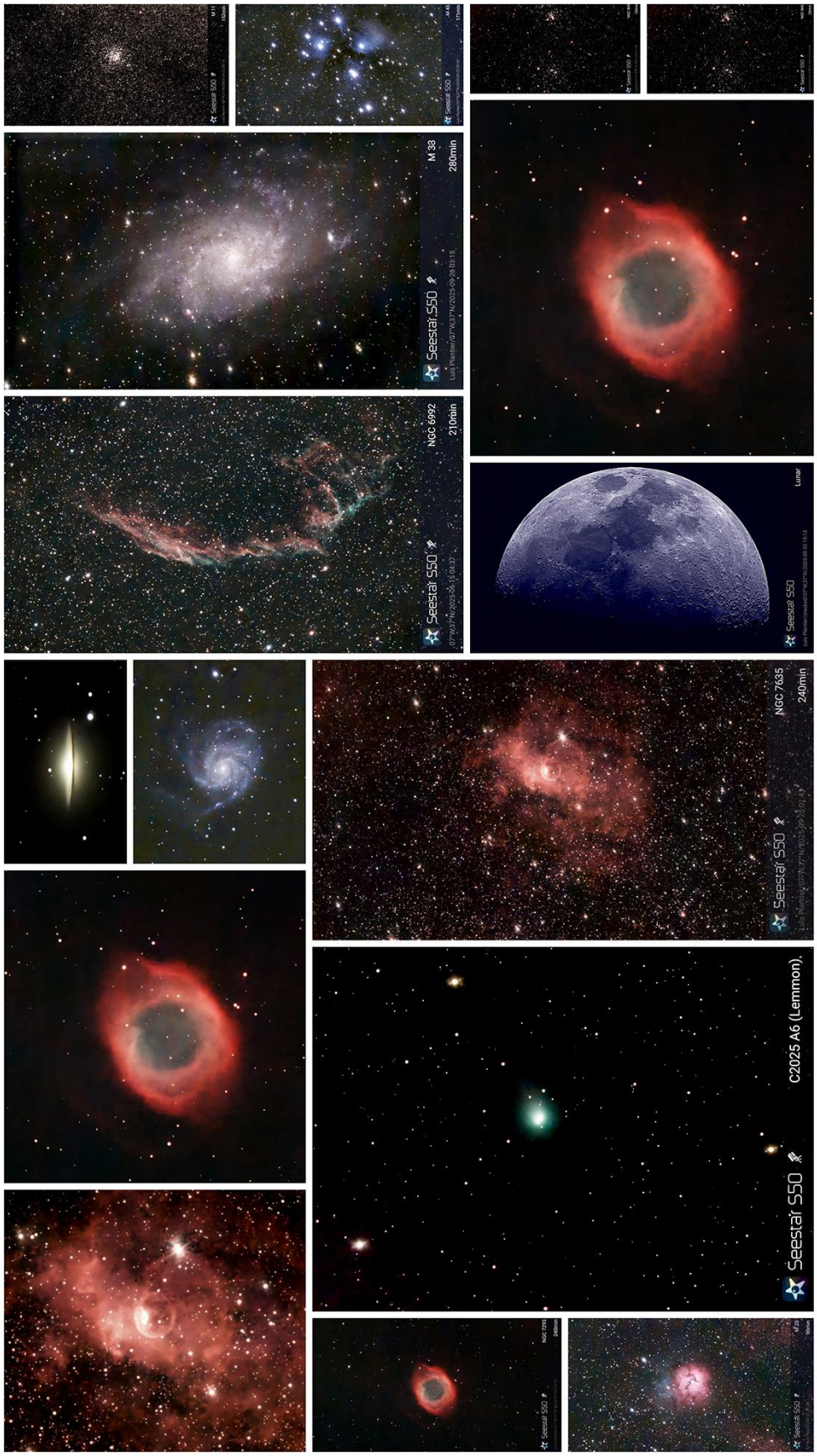


Figura 1 – Seestar S50, imagens Luís Plantier.


Seestar S50
M 33
07°W,37°N/2025-11-22 00:45
240min

Construção de um Observatório Astronómico Residencial em Sesimbra

Rui Horta Lourenço

1. Introdução

O presente artigo descreve o projeto de construção de um observatório astronómico particular situado em Sesimbra, Portugal.

O objetivo principal é criar um espaço funcional e tecnicamente adequado para observação astronómica e recolha de dados de forma que possam ser usados num sentido recreativo e/ou de uma forma científica.

Integrando dois núcleos distintos o observatório 1 dedicado a objetos de céu profundo e o observatório 2 para estudo do Sistema Solar (por finalizar).

Este projeto visa não só o uso pessoal e educativo, mas também a colaboração ocasional em projetos científicos e campanhas de observação astronómica nacionais e internacionais.

2. Localização e Condições do Local

O observatório foi construído numa propriedade privada em Sesimbra, local que apresenta razoáveis condições para a observação astronómica (Bortle 5 numa noite excecional) devido à relativa distância de grandes centros urbanos e, consequentemente, menor poluição luminosa.

A zona apresenta boa estabilidade térmica, mas humidade relativa superior ao que seria desejável devido à proximidade do oceano a Sul, 6,2km e a Oeste, 10,9km.

A configuração da casa dispõe de duas áreas com dimensões suficientes para duas pequenas estruturas independentes, com orientação favorável, com alguns constrangimentos a Sudeste com a presença de um obstáculo natural (um alto sobreiro) que impede a visibilidade entre o Azimute 100°-135° e Altitude até aos 40°, para o observatório 1. Para o observatório 2 a visibilidade está comprometida entre os Azimutes 25°-50° e 300°-345° e Altitudes até aos 30°.

3. Objetivos do Projeto

- Criar um espaço dedicado à observação astronómica de carácter pessoal e científico.
- Instalar duas infraestruturas distintas que permitam observações complementares:
- Um observatório voltado ao estudo de objetos do céu profundo e astrofotografia lúdica
- Um observatório voltado ao estudo do Sistema Solar (planetas e seus satélites, Lua, Sol, asteroides e cometas).
- Permitir a integração em redes de observação colaborativa, como campanhas de fotometria, astrometria ou registo de trânsitos exoplanetários.
- Garantir segurança, estabilidade e precisão nas observações.

4. Descrição das Estruturas

4.1 Observatório 1 (Céu profundo)

- Tipo de estrutura: Cobertura deslizante (“roll-off roof”), não automatizada, em painel sandwich de alta estanquicidade e conservação térmica em substituição do telhado de telha lusa existente. Aproveitamento de uma arrecadação com pé-direito de 3,25m na sua zona mais alta o que permitiu a construção de uma placa em betão para suporte da estrutura do pilar do telescópio a 1,50m do chão.

- Telescópio: William Optics Apocromático Triplet 102/703 mm + Askar SQ55 APO Quintuplet
- Montagem: iOptron 70G de precisão elevada.

  - Alinhamento Polar: Câmara iPolar integrada. Permite o alinhamento polar de forma simples e precisa com o software incluído.
  - Motores de passo (1,8° com 128 micros passos)
  - GPS de 32 canais
  - Integra a sua própria câmara guia (30mm abertura/120 mm distância focal, pixel size 3.75µm), o iGuider de iOptron
  - Interfaces WLAN (WiFi) e Hi-Speed USB 3. 0
  - Carga máxima 31kg
- Função principal: Astrofotografia e recolha de dados de objetos de céu profundo.
- Requisitos estruturais:
  - Pilar de betão armado com isolamento vibracional.
  - Rede elétrica estabilizada e pontos de ligação para computadores e câmaras CCD/CMOS.
  - Ligação à rede Wi-Fi para controlo remoto.

4.2 Observatório 2 (Sistema Solar)

- Tipo de estrutura: Cobertura deslizante ("roll-off roof"), não automatizada, em placas sandwich de alta estanquicidade e conservação térmica em substituição do telhado de telha lusa existente. Para criar as calhas de deslizamento da estrutura teve ser criada uma extensão lateral para o exterior do telhado, permitindo assim maior facilidade para a operação manual.
- Telescópio: Celestron Schmidt-Cassegrain de 11 polegadas + Luneta guia com ASI 120mm
- Montagem: EQ6 equatorial alemã.
- Função principal: Observação e registo de detalhes solares, lunares e planetários.
- Requisitos estruturais:
  - Pilar de betão armado com isolamento vibracional (por construir)
  - Rede elétrica estabilizada e pontos de ligação para computadores e câmaras CCD/CMOS.
  - Ligação à rede Wi-Fi para controlo remoto.

- Isolamento térmico do chão de ambos os observatórios com revestimento de **Tapete antiderrapante de borracha de 3mm de espessura**

5. Planeamento, execução e custo da Obra (o custo inclui mão-de-obra e materiais)

Observatório 1 (finalizado em 2021):
5.1 Por ser uma antiga arrecadação foi necessário a preparação do espaço retirando prateleiras e estruturas desnecessárias e limpando paredes de ferragens e artefactos desnecessários (0€)
5.2 Retirar telhas e corte de vigas de suporte, com preparação da zona circundante do telhado existente (235€)

5.3 Construção da placa intermédia para suporte de pilar independente e construção do mesmo (785€)

5.4 Aplanamento e nivelamento do chão em aguadilha de cimento para preparação de colocação do revestimento (210€)
5.5 Corte e montagem do Painel Sandwich (imitação de telha lusa) com isolamento térmico (inclui a instalação dos carris para as roldanas do painel) (518€)
5.6 Instalação elétrica (188€)
5.7 Acabamentos e pintura (125€)

5.8 Revestimento do chão com tapete antiderrapante (255€, não inclui mão-de-obra porque foi eu que o instalei)
Total = 2.316 €

Observatório 2 (em conclusão atualmente):
5.1 Preparação do espaço abrindo uma zona na parede para a porta e elevando as paredes para que a altura fique a adequada para a operação de todo o sistema (225€)
5.2 Retirar telhas e corte de vigas de suporte, com preparação da zona circundante do telhado existente (335€)

5.3 Aplanamento e nivelamento do chão em aguadilha de cimento para preparação de colocação do revestimento (210€)

5.4 Construção da estrutura metálica lateral à parede exterior para prolongamento dos carris permitindo assim a abertura completa do painel sandwich (275€)
5.5 Corte e montagem do Painel Sandwich (imitação de telha lusa) com isolamento térmico (inclui a instalação dos carris para as roldanas do painel) (655€)
5.6 Instalação elétrica (125€)
5.7 Acabamentos e pintura (150€)

5.8 Revestimento do chão com tapete antiderrapante (255€, não inclui mão-de-obra porque foi eu que o instalei)
Total = 2.230€

6. Segurança e Manutenção (opcional)

- Instalação de fecho metálico e sistema de alarme simples com câmara de vídeo para deteção de movimento e acompanhamento (live) da operação dos telescópios (75€).
- Impermeabilização de paredes exteriores e interiores e ventilação/desumidificação adequada (110€)

7. Potencial de Colaboração Científica

O observatório poderá integrar programas colaborativos como:
- AAVSO (*American Association of Variable Star Observers*);
- *Minor Planet Center*, para registo de asteroides e cometas;
- *ExoClock Project*, dedicado ao acompanhamento de trânsitos exoplanetários;
- Projetos nacionais de divulgação científica e educação astronómica.

8. Conclusão

A construção deste observatório astronómico residencial permitiu-me dar o salto que há muito desejava na astronomia amadora.

Ter condições para iniciar o trabalho em poucos minutos, tendo apenas o incómodo de abrir e fechar os telhados manualmente, que mais tarde podem ser automatizados, faz toda a diferença.

É muito importante que este tipo de projetos, sejam muito bem estudados em croquis simples, com várias hipóteses de instalação, com medidas precisas para que não sejam necessárias muitas correções posteriores (que vão sempre existir, mas que sejam simples e viáveis).

A altura das paredes que obstruam o horizonte, a altura dos pilares de suporte das montagens, a completa rotação de todo o sistema sem obstruções/bloqueios que possam pôr em causa a integridade dos equipamentos, a rigidez na ligação da montagem ao pilar para que as vibrações sejam mínimas ou inexistentes, é fundamental.

Não é por acaso que depois de preparadas as paredes, mas ainda em cabouco, importa que o equipamento (com o tripé da montagem ou com algo a simulá-lo) seja montado no local desejado para operar manualmente todo o sistema em todo o azimute e assim seja avaliada a altura desejada para o pilar, para que seja possível a visibilidade do máximo de horizonte.

Preocupem-se com a questão da estanquicidade e possíveis infiltrações e reparem na solução encontrada neste projeto, até agora deu provas mesmo com chuvas muitas intensas.

Com um investimento equilibrado e uma escolha de equipamentos de qualidade, o projeto permitirá obter observações lúdicas (astrofotografia) e outras de maior rigor, com potencial de integração em redes de investigação colaborativa e contributo significativo para a astronomia amadora portuguesa e para a nossa realização pessoal enquanto astrónomos amadores.

Figura 1 – Observatório 1.

Figura 2 – Observatório 1.

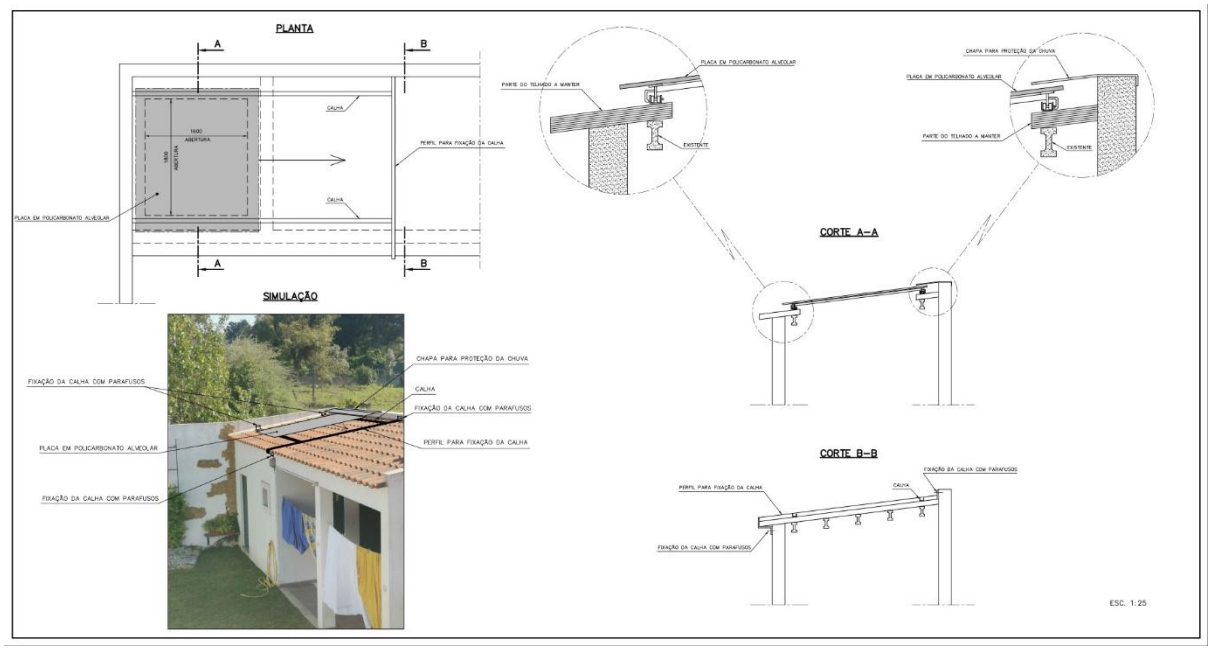


Figura 3 – Planta - Observatório 1.

Figura 4 – Observatório 2.

Construção e utilização de uma câmara AllSky na Ilha de São Miguel, Açores, com instalação no OAR - Observatório Astronómico dos Reis

Valter Reis

Resumo: Este artigo apresenta a montagem, instalação e operação de uma câmara All-Sky instalada no Observatório Astronómico dos Reis, ilha de São Miguel, Açores. Utilizando um sensor de alta sensibilidade (Sony IMX477) conectado a um Raspberry Pi 5, o sistema foi desenvolvido com o objetivo de monitorizar continuamente o céu noturno para fins científicos, educativos, ambientais e integração com a utilização do **OAR - Observatório Astronómico dos Reis**. São detalhados os componentes utilizados, o processo de montagem e os primeiros resultados de operação, que incluem deteção de meteoros, monitorização de cobertura de nuvens e avaliação da poluição luminosa. Discute-se também o potencial de automação futura do observatório, visando maior autonomia e integração em redes de monitoramento global. Por fim, são apresentados conceitos fundamentais para análise dos dados adquiridos, como timelapses e keogramas, instrumentos essenciais na observação do céu. O projeto exemplifica o potencial para a implementação de sistemas de observação astronómica de baixo custo, mas elevada eficácia.

Introdução

A utilização de câmaras All-Sky — sistemas de imagem hemisférica com campo de visão de 180° — é hoje uma **ferramenta essencial para a monitorização do céu em tempo real**. Estes sistemas são utilizados para a deteção de meteoros, avaliação da qualidade do céu, deteção de auroras e análise de poluição luminosa.

A ilha de São Miguel, em especial a freguesia de Capelas, apresenta condições para a instalação deste tipo de equipamento, devido à sua localização costeira, topografia elevada em algumas zonas, e reduzida densidade luminosa em comparação com zonas urbanas próximas.

Neste contexto, o Observatório Astronómico dos Reis (OAR), foi o local escolhido para a implementação de uma câmara AllSky de última geração. A seguir descreve-se o processo de construção, montagem e operação do sistema, com destaque na replicabilidade da solução por outras instituições científicas e educativas.

Localização

O sistema foi instalado no topo da estrutura principal o Observatório Astronómico dos Reis, em Capelas, São Miguel. A localização foi escolhida devido à boa exposição ao céu noturno, horizonte relativamente desimpedido e baixa interferência de luz artificial direta. Para o efeito utilizou-se uma estrutura em metal, personalizada, que permite rodar e inclinar o sistema de forma manual e sem ter que abrir a caixa onde está colocado todo o equipamento eletrónico utilizado.

Equipamento Utilizado e estimativa de custos

- Sensor de imagem: Sony IMX477, 12.3 MP, 1/2.3", sensível a baixa luminosidade, com suporte a RAW e vídeo 4K. Atenção ao cabo, porque o cabo que vem com a câmara, não permite ligar ao Raspberry Pi 5 – existe um **cabo específico** - (Raspberry Pi SC1130 - Cabo FPC adaptador de câmara para Raspberry Pi - 15pin para 22pin - 500mm)
- Lente: Lente olho-de-peixe 1.7 mm, f/2.0, com campo de visão de 185°
- Computador: Raspberry Pi 5 com 8 GB RAM, dissipador de calor ativo e sistema operativo Raspberry Pi OS (Linux)
- Armazenamento: Cartão microSD de 128 GB com boa velocidade leitura/escrita
- Cúpula de proteção: Cúpula acrílica hemisférica com tratamento UV e instalação de sistema anti condensação (resistência de 5W)
- Caixa: **caixa estanque** IP66 para montagem da cúpula e colocação do computador, câmara e restante equipamento,
- Alimentação: Ligação elétrica estável 220V
- Software: AllSky (versão adaptada para RPi5 com IMX477, disponível gratuitamente no GitHub: **https://github.com/AllskyTeam/allsky**

Com base no equipamento utilizado e recorrendo a diferentes fornecedores, a maioria lojas online, **estimou-se um custo final aproximado de 292 euros**.

Raspberry Pi 5 + ventoinha: ~ 120€

Câmara Pi HQ: ~ 65€

Lente + adaptador: ~ 27€

Cartão SD: ~ 12€

Fonte de alimentação do Pi: ~ 35€

Cúpula para protecção: ~ 19€

Caixa estanque IP66: ~14€

Outros materiais foram utilizados (tubo, vedantes, parafusos, cola quente, fita, fio elétrico, etc.), no entanto os mesmos têm custos muito variáveis, muitos aproveitados por já possuir ou foram oferecidos – estes são sempre os melhores!

Montagem

É aqui que entra a **criatividade**: muitos amadores usam tubos de PVC, tampões de canalização, caixas estanques (o exemplo apresentado), etc.

A parte mais importante é a cobertura da lente: uma cúpula transparente (idealmente de acrílico ou policarbonato e resistente a UV), que pode ser adquirida online ou adaptada de objetos do dia-a-dia, por exemplo de cúpulas de câmaras de vigilância. Investir na **vedação** e **proteção** contra intempéries é crucial!

A condensação é um problema comum que pode ser resolvido com um pequeno ventilador interno ou anel aquecido (dew heater). Outra alternativa é o uso de sílica-gel no interior. No caso apresentado, utilizo um recipiente com cloreto de sódio, utilizado nos desumidificadores manuais e com bons resultados. Ter **atenção** que com o tempo, o recipiente fica cheio de líquido e é necessário trocar e ter cuidado para não derramar líquido no equipamento eletrónico.

Antes de iniciar os trabalhos, **recomendo testar todo o equipamento, incluindo a instalação e utilização do software**. Também recomento testar a colocação do Raspberry na caixa estanque e decidir a melhor forma de fixação de todo o equipamento. Assim, e após ter testado tudo, quer equipamento, quer software, segue-se uma sequência recomendada de construção, baseada na minha experiência.

1 – No exterior da tampa da caixa estanque, marcar o diâmetro da cúpula.

2 - Na tampa da caixa estanque perfurar um orifício com espaço suficiente para que a lente passe, e de modo a permitir rotação para focagem. Perfurei o orifício no centro do diâmetro da cúpula.

3 - A lente olho-de-peixe foi conectada ao módulo de câmara HQ com sensor Sony IMX477, usando um adaptador C-mount adequado (adquirido na internet).

4 - Inserir a lente pelo orifício e marcar os orifícios da montagem da câmara no tampão. A câmara possui em cada canto um orifício que serve para o efeito e serão necessários espaçadores hexagonais de latão (existem caixas à venda na internet que trazem os espaçadores, parafusos e porcas, e que são muito úteis).

5 – Fazer os furos marcados (cuidado para não danificar a tampa da caixa estanque) e testar a montagem da câmara.

6 – Fixar no exterior da tampa da caixa estanque, o equipamento anti condensação e passar todos os cabos necessários. Vai ser necessário abrir mais furos, dai ser importante testar como vai ficar tudo, antes de fazer furos e fixar o equipamento.

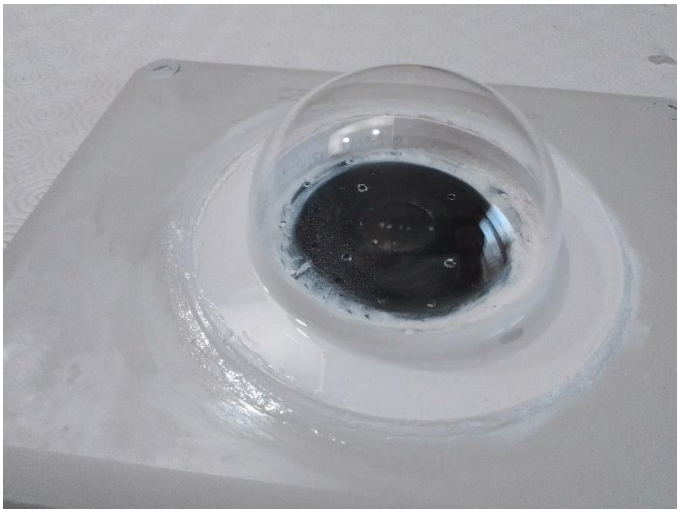
7 - Colocar a cúpula acrílica na tampa da caixa estanque. Se não vier perfurado, marcar e furar furos para parafusos de fixação. Optei por não furar e fixar utilizando um selante veda e cola. Esta opção apesar de ser muito eficaz a selar e fixar a cúpula, não é a mais conveniente para posterior focagem da lente e para limpeza do interior da cúpula, quando necessário, como podem imaginar. Caso optem por furar, não esquecer de vedar depois, utilizando silicone ou outro vedante que possa ter o mesmo efeito. Não utilizar selante em demasia, porque depois fica a cúpula suja e terão de remover para limpar. Aguardar o que for necessário para que o selante seque/solidifique.

8 – Montar na caixa estanque o Raspberry de forma a permitir ventilação e dissipação do calor.

9 – Para alimentar o Raspberry, será necessário passar alimentação para dentro da caixa estanque. Optei por fazer um orifício e passar um cabo de alimentação para montar uma tomada dentro da caixa. Para o efeito, passei o cabo num bucim de forma a isolar e fixar o cabo à caixa.

Em alternativa, se tiver possibilidade, um HAT PoE também é uma boa alternativa.

10 – Ligar os cabos necessário e ter cuidado para evitar dobragens. Especial atenção ao cabo “ribbon” que vai ligar à câmara.



Software e Configuração

O software AllSky é um pacote **open source** especificamente desenhado para operar câmaras AllSky em Raspberry Pi, altamente configurável e eficiente para captura contínua e processamento automático de imagens do céu. Previamente terá de instalar no Raspberry o sistema operativo Raspberry Pi OS (preferencialmente versão recente, 64 bit, se possível). Versões mais recentes (Bookworm) são recomendadas. Esta informação e forma de o fazer, está disponível na internet e não será abordada. Facilmente encontra a informação no site **https://www.raspberrypi.com/software/**

Instalação do software Allsky

No Pi, atualizar pacotes, abrindo o "Terminal e utilizando:

sudo apt-get update && sudo apt-get upgrade

Após ter atualizado, clonar o repositório Allsky do GitHub, escrevendo no "Terminal":

git clone https://github.com/AllskyTeam/allsky.git

Entrar no directório "allsky" e executar o script de instalação

./install.sh

Esta informação e informação adicional relevante, está disponível na página de internet do software na documentação disponibilizada na página - **https://htmlpreview.github.io/?https://raw.githubusercontent.com/AllskyTeam/allsky/master/html/documentation/installations/Allsky.html**

É altamente recomendável a leitura e releitura de toda a informação disponibilizada!

Funcionalidades e Configuração

O software Allsky permite gerir a **captura automática de imagens**, **criar timelapses diários**, **startrails**, **keogramas**, e até configurar uma **interface web para aceder remotamente à câmara**.

Principais funcionalidades:

- **Captura programada de imagens:** Definição de intervalos para exposições de curta e longa duração.
- **Processamento em tempo real:** Ajuste de brilho, contraste e remoção de ruído para imagens noturnas.
- **Deteção de eventos:** Identificação automática de meteoros, rastos e alterações no céu.
- **Timelapse e keogramas:** Geração automática destes arquivos a partir das imagens capturadas.
- **Interface web:** Painel de controlo acessível remotamente para visualização, download e controlo do sistema.
- **Configuração via arquivo:** Permite definir parâmetros como exposição, ISO, intervalo de captura, nomeação dos arquivos, diretórios de armazenamento, entre outros.
- **Integração com serviços externos:** Possibilidade de upload automático para servidores FTP, sistemas de cloud ou redes de monitoramento astronómico.

Focagem da câmara:

Durante o dia, apontar para algo distante (≥100 metros) e tirar fotos de teste. Ajustar a lente (rosquear/desenroscar) até encontrar um bom compromisso de nitidez. Importa que estrelas apareçam como pontos ou ligeiramente desfocados dependendo do efeito desejado. Ver a documentação disponível online.

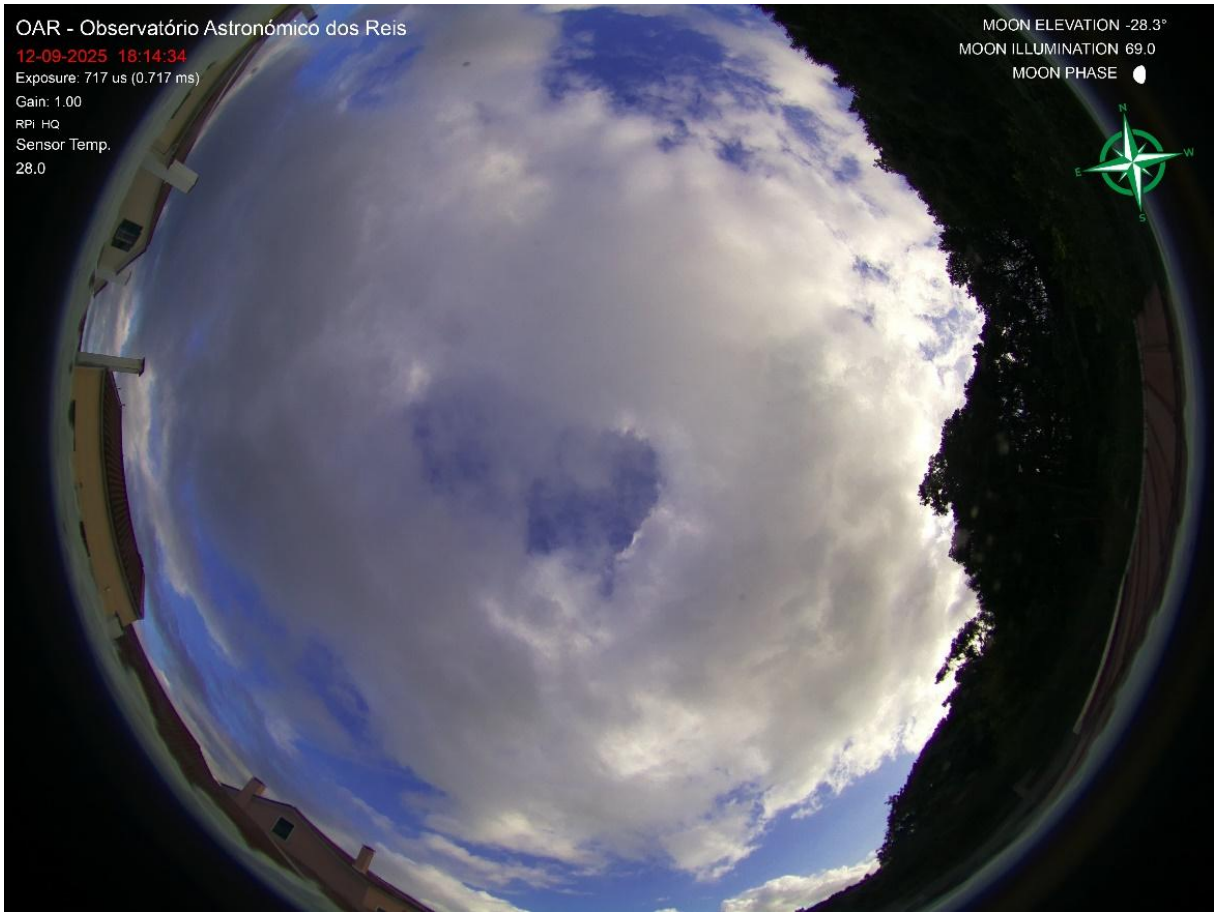
https://htmlpreview.github.io/?https://raw.githubusercontent.com/AllskyTeam/allsky/master/html/documentation/miscellaneous/FAQ.html

Orientação:

Orientar a câmara de modo que o sensor fique alinhado (por exemplo, Norte "para cima" nas imagens) para uniformidade nas visualizações de céu noturno. Isso facilita a geração de startrails e keogramas.

Configuração de captura

• Definir intervalos de exposição automáticos/no adaptativos, variar exposição conforme luz ambiente.
• Definir intervalo entre capturas (ex: a cada 30 ou 60 segundos).
• Ativar o web interface (WebUI) para monitorizar imagens actuais, decidir configurações, visualizar os resultados, etc.
• Gerir armazenamento: definir quantos dias manter imagens locais, automatizar remoção de dados antigos.



Cuidados e Ambiente

Existem alguns cuidados e tarefas a realizar com regularidade, de modo a mantar um bom estado e funcionamento do equipamento.

Verificar a proteção contra humidade e condensação: se a cúpula está bem vedada, se o selante não apresenta fissuras, verificar a sílica colocada durante montagem e o aquecedor ou ventoinha se necessário.

Monitorizar a temperatura de funcionamento: a câmara e a placa podem aquecer; ventilação ou dissipação de calor ajudam a manter desempenho estável. Isto pode ser realizado, numa fase mais avançada, com a colocação de sensores de temperatura e humidade, que são suportados pelo Raspberry Pi e podem ser configurados através do software AllSky.

Resultados

As primeiras noites de operação revelaram imagens de alta qualidade, com boa definição de estrelas até magnitude +4. Foram captados:

- Meteoros;
- Passagens da Estação Espacial Internacional (ISS);
- Rastos de satélites e aviões;
- Gradientes de poluição luminosa visíveis nas margens do campo.

A análise de cobertura de nuvens baseada em histogramas de luminosidade revelou-se eficaz, com correlação positiva com dados do IPMA. As imagens também demonstraram utilidade para avaliar o seeing noturno e o tempo útil de observação.

Timelapses

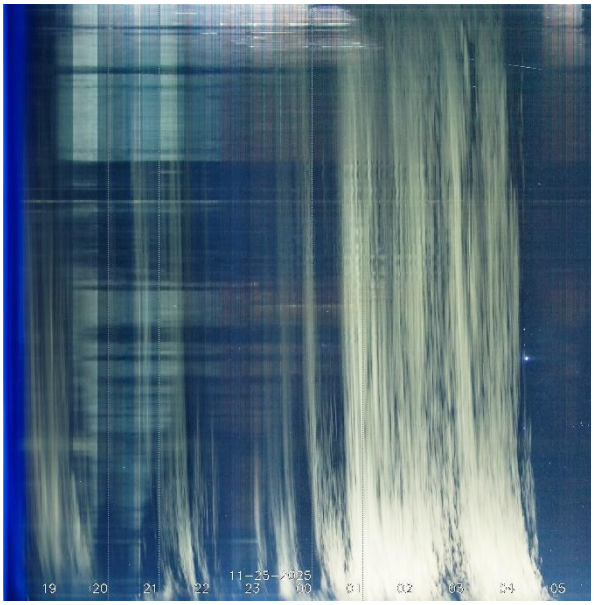
Um timelapse é uma sequência de imagens capturadas em intervalos regulares que, quando reproduzidas em velocidade acelerada, permitem visualizar fenômenos que ocorrem lentamente para o olho humano, como o movimento das estrelas, formação de nuvens e passagem de objetos celestes. No contexto da câmara AllSky, os timelapses são usados para resumir longos períodos de observação noturna, facilitando a identificação rápida de eventos astronómicos ou meteorológicos. O software cria os timelapses de forma automática, de acordo com as indicações do utilizador.

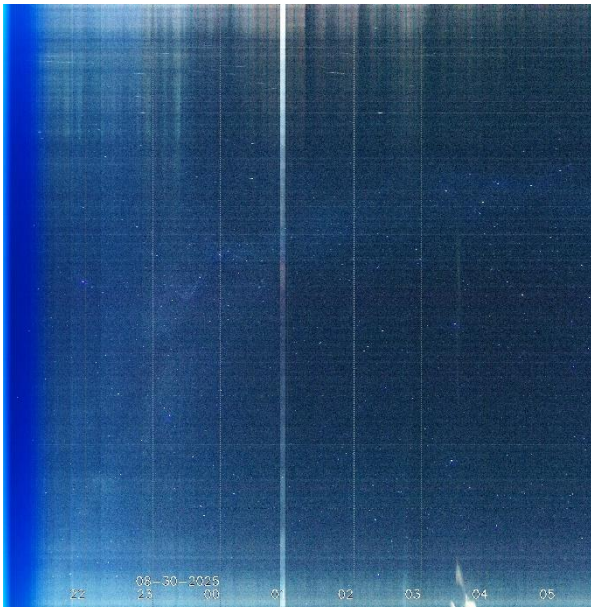
Os timelapses, no caso da minha câmara, bem como de outras em todo o mundo, são disponibilizados diariamente no site All Sky Map, disponível em

https://www.thomasjacquin.com/allsky-map/

Keogramas

O keograma é uma representação gráfica criada a partir da combinação de colunas verticais ou horizontais de imagens sequenciais, mostrando a variação temporal do céu ao longo da noite. Normalmente, cada coluna representa uma linha do campo de visão da câmara capturada num dado instante, e a sequência dessas colunas forma uma imagem que destaca a presença e movimento de nuvens, auroras ou outras variações no céu. Keogramas são ferramentas úteis para o estudo da dinâmica atmosférica em grandes escalas temporais.





Potencial de Automação Futura

A **automação** do observatório envolve a **integração de sistemas de controlo remoto** e inteligência artificial para gestão autónoma da câmara e de outros instrumentos astronómicos. Para o Observatório Astronómico dos Reis, a instalação da câmara AllSky com Raspberry Pi 5 oferece uma base sólida para:

- **Monitorização 24/7** com deteção automática de eventos relevantes (meteoros, auroras, variações de poluição luminosa);
- **Ajuste automático** das configurações de captura baseado em condições meteorológicas e ciclo lunar;
- **Ativação e desativação do sistema** conforme condições ambientais (ex: fechar telhado do observatório em caso de chuva);
- **Envio de alertas e relatórios automáticos** para a equipa do observatório e para redes internacionais;
- **Integração em redes de observação globais**, possibilitando colaboração científica remota.

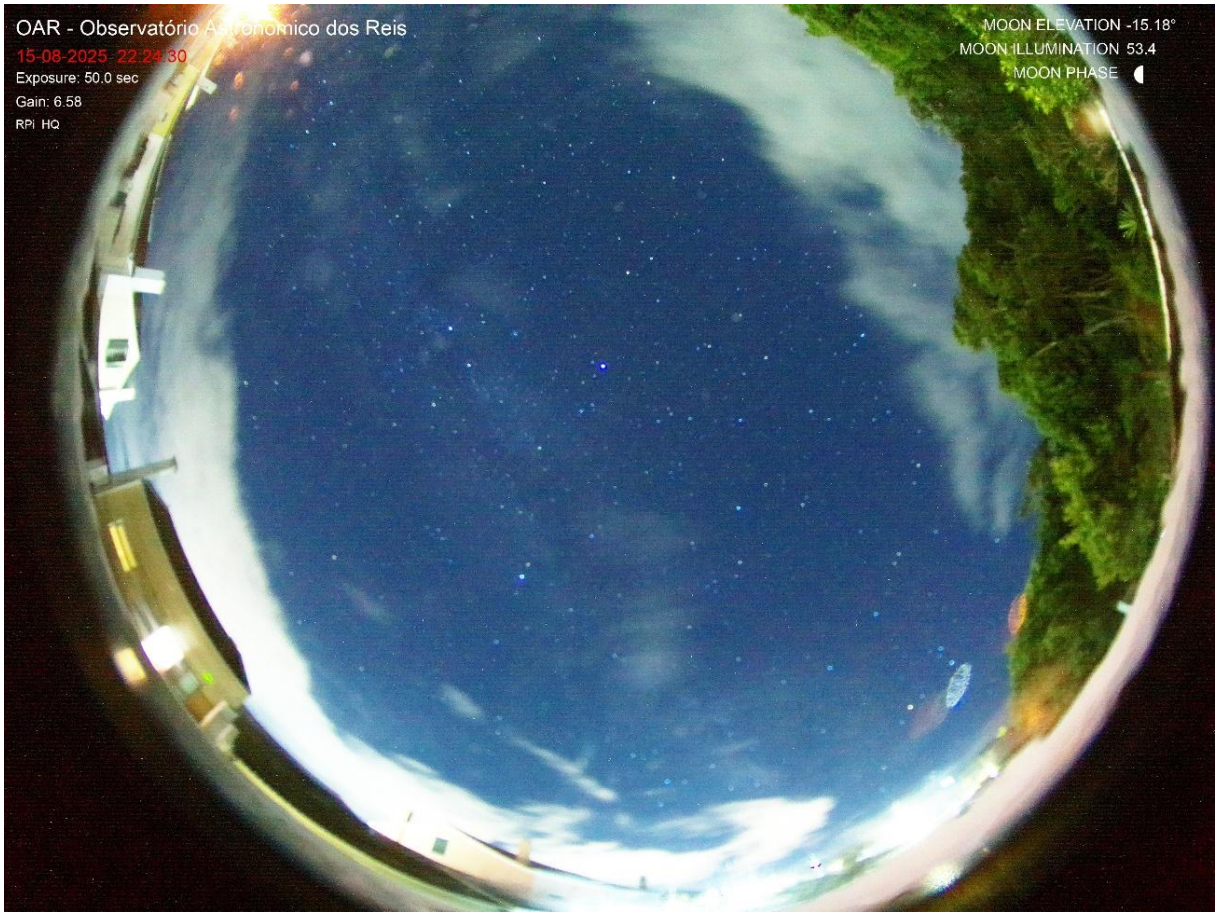
Essa automação contribui para maior eficiência operacional, melhor qualidade dos dados e possibilitará uma rápida resposta a eventos astronómicos transientes.

Conclusões

A implementação deste sistema no Observatório Astronómico dos Reis permite:

- Contribuir com dados para redes internacionais de **deteção de meteoros e análise do céu noturno**;
- **Sensibilizar a população local** para o problema da poluição luminosa;
- Reforçar a **educação científica** nas escolas da região através de workshops e dados em tempo real;
- **Gerar timelapses** e imagens de divulgação científica com valor estético e educativo.

Além do valor científico, o sistema serve como ferramenta pedagógica para a comunidade local, fortalecendo o interesse pela ciência e a proteção do ambiente noturno.



Fontes:
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https://markmcintyreastro.co.uk/2024/06/03/building-a-raspberry-pi-allsky-camera/
https://thomasjacquin.com/make-your-own-allsky-camera/
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AllSky Camera Project – https://github.com/aaronwmorris/AllSky
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Molau, S., & Rendtel, J. (2009). **Meteor science using all-sky cameras**. *WGN, Journal of the IMO*, 37(4), 98–104.

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Walker, C. E. (2008). **Light pollution and its impact on astronomy**. *Physics Today*, 61(4), 52.
NOTA: Todas as imagens utilizadas no artigo, são da autoria do autor.


OAR - Observatório Astronómico dos Reis
05-11-2025 10:44:16
Exposure: 870 us (0.870 ms)
Gain: 1.00
RPi HQ
Sensor Temp.
29.0
MOON ELEVATION -29.51°
MOON ILLUMINATION 99.9
MOON PHASE

Cinquenta anos sob o mesmo céu

A Jornada Estelar da Associação Portuguesa de Astrónomos Amadores

Há meio século, um grupo de sonhadores ergueu os olhos ao firmamento e decidiu transformar o fascínio pelas estrelas num movimento coletivo.

Assim nasceu a APAA – Associação Portuguesa de Astrónomos Amadores, com uma missão simples, objetiva e atual: "…reunir todas as pessoas interessadas teórica ou praticamente pela Astronomia e promover a sua expansão e divulgação", conforme se lê no artigo primeiro dos seus estatutos.

Nos anos 70, quando a tecnologia era modesta e a astronomia parecia inalcançável para os pequenos observatórios, a APAA ergueu-se como um farol de democratização do conhecimento. Reunindo mentes brilhantes e inquietas nas mais diversas áreas da astronomia amadora, proporcionou a todos os interessados — mesmo com poucos recursos, mas com muita motivação — a possibilidade de alcançar o sempre desejado meio de observar o universo.

Ao longo de cinco décadas, a APAA promoveu encontros, sessões de observação, projetos educativos e noites inesquecíveis, onde o frio sereno era aquecido pelo brilho de Saturno nos olhos de uma criança.

Cinquenta anos depois, o legado da APAA é mais do que científico: é humano. São milhares as histórias partilhadas em torno do telescópio e amizades nascidas sob a Via Láctea.

A APAA é o testemunho de que o amadorismo, longe de ser uma limitação, é paixão pela descoberta, pela partilha e pela curiosidade pelo desconhecido.

Em 2026, ao celebrarmos os 50 anos, olhamos para o futuro com a mesma admiração dos nossos fundadores. O universo continua a expandir-se, e com ele expande-se também a vontade da APAA de inspirar, educar e unir.

Num mundo tantas vezes ensombrado pelo ruído e pela pressa, a astronomia amadora permanece como um convite à pausa e à contemplação.

Parabéns APAA