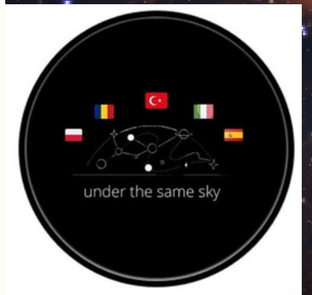
Astrophotography For Beginners

Erasmus + 2020-1-TR01-KA229-094247

Under The Same Sky

Project coordinator: Eczacı Bahattin Sevinç Erdinç Fen Lisesi Türkiye
Beneficiary Partners:
Itis Ettore Majorana Italy
Colegiul Tehnic Edmond Nicolau Focsani Romania
Akademickie Liceum Ogolnoksztalcace Politechniki Slaskiej Gliwicach Poland.



Erasmus+

Contents

1. Introduction

This booklet was prepared to provide beginner-level information for high school students and teachers who are interested in Astorophotography. This book was prepared with the information that was obtained as a result of Astrophotography studies and trainings of the astronomy themed project named Erasmus + Under the same sky. Under the same sky project partnership was carried out betwen Eczacı Bahattin Sevinç Erdinç Fen Lisesi (Türkiye), Itis Ettore Majorana (Italy), Colegiul Tehnic Edmond Nicolau Focsani (Romania), Akademickie Liceum Ogolnoksztalcace Politechniki Slaskiej Gliwicach (Poland) schools. Project started in December 2020 and ended in December 2023. You can use and share this booklet.

2. What is the astroporography?

Astrophotography is the photography of astronomical objects (stars, planets, Galaxies, satellites, etc.), celestial events and night sky areas.
Astrophotography is technically demanding, time consuming and requires a long learning curve. Astrophotography is not liking the photo of sky objects. So you have to be sure that you really want to take photos and endure all difficulties of process. If your interest just looking deep space objects photes you can find the best one so easily on web. It is cheap, easy, no fancy equipment and you don't risk losing extremities during nights.

If you are new to astronomy. You should increase your astronomy knowledge before starting.
To devolep your astronomy knowledge you can do the following

.Learn the night sky, constellations and stars
• Go to star parties and observe through telescopes; see what objects you can find

• Read about the objects you see

• Go to planetarium shows

Planetarium

What Equipment do you need ?

1. Camera
2. Telescope
3. Mount
4. Focusing & Guiding

1. Camera

In order to start taking a few shots of the sky, one must have a camera with the option to extend the exposure time up to at least 30 minutes. For this you can use CCD camera or DSLR cameras.

Beginners usually start with an entry-level DSLR or mirrorless camera as they are cost-effective and versatile,

DSLR camera

A DSLR or mirrorless model uses an interchangeable lens, and this is extremely beneficial for astrophotography

For the more proficient photos you can also choose CCD cameras that have Solar System camera • Deep Space Camera III • Deep Space Camera Pro •Parsec Series options.

Some CCD cameras for astrophotograph

2. Telescope

When you use lens with camera it is not mandatory to use telescope. But using a telescope with appropriate camera will give you some advantageous.

1) a telescope allows you to place a guidescope on top of it, which is essential for exposures over 1 minute long and 2) a telescope allows you to put a filter or a filter wheel in the optical path much more easily.

Astrophotography telescope

3. Mount

In order to track an object in the sky we must compensate for the Earth's rotation using a Right Ascension (RA) tracking motor and properly Polar Align the scope along the axis of rotation otherwise the tracking will not follow accurately. Also, finding objects can become quite difficult.

You should select Equatorial mount with Quality of Motors and Auto-Guiding. If you have computer control it will save more time and energy.

Equatorial mount

4. Focusing and guiding

Whether you're using a camera lens or a telescope, learning how to focus your camera for an astrophotography image is one of the first big hurdles to overcome when take a sky photos.

If you're using a camera lens, it needs to be on manual focus (MF) mode, as the stars are too dim and too small for the camera to use autofocus on. Autofocusing a lens or telescope for astrophotography is possible, but requires some additional hardware and software

Orion AccuFocus electronic focuser

When it comes to astrophotography, telescopes are often easier to focus than camera lenses. This is simply because telescopes usually have precision, robust focusers that lock into place. A camera lens designed for daytime photography, on the other hand, was meant to move quickly to accurately focus on moving subjects.

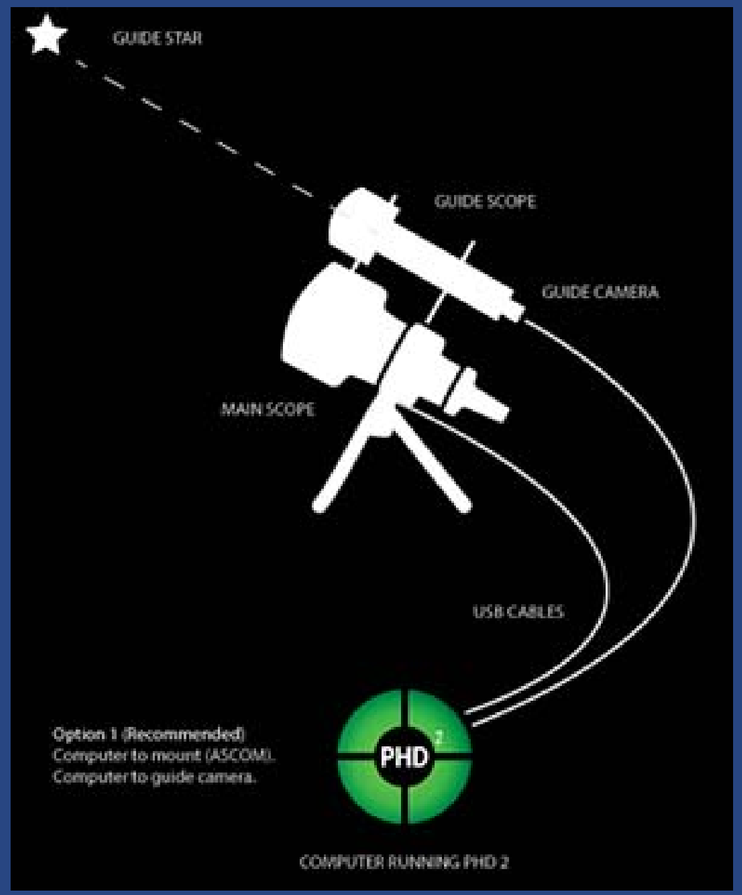
In the world of astrophotography, autofocus can only be done with a combination of software and a motorized focuser. This is because a reading of the star size (FWHM or HFD) must be made and applied to your lens or telescope in real-time.

Electronic focuser for telescope

Guiding

Better images can be obtained by collecting more light with long exposure in the astrophotograph. However, in order for the focused celestial object to always be visible to the camera in the same frame, the tracking system of the mount must be perfect. However, unfortunately, no mount performs such a function. For these reasons, small deviations from the target must be corrected. This job requires automatic guiding.

Whether you're shooting with a DSLR or a dedicated astronomy camera, capturing longer exposures means that more light (or signal) can be recorded in a single shot.



Autoguiding tools

4. Selecting time and Location

The most important feature of the place you choose for astrophotography is that it has low light pollution. If there is light pollution, even finding celestial objects may be impossible.

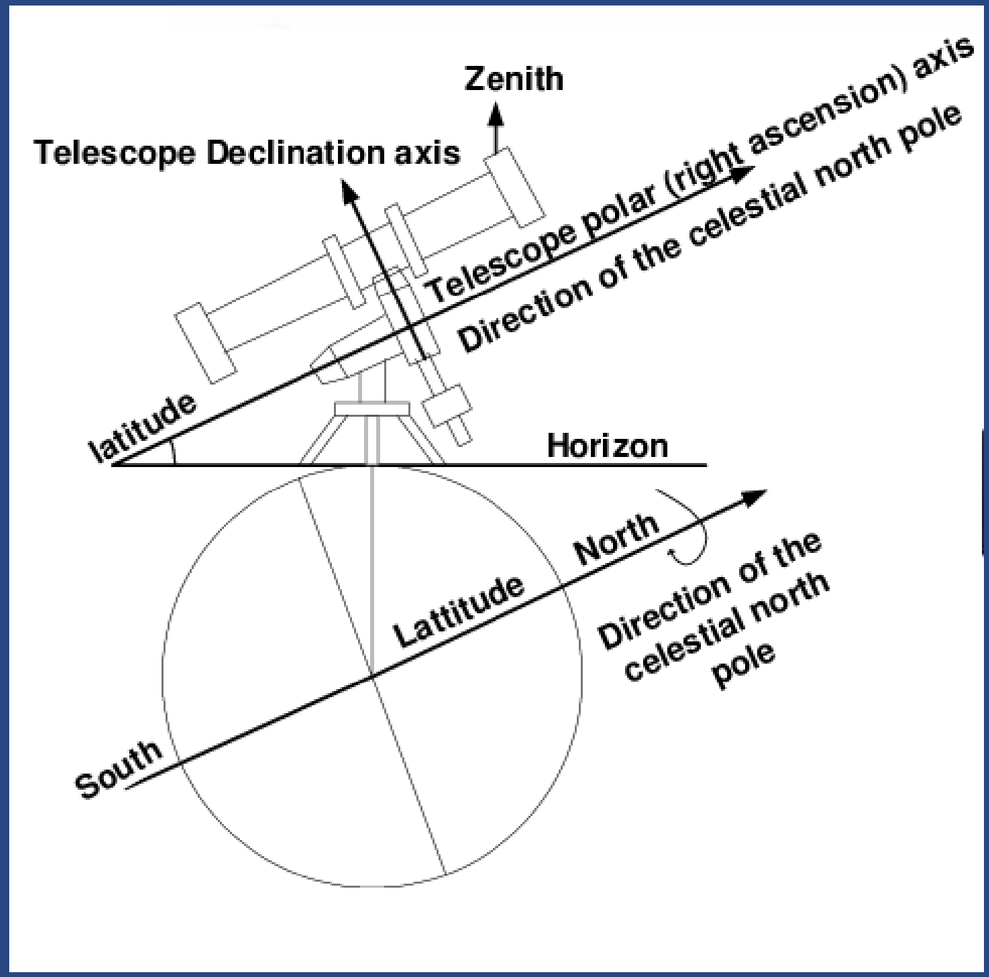
Some filters can be used to reduce errors caused by light pollution. One of the factors that deteriorates image resolution is the atmosphere. High places should be preferred to be less affected by the negative effects of the atmosphere and humidity. On the preferred day, the weather should be dry and cloudless. For this purpose, sky weather forecast should be checked. There are some web pages that provides this information. one of them is ttps://www.metcheck.com/HOBBIES/astronomy.asp)

Tübitak National Observatory in Antalya

Light pollution filter

5. Alignment and focusing.

Whether a telescope is used or just a camera fixed on the mount, the polar orientation of the mount is critical importance. For this, it must be done using two or three celestial objects and the polar alignment must be perfect. Otherwise, even if the best cameras and equipment are used, bad results will be obtained.
Many modern telescopes offer automatic alignment systems that simplify the alignment process. These systems utilize GPS, built-in databases, and motorized mounts to automatically align the telescope with celestial objects. Automatic alignment systems are user-friendly, making them ideal for beginners or those who prefer a more straightforward alignment process.



Polar axis alignment process

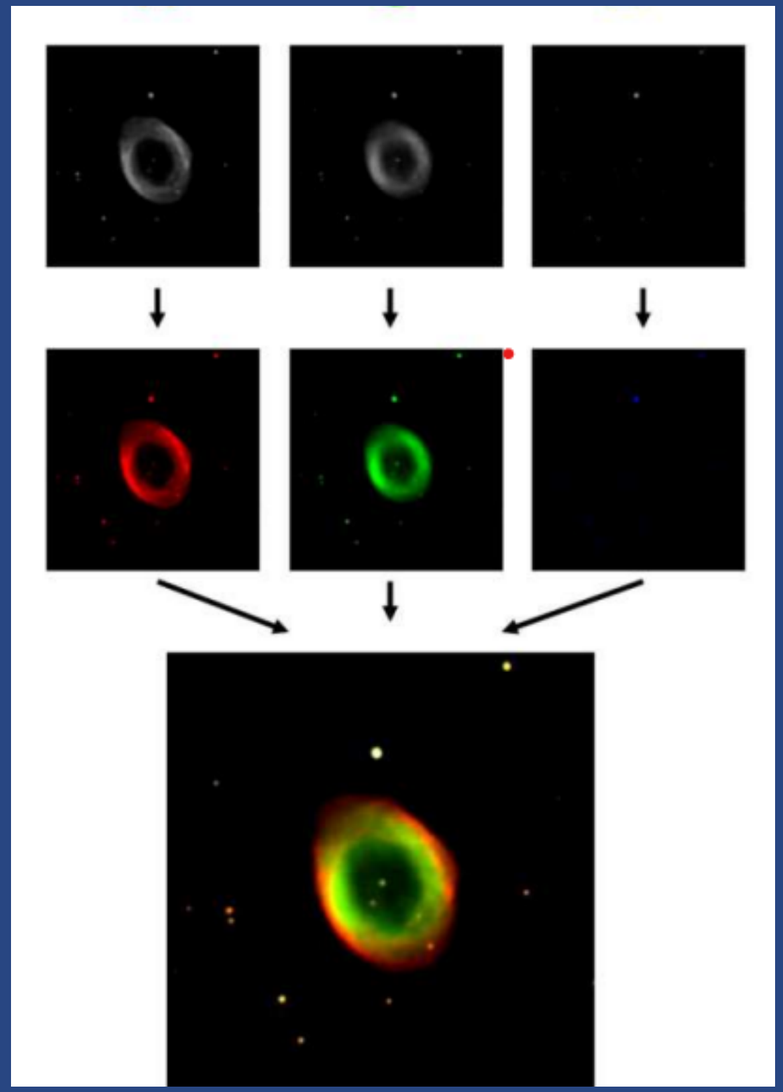
Whether you’re using a camera lens or a telescope, learning how to focus your camera for an astrophotography image is one of the first big hurdles to overcome when entering this hobby.

Focusing your telescope is another crucial aspect of calibration. Use the fine focus knob to achieve a sharp and clear image of the celestial object you are observing. Take your time to make small adjustments until you achieve optimal focus. Additionally, using a barlow lens can enhance the image magnification and improve overall focus.

Focusing process

6. Coloring the images

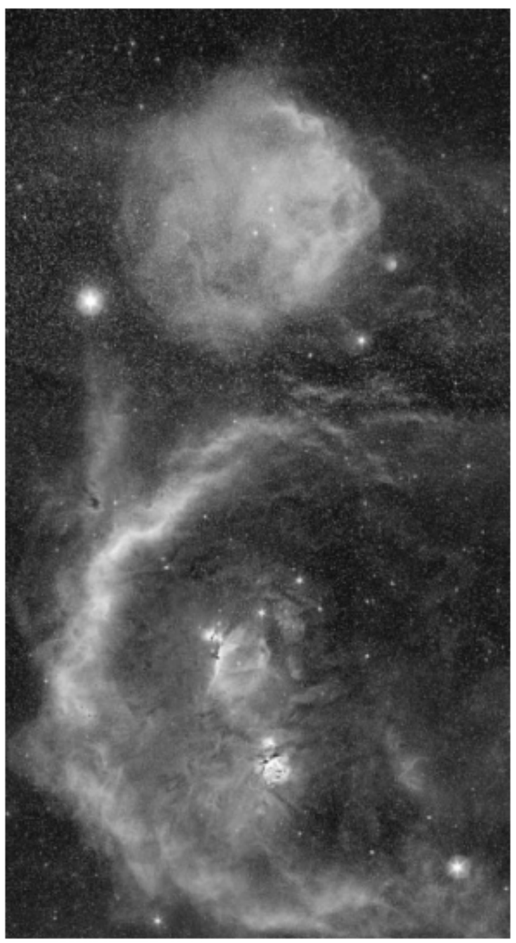
Many CCD cameras used in astronomy take black and white images. Various filters are used for this. The most used of these is the RGB filter set. In this process, CCD images are first taken separately for each of the 3 filters. In addition to these three filters, the Luminance image symbolized by the letter 'L' can also be used. The luminance image is usually obtained using a transparent filter. Then, the steps we explained above are applied to all of these raw images. Finally, these images taken with different filters were processed with a graphics processing program (e.g. Maxim DL).colors are combined.



Coloring the image of the Ring Nebula with the RBG filter.

Narrow Band Filters

Obtaining images with narrow band filters is achieved by using images taken using specially produced filters for these elements (Oxygen and Hydrogen) that emit radiation in certain wavelength ranges. Narrow band filters filter out the effects of city lights and skylight. Since they do not transmit radiation, they enable a healthier image to be captured



The photo on the left shows the narrowband Hα image of the Orion/Barnard loop at 656 nm. In the one on the right, the Hα image is used instead of the images taken from the L and R bands in the LRGB set.

References

https://www.telescope.com/assets/images/customerphotos/customerprofiles/Amateur-Astrophotography-Chanan-G.pdf

https://skyandtelescope.org/wp-content/uploads/AstrophotographyPrimer_reduced.pdf

https://www.astroshop.de/Produktdownloads/Astrofotografia%20Paesaggistica_EN.pdf

https://www.telescope.com/assets/images/customerphotos/customerprofiles/Amateur-Astrophotography-Chanan-G.pdf

https://astronomi.istanbul.edu.tr/egitim/agay/uygulama/astrfoto.htm