



EVERY CLEAR NIGHT IS AN
INVITATION TO WONDER

MATCHING CAMERAS TO TELESCOPES

One of the most common misconceptions among newcomers is that the camera alone determines image quality. In reality, the telescope and camera work together as a single optical system. A camera that performs exceptionally well on one telescope may be poorly suited to another.

Choosing the right camera therefore involves more than comparing specifications. Sensor size, pixel size and camera performance all need to be matched to the telescope and the astronomical objects you wish to photograph.

BUYING GUIDE #8

Earlier buying guides explained how modern astronomy cameras work and the different types of cameras available. The final step is choosing a camera that complements your telescope.



THE GOAL ISN'T THE
LARGEST SENSOR – IT'S
THE LARGEST SENSOR
YOUR TELESCOPE CAN
ILLUMINATE WITH
PINPOINT STARS

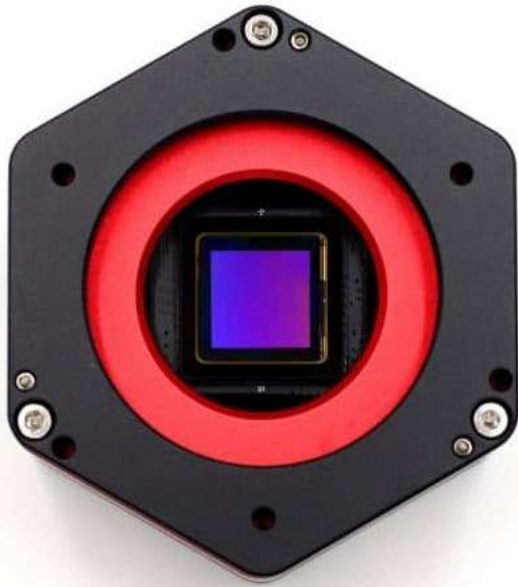
IMAGE CIRCLE

Before selecting a camera, it's helpful to remember that the telescope projects the image onto the camera sensor. The overall size of that illuminated area on the sensor is known as the "image circle". The actual size of the image circle is dependent on the telescope properties including focal length and optical design. A short focal length telescope produces a wide field of view, making it ideal for photographing large nebulae and sweeping star fields. By contrast, a long focal length telescope produces a much narrower field of view, making it better suited to smaller objects such as galaxies, globular clusters and the planets. The camera simply records the image produced by the telescope.

Sensor size determines how much of the image projected by the telescope is recorded. Larger sensors capture a wider field of view, allowing large nebulae, nearby galaxies and rich star fields to fit comfortably within a single image. Smaller sensors record a narrower section of the image.

Larger sensors also require the telescope to produce a correspondingly larger image circle. If the sensor extends beyond the corrected image produced by the telescope, the corners of the image may become darker (vignetting) or stars near the edges may appear distorted. For this reason, many entry-level imaging systems pair APS-C sensors with small apochromatic refractors, while larger full-frame sensors are generally reserved for telescopes specifically designed to illuminate a larger image circle.

Today, most dedicated astrophotography refractors produce a corrected image circle between 33 mm and 44 mm which matches well with APS-C cameras and full-frame cameras. Premium models extending to 55 mm for medium-format sensors.



RESOLUTION IS EARNED
THROUGH MATCHING
PIXEL SIZE TO FOCAL
LENGTH - NOT BY
CHOOSING THE
SMALLEST PIXELS

PIXEL SIZE

While sensor size determines the field of view, pixel size determines how finely the image is sampled. Small pixels are capable of recording very fine detail and generally work well with short focal length telescopes, where the image projected onto the sensor is relatively small. Long focal length telescopes naturally produce a larger image scale. In these systems, very small pixels may record more detail than the atmosphere is capable of delivering, while larger pixels often provide a better balance between resolution and sensitivity.

Although modern software can compensate for many imaging challenges, no camera can recover detail that has been blurred by atmospheric turbulence. Matching pixel size to the telescope's focal length is therefore far more important than simply choosing the camera with the highest resolution.

Which Should You Choose?

As a general guide, shorter focal length telescopes are well suited to cameras with smaller pixels, while longer focal length telescopes often benefit from somewhat larger pixels. A well-matched system will usually outperform one that simply has the highest number of megapixels.



WITH A SMALL
COLLECTION OF
CAMERAS YOU CAN
SELECT BASED ON
YOUR TARGET

MATCHING BY ASTRONOMICAL TARGET

Different astronomical objects place different demands on both the telescope and the camera.

THE MOON. Bright and rich in fine detail. High frame rates are more important than long-exposure sensitivity, making planetary cameras an excellent choice.

PLANETS. Planetary imaging relies on capturing thousands of short exposures in rapid succession. Small-sensor, high-speed cameras produce the best results when combined with long focal length telescopes.

NEBULAE. Often faint and many occupy a large area of the sky. Cooled deep-sky cameras with low read noise and high sensitivity pair particularly well with short focal length refractors and imaging Newtonians.

GALAXIES. Many galaxies are relatively small and benefit from longer focal length telescopes. Cameras with good dynamic range and low noise help reveal subtle detail within these distant objects.

STAR CLUSTERS. Open clusters often benefit from wider fields of view, while globular clusters generally favour somewhat longer focal lengths. Almost any modern astronomy camera can produce excellent results when appropriately matched to the telescope.

THE SUN. Solar imaging relies on specialised solar telescopes and high-speed cameras capable of freezing atmospheric turbulence. Colour and monochrome cameras are both used depending on the type of solar telescope and the imaging technique employed.



THE BEST CAMERA ISN'T
THE BIGGEST OR MOST
EXPENSIVE - IT'S THE ONE
THAT BEST MATCHES
YOUR TELESCOPE'S
OPTICS AND YOUR
INTENDED TARGETS

MATCHING BY TELESCOPE DESIGN

Different telescope designs naturally lend themselves to different styles of astrophotography.

SHORT-FOCAL-LENGTH REFRACTORS. Small APOs are among the most popular telescopes for deep-sky imaging. Their wide fields of view pair particularly well with APS-C and full-frame cameras, making them excellent for photographing large nebulae, dark nebulae and expansive star fields.

IMAGING NEWTONIANS. Combining relatively large apertures with moderate focal lengths, creates versatile instruments for deep-sky astrophotography. They are commonly paired with APS-C and full-frame cameras, although a coma corrector is generally required to produce sharp stars across the entire field.

SCHMIDT-CASSEGRAIN TELESCOPES. SCTs provide much longer focal lengths and are particularly well suited to smaller galaxies, globular clusters and planetary nebulae. Many astrophotographers pair them with APS-C cameras and use focal reducers when a wider field of view is required.

MAKSUTOV-CASSEGRAIN TELESCOPES. With their long focal lengths and excellent optical quality, MCTs are particularly well suited to lunar and planetary imaging. High-speed planetary cameras are usually the preferred choice.

SOLAR TELESCOPES. Dedicated solar telescopes are generally paired with specialised solar cameras capable of recording high frame rates. This allows software to compensate for atmospheric turbulence and reveal fine detail in the Sun's surface and atmosphere.



SUCCESS COMES FROM BUILDING A BALANCED SYSTEM

BUILDING A BALANCED IMAGING SYSTEM

It's all too easy to focus on the camera alone, but experienced astrophotographers know that every component contributes to the final image. A premium camera cannot compensate for a telescope that is poorly suited to the target, just as an excellent telescope cannot reach its full potential if paired with an unsuitable camera. When planning an imaging system, think of the telescope and camera as complementary components rather than independent purchases. A balanced system, where the optics, camera and accessories are well matched, will almost always produce better results than one built around a single outstanding component.

In summary, the best astronomy camera is not necessarily the one with the largest sensor, the smallest pixels or the highest resolution. It is the camera that best complements your telescope and is suited to the objects you most enjoy photographing.

Understanding how sensor size, pixel size and telescope focal length work together will help you build an imaging system capable of producing rewarding images for many years to come. As your experience grows, you can continue to upgrade individual components with confidence, knowing that each new camera expands the overall capability of your astrophotography system.

ABOUT NSO

Our Vision

We envision a world where anyone with an interest in astronomy can begin their journey with confidence and enjoy rewarding first light experiences. Where choosing equipment is exciting rather than overwhelming, expert guidance is always within reach, and every astronomer has a trusted partner throughout their journey under the stars.

Our Commitment

We believe our responsibility doesn't end with a sale. We are committed to supporting our customers throughout their astronomy journey.

- Expert Guidance
- Carefully Selected Stock
- Accessible Value
- Long-Term Partnership

