



A TELESCOPE COLLECTS
THE LIGHT, THE EYEPIECE
SHAPES THE EXPERIENCE

EYEPIECES, BARLOWS & DIAGONALS

In visual astronomy, an eyepiece is the final optical component. While the telescope collects and focuses light from distant celestial objects, it is the eyepiece that magnifies this image and presents it to your eye.

Although eyepieces are often viewed as simple accessories, they play a significant role in determining the quality and character of the view. Their focal length, field of view, eye relief and optical design all influence what you see through the telescope and how comfortable the observing experience becomes.

BUYING GUIDE #5

This buyers guide to explain eyepiece design and performance characteristics to help you choose eyepieces that complement your telescope and make the most of every observing session.



THE VISUAL TRAIN

The components between the telescope and your eye are collectively known as the visual train.

EYEPIECES. Every telescope forms a real image at its focal plane. The eyepiece acts as a magnifier, enlarging this image so it can be viewed comfortably by the human eye. Changing the focal length of the eyepiece alters the magnification, field of view and observing experience without changing the telescope itself. This makes the eyepiece one of the most versatile components of any observing system. While the telescope determines how much light is collected and the amount of detail available, the eyepiece determines how that image is presented to the observer.

DIAGONALS & VISUAL BACKS. Telescope designs where the light exits at the back, such as refractors and some reflectors like SCTs, MCTs require a star diagonal to bend the light path through 90 degrees, placing the eyepiece in a much more comfortable viewing position when observing objects high in the sky. Available in both 1.25-inch and 2-inch formats, quality diagonals also help preserve image brightness and contrast by using highly reflective mirror or precision prism optics.

The 'visual back' is the component that connects the diagonal or eyepiece to the telescope. While many telescopes are supplied with a simple thumbscrew holder, premium click-lock visual backs provide a more secure and convenient alternative. By tightening evenly around the eyepiece or diagonal, they offer improved grip, reduce the risk of components slipping or becoming misaligned, and make changing accessories quicker and easier, particularly when wearing gloves on cold nights.

A RELAXED EVENING
UNDER THE STARS
STARTS WITH THE
RIGHT VIEWING ANGLE



THE BEST EYEPIECE IS
THE ONE THAT REVEALS
THE MOST DETAIL, NOT
THE LARGEST IMAGE

HOW EYEPIECES WORK

FOCAL LENGTH

The focal length of an eyepiece determines its magnification when used with a particular telescope.

Every eyepiece is identified by its focal length, usually expressed in millimetres (mm). Common focal lengths range from around 3mm for high-power observing to 40mm or more for wide-field viewing.

A shorter focal length eyepiece produces higher magnification, while a longer focal length produces lower magnification. However, an eyepiece does not have a fixed magnification of its own. The magnification depends entirely on the focal length of the telescope in which it is used. For this reason, the same eyepiece can provide dramatically different views when used in different telescopes.

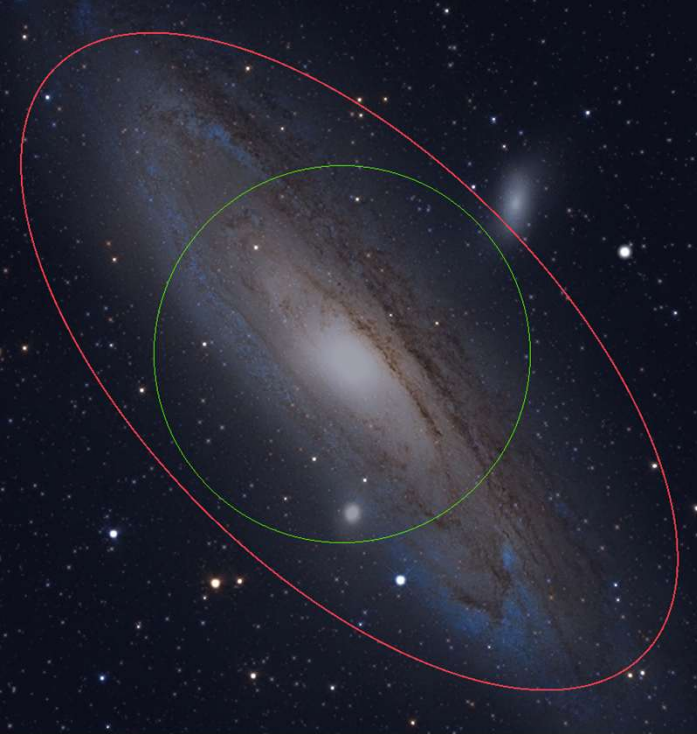
MAGNIFICATION

Magnification depends on both the telescope and the eyepiece.

Magnification describes how much larger an object appears compared with the unaided eye. It is determined by the relationship between the telescope's focal length and the eyepiece's focal length.

Although beginners often assume higher magnification produces better views, this is not always the case. As magnification increases, the image becomes dimmer, the field of view narrows and atmospheric turbulence becomes more apparent.

The highest useful magnification is therefore determined not only by the telescope, but also by the stability of the atmosphere and the brightness of the object being observed.



A WIDER FIELD DOESN'T
JUST SHOW MORE SKY-
IT TRANSFORMS THE
OBSERVING EXPERIENCE

FIELD OF VIEW

APPARENT FIELD OF VIEW (AFOV)

Apparent field of view determines how immersive the view appears through the eyepiece. The apparent field of view (AFOV) describes the angular width of the image seen when looking through the eyepiece. Common designs range from around 40-50 degrees for traditional eyepieces to 100 degrees or more for ultra-wide-angle models. A wider apparent field creates a more immersive observing experience, giving the impression of looking through a window into space rather than through a narrow tube. However, a wider apparent field does not necessarily mean more sky is visible. That depends on both the eyepiece and the telescope.

TRUE FIELD OF VIEW (TFOV)

True field of view depends on both the eyepiece and the telescope.

The true field of view (TFOV) is the actual area of sky visible through the telescope. Unlike apparent field of view, the true field depends on the focal length of both the telescope and the eyepiece. The same eyepiece may show a large section of sky in a short focal length refractor but only a small portion when used in a long focal length Schmidt-Cassegrain telescope.

Understanding this relationship is one of the most important aspects of selecting eyepieces, as it determines whether large objects such as the Pleiades or the Andromeda Galaxy will fit comfortably within the field of view.



COMFORT
ENCOURAGES LONGER
OBSERVING - AND
LONGER OBSERVING
REVEALS MORE

USEABILITY & COMFORT

EXIT PUPIL

Exit pupil influences image brightness and observing comfort. The exit pupil is the small beam of light that leaves the eyepiece and enters your eye. Its diameter affects both the brightness of the image and how comfortable the telescope is to use. Large exit pupils provide bright, wide-field views that are ideal for sweeping star fields and observing extended nebulae. Smaller exit pupils increase magnification and reveal finer detail but produce progressively dimmer images. Selecting an appropriate exit pupil often results in better observations than simply choosing the highest possible magnification.

EYE RELIEF

Comfort becomes increasingly important during longer observing sessions. Eye relief is the distance between the eye lens and the position where your eye must be placed to see the entire field of view. Eyepieces with generous eye relief are generally more comfortable to use, particularly during extended observing sessions and for observers who wear spectacles. Short eye relief often requires the observer's eye to be positioned very close to the eyepiece, which some users may find less comfortable. For many astronomers, observing comfort is just as important as optical performance.

BARREL SIZE

Most eyepieces are available with either a 1.25-inch or 2-inch barrel. The 1.25-inch format is the most common and accommodates the majority of eyepieces used for general observing. The larger 2-inch format is primarily used for long focal length, wide-field eyepieces where a larger field stop allows a wider TFOV to be achieved.



FROM CLASSIC DESIGNS
TO MODERN
WIDE-ANGLE OPTICS,
EVERY EYEPIECE OFFERS
A DIFFERENT WINDOW
ON THE NIGHT SKY

OPTICAL DESIGNS

Modern eyepieces are available in a variety of optical designs, each developed to optimise different aspects of the observing experience. While some prioritise sharpness and contrast for lunar and planetary observing, others provide an expansive FOV that creates a more immersive experience when exploring star fields and deep-sky objects.

TRADITIONAL EYEPIECES: Classic designs such as Kellner, Plössl and Orthoscopic eyepieces remain popular for their simplicity, sharpness and excellent value. Plössl eyepieces are widely regarded as versatile all-round performers, while Orthoscopic designs are particularly prized for their high contrast and planetary performance. Although their AFOV are narrower than many modern designs, they continue to offer excellent optical quality at a reasonable price.

WIDE-ANGLE EYEPIECES: Wide-angle eyepieces typically offer AFOV between 60° and 82°, creating a noticeably more immersive observing experience. Their wider view also allows celestial objects to remain visible for longer in manually operated telescopes, making them especially popular with Dobsonian users and deep-sky observers.

ULTRA WIDE-ANGLE EYEPIECES: With apparent fields often exceeding 82°, ultra wide-angle eyepieces deliver an expansive, almost panoramic view of the night sky. Their sophisticated optical designs provide excellent edge correction and exceptional viewing comfort, although they are generally larger, heavier and more expensive than conventional eyepieces.



QUALITY,
NOT QUANTITY,
DEFINES A GREAT
EYEPIECE COLLECTION

OPTICAL QUALITY

Optical quality influences sharpness, contrast and viewing comfort.

The quality of an eyepiece depends on far more than magnification alone. Lens design, optical glass, manufacturing precision, internal baffling and anti-reflection coatings all contribute to the final image. A well-designed eyepiece produces sharp stars across the field, maintains good contrast and minimises optical aberrations such as distortion, astigmatism and internal reflections. While premium eyepieces often command higher prices, many modern designs provide excellent performance and represent outstanding value for amateur astronomers.

CHOOSING AN EYEPiece IS ABOUT BALANCING MAGNIFICATION, FIELD OF VIEW AND COMFORT



CHOOSING THE RIGHT EYEPiece

There is no single "best" eyepiece for every telescope or observing situation. Instead, aim to build a small collection of complementary eyepieces that provide low, medium and high magnifications. A quality low-power eyepiece is ideal for locating objects and observing large nebulae or star clusters, a medium-power eyepiece will suit most general observing, while a high-power eyepiece is reserved for detailed views of the Moon, planets and for resolving double stars when atmospheric conditions allow.

When comparing eyepieces, look beyond magnification alone. Consider the apparent field of view, eye relief and overall optical quality, and choose eyepieces that complement your telescope's focal length and your preferred observing style. A carefully selected set of three or four eyepieces will usually provide a more rewarding observing experience than a larger collection with overlapping focal lengths.

A NOTE ON BARLOW LENSES

A Barlow lens is a popular accessory that fits between the telescope and eyepiece to increase the effective focal length of the telescope, typically doubling or tripling the magnification. This allows a single eyepiece to provide multiple magnifications, making a Barlow a cost-effective way to expand an eyepiece collection. While a quality Barlow can deliver excellent optical performance, it should be viewed as a complement to a well-chosen set of eyepieces rather than a substitute for one.

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

