Choosing Binoculars for Astronomy

Beginners are surprised to learn that binoculars are the perfect first telescope. The wide field of view allows you to find an object even if you are a little off target. The wide view can represent a significant chunk of typical constellations, meaning that it is easy to relate what you see to naked-eye views and to whole-sky maps such as those found in the *Observer's Handbook, SkyNews*, or other resources.

The low power of binocular views reinforces the fact that sometimes the best magnification in a telescope for some objects is a very low one.

Binocular Parameters

Every binocular has a two-number designation, such as 6×30 or 10×50. The first number is the magnifying power; the second is the diameter of the objective (front) lenses in millimetres. The bigger the objective lenses, the brighter objects will appear. Many astronomical objects are hard to see not because they are small and need more magnification, but because they are faint and need more aperture. Binoculars with an aperture of 50 mm gather twice as much light as gathered by 35-mm lenses.

Generally, the best binoculars for night viewing have moderate magnification and large objectives; 7×50 and 10×50 are ideal. Magnifications higher than 10 are tough to hold steadily and lead to narrow fields of view, while the light grasp of lenses smaller than 50 mm means that fainter objects may be invisible.

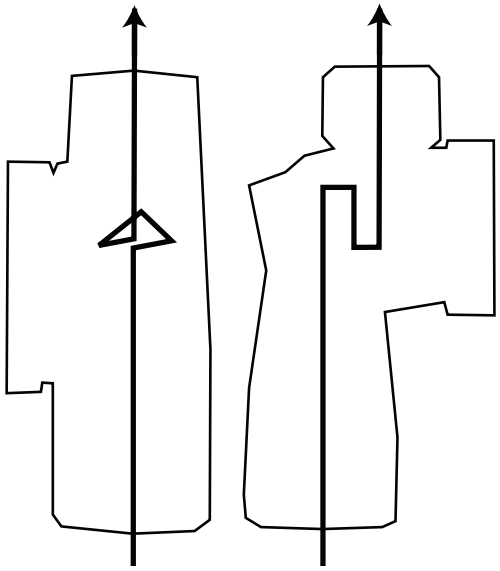
Most binoculars have a field of view around 6° or 7°. High-power models will shrink this while wide-angle models will take in 8° to 10°. The field of view is usually indicated on the binoculars or packaging.

Exit pupil describes the width of the beam of light leaving the eyepiece. It is calculated by dividing the aperture by the magnification. All 10×50 binoculars have an exit pupil of 5 mm; 7×50s have exit pupils of 7 mm. Most people younger than 30, who observe under a dark, rural sky will have pupils that dilate to about 7 mm. By the time you are 40 or older, the pupil probably will not dilate beyond 5 mm. If you use binoculars with an exit pupil wider than your pupil size, some of the incoming light will not get into your eyes and images will appear dimmer.

Binocular Features

Most binoculars are center-focus, meaning you turn a knob in the center to focus both eyes at once. The right-hand eyepiece is also individually focusable so you can correct for differences between your eyes; this should only have to be done once. Binoculars use prisms to make the image appear right-side up. These prisms come in two varieties. Roof-prism models have straight barrels and are more compact. These tend to be more expensive and produce slightly dimmer images, making them less desirable for astronomy. Porro-prism binoculars have a zigzag shape and usually are heavier and bulkier than roof-prism models.

Look for anti-reflection coatings, which increase light transmission and contrast, both of which are especially important in astronomy. "Multicoating" is the best kind.



The light path through roof prisms (left) and Porro prisms (right).

Rubber eyecups are useful, especially if artificial lights intrude on your observing site. Be sure that they fold down if you need to wear glasses for astigmatism.

Selecting Binoculars

For reasonable quality, try to spend at least $100 on a pair of new binoculars. Zoom binoculars generally do not have the same optical quality as fixed magnification binoculars, so it is best to ignore them.

The following tests will enable you to judge the quality of any binoculars, new or used.

1. Hold the two barrels and try to twist them slightly. If there is any play in the joints or anything rattles, reject the pair. Move the barrels together and apart; the hinges should work smoothly, with steady resistance, as should the focusing motions for both eyepieces. On center-focus binoculars, the eyepiece frame should not tilt back and forth when you turn the focus in and out.

2. Hold the binoculars normally but away from your face. Aim them at the sky or a bright wall. Look at the little disks of light seen floating just outside the eyepieces. These are the exit pupils. In good binoculars, they are uniformly bright circles. They should be surrounded by darkness, not by reflections from inside the barrels.

3. Look through the binoculars. Adjust the separation of the barrels to match the spacing of your eyes, then focus each side separately. A filmy or gray image indicates an unacceptable contrast problem. If you have to wear glasses to correct for astigmatism, make sure you can get your eyes close enough to view the full field with the glasses on. If your glasses do not correct for astigmatism, you can take them off.

If you see a double image or feel eyestrain as your eyes compensate for the binoculars' misalignment, do not buy the binoculars. Misalignment due to flimsy prism supports is the worst problem of cheap binoculars; even a small knock can render a working pair worthless.

Notice the size of the field of view: the wider the better. However, the edges of a wide field usually have poor optical quality. Sweep the field at right angles across a straight line, such as a doorframe or telephone wire. Watch whether the line bows in or out near the edges. This distortion should be slight.

Look at sharp lines dividing light and dark, such as dark tree limbs or the edge of a building against a bright sky. Do they have red or blue fringes? No instrument is perfectly free of this chromatic aberration, but some are better than others.

A star at night is the most stringent test of optical quality, so try the binoculars on real stars if you can. If not, look for an 'artificial star' such as sunlight glinting off a distant piece of shiny metal. Center it in the field of view. Looking with one eye at a time, can you bring it to a perfect point focus?

Move the star from the center of the field to the edge. It will go out of focus unless you have a perfectly flat field and freedom from various other aberrations. As a rule of thumb, no degradation should be visible until the star is at least halfway to the edge of the field.