Binoculars

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Binoculars are probably the easiest way to learn astronomy. Simply aim at the stars. The image seen through binoculars is upright. Therefore, easy to follow. Binoculars can also be simple and inexpensive or highly advanced and expensive.

Try this experiment. Look up and around the room you are in. Close one eye. Then, open it. Try this several times. The depth perception with both eyes is much greater than the depth perception with one eye. It is the difference between 2D and 3D vision. This is the difference between viewing through binoculars and telescopes.

Binoculars are specified as power and aperture. The aperture is the width of the optical lens. For example, a 7 x 50 binocular would have a power of 7 times that of the normal eye with an aperture of 50 mm. Seven power is usually the limit of power that can be held by hand without any support. Higher power will require a tripod, monopod, or other device. The larger the aperture, the more you can see, and the heavier it will be. A binocular of 10 x 50 will reveal much more than a 7 x 50. Some kind of bracing with ones elbows may work to replace a tripod.

Generally, fixed eyepiece binoculars have lower power capabilities than telescopes. Most binocular powers range from 7x to 25x. Common telescopes often range to 300x. Binoculars are good for observing the moon, planets, nebula, and large galaxies like M31 (Andromeda). Telescopes can be used for deep space observation (DSO) at higher power. Higher power will require a tripod and tracking capabilities to keep up with the earth's rotation, which will be discussed later.

The higher the power, the more difficult it will be to hold steady. Several manufacturers offer image stabilized binoculars. They use electronic circuitry to stabilize the image. They are generally more expensive than standard binoculars.

Eye relief is the distance between the optics and your eye. If you wear glasses, you want a long eye relief of at least 15 mm. You may need to fold the rubber eye cups down if you wear glasses. Some binoculars have helical or flip up eye cups that raise and lower by twisting the eyecups.

The distance between the center of your eyes varies from person to person. This is known as the Interpupillary Distance (IPD). When looking through a pair of binoculars the ocular lenses must line up perfectly with your pupils. If not, you will see a dark halo forming around the image and only see a small part of the image you are viewing. Most binoculars use a hinge system between the two barrels allowing you to adjust the barrels. With some binoculars, only the eyecup is moved.

Some tripods that can be used are the Celestron Trail Seeker Tripod ($100) and the Celestron Regal Premium Tripod ($150). The Regal tripod is heavier and sturdier, which may be required for heavier binoculars. 10x50 binoculars are popular, however they will most likely require a

tripod or monopod. The most common binoculars used for astronomy are 15x70, 20x60, 20x80, and 25x100. These large binoculars will definitely require a tripod or monopod. There are also parallel arm tripod assemblies made for use with binoculars such as the Orion Paragon-Plus Binocular Mount and Tripod that can be lifted or lowered to any position without changing the angle of the binocular ($250). Some people lay in a zero gravity lounge chair while viewing the sky with binoculars. The Celestron SkyMaster Pro binoculars DO NOT accept 1.25” filters as some websites state.

To advance further, there are the Orion BT-100 binoculars with 90 degree angled 1.25” interchangeable eyepieces ($1,200). There is also the Vixen Optics 25x81 BT81S-A Astronomical Binocular with 45 degree angled 1.25” interchangeable eyepieces ($2,000). Interchangeable eyepieces will allow for higher power and accept 1.25” filters. Both require the use of a tripod.

A good binocular to start astronomical observations with would be a 7x50 binocular. Generally, the more expensive the binocular, the better is the quality. Generally, binoculars that cost less than $100 are only fair in quality.

Some binoculars, weights, and current prices:
Canon 15x50 IS Image Stabilized, 21.2 oz. (2.7 pounds), $1,000
Celestron Outland X 8 x 42, 22 oz. (1.38 pounds), $60
Celestron Cometron 7 x 50, 27.3 oz. (1.70 pounds), $25
Nikon Aculon 7 x 50, 31.9 oz. (1.99 pounds), $100
Nikon Aculon 16 x 50, 32.6 oz. (2.04 pounds), $120
Nikon PROSTAFF 5 10x50 (1.8 pounds), $200
Nikon Model MONARCH 3 10x42 ATB (1.5 pounds), $250
Pentax 10 x 50 SP WP, 37.4 oz. (2.19 pounds), $250
Pentax 20 x 60 SP WP, 49.4 oz. (3.09 pounds), $250
Celestron Sky master 20 x 80, 94.24 oz. (5.86 pounds), $115
Celestron Skymaster Pro 20 x 80, 86.4 oz. (5.4 pounds), $250
Vixen 20 x 80, 84.8 oz. (5.3 pounds), $700

The Unimount and Tripod in the reclining position with a zero gravity or other chair is also a great method for viewing using higher powered binoculars.

Binocular Collimation

Basically, binoculars are two telescopes side by side. Each telescope presents an image to each eye. These two telescopes must be perfectly aligned (collimated) in parallel. If they are not, the images will be misaligned in the eyepieces at which point the brain will try to adjust them to a single image. The result may be eye strain and headaches. Binoculars can easily become misaligned if they are dropped or mishandled.

If binoculars are misaligned, highly trained people and equipment are required to properly align them.

To test binoculars for alignment do the following:

1. Point the binoculars at a straight horizontal line in the distance. It could be a roof or power line.

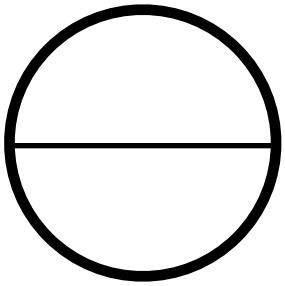
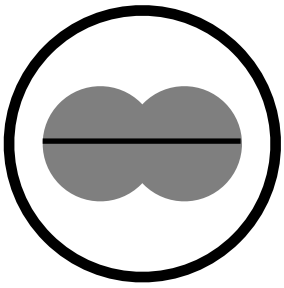
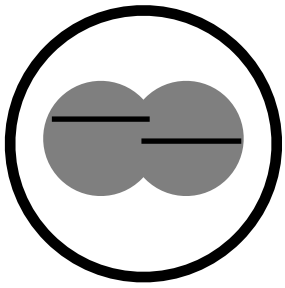


Image with eyes close to the binoculars

2. Slowly bring the binoculars 2-3 inches away from your eyes. The image will separate into two circles. If the binoculars are aligned, there will be a straight line through the two circles. If they are not aligned, there will be two separate lines as can be seen below.



Aligned



Misaligned