

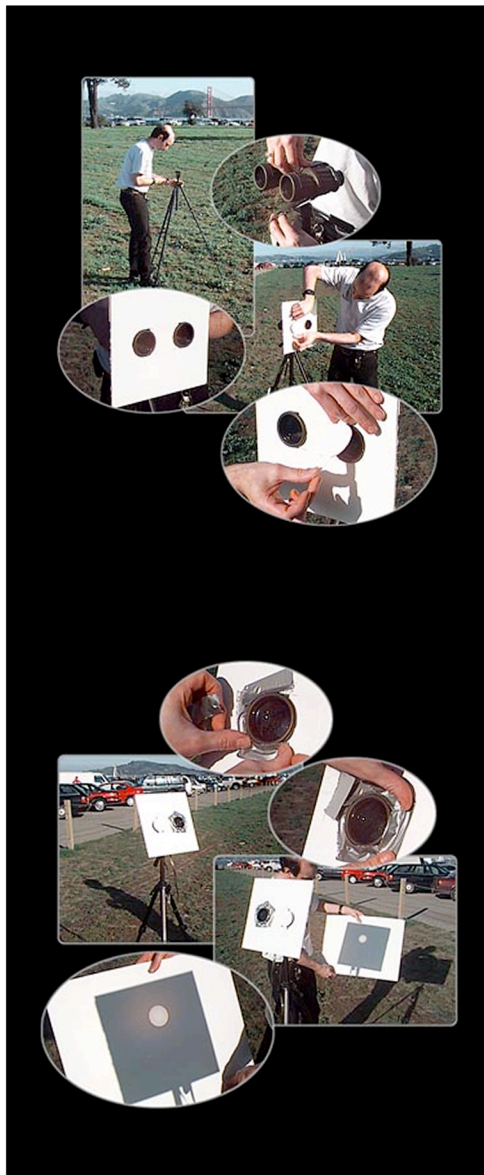
# Make an Optical Projector to View Transits & Solar Eclipses!

The usual way that you are told to view the sun is by building a pinhole projector. Unfortunately, this method probably won't work for the transit of Mercury. Pinhole images are pretty dim and small. They also lack the proper resolution to view the tiny disk of Mercury. But there's another projection method that uses a pair of binoculars.

**DO NOT LOOK THROUGH THE BINOCULARS!**

1. First, you should firmly fix the binoculars to a tripod. You can do this with duct tape (what else?).
2. Cut out a cardboard shield and tape it to the front of the binoculars with the lenses sticking through holes.
3. Put the lens cap over one of the large binocular lenses or tape over one of the front lenses with duct tape. (You really only need one lens.)
4. Use the duct tape to seal any holes that leak light past the cardboard.
5. Point the binoculars toward the sun while holding a piece of white cardboard about a foot behind the eyepiece.
6. It will take a little effort to find the image of the sun. Once you do, you can focus the binoculars to create a sharp image of the sun.

Be careful not to put your hand or anything flammable near the eyepiece! The concentrated sunlight exiting there can cause a nasty burn or set something ablaze! Now you can watch a beautiful, bright, magnified image of the sun as the transit proceeds. You will have to adjust the tripod to account for the earth's rotation. One possible warning here: You might give your binoculars a cooling break now and then. The eyepiece can become overheated and the lens elements may separate if you leave it focused on the sun too long.



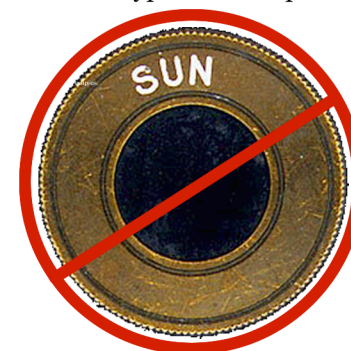
## Filters

If you feel that you just have to look directly at the sun, be absolutely sure that you have the correct filter. Just because a filter makes the sun seem dim does not mean that it's blocking invisible infrared or ultraviolet radiation that will certainly cause eye damage in short order.

Do not use sunglasses, polaroid filters, smoked glass, exposed color film, X-ray film, or photographic neutral density filters. Make sure that the supplier of your solar filter is reputable and reliable. A few are listed below. You can, for instance, look at the sun with a number 14 welder's glass. Get this from a welding supply store. Silver-based black-and-white photographic emulsions, when exposed and developed fully can be used if you are experienced and knowledgeable in this area. You might need several layers. It's easier, though, to spend a couple of bucks on a filter you know is safe. If you want to use a filter on a telescope, only use the filter supplied by the manufacturer or by a manufacturer who makes a filter specifically for the instrument you are using. And it must be a filter that attaches to the front end of the telescope.

The suppliers of some cheap refractor telescopes supply a welder's glass filter that screws onto the eyepiece. **DO NOT USE THESE!** They may heat up and crack as you are looking through the telescope. A proper solar filter always goes on the front end of the telescope, blocking the sunlight *before* it enters the optical system.

Do not use this type of telescope filter:



<http://www.exploratorium.edu/transit/>