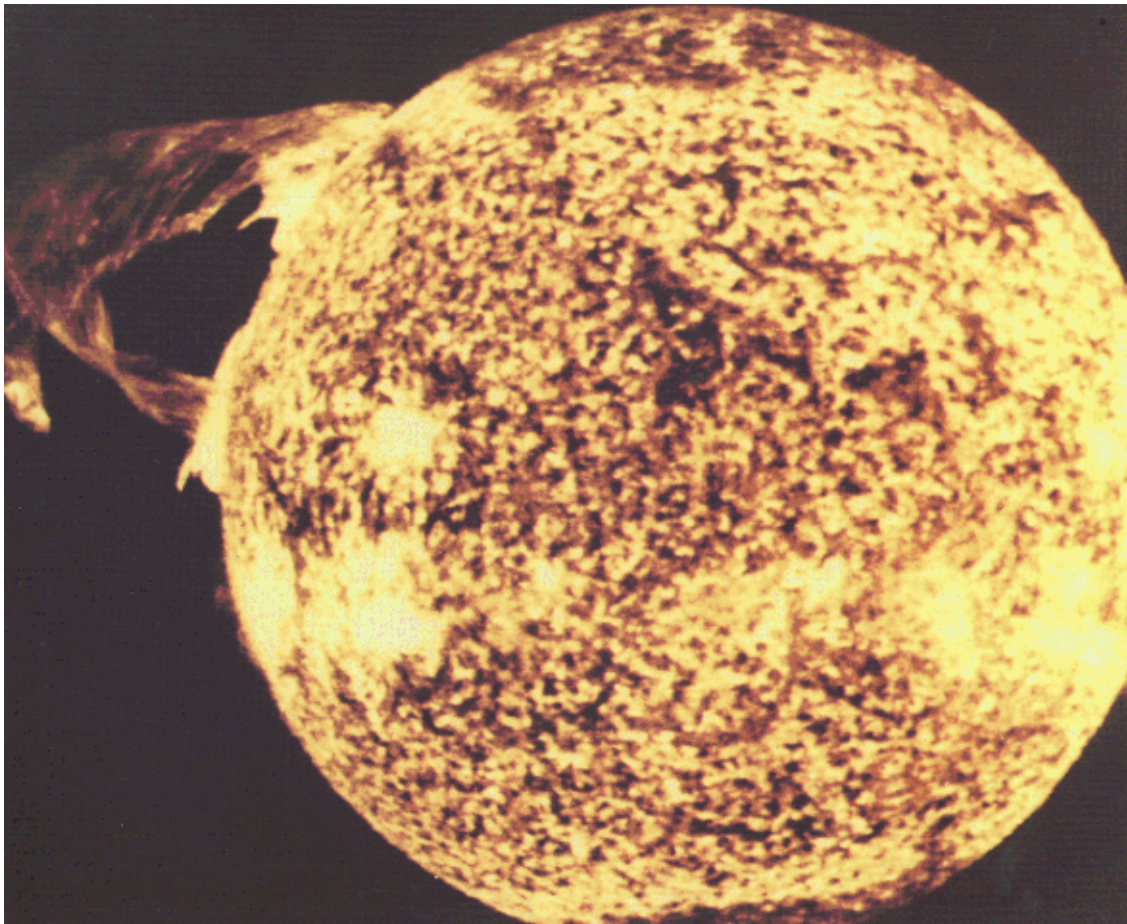


Solar Eclipse Information Pack

For the May 10, 1994 Annular Eclipse of the Sun



*A huge solar flare or prominence photographed in hydrogen-Alpha light.
Courtesy CompuServe Information Service*

May 4, 1994
Gary A. Donahue

Solar Eclipse Information

Yes folks it's coming! The event you've all been waiting for! The May 10, 1994 Annular Eclipse of the Sun! Here's some information and pointers for safe and enjoyable viewing of this rare celestial event.

First lets talk about the sun.

The "Sun" as we call it is in reality called "Sol". The term *solar system* refers to our planets orbiting around our star. It is improper then to refer to other planetary systems as solar systems, for that infers the system orbits around Sol!

Here are some statistics regarding the sun:

Diameter:	865,000 miles (That's 109 Earth's side by side!)
Surface Temperature:	11,000 Degrees Fahrenheit (Sunspots are usually about 8,000 degrees)
Core Temperature:	25,000,000 Degrees Fahrenheit
Mass:	Approx. 332,950 Earth masses! (One Earth = Approx. 1,250,000,000,000,000,000,000 Tons)
Escape Velocity:	385 Miles per Second.
Rotational Period:	30 days on average (See Below).
Mean Density:	1.41 (Water = 1)
Average Apparent Size:	Approx. 1/2 Degree (The Moon is also Approx. 1/2 Degree!)

The sun rotates, but it rotates unevenly. Being a body of pure gas (It is by far too hot for solids), separate zones of the sun are free to move at different speeds than others. Near the poles for example, the sun makes one complete revolution in about 34 days. Between the poles and equator, about 30 days, while at the equator, the sun revolves in a mere 25 days. Some scientists believe this shearing activity may be what causes sunspots.

Sunspots are regions on the sun's Photosphere (The part we see), that are substantially cooler than the surrounding area. They are also a source of great magnetic activity and are directly related to the Earth's Aurora Borealis phenomenon.

And now for some information regarding eclipses.

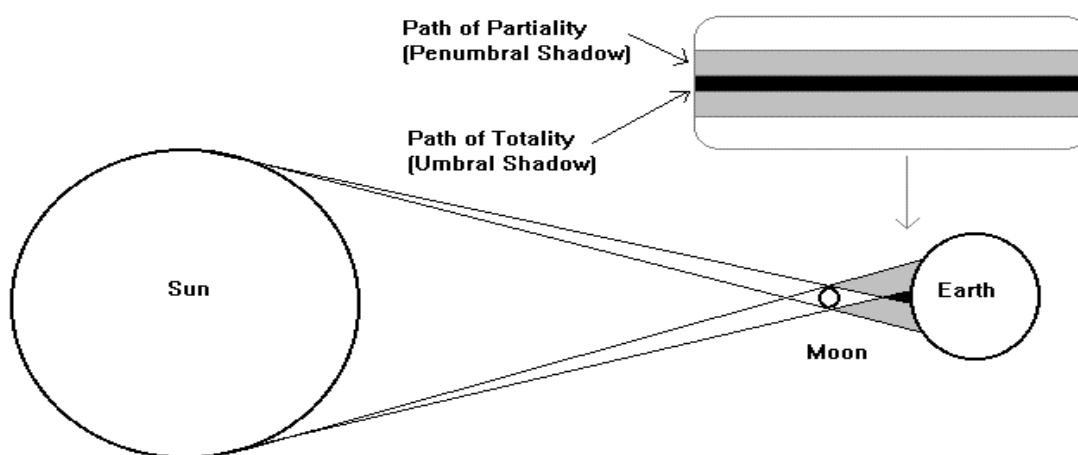
A solar eclipse occurs when simply speaking, the Moon comes between the Earth and the Sun. While this sounds like it may happen relatively frequently, it is in reality quite rare. The reason for this is actually very simple. The Sun and the Moon do not orbit on the same plane. The Earth orbits the Sun on a plane called the *ecliptic*. The ecliptic is the imaginary plane on which all the planets of the solar system reside (Except Pluto). The moon however, does not orbit the Earth on the ecliptic. If the Moon and the Sun were on the same plane, there would be a solar eclipse of some kind every month!

For a solar eclipse to occur, the Moon must be on the *Pons*. This basically means that the moon's orbit has intersected with the ecliptic. The next thing that must happen for a solar eclipse to be visible is a little more complicated. Since the Moon is much smaller than the Sun, and only appears to be the same size, it casts a very small shadow on the Earth.

<continued>

Solar Eclipse Information

As you can see in the illustration, the shadow cast by the Moon onto the Earth is quite small (and of course greatly exaggerated here). For this reason, a solar eclipse is only visible in a very select area of the world at any given time. Due to the Sun being such a large light source and the Moon being a much smaller body, a total or annular eclipse can only be viewed fully in an even smaller region known as the *path of totality* (or annularity as the case may be). It is for this reason that NJ will only see a partial eclipse, whereas NH will see the annular eclipse.



**Illustration of Solar Eclipse Geometry
(Not to Scale)**

A **total eclipse** occurs when the moon is close enough to the Earth, that when Moon blocks the Sun, it covers the entire disk. This is a very desirable occurrence, as it is the only time that we can see the Sun's *corona*. The corona is a thin gaseous area of space immediately surrounding the Sun. It is in fact the outer atmosphere of the sun and burns much brighter than the photosphere. The reason we do not usually see the corona, is that the photosphere is so bright, it simply washes out all light from the corona. During an annular eclipse the corona is not visible.

An **annular eclipse** occurs when the Moon is too far away from the earth to cover the entire disk of the Sun. In the path of annularity, the viewer sees the brilliant sun, with the moon sitting right in the middle, like a bulls-eye. The term annular comes from the Latin *annulus* meaning "ring" (the Sun appears to form a ring around the moon.) This is the type of eclipse that will occur on May 10, 1994.

<continued>

Solar Eclipse Information

Safely Viewing the Eclipse

The first rule of solar viewing (and you would think the most obvious) is **NEVER LOOK DIRECTLY AT THE SUN!** The only exception to this rule is with the use of a properly designed solar filter or #14 welders goggles. A properly designed solar filter has a neutral density of 5 (for you photography buffs) and may be called a type II solar filter. This filter diminishes the visible light by 100,000 times! Just as important however is the filters ability to filter ultraviolet and infrared wavelengths as well as heat.

It is important to note here, that during a full eclipse, you may be tempted to look at the sun because it will be mostly covered, and thus much dimmer than normal. The problem here is that the brain becomes confused. When you look at an eclipsing Sun, the brain seems to think that since it is not very bright anymore, it is safe to look. Because of this confusion, you feel no pain when looking to the eclipsing Sun. Feeling no pain of course leads you to continue looking at the Sun. The problem here is that even though the sun is greatly diminished in size and brightness, it is still pumping harmful radiation into your eyes. Although you feel no pain looking at the Sun, as you walk away from the eclipse you will start to see spots as if someone took a flash picture of you. As time goes on the spots will get bigger and could lead to total blindness. The moral here is don't look at the sun!

Use of the Thousand Oaks Solar Viewer

Many of you may have a small rectangular solar filter made by Thousand Oaks. This filter was specially designed for solar viewing. The basic idea here is just hold the filter in front of your eyes and look at the Sun! It is important that you hold the filter over your eyes **BEFORE** you look at the sun. Don't look up at the sun to find it, and then put the filter in front of your eyes. Think about it. It only makes sense. This filter may be used over and over, provided it does not become damaged in any way. Do not use the filter (Or any solar filter for that matter) if it is scratched, bent, or has any pinholes in it.

Using a Telescope to View The Sun

A telescope or binoculars may be used to view the eclipse provided a proper solar filter (see above) is used. If you do plan to use a solar filter on a telescope, make sure you follow these important guidelines.

- 1) Only use a solar filter of type I or II. Never type III (Only used for Photography)
- 2) Always cover the objective (Front) lens of the telescope. A solar filter filters heat too! If you don't have a filter on the front of your scope, you basically have a solar torch as well as VERY concentrated sunlight coming out of your eyepiece. Not only can this be dangerous to you and whoever else may be near the scope, but it may damage the scope. Never use a filter that covers only the eyepiece.
- 3) If you have a finder-scope on your telescope, make sure it stays covered. Just because you don't look through it, doesn't mean it still isn't magnifying light and heat. It may burn you as you bend over it.

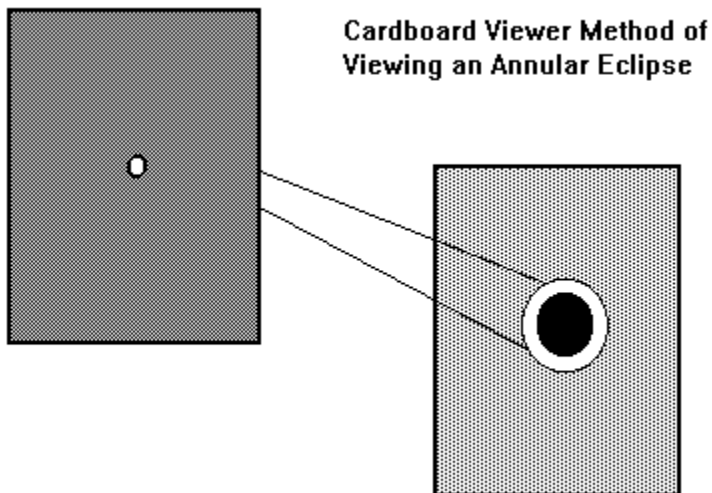
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Solar Eclipse Information

- 4) You may use a small refractor to project the image of the Sun onto a piece of white cardboard, but be careful not to put yourself in the path of the image. This technique is not recommended unless you are absolutely sure of what you are doing. Never use a compound telescope (Schmidt Cassegrain, Newtonian etc.), as the mirrors may become damaged.
- 5) All of the same rules apply to binoculars!
- 6) Make sure that the solar filter is properly attached to your viewing device and that there is absolutely no way it can accidentally fall off!
- 7) Use common sense at all times!

Viewing the eclipse without filters.

The only way this can be done, is with the pinhole method. Take two pieces of cardboard, and punch a small hole into the center of one. Place the one with the hole closest to the sun and the plain one behind it at approx. two feet away. An image of the sun should appear on the plain cardboard. Adjust the distance between the two pieces to get a good image. The size and cut of the hole will change the quality of the image.



Local Eclipse Information For May 10, 1994.

On May 10, 1994, we will experience an annular eclipse of the Sun. Unfortunately in New Jersey, we will not be in the path of Annularity. We will however see a partial eclipse with the Moon covering approx. 85-90% of the Sun. The eclipse will last approx. 3 - 3.5 hours with the maximum eclipse coverage happening at around 1:36pm. If you want to see most of the sun covered by the moon, set you alarm for 1:20pm and watch for a few minutes. If you want to see the whole eclipse, plan on starting at least by 11:30. The most exciting part of course is the maximum phase or annularity if you are lucky enough to be in the path of annularity.

Solar Eclipse Information

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Some things to look for during the eclipse.

During any phase of a solar eclipse, look to the ground under a leafy tree. The image of the eclipsed sun will be projected onto the ground thousands of times by the light passing through pinholes between the leaves! Also look to notice that normally diffuse shadows will become much sharper as the light source becomes smaller. During maximum eclipse be ready to notice that the sky and surroundings will become perceptibly darker. The wind may also pick up and the temperature may drop noticeably as well. Notice also that during maximum eclipse the brightest planets should become visible! Venus should be visible 28 degrees east of the sun, although you may have to block out the sun's light with your hand.

One Last Note.

You have a chance to witness what many people never do, A solar eclipse. The next annular eclipse of the Sun visible in the US will not be until May 20, 2012! The next total eclipse of the Sun will not be for another 7 years after that! Now is your chance! Don't miss it! And let's all hope for clear skies, wherever we may view from. If you have any questions, stop by and ask or give me a call. I will be happy to answer anything I can, and point you to any number of books on the subject.

Happy (SAFE!) Viewing!

Gary A. Donahue

Solar Eclipse Information

Acknowledgments

Astronomy Magazine. Kalmbach Publishing Co, Waukesha Ill.

Sky and Telescope Magazine Sky Publishing Corp., Belmont, MA

The Cosmic Voyage: Through Space and Time William K. Hartmann. Wadsworth Publishing Company, Belmont Calif.