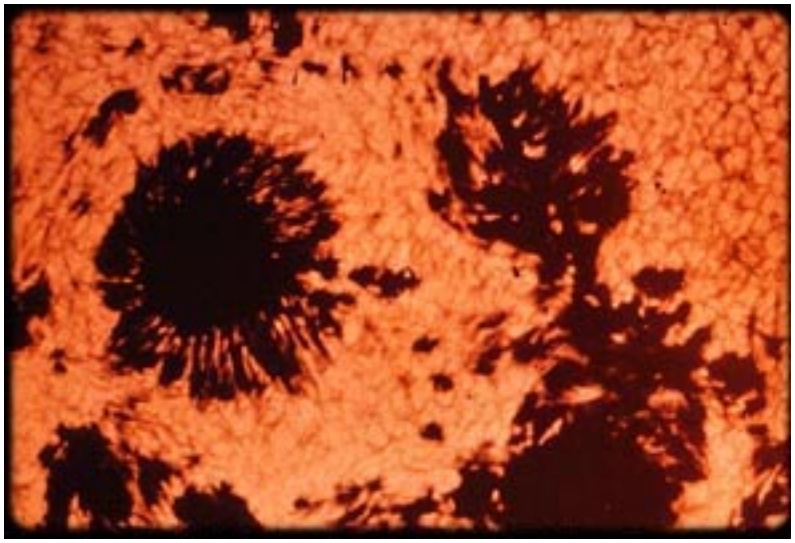
[What to See During an Eclipse]

By Ron Hipschman

If you are lucky enough to find yourself inside the path of totality there's lots to see. Let's digress briefly and look at what there is to see on the sun itself.

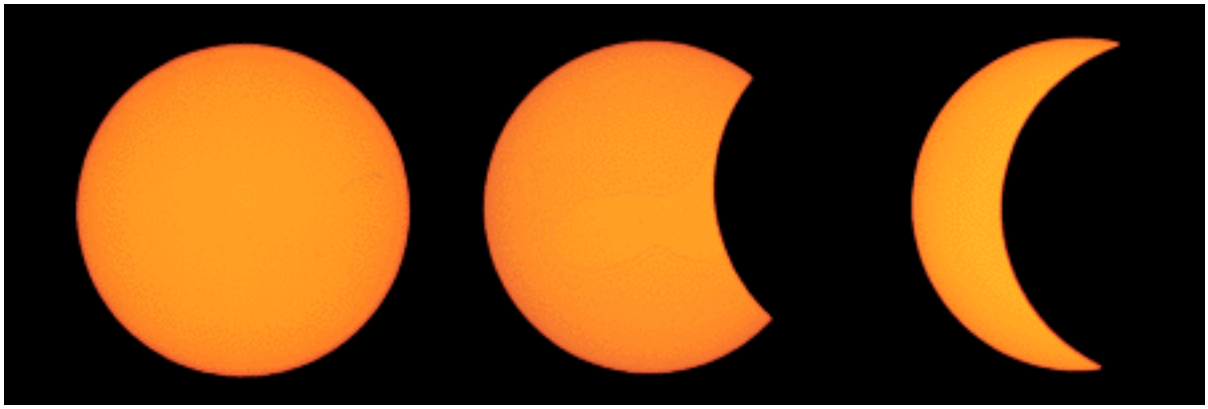
Our thermonuclear furnace has a surface temperature of about 6000 degrees Centigrade. The word "surface" is a bit misleading as the sun is not a solid ball, but rather a gaseous body. If you heat up a gas enough, it becomes ionized (the gas loses outer electrons) and the gas becomes opaque. This opaque and very bright surface of the sun is called the "photosphere." Because the gases of the photosphere are moderately dense, they give off an incandescent white light, like the filament of a lamp.



An image of the region around a sunspot. The mottled appearance is due to turbulent eruptions at the surface of the sun. (Photo courtesy National Solar Observatory, Sacramento Peak)

Before the eclipse starts - assuming you have the correct and safe viewing apparatus - you will be able to view the entire face of the sun. This is a good chance to see sunspots. Sunspots are slightly cooler areas (about 1500 degrees C cooler) on the sun that look dark compared with the blinding photosphere. If you could move a sunspot off the surface of the sun and look at it all by itself, it would actually be very bright. It's just dark in comparison to the hotter surface of the sun.

Above the photosphere, the gases are cooler, more rarefied, and give off a spectrum of light that is representative of the chemical elements that compose that gas, mainly hydrogen. This thin layer, the upper atmosphere of the sun, is called the "chromosphere" because of its colorful nature. Normally you can't see the chromosphere, but the eclipse gives us just the right conditions to observe this beautiful phenomenon. There are always eruptions on the sun which throw huge amounts of glowing gas, often much larger than the earth, high above the sun's surface. These "prominences" are easily visible along the edge of the sun during the total eclipse. The whispy-thin and incredibly hot outer atmosphere of the sun, called the "corona," is also only visible during totality. So now let's get back to the eclipse!



[First Contact]

The moon is up there in the sky too; you just can't see it during the day because the lit side is facing away from us (a phase called "New Moon") and the blue sky washes everything out. As the moon just "touches" the sun (actually coming **between**, us and the sun, not touching!) you see the first bite taken out of the edge of the sun's disk. This is called **"first contact."** This is where the partial phases of the eclipse start. In Aruba, this will be at about 11:38 AM, local time.

For the next hour and a half the moon will cover more and more of the sun's disk. As the total phase of the eclipse approaches, the lighting becomes very strange. It gets much darker, but unlike at sunset, the color of the remaining light does not become orangish and reddish. It just gets grayer. If there are animals around to observe, the daytime animals become quiet and prepare for sleep, while at the same time the nocturnal animals get ready to come out. This must be a very confusing time for them because their internal biological clocks must be telling them it's still daytime!

When only a sliver of the sun is left, with only a few minutes to go until totality, you might notice long, straight bands of shadows moving across the ground. These "shadow bands" form from refraction, or bending of light in the earth's atmosphere. This is the same thing that causes stars to twinkle. With the sun only a long slit of light, the distortions in the atmosphere become visible as moving bands, parallel to the remaining slit of sunlight. They are usually very low in contrast and it helps to spread a white sheet on the ground to help viewing. They are VERY difficult to photograph. I've never seen any pictures of shadow bands. Of course, this could be because everyone has their cameras trained on the main event about to happen which is, admittedly, much more spectacular.

First Contact Second Contact Third Contact Fourth Contact

	GMT	Aruba	San Francisco
1st Contact	16:38:49	12:38:49	08:38:49
2nd Contact	18:09:48	14:09:48	10:09:48
3rd Contact	18:13:17	14:13:17	10:13:17
4th Contact	19:36:02	15:36:02	11:36:02

[Second Contact]

Second contact, when the moon completely covers the sun, happens at about 2:09 PM in Aruba. Now the action really heats up! The edge of the moon is not perfectly round. There are mountains and valleys that make the edge less than smooth.

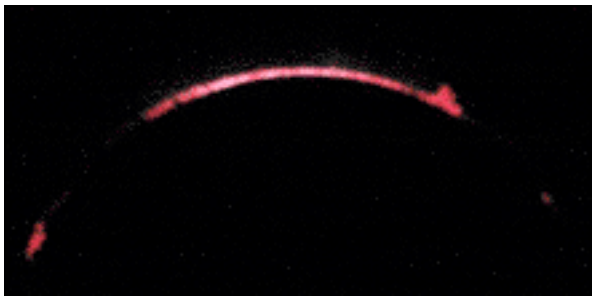
[Bailey's Beads]

As the moon covers the last slice of the sun, the photosphere shining through the valleys creates an effect called "Bailey's beads." The last sliver of sun breaks up into a chain of bright pearls around the edge of the moon. The corona is visible on the other side of the moon at this point.

Baily's beads and a prominence (on the left) photo by Fred Espenak

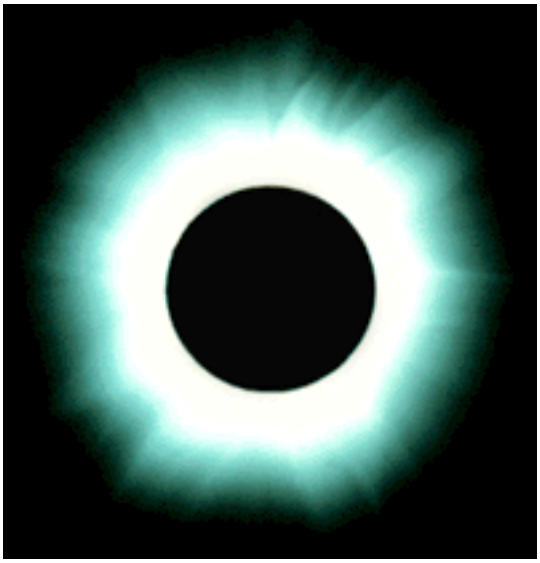
[Diamond Ring]

As the last bit of photosphere disappears, you see something called the "diamond ring" effect - the beautiful inner corona forming a ring around the moon with a brilliant white jewel of light.



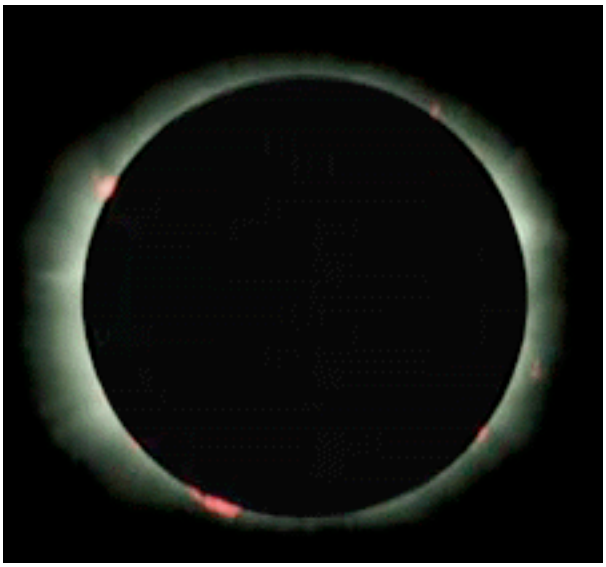
After the diamond ring disappears, you only have a couple seconds to notice the crimson-colored chromosphere before it too is eclipsed.

One surprising thing about this part of the eclipse is how quickly it gets dark. Even though we all know exactly what is happening on an intellectual level, it's still somewhat frightening on some inner, instinctual level. Fortunately, there's so much to do at this point, and the spectacle is so exciting, that this wave of horror passes quickly.

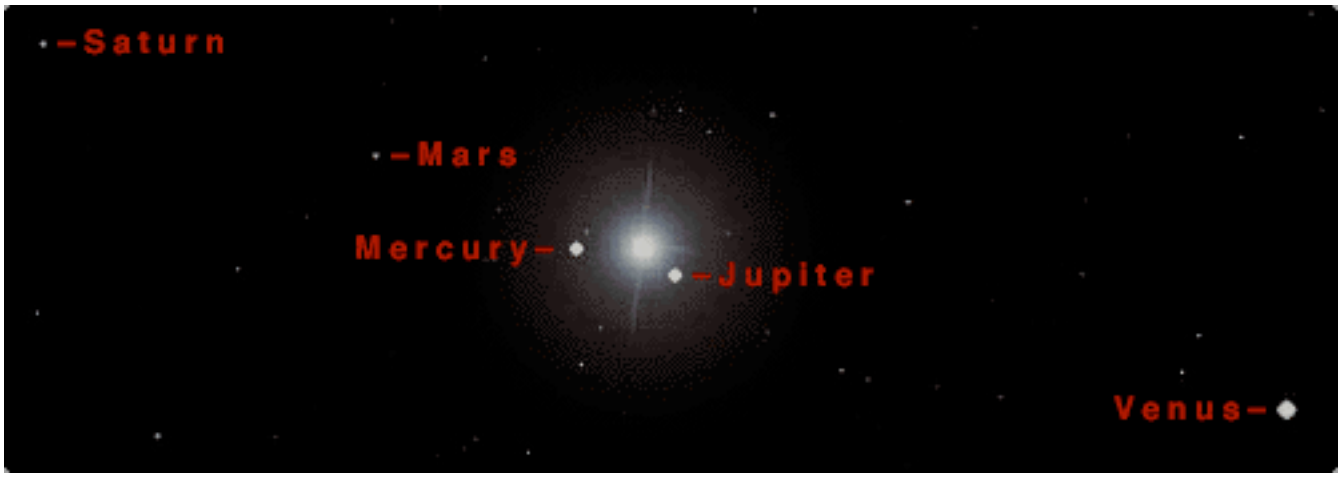


Once the sun is completely hidden, you will see the full glory of the solar corona.The corona is about the same brightness as the full moon. You don't normally see it because of the blue sky. If you were in orbit above the atmosphere, you would only have to block the bright portion of the sun to see the corona. This is what orbiting solar observatories do. They can create artificial eclipses with occulting disks and observe the corona whenever needed, and for as long as is necessary.

The second striking thing you may see during totality are the beautiful prominences. These gigantic jets and loops of gas around the edge of the sun follow local magnetic fields usually emanating from sunspots. They are the beautiful crimson color of glowing hydrogen gas.



If you can draw your eyes away from the sun for a few moments, you will notice that it has become quite dark, comparable to twilight, and that the brighter stars and planets have come out. As you can see in the wide-angle chart below, five planets will be visible. The horizon (if you have a good long-distance view) has a beautiful orange cast to it - like it's sunset all around, which it is! These are portions of the earth still in the brighter "penumbra". The area of the earth out there in the penumbral regions are experiencing a partial eclipse, but still are brightly illuminated by at least a portion of the sun's blazing photosphere. These areas are far enough away that the light's trip through the earth's atmosphere colors the distant scene yellow and orange, just like at sunset.



At our location on the southern tip of Aruba, we'll have about 3 minutes and 32 seconds of total eclipse. As this time expires, the sun will once again emerge from behind the moon (called third contact) and we'll see the chromosphere, followed by the diamond ring and Bailey's beads, and another hour and a half of partial eclipse. The very last portion of the sun is uncovered at fourth contact, everyone is exhausted and we all retire for refreshments under the sunny skies of beautiful Aruba.

[All Photos unless otherwise noted by Ron Hipschman]

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