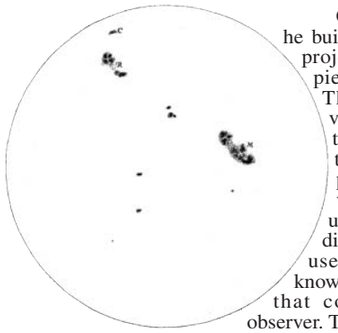
"THE SUNSPOT CYCLE"
Part 1

This year we are celebrating the International Year of Astronomy. Four Hundred years ago man first used a telescope to view the universe and one of the names we closely associate with the first telescopic views of the heavens is Galileo. Galileo did not invent the telescope but was one of the first to use it for astronomical purposes. Galileo was also one of the first people to see sunspots through a telescope and make detailed records of his observations. This soon led to a controversy since the sun was assumed to be flawless and claims that the sun had blemishes worked against accepted philosophical ideas of the day.



Galileo's Drawing of Sunspots

Galileo used the telescopes that he built himself to view sunspots by projecting the image on a wall or piece of paper (see illustration). This was the only safe way to view sunspots, since looking at them directly through a telescope would produce permanent eye damage and is very dangerous. Today we can use special filters to view the sun directly, but these should only be used by trained individuals who know how to check them for defects that could be dangerous for the observer. The projection method is still the only safe way for the beginning amateur astronomer to work.

On relatively rare occasions a sunspot can be large enough to see without a telescope but it is still necessary to have a filter to protect the eyes. Check with the nearest Royal Astronomical Society of Canada chapter for help before attempting to use any filters.

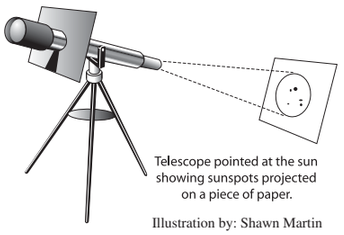
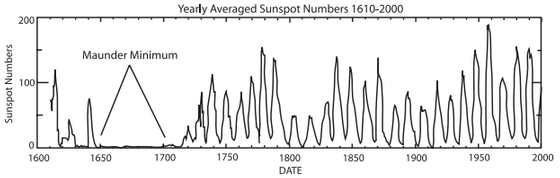


Illustration by: Shawn Martin

We have some records of sunspot observations long before the invention of the telescope, but the spots were probably seen under conditions when clouds or dust storms were just the right density to act like filters. However; it is never advisable to look directly at the sun, any time.

We have a reliable 400 year record of sunspots (see illustration). When we examine the data we see that the number of sunspots increases over a period of years to a maximum, then over a few years falls to a minimum. We call this the sunspot cycle and one cycle lasts approximately 11 years. Some sunspot cycles are more intense than others showing greater numbers of sunspots and groups of spots.

It is not clear how the sunspot cycle is related to climate on Earth, but from 1645 to 1715 there should have been a total of 40 000 to 50 000 spots but only 50 sunspots were seen for the whole period. This period is known as the Maunder Minimum and it occurred during a time when Europe and North America were subjected to bitterly cold conditions we now call this the "Little Ice Age".



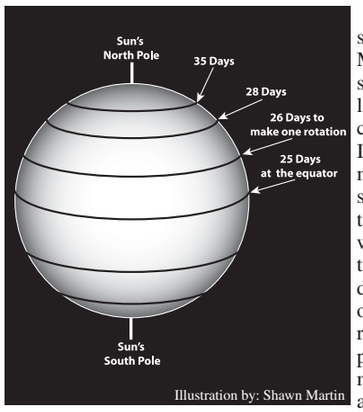


Illustration by: Shawn Martin

Sunspots form on the sun's surface (the photosphere). Many spots only last days but some larger ones may last long enough to make a complete rotation of the sun. In fact this is a way to measure the rate at which the sun rotates on its axis. When this was first investigated it was found that unlike earth that rotates as one unit, the different north-south regions of the sun rotate at different rates. It takes 25 days for a point on the sun's equator to make a complete rotation around the sun but it takes over 35 days in the polar regions.

To explain what a sun spot is and how it is formed we must first look at magnets. The space around a bar magnet where the magnetism can be felt is called the magnetic field. The field is made up of magnetic lines of force that run from the magnet's north pole to its south pole and produce a pattern as shown in the illustration. A strong magnet will have a higher concentration of lines of force than a weaker magnet.

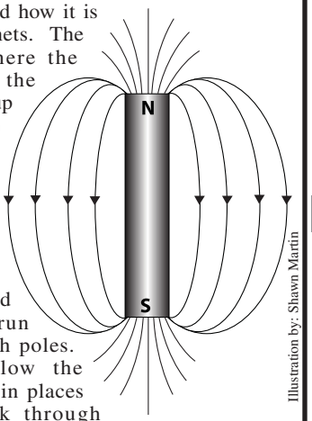


Illustration by: Shawn Martin

The sun also has a magnetic field made up of lines of force that run between the sun's north and south poles. These lines of force run below the photosphere (visible surface) and in places break through the photosphere. Where they break through the surface they stop the circulation of hot gases and therefore appear darker. If viewed by themselves sunspots would be bright but compared with the surrounding sun they are cooler and appear dark.

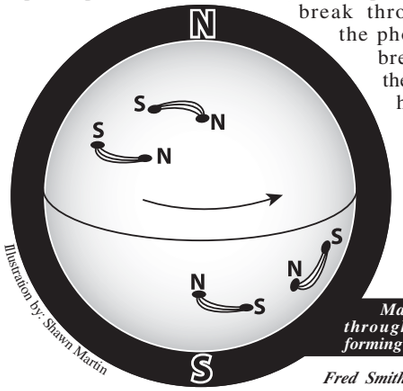


Illustration by: Shawn Martin

Magnetic field lines breaking through the sun's photosphere forming sunspots.

Part 2 next week...

Fred Smith RASC, St. John's Centre

ACTIVITIES

1. Check the weather section in The Telegram for the local sunset and sunrise times.

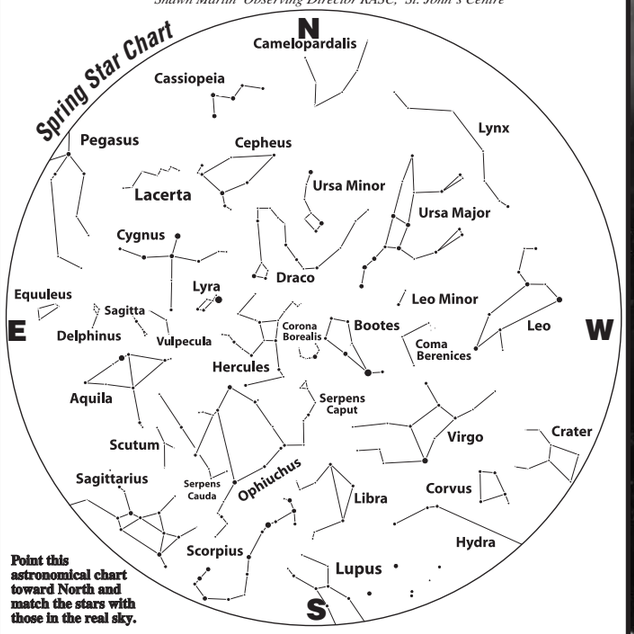
2. Looking through The Telegram can you find any information concerning the effect of the sun on everyday life?

For more activities go to **www.thetelegram.com** and click on Our NIE Program

"What's Up"

June 5 - 12

Shawn Martin Observing Director RASC, St. John's Centre



Planets

Viewable in a pair of Binoculars or small telescope

Mercury - is hidden deep in the glow of sunrise.

Venus - (magnitude –4.5) near the Pisces-Aries border, shines brightly due east during dawn.

Mars - (magnitude +1.2) near the Pisces-Aries border, remains about 5° to Venus's lower left in early dawn all week.

Jupiter - (magnitude –2.3) in Capricornus, shines brightly in the southeast before and during dawn.

Saturn - (magnitude +0.9) in Leo, is now high in the southwest at nightfall.

Uranus - (magnitude 5.9) in Pisces, is midway between Venus and Jupiter before dawn.

Neptune - (magnitude 7.9) in Capricornus, still appears only about 1/2° from Jupiter.

Pluto (dwarf planet) - (14th magnitude) in northwestern Sagittarius, is highest in the south in the early-morning hours.

Moon

Waxing	First Quarter	Full	Last Quarter	Waning	New
June 27	June 29	June 7 July 7	June 15 July 15	June 17	June 22

Total Lunar Eclipse: A total lunar eclipse occurs when the whole moon disappears as it passes through the Earth's umbral shadow.

Umbra: The area of total darkness in the shadow caused by an eclipse

You can contact the Royal Astronomical Society of Canada, St. John's Centre at www.rasc.ca/stjohns/

WARNING!" When using a telescope or binoculars, always be sure NEVER TO LOOK AT THE SUN! This can cause serious and permanent eye damage. To be safe, always make sure the Sun is fully set below the horizon before going outside with your telescope or binoculars."