

Polarity Reversal



From the Everett and Seattle Astronomical Societies, this is IT'S OVER YOUR HEAD for the week beginning August 29th, a look at what's up in the sky over Puget Sound.

Mars, which began the month at magnitude -1.4 , fades to magnitude -0.8 by the end of the month due to the increasing distance between Earth and Mars. Mars will be difficult to observe because of its low altitude. Ceres, the 600-mile wide asteroid, can be seen within the Teapot asterism of Sagittarius. At magnitude 7.8, it is brighter than the Milky Way background. Uranus is an easy binocular object, shining at magnitude 5.7 among the stars of Capricornus, the Sea-Goat. The moon will be full on September 2nd.

Sunspots, the dark, cooler areas on the solar surface, associated with strong magnetic fields, were first identified in 325 B.C. Heinrich Schwabe, a 19th century pharmacist, is credited with the discovery of the solar cycle. He won his first telescope in 1825 in a lottery but soon purchased a more powerful one. His primary interest in astronomy was discovering possible intramercurial planets. He was hoping to discover a planet below Mercury. In 1826 he began recording sunspot positions to eliminate them from his searches. Of course, he never discovered any planets but after many years of observing he noticed a 10-year cycle of the number of visible sunspots on the sun. He continued his observations on a daily basis, as weather permitted, for 42 years. In 1852, the Swiss astronomer, Johann Wolf, assembled all the historical information on sunspots that he could find and found that the average period was 11.11 years.

In 1851, the Scottish astronomer John Lamont published a paper on a discovery he had made that the Earth's magnetic field also seemed to vary with a period of about 10 years. The relationship between the solar cycle and the Earth's magnetic field would take nearly another 100 years to unravel.

In 1896, Olaf Birkeland of Norway came up with the idea that peaks of geomagnetic activity, magnetic storms, were caused by the sun. He believed that these charged particles were drawn in to the Earth's magnetic field near the poles and gave rise to the aurora borealis and aurora australis (the northern and southern lights). At the turn of the century, Edward Maunder, from the Greenwich Observatory, discovered that the greatest geomagnetic storms coincided with large sunspots near the central meridian of the sun and that geomagnetic storms averaged about 27 days, which is the sun's period of rotation. He came to the conclusion that they were due to some streaming effect from localized regions of the Sun, and that this streaming took about a day to reach the earth.

In 1905, George Hale, made the first photographs of a sunspot spectrum. The analysis of these spectrum photographs revealed vortex motions in the hydrogen clouds near sunspots. Hale believed that these motions could be the source of magnetic fields and that the widening of the lines in the sunspot spectra was due to those magnetic fields. This turned out to be an example of the Zeeman effect, the splitting of spectral lines that occurs when light is passed through an intense magnetic field. In the 1930s it was found that flares in the Sun's chromosphere caused interruptions in short wave radio transmissions.

Further studies by Hale led to the discovery that at the end of the eleven-year cycle the solar magnetic fields reverse polarity. Because of this reversal, the solar activity cycle actually spans a 22-year "Hale cycle." The current cycle, cycle 23, is the last half of the current Hale cycle (composed of Cycles 22 and 23) that began in 1986. According to NASA, the current solar cycle peaked in February 2001. The Sun's magnetic north pole, which was in the northern hemisphere, now points south. The solar maximum is the two-to-three year period around the peak when the Sun's activity is most complex and turbulent and the space around the Earth is most disturbed. The increase in sunspots, solar flares, and coronal mass ejections effect communications and weather here on Earth.



As we have learned about the solar cycle in the last several hundred years, it is now understood that sunspot cycles coincide with fluctuations in growth in plants as shown by tree rings and fish stocks in the oceans among other things. Based on geological evidence, it is now accepted that sunspot cycles have occurred for at least 700 million years.

For more on this week's topic, or to find out about local astronomy groups and activities, set your browser to www.ItsOverYourHead.org and you'll be on your way. Our broadcast was written by Jim Ehrmin and engineered by Greg Donohue. Until next time, this is Jim Ehrmin (and _____), wishing you clear skies and good viewing!

References:

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