Mountain Skies

March and April 2001

Three bright planets gleam in the evening skies as spring sweeps across the North Country. Jupiter and Saturn, separated by only 7.3° on January 25th, have been slowly separating as they have moved from the southern to the southwestern sky at dusk. The first of March finds them gathered with the moon and still huddled close to the Pleiades as though for the warmth of a campfire. Below them, but still 25° above the western horizon, Venus outshines all but the moon. Venus has been slowly approaching Jupiter and Saturn while they have lingered in Taurus.

On March 6, Venus will be at its closest to the giants, about 40°, which is the width of both hands spread wide and held at arm's length with the thumbs touching. As though startled by the larger pair, Venus will then seem to freeze against the stars. The three worlds will then march toward the dusk horizon as Earth's motion makes the sun move rapidly against the background stars. Venus will be lost to view by the end of March, but Jupiter and Saturn will be visible into the beginning of May when swift, ellusive Mercury will join them for a brief but lovely conjunction.

In the morning sky, Mars, November's and December's tour guide to Virgo, has moved into Scorpius and 5° north of its namesake, Antares. Look for the pair on the morning of March 15 when the waning crescent moon will join them. Mars is the brighter of the two and is brightening as Earth catches up to it in its orbit. By March 24, Mars is as bright as Vega that is higher than Mars in the southeastern sky. By the end of April, Mars has moved into Sagittarius and is almost as bright as Sirius (in Canis Major, east of Orion, cf. Mountain Skies March/April 1999) which is the brightest star in Earth's sky.

March 20 is the day of the vernal or spring equinox this year. The sun will be directly above Earth's equator at 8:28 am EST, then moves into the northern sky. Venus moves into the morning sky at about this time and passes between Earth and the sun on March 30. Through July, Venus will rise in the sky, but it is moving away from Earth in its orbit, so it will gradually fade, having been brightest in early May. By the end of April, though it rises an hour and a half before the sun, it is only 15° above the horizon at dawn.

SUNSPOTS

Amidst the stars, some of the most spectacular displays may occur only a few hundred kilometers above Earth's surface. The sun is in its active phase, which occurs about every 11 years. Galileo is credited with discovering sunspots, but ancient Chinese records dating from 28 BCE show cycles of dark patches on the face of the sun. Galileo, though, was the first to observe them through a telescope. Rice University hosts a "Galileo Project" web page at <http://es.rice.edu/ES/humsoc/Galileo> which includes a page at <http://es.rice.edu/ES/humsoc/Galileo/Things/g_sunspots.html> describing his sunspot observations, and includes animations of the diagrams over time so that the rotation of the sun becomes apparent.

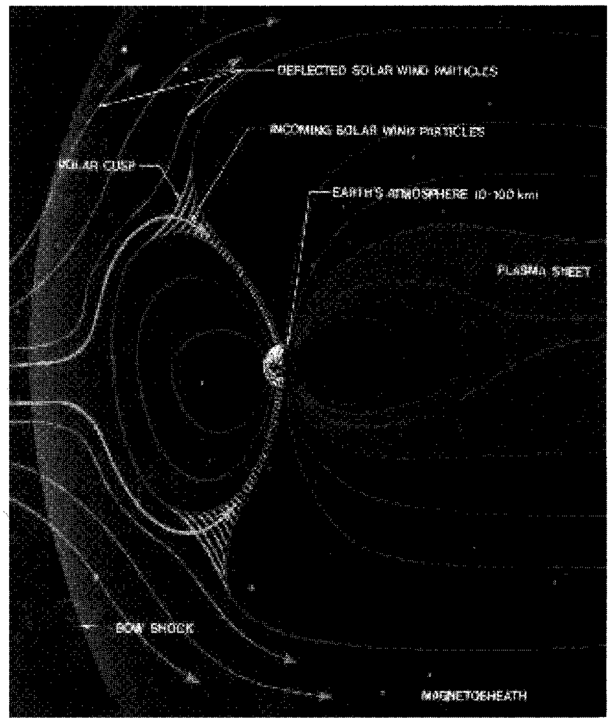

FIGURE 2: SOLAR WIND

This diagram shows the particles of the solar wind impacting Earth's magnetosphere and being deflected by it. Particles that go straight to the poles create the dayside aurora. Nightside aurora are generated by particles that move into eddies in the plasma sheet behind Earth and are then funneled toward the poles from the night side.

Since his discovery of sunspots, many observers have watched the number of them wax and wane across the face of the sun. These observations across the past 400 years have shown a strong 11-year cycle that varies in intensity, and even disappeared for nearly half a century. It has been determined that the sun is slightly warmer during periods of intense sunspot activity, so a lack of sunspots could contribute to the cooling of the climate.

To observe sunspots, Galileo's method of observation is best. Use a pair of binoculars (with one "eye" covered since only one image is desired) or a spotting scope to project the image of the sun onto a piece of paper instead of your retina. Be careful not to leave the binoculars in the sun too long; the focused heat can melt the glue in the eyepiece! See <http://www.exploratorium.edu/sunspots/history4.html> for diagrams of this technique.

Sunspots are a magnetic phenomenon where the magnetic field of the sun bulges out of the surface in a loop rather like a magnetic hernia. Particles from the surface then run up the magnetic field lines, cooling the surface so that it is slightly darker than the surrounding surface. The sun is slightly warmer when there are lots of sunspots and sunspots may be the result of increased internal energy, but it is not yet known.

The spots usually last only a few days, but some of them can linger for up to three months, reappearing two or three times as the sun rotates in 27 days.

AURORAS

An effect of the sunspots that is not controversial is auroral displays in the northern and southern polar skies. These arise when energetic ions from the sun impact on the magnetic field of Earth. The charged particles are steered by the magnetic field to the magnetic poles where they collide with atoms and molecules in the atmosphere. A web site hosted by Rice University provides a movie showing the paths of incoming solar wind particles at <http://rigel.rice.edu/~freeman/dmb/spwea.html>.

The sun is simply a nuclear fusion explosion held together by gravity, and all the energy produced blows off a constant "solar wind." Since the solar wind is always present, low-energy aurora are always occurring, but they are mostly in the infrared region of the spectrum, not detectable by human eyes. For the aurora to become visible, the particles striking the atmosphere must have high energy because our magnetosphere provides a formidable barrier to incoming charged particles. Without it, living things would not last long in the harsh radiation environment of space.

Visible aurora are most often green. Powerful displays, however, are often red.

As well as producing light and heat, the aurora have electrical and magnetic effects. Quebec's power grid was knocked out in 1989 because all the motion of charged particles in the atmosphere creates electrical fields and currents on the ground that happily follow our electrical wires and pipelines just as lightning follows wires and plumbing. This had to be taken into account in the construction of the Alaska oil pipeline since the currents increase corrosion of the pipes.

The best time to look for the aurora is between midnight and 2 a.m. The displays, however, can occur at any time of night. Also, since they are solar and Earth-driven in nature, they are independent of the seasons. It is only the long hours of darkness that make the aurora more likely to be seen in winter. So as you step out to check on Jupiter, Saturn, Orion and the northern bears, keep an eye to the north for faint vertical rays that appear, disappear, pulse and wave as the sun brushes Earth with its long, gossamer tentacles of protons.

Author's name