

The Aurora — A Most Pleasing and Sublime Spectacle

by Moki Kokoris

Although not many of us have had the privilege of watching the shimmering fires sweep across polar skies, we know that there is something quite magical about the aurora. Still fewer of us understand how and why the lights occur. Throughout the ages—their magnificence and grandeur evoking both awe and fear—people have wondered where they come from, what makes them dance and swirl, and what their meaning could be. As mystifying as aurora legends of distant cultures have been since ancient times, the scientific explanation for the lights is no less awe-inspiring and only adds more intrigue to this phenomenon.



So, what are the lights telling us about the mysterious stardust universe in which we live? Researchers around the world have been seeking the answers to this and other questions. They do so with persistence and creativity and even humor. On a building in Poker Flats, Alaska, where the aurora is fervently studied, hangs a sign announcing the purpose of the facility. It states: "Center for the Study of Something which, on the face of it, might seem trivial, but on closer examination takes on Global Significance." The wit of the message aside, let's explore both ends of the spectrum of these geo-

physical dragons that swim through the heavens—the myths and the science.

The aurora is ever present day and night, summer and winter, shaped by our planet's magnetic field, powered by particles from the sun and colored by various gases of the upper atmosphere that create its palette of hues. Seen from outer space, the aurora reveals itself as two broken rings of light that hover over the polar regions of Earth. These haloes which are approximately 4000 kilometers in diameter, cavort at heights ranging between 100 and 1000 kilometers which establishes their lower edge at 10 times the height of a cruising airplane. During the International Geophysical Year in the late 1950s, the Aurora Data Center reported "a wall of light as long as the U.S. is wide, over 100 miles tall with its bottom 60 miles from the ground, moving at 700 miles per hour." The lights appear simultaneously and in near synchrony in both the northern and southern hemispheres; aurora borealis in the Arctic, aurora australis over Antarctica, their performances mainly for the enjoyment of polar bears and penguins.

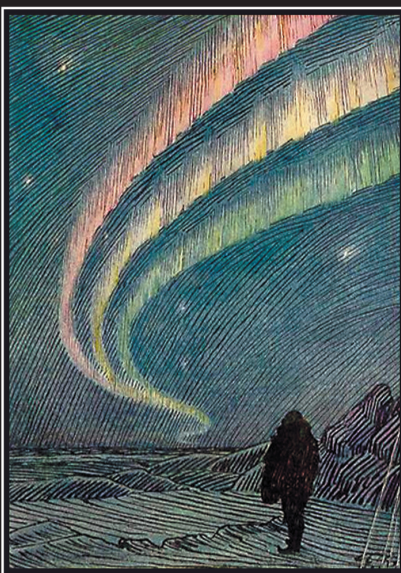
Carl Sagan characterized them as "the most influential error in the history of astronomy, contributing to a detour from reality." Scientists, however, were not the

first to notice the aurora. In addition to early explorers such as Nansen and Cook, ancient people gazed up at the night skies and saw in them ceremonial journeys of angels, departed ancestors, supernatural creatures and children yet unborn. Others saw the lights as harbingers of evil or divine warnings that foretold calamity and bloodshed. Some cultures believed the aurora could be invoked as a healing spirit for their shamans.

Because the aurora can be both wondrous and alien, through countless millennia, our ancestors created their own interpretations of its meaning. The Inuit of Alaska described the lights as the dancing souls of their favorite animals: caribou, seals, salmon and beluga whales. The tribes of Finnmark believed they were "fire foxes" that lit up the sky with sparks that flew from their glistening coats. To the Scots and Swedes they were merry dancers while to the people of the Hebrides they appeared to be shining fairies. The Finns used to say "the women of the North are hovering in the air", and the Saamis of Sweden thought of them as "girls running around the fireplace dragging their pants."

The Chuvash people of central Asia identified the lights as Suratan-tura (birth-giving heaven), the diety called upon to ease women through labor pains. Lakota Sioux thought the lights might be spirits of future generations waiting to be born, and many Japanese honeymooners to this day visit northern Canada believing that children conceived under the spell of the lights will be more fortunate. Fisherman of Scandinavia still look on the lights as an omen of abundance, interpreting them as sunshine reflecting off large schools of herring in the northern seas.

To the many circumpolar indigenous peoples, be it the Inuit of Canada and Greenland, the Saamis of Scandinavia and Russia or the other ethnic groups in Siberia, the northern lights are the souls of those who died through loss of blood, whether in childbirth, by suicide or through murder. Having risen to the frozen snowfields in the night sky, these spirits dash around playing a macabre game of soccer, sometimes using a wal-



Aurora as depicted by Fridtjof Nansen



IMAGE: BERNARD SANDER. COURTESY OF PAAL BREKKE

rus skull as the ball.

In the Middle Ages, a brilliant aurora caused total panic among Europeans. It is said that people fainted and went mad at the sight. Even in the sixteenth century, country residents were so

alarmed by these signs of divine displeasure that they poured out of the villages to make penance at major cathedrals.

Stranger still, and left for each of us to contemplate, in January, 1938, the heavens over western Europe were "filled with a strange and terrible crimson fire" that to many presaged the Nazi invasion of Austria three months afterwards. Four years later, violent auroral displays flared over the United States for three consecutive nights, as far south as Cleveland, Ohio, an awful omen, it was said, of Japan's assault on Pearl Harbor.

Such is the supernatural power of the aurora, capable of inspiring delight and dread as well as some of the most fantastic interpretations that take ordinary people to the farthest edges of their beliefs and sanity.

The science behind the aurora is understandably very complex. In very simplified terms, auroral light is produced by a high-vacuum electrical discharge powered by interactions between the Sun and Earth. It is specifically sunspot activity in the form of solar wind (the stream of particles and gas) as well as solar flare

energy releases as they come in contact with Earth's magnetic field that paint the shimmering bands, pulsing ribbons or curtains of color across the sky.

The colors of the aurora result from the solar flare or wind's charged particles coming in contact with various gases at different levels in the Earth's atmosphere. Light yellow-green is most common resulting from oxygen contact at about 60 miles above the Earth. Blue or violet colors appear when the particles come in contact with nitrogen in the atmosphere, while high-altitude oxygen atoms (at about 200 miles) produce rare, all-red auroras.

The number of sunspots (a sign of solar activity) varies according to an eleven-year cycle and strong auroras can sometimes be seen in the continental U.S., particularly in the north during sunspot maximum years (the last one being 2000/2001). Although the aurora is always present, it is not visible during the day nor during the long twilights of summer. Its intensity also varies from night to night, the more vivid displays recurring at 27-day intervals becoming most dramatic around the spring and fall equinoxes. In general, auroras are most spectacular in the hours around midnight.

Active auroras cause magnetic disturbances, namely fluctuations in the Earth's magnetic field that can be felt by sensitive instruments. Even though our magnetosphere protects us from direct effects of the solar wind, auroras can nevertheless seriously disrupt radio communications, radio navigation, some defense-related radar systems, and power transmission lines. Strong magnetic disturbances also create problems with industrial installations in the Arctic. The fluctuat-

ing magnetic fields cause electrical currents to flow through pipes, transmission wires and conductors which leads to corrosion and equipment failure. The magnetic storm in March of 1989 knocked out Hydro Quebec's entire power grid, leaving six million people in darkness for nine hours.

Lastly, but perhaps most significantly, the force of magnetic storms may also affect us much more directly. Some scientists believe that living cells are acutely sensitive to the Earth's magnetic field as well and that even delicate fluctuations may affect such basic biological functions

as metabolic rates, immune response, orientation systems, and sleep/wake cycles. It also appears possible that there are psychopathological effects on human behavior in general as some studies have indicated.

In the 1970s, researchers in the U.S.S.R. published the results of a study in which they found that people are

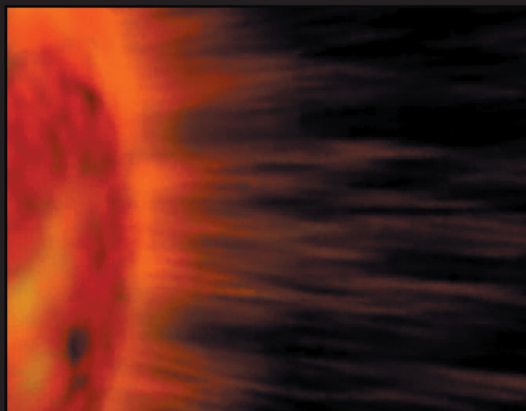
more likely to have heart attacks—especially fatal ones—under conditions that also produce vigorous auroras. If these correlations are true, it would prove that the living world is indeed "wired" to the auroral circuits and would demonstrate the dynamic link between ourselves and the cosmos beyond.

So, the next time you look toward the Sun, ponder how profound its existence really is. The aurora—whether it appears to us as an enigmatic ancestral dance or a most beautiful night sky painting or a beguiling mystery—it is there to remind us of the Sun's power and significance and to perhaps also stimulate our imagination.

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