LIGHT UP THE NIGHT

Why 2013 will be the best year in a long time for viewing Montana's spectacular aurora borealis BY SAMUEL VEICH

OTHERWORLDY DISPLAY
Northern lights pulse and sway over Lake McDonald in Glacier National Park. The colorful arcs, bands, and wisps are made by charged particles from the sun bombarding Earth's atmosphere.
JOHN ASHLEY

In the middle of a winter night when I was nine years old, my mother woke me and my sister and hurried us outside. She pointed to the Whitefish Range north of our home in the Flathead Valley. We watched in wonder as curtains of pale green and white light danced in the night sky over the mountain peaks. Ever since that spellbinding sight nearly four decades ago, I have been enthralled by the northern lights.

These next two years will be ideal for aurora fans, as well as those seeing the northern lights for the first time. Scientists predict these glowing, horizon-wide arcs, bands, and wisps will occur more regularly and frequently in 2013 and 2014 than at any time in the past decade.

"FIRE" IN THE SKY

Throughout the world, people have long been fascinated by the northern lights—known in the Northern Hemisphere as aurora borealis (named for the Roman goddess of the dawn, Aurora, and the Greek north wind god, Boreas) and aurora australis or southern lights in the Southern Hemisphere.

The night sky phenomenon inspired many North American aboriginal legends. In one, the Algonquin god Nanabozho, who created the universe, traveled north after completing Earth and built large fires that occasionally illuminated the sky and sent a sign of celestial goodwill. In some Eskimo cultures, the lights are spirits of their dead playing ball with a walrus skull; in others, auroras are spirits of dead walruses playing with a human skull. Some Inuit tribes believe the lights are the dancing souls of ancestors, while the Point Barrow Inuit people

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AURORAL GOBLIN **A monstrous curtain of light takes the shape of a giant creature advancing over the horizon. So eerie and seemingly inexplicable are the northern lights that people throughout history have considered them to be manifestations of the spiritual world.**

ANDY LONG

carry knives to protect themselves from auroras, which they believe are evil spirits.

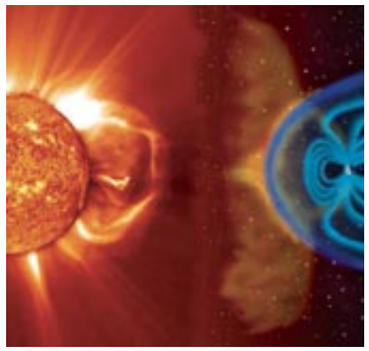
Elsewhere in the world, auroras have been perceived as a monstrous fox, the fiery breath of dragons, or a sign of weather to come. Norse mythology from the 13th century considered auroras to be guiding lights leading to the heavenly hall of Valhalla. In AD 37, the Roman emperor Tiberius, believing the port city of Ostia was burning, sent his army north to help the citizens. What he actually saw was a rare brilliant red aurora.

In modern times, many UFO "sightings" are actually the northern lights. That's not surprising. Many people still don't know why the night sky occasionally pulses with otherworldly green, purple, and white light.

PARTICLES HITTING PARTICLES

Auroras are indeed created by visitors from space—not aliens, however, but electrically charged particles released from the sun's atmosphere that collide with gaseous particles in Earth's atmosphere.

The sun constantly throws off electrons and protons produced by its intensely hot surface. Earth's magnetosphere—atmospheric shields created by the planet's magnetic fields—usually protects us from these streams of charged particles known as solar winds. But when the sun produces large coronal mass eruptions (CMEs), solar wind speeds can increase to nearly 1 million



COLORFUL CLASH **Northern lights occur when collisions between electrically charged particles from the sun (left) enter Earth's atmosphere (right). "Excited" electrons concentrated above the magnetic poles of the Northern and Southern Hemispheres then emit visible light.**

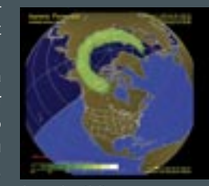
BROAD PALETTE **The diverse colors of auroras come from the different atmospheric gases being disrupted. Nitrogen atoms produce blues and deep purples, while oxygen creates greens and light reds. Various combinations of the two gases can make the sky turn violet or yellow. A rare pale blue hue sometimes occurs just before dawn or right after sunset.**

CLOCKWISE FROM TOP LEFT: NORMAN JACOBSON; SAMUEL VEICH; SWPC.NOAA.GOV; SAMUEL VEICH; STEVE MITCHELL; NASA.GOV

SEE THE LIGHTS

Even though 2013 and 2014 will be great years for seeing auroras, the lights don't appear every night—and sometimes not for weeks or even months. That's why you need to know about the K-index.

The K-index (Kp) is a measurement of the relative fluctuation in Earth's geomagnetic fields. The higher the K-index (on a scale of 0 to 9), the better your chances of viewing the northern lights and seeing them at lower latitudes.



Auroral activity

For regions of Montana south of I-90, a Kp of 7 or higher is generally required to see the northern lights. As you approach the Canadian border, auroras are visible at Kp 6 or even Kp 5. In other words, there has to be much more geomagnetic activity in the atmosphere for someone in Billings to see the northern lights than for someone in Columbia Falls.

Locate the current K-index in the left column of the informative website spaceweather.com. There you will also find the National Oceanic and Atmospheric Administration's (NOAA's) forecast for solar geomagnetic storms. The greater the probability of a storm, the greater the odds of spectacular aurora displays. (It usually takes two or three days for a large storm to show up as auroras here on Earth.)

If you don't want to check for solar activity each day, you can buy a cell phone app (http://spaceweathertext.com/) that tells you when the Kp for your area reaches a certain level (which you specify).

Another helpful site is NOAA's Space Weather Now Page (swpc.noaa.gov/SWN/index.html), which shows geomagnetic storm activity. The storms are rated on a scale of increasing intensity from G1 to G5. Look for storms of G2 or greater for the best northern lights viewing potential in Montana.

Both websites also include a map displaying the current "auroral oval," the estimated area of northern lights distribution.

OTHER VIEWING TIPS:

- Seek areas away from urban light pollution. If the aurora is strong enough, you can see it from towns and suburbs, but the display will be much brighter if you move at least a dozen or so miles away from city lights.
- Auroras can show up any time of year, but the longer nights of late fall, winter, and early spring offer more viewing opportunities. Though you can see auroras any time of the night, peak times are from an hour before midnight to an hour after.
- Cloudless nights are best.
- You may need to wait 15 minutes or more before your eyes adapt to the dark, allowing you to see faint auroras.
- The days of a new moon and three or four days before and after (waning and waxing) allow for better viewing. Auroras may be seen during a full moon, but the lights are washed out by the lunar brightness.

miles per hour. During these solar storms, which increase then decrease in frequency over 11-year cycles, the sun's high-energy particles smash into Earth's magnetosphere, which funnels them toward the two magnetic poles. The disruption, 50 to 400 miles above Earth's surface, causes electrons of nitrogen and oxygen to become "excited," or transition to a higher energy state. Similar to what happens in a neon sign, the electrons then "de-excite" and return to their original condition, emitting a tiny visible light.

That chemical process, multiplied trillions and trillions of times, produces the northern lights.

The colors of auroras depend on which atmospheric gas is being disrupted. Excited oxygen atoms create green and light red hues, while nitrogen atoms produce blues and deep purples. Tinges of violet and yellow occasionally appear, depending on the proportions of oxygen and nitrogen. The waving curtain-like displays I first saw as a boy are produced by light hitting undulating magnetic field lines.

Auroras may occur at any time. But the greatest number takes place within a year or two of the "solar maximum"—the year during the solar cycle in which the occurrence of sun spots (giant magnetic islands on the sun that produce CMEs)—is at its greatest frequency.

Because scientists predict 2013 to be the solar maximum of this current cycle, this year and 2014 will provide many excellent opportunities to see the beautiful dance of the night sky in Montana.

STEADY SHOT **A photographer adjusts his camera and tripod before using a shutter release cord to prevent camera shake that blurs photos. Note in this photo how including a person and background scenery enhances the northern lights' effect.**

SHOOT THE LIGHTS

When photographing auroras, you'll need a tripod to keep the image from blurring during the long exposure time required. A cable or electronic shutter release is also valuable.

For sharper aurora images, set your digital camera to a faster ISO (1000 or greater). This will give you less "smearing" in your images, though it also results in less color saturation and increased graininess. While producing images with less sharpness, a lower ISO setting (100 or 200) greatly improves color saturation because the longer exposure allows the camera to pick up more auroral colors and hues than what you see with your eyes.

Exposure times vary with auroral intensity. For best results, experiment with exposures starting at around 20 to 30 seconds.

OTHER PHOTOGRAPHY TIPS:

- The best photos come from digital SLR cameras that adjust for the "noise" (pixilation) that comes from the long exposure times required for night sky photography.
- Wide-angle lenses work best.
- Try to include trees, hills, or skyline in your photograph (see examples in this article). Background scenery helps provide visual context for the northern lights' massive scale, and it connects the colorful display to the dark landscape below.

LEFT: ROBERT BERDAN; OPPOSITE PAGE: ANDY LONG

WAVING GOODBYE **Undulating curtain-like movements are produced by light hitting magnetic field lines. Your best chance to see these and other auroral effects will be early this spring and all of next winter.**