Chasing the Elusive Aurora

Aurora and Church

Tatiana Slepukhin-Zamachnaia
Toronto, Canada

People have been fascinated by the dancing lights of the *Aurora Borealis* since the beginning of time. *Northern Lights* are on *the must see before I die list* of many. But it's a mistake to think that the only way to photograph the Aurora is to pay for an expensive trip to Alaska. Fortunately, Aurora chasing does not necessarily have to be overly expensive or complicated. You can enjoy the Aurora displays throughout US and Canada. While this article contains technical information for taking lovely photographs of the Aurora, it will also explain the basics physics that happen behind the Aurora curtains. May you never lose the sense of wonder looking at the dancing lights in the night sky!

Shining

Northern Lights are caused by geomagnetic storms, which disturb the Earth's magnetic field. The storms are caused by solar activity: to be exact—by the solar spots that form and burst on the sun surface. When they burst, the matter is carried away from the sun; and if the earth happens to be in its path, the electrons that are brought with the solar wind collide in the Earth's ionosphere, and cause electromagnetic radiation. The greenish color of the Aurora is the result of excited oxygen molecules. Pink light is caused by nitrogen.

The sun has its own cycle, which is 11 years and is marked by solar maximum and solar minimum. During solar minimum the sun is relatively dormant and sunspots are a rare occurrence. Around solar maximum there could be hundreds of spots on the surface of the sun and this time is marked by increased geomagnetic activity. The next solar maximum is in 2011 (Solar Cycle 24), which means there will be more geomagnetic

Here is a sample of the forecast from the National Weather Service:

UTC Date	Radio Flux Largest 10.7 cm	A Index	Kp Index
2008 Mar 24	70	5	2
2008 Mar 25	70	10	3
2008 Mar 26	70	20	5
2008 Mar 27	70	25	5
2008 Mar 28	70	20	5
2008 Mar 29	70	8	3

storms happening as we approach the peak. The sun activity will start diminishing a couple of years after the peak.

Geomagnetic storms are quite predictable and there are various forecasts available online. A 27-day forecast provided by the National Weather Service is quite accurate. In fact, you'd be surprised to learn that the space weather forecast might seem more accurate than the forecast for earth weather.

You could also subscribe to the Aurora alerts with the Space Weather site and receive email notifications and/or a phone call just before the magnetic storm hits Mid-Latitudes. Mid-Latitudes are the areas of North America located within the geographical latitude of 60-30 N.

The most important value in the table above is the *Largest Kp Index*, which indicates the intensity of a magnetic storm for a 3-hour period. The higher the Kp value - the higher the intensity of a geomagnetic storm. A higher Kp value also means that a geographical area where Aurora is visible will spread further south into higher Kp zones.

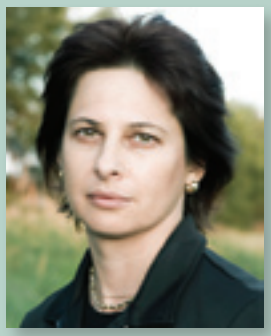
The Earth is divided into Kp zones with the lowest starting North at the Magnetic Pole for the Northern Hemisphere. Chicago, Montana, Seattle, Ottawa, Montreal, Toronto, and most of New England are located in the 5 Kp zone. For instance, if the Kp Index of the magnetic storm is 5, then the Aurora should be visible in that zone.

Using web-based calculators, you can determine your Kp zone and magnetic latitude based on your geographical latitude and longitude. Once you know your Kp zone, it is very easy to know if the Aurora is happening in your area—the Kp Index in the National Weather Service forecast should be equal or greater than the value of your Kp zone. Note that the date of the activity is given as a Coordinated Universal Time (UTC) value, so you'd have to adjust it to your local time.

Photos © Tatiana Slepukhin-Zamachnaia

Light painted Aurorascape

Aurora and Badlands



Tatiana Slepukhin-Zamachnaia

www.tatianaphoto.com

You can also check space weather sites that post sun activity and monitor sun spots. Solar radiation would normally reach the earth within a few days and is a subject of the solar wind speed.

Earth Weather, Lunar Cycles and Other Considerations

A favorable space weather forecast doesn't necessarily coincide with good weather on Earth. This is a very frustrating aspect of Aurora chasing. You can wait for the geomagnetic storm for months, but when it finally comes, there is no guarantee that the sky will be clear. Check satellite images in advance and see if you can outrun the clouds. Sometimes a clear sky is just within a 2-3 hour drive and it's worth pursuing. A geomagnetic storm usually lasts 24-48 hours and longer so it is possible to catch the Auroras the next day if the Earth weather doesn't cooperate. Pay attention to Moon phases. If the Moon is full or nearly full, light pollution from it will interfere with the Aurora display. The moon would also make a dramatic difference in affecting your ISO settings. Moonless nights are your friends. There is more activity around equinoxes.

If you are planning an Aurora Chasing trip to the low latitudes, you should take into consideration the time of the year. During spring and summer months, low latitudes get *white nights*, which would normally prevent you from seeing the Aurora. Although this author did witness magnificent displays during white nights, the Auroras of such intensity don't happen often.

While the Aurora can be seen any time of night, it usually starts appearing around midnight. Look north for the low arc before midnight. The arc is normally shimmering silver, and renders greenish on your camera sensor. Sometimes it is barely visible, but if it's large, it is normally an indication that the display will be strong.

Your Ideal Observing Spot

Your perfect spot should have a clear horizon in the following directions: NW, N, and NE. It should be far enough away from any source of light pollution, which can interfere with the Aurora display.

While the Aurora on its own makes a superb subject, try to find an interesting landscape that will compliment it. A large tree in a foreground, a silhouette of a small mountain, or an interesting old building will do. Shooting on the shore of a big body of water can add to suspense and allow one to witness and capture the Aurora's reflection. Make sure your perfect observation spot is far from well-traveled roads. The headlights of an oncoming car can blind you and your camera.

If you are new to Aurora chasing or night photography, try to find an observation spot in advance. It can get pretty dangerous at night. You can find yourself close to the edge of a cliff or in somebody's backyard in the dark. Even though it is hard to stay cool while chasing dancing lights, use common sense. If you intend to outrun the clouds, study road maps and satellite images in advance and make sure you can monitor weather while in the vehicle. Dress appropriately—temperature drops at night can be quite dramatic. Pay special attention to wild life as you will be most likely be out in the country.

Elusive Aurora

Equipment and Process

You will need an SLR camera (digital or film) equipped with a shutter release and mounted on a sturdy tripod. It is better to use an ultra wide-angle lens to get as much action as possible. Fast lenses are preferable as they indeed make a huge difference when shooting the Aurora. Strive to invest in a good 2.8F lens, or even 1.4 or 1.2 if you can afford it.

Set lens autofocus to Manual and focus to infinity prior to shooting. It is actually helpful to check all settings in advance as the Aurora is unpredictable and you might not have enough time to get ready if she appears for a brief period of time. Make sure to take a Polarizer, a UV, or any other filter off. While temperature correction filters are very useful, they require an exposure increase, which is not desirable as the objective is to reduce exposure time.

White balance should be set to tungsten (3200K) or, if you can control temperature—to some value between 3600K and 4000K. You can always adjust temperature using your camera's software, but it is always better to start with a colder temperature. Make sure you shoot in RAW to be able to control that setting.

ISO settings vary depending on the brightness of the Aurora display and the presence of the moon and its phase. ISO settings should normally be anywhere between 200 and 400 providing you have a fast enough lens. Exposures for the Aurora are quite tricky because your ultimate goal is to capture the Aurora undulation. If your exposure is too long, you will only capture a smooth band of coloration in the sky.

During a display of an average intensity, your exposures ideally shouldn't be longer than 25 seconds. Anything longer than 25 seconds tends to flatten undulation. That's when the fast lens comes to your aid. Make sure that you never shoot on the lowest F-stop settings. For instance, if your lens is 2.8F, set the F-stop to 5.6F. It is a matter of practice to strike the proper balance between having acceptable Depth of Field and capturing beautiful undulation. Your pictures should render slightly over-exposed on a normally adjusted camera's LCD screen.

Photographing the Aurora is a fairly easy process and this article provides enough information to get you started. Visit Web sites from the list provided below—you will find a plethora of information on the Aurora (Borealis and Australis).

National Weather Service:
http://www.swpc.noaa.gov
Government of Canada Space Weather Site:
http://www.spaceweather.gc.ca/
Space Weather Site:
http://www.spaceweather.com/
The Auroral KP Index:
http://sprg.ssl.berkeley.edu/htbin/forecast/TheAuroralKp.pl

Warning: Aurora chasing is highly addictive!

Tatiana Slepukhin-Zamachnaia is a mentor on the New Member Web site/mentors at http://psa-newmember.org/firstyearhappenings.html