Canadian Space Agency | Agence spatiale canadienne

Aurora Borealis: Northern Lights

Canada and the Northern Lights

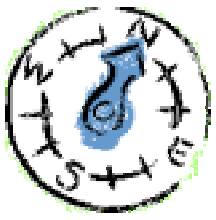
Why is the Aurora so important?

The same vast, northern geography that has inspired and challenged the Canadian pioneering spirit for centuries has also given birth to Canada, a nation of scientific explorers in space. Spread across millions of square kilometres from sea to sea, Canadians turn skyward to communicate with one another, ultimately creating a country bound together by space technology.

Canadians have observed some pretty spectacular events in the night-time sky. As you will soon find out, Canada's proximity to the northern magnetic pole is the main reason we see a predominantly Canadian random act of nature called the Aurora Borealis, or Northern Lights.

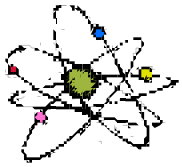
What is the Aurora?

The Aurora is a phenomenon that takes place in the upper atmosphere. The Earth's magnetic field acts like a huge magnet, and is responsible for attracting electrically charged particles to the north and south region of the globe. This is why a compass needle always points north! Did you know that the Aurora is also made up of electrically charged particles? The Earth's magnetic field attracts the particles found in the Aurora. When these particles hit the upper atmosphere, they cause a spectacular spectrum of colours to shower the night-time sky.



Canada

At the southern magnetic pole the Aurora is called Aurora Australis while at the northern magnetic pole, located in Canada, it is called Aurora Borealis, or Northern Lights.



Where do these particles come from?

The solar wind is a super hot stream of plasma (made of negative electrons and positive protons) emanating from the sun into the galaxy. Sometimes a flare of plasma erupts from the sun and heads towards Earth. When this gust of wind reaches the upper atmosphere, what do you think happens? Remember the magnetic field mentioned earlier? This force attracts the plasma particles and directs them to the northern or southern poles of the Earth where they produce the Aurora.

The Northern Lights are more than just Pretty Lights in the Sky: A Bit of Canadian History

Canadian scientists have been attempting to unravel the mysteries of the Northern Lights for over 160 years! It all started with Sir Edward Sabine's establishment of the first magnetic observatory at the University of Toronto in 1839.

But why would these scientists want to study the upper atmosphere in the first place? It just so happens that fluctuations in the Northern Lights are believed to have caused widespread power outages on Earth, as well as disrupting orbiting satellites. Therefore, these Canadian scientists research the upper atmosphere, where the Aurora takes place, to help us better understand the effects of variations in the Earth's magnetic field.

Can you see the Big Dipper through the Northern Lights?

Observation of the Earth's upper atmosphere can help us understand similar events happening throughout the rest of the universe since related phenomena have been observed on other planets.

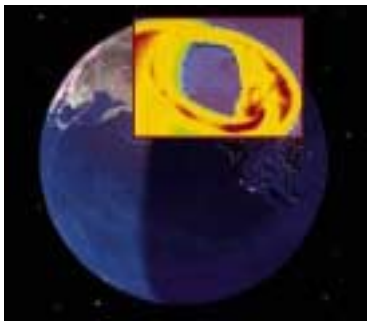
What makes the beautiful colours of the Northern Lights?

The colours of the aurora are either a combination of red and green light, or red and blue light. It is the nitrogen in the atmosphere that makes the aurora red and blue and the oxygen that causes the red and green colours to appear.

Electrons colliding with oxygen atoms in the atmosphere produce a very bright green light. In the lower atmosphere, there are more nitrogen molecules. Therefore, the lower edge of the Aurora is mostly red. This burst of light is what gives the viewer the impression that the sky is on fire.

The Aurora is always there

The Aurora is really an oval that covers the north and south magnetic poles. Here in the north, the auroral oval cuts across most of northern Canada and Alaska. The aurora begins about 96 kilometres above the Earth and ends at about 386 km above the Earth. That's really high!



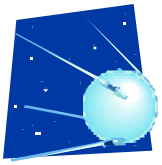
This image features the Northern Lights oval with a magnetic space storm over Northern Canada (the swirl). The CSA's Ultra-Violet Auroral Imager photographed the inset on March 1, 1997.

The size and shape of the auroral oval changes depending on the speed of the solar wind. Similarly, keeping your hat on your head all depends on the speed of a gust of wind.

When activity on the sun is reduced and the solar wind is calm, the auroral oval is small and thin. When the sun is more active, it sends more particles towards the Earth. If there are more particles in the atmosphere, it can get really crowded - just like the school halls do when the last bell rings! So, the magnetic field attracts all those particles to the north and south poles making the oval wider, stretching it towards the equator. Chances of viewing the Northern Lights in Southern Canada and even the United States is increased.

The Northern Lights and Canada Today

The Aurora Borealis is a hard to miss phenomenon occurring in the upper atmosphere. Even before the Soviet Union launched its first Sputnik in the 1950's, Canadian researchers were looking towards space for communication solutions.



At that time, the most effective way of communicating across Canada was by radio signals. These short wave radio signals were reflected into the upper atmosphere and transmitted across the nation. But these transmissions were often interrupted by the Aurora Borealis.

Canadian scientists seized the opportunity to study the underlying nature of the Northern Lights by trying to improve radio communications. It was these radio scientists who proposed that the first Alouette satellite be built to study the upper atmosphere. This was the breakthrough Canada needed to enter the space age.

The Alouette program is the cornerstone on which many of Canada's later achievements, such as the Anik series of communications satellites, are based.

Canadians, inspired by the uniqueness of their environment, have learned to develop the potential of spacecraft in areas specifically related to Canadian needs and their surroundings, consequently becoming world leaders in the fields of satellite communications, earth observations and space science.