

Auroras



(Photograph by Jan Curtis; taken at Fairbanks, Alaska)

Prepared by: a good Ph-223 student

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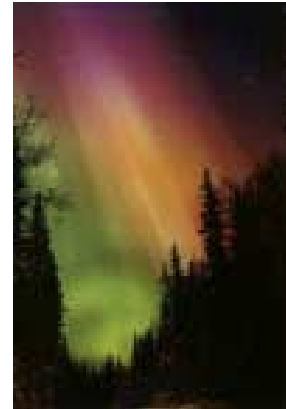
Professor Andres La Rosa

What are auroras?

Auroras are ghostly curtains that appear in the upper and southern region of the Earth's poles.

Auroras that appears in the North Pole are called "aurora borealis" also refers to as northern lights.

Auroras that appears in the South Pole are called "aurora australis" or refers to as southern lights. When

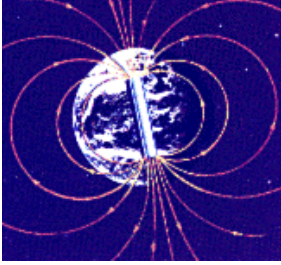
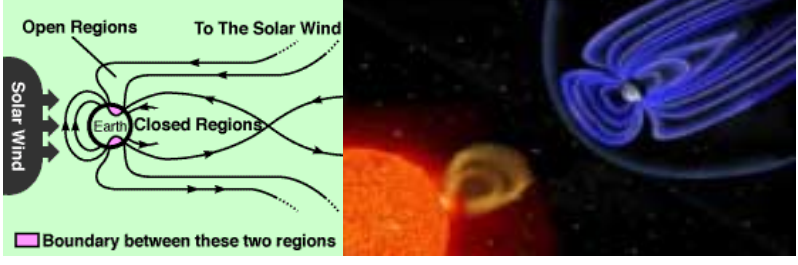


this phenomenon appears it is followed by disturbances to the earth's magnetism and interferences with radio, telephone, and telegraph transmission. Auroras needs several sources in order for them to appear they require the sun, solar winds, the earth's magnetic field, and the earth's atmosphere. The way auroras functions are like neon signs, they are created by a high-vacuum electrical discharge. Where protons and electrons collide with the Earth's atmosphere which contains gases (atoms and molecules); therefore, the collision between the charged particles and molecules emits colored lights. In our atmosphere it contains different gases; therefore, there have never been two auroras that look alike. Each time a phenomenon occurs they are always different; different in color, and in shape.

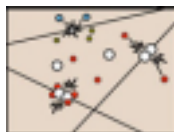


Why does auroras need several types of sources?

The basic elements that create an aurora are the sun, solar winds, earth's magnetic field, and the earth's atmosphere. Each has a role of their own in order for auroras to exist. The auroras need the sun, because the sun is what fuels the auroras. The fuel that feeds the auroras mostly comes from sunspots. Where sunspots frequently emits excess charged particles (the protons and electrons) out in space spreading in a constant stream. These streams of charged particles are known as solar winds that travel at about 500 km per second. The solar winds have a capability to change the earth's magnetic field lines, creating a space called a magnetosphere. While at the same moment the earth's strongest magnetic area (the North and South pole) attracts the charged particles toward the earth's most northern and southern region into the atmosphere.

	
<p>If there were no solar wind, the Earth's magnetic field would be like that of a bar magnet.</p>	<p>The effect of the solar wind is to divide the Earth's magnetic lines into two zones.</p>





But the earth has a terrestrial atmosphere which protects us from particles that exists out in space. This terrestrial atmosphere is highly ionized (formation of electrically charge atoms and molecules); which forms an electrically conductive plasma.



Where "Plasma" is a state in which some negatively charged electrons move freely, separated from the attractive force of positively charged atomic nuclei. When the solar wind hits the terrestrial atmosphere, it generates electrical energy. This energy is produced when the magnetic field of the solar wind's charged particles cut across the electrically conductive atmosphere. The charged particles travel along the field lines with so much energy that they penetrate the terrestrial atmosphere, where they hit gas atoms and molecules. These collisions give off energy that we see as colored light; thus, the aurora is formed.

Why does auroras have different colors?

In our atmosphere exists different gases, but it is mostly made up of oxygen and nitrogen. When charged particles hit the atmosphere containing particles it creates an illumination. These particles are mostly made up of gases especially oxygen and nitrogen. Each gas has a color of its own, for instance oxygen produces a green or red color when it collides with a charged particle. Nitrogen produces a color from pink to red when it comes in contact with a charged particle. Since our atmosphere is made up mostly of oxygen and nitrogen; therefore, the general colors for auroras are green, red, or pink. If an aurora displays a different color it is considered either rare or that gases other than oxygen and nitrogen is present when the phenomenon occur. Out in the real world there are people who study the color that is displayed by auroras. This field of study, known as spectroscopy, where an analysis of the light of an aurora takes place. By analyzing the light of an aurora we can learn what atoms and molecules are dominant in the upper atmosphere where the aurora forms. Not only gases produce colors, but also elements. Such as strontium, calcium, cesium, and barium produces color of their own.

			
Strontium (Sr)	Calcium (Ca)	Cesium (Cs)	Barium (Ba)

In conclusion, auroras helped us understand more of our magnetic field, solar winds, and our atmosphere. They are not just spectacular phenomenon for spectators to enjoy, but rather they gave us a better understanding of our magnetic field. What we learn in a physics sense is the Earth's magnetic field, the would have looked like a magnet bar, but due to solar winds its magnetic field is deformed. What we learn in an astronomical sense auroras helped us see and understand solar winds and where they come from. In the sense of chemistry we have learned an idea that each gas has their own colors when they are heated or collided by charged particles. Which helps us identify them in the aurora display.

Why did I choose to do this project and what have I learn?

Sometime ago my cousin read an article on astronomy and he came across on auroras. He asked me what are auroras and how do they work? I didn't know much about it so I didn't really give him a definite answer. So this subject has been stayed in my mind for a while. When we got into magnetism I've notice the front cover chapter 29 on magnetic fields triggered me to learn more on the subject of auroras. That is why I choose to do this project on Auroras, because to me it will always be a mysterious phenomenon even though it is not mystery anymore. I've never seen an aurora but from looking in pictures and magazine it just looks phenomenal. Looks like now I can give a definite answer to my cousin on auroras.

This project got me involved in different aspects of science. The aspects of science that I've learned during this project were physics, astronomy, and chemistry. In the physics aspect I've learned that the earth's magnetic field lines does not look like the magnetic field of a magnet bar. Instead of having the magnetic field lines like a magnet bar it the earth's magnetic field looks like a comet shape due to the effect of the solar winds, this new magnetic field is known as the magnetosphere. Also the earth's magnetic field is strong enough to attract outer space magnetic particles. The solar wind is a link to which I've learn a little bit about the astronomy. When the solar wind intertwines with earth's atmosphere the magnetic particles loses their energy giving off a color due to the interactions with gases. These interactions with gases gave me a glimpse on the aspects of chemistry.

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