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The Engineering Explorations Newsletter

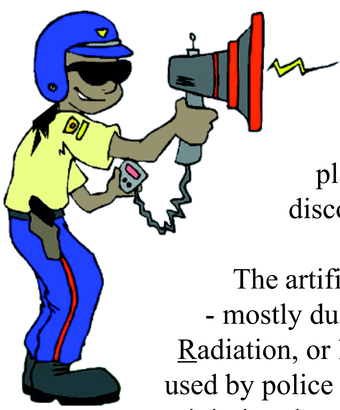
Harmonics

Engineered Light

In the beginning nothing existed — no earth, no sky, no sun, no moon, only darkness was everywhere. Suddenly from the darkness emerged a thin disc, one side yellow and the other side white, appearing suspended in mid-air. Within the disc sat a small bearded man, Creator, the One Who Lives Above. As if waking from a long nap, he rubbed his eyes and face with both hands. When he looked into the endless darkness, light appeared above. He looked down and it became a sea of light. To the east, he created yellow streaks of dawn. To the west, tints of many colours appeared everywhere.

- Apache Creation Story
http://www.dreamscape.com/morgana/miranda.htm

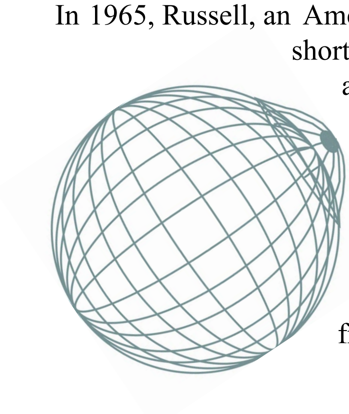
All peoples, everywhere on Earth, have stories about how light came to the world. In some stories, light is one of the first things made by the Creator; in others, great beings or creatures like Raven or Coyote bring light to the world; and in still others, people are brought from the underworld into the lightThe focus on light is hardly surprising, the sun provides not only light to see, but the energy required for plants (and animals) to thrive and grow. Without sunlight, life on Earth would not exist.



About 500,000 years ago, humans learned to make artificial light by harnessing the power of fire. Fire - fueled by just about anything which would burn - remained our main source of artificial light until just over 100 years ago, when the large electrical networks we know today got their start. In the century which has passed since Thomas Edison opened the first commercial electric plant to power 400 street lamps in New York, scientists and engineers have discovered many other ways of harnessing the power of light.

The artificial light we use today, not only brightens our world, but helps us in our work - mostly due to invention in the 1950s of Light Amplification by Stimulated Emission of Radiation, or lasers. Lasers harness the power of light in some really useful ways. They are used by police in radar detectors to measure the speed of cars; by surgeons in scalpels which minimize damage to human tissue; by engineers in measuring and cutting devices which work to precise measurements. Most of us use lasers everyday without even knowing it: they let us talk to faraway friends and family by beaming light through fibre-optic cable; they let us produce good-looking documents by fixing ink to paper in laser printers; they even let us listen to music and watch movies. Engineers and scientists, like James T. Russell, thought up and designed all these uses for light.

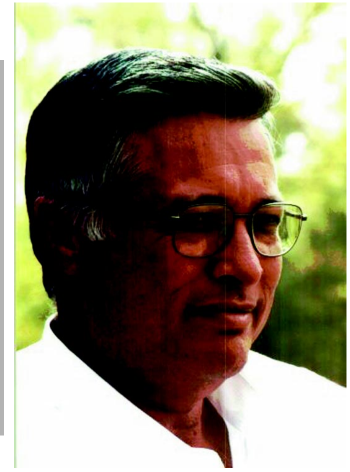
In 1965, Russell, an American physicist and music lover, was getting frustrated with the sound quality and short life span of his vinyl records. He thought the best way to improve both the durability and quality of recorded music would be to develop a system where sounds could be recorded and played back without any physical contact between dif ferent parts of the system. So, he invented what we now know as compact disk technologyDuring manufacture, the recordings of artists like Nelly Aleisha Keyes, Eminem and Mary J. Blige become tiny, tiny bumps on the surface of a CD. These bumps are actually 0s and 1s or binary data. In yor CD player, a laser reads the bumps and sends the information to a computer chip which converts them back into the music. Sound from light, now thatÕs an enlightening idea.



Native Engineers & Scientists

A place to meet people from your community.

Name: Howard Phillips
Nation: Choctaw Nation of Oklahoma
Schools Attended: Oklahoma State University, University of Oklahoma, University of New Mexico
Degrees: B.Sc. in Electrical Engineering
Masters degree in Nuclear Engineering
Ph.D. in Electrical Engineering and Computer Science
Job Title: Professor, Electrical and Computer Engineering
Favorite thing about job: *"Teaching and student interaction; and forecasting theory research."*



Howard Phillips was one of those kids who loved to take things apart; he was fascinated with anything electronic, and had a passion for amateur radio. In high school he Òliked math and science courses more than other subjects.Ó So itÕs hardly surprising he became an engineer.

As an undergraduate, Howard studied electrical engineering at Oklahoma State University. He then earned a masters degree in nuclear engineering at the University of Oklahoma and worked in industry for a few years, before attending the University of New Mexico to do a Ph.D. in electrical engineering and computer science. In the twenty years between finishing his doctorate and becoming a professor at the University of North Carolina, Howard worked in the microelectronics industry. One of his most challenging and significant projects was designing microcircuits - very small electronic circuits - for use on spacecraft.

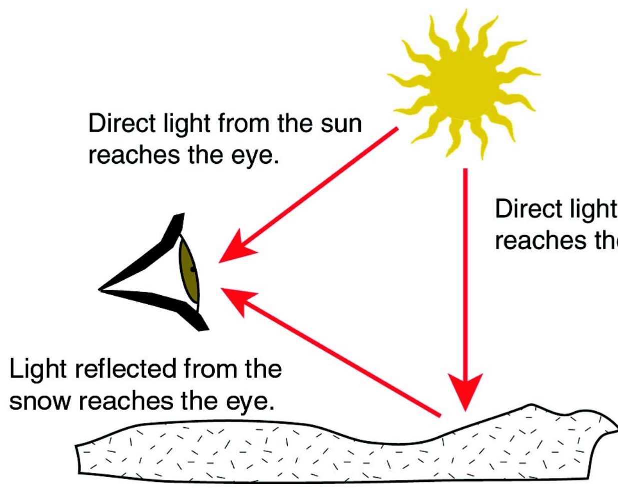
Howard has also been very involved in a project designed to bring sight back to the blind. He holds, in partnership with two medical doctors, patent number 5,109,844 called Retinal Microstimulation. It involves the design and development of a microchip, similar to the one found in your computer, which can be implanted in the eye, and used to restore vision to people who are losing their sight. While it might sound like science fiction, itÕs not.

In fact, what Howard and his colleagues propose for the blind, already exists for the deaf. Certain types of deafness can be alleviated through the use of an electronic device called a cochlear implant. This implant uses electrical signals to bypass damaged and non-working neurons involved in hearing and send sound signals directly to the brain. HowardÕs project would bypass, damaged and non-working photoreceptors (elements in the eye which respond to light) and send light signals directly to the brain. While the microcircuit is still being tested, it could one day bring light back to people who are living in darkness.

While HowardÕs research and teaching in a big university may seem really far away from life among the Choctaw Indians in Oklahoma, he never forgets where he comes from. In fact, he has developed a popular presentation called, *How to Make an A in every Class and Have Fun Succeeding*, which he gives to Native (and non-Native) students to encourage them to excel in school. In addition, Howard encourages them to pursue studies in science and engineering, because as he says, Òthis is the key to a successful future.Ó

Snow Blindness

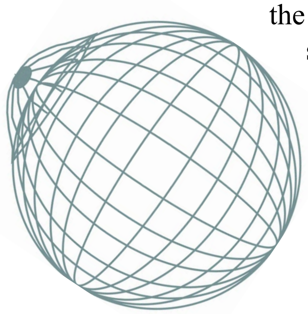
In the middle of a bright, sunny summer day, you probably know itÕs a good idea to wear sun screen and sunglasses when you go outside. If you donÕt, you may go home at night with a painful sunburn and sore eyes caused by over exposure to ultraviolet (UV) light. Did you know the same thing can happen in the winter? Even though the winter sun is much weaker than the summer sun, its UV rays can still do a lot of damage. In winter, your skin is really well protected because youÕre wearing so much clothing to keep warm. But what about your eyes?



Snow blindness is a sunburn of the eyes which temporarily decreases vision. As the name implies, it usually effects people in winter when their eyes are exposed to both direct sunlight and light reflected off the snow. (A similar condition can occur to boaters in the summer, when they are exposed to too much light reflecting off the water.) Like any other type of sunburn, it is painful. People suffering from snow blindness have red, itchy eyes that are overly sensitive to light. The condition improves by resting the eyes; it can be avoided by wearing sunglasses. Just as repeated sun burns can produce long-term dmage to your skin, repeated incidents of snow blindness can produce long-term damage to sight.

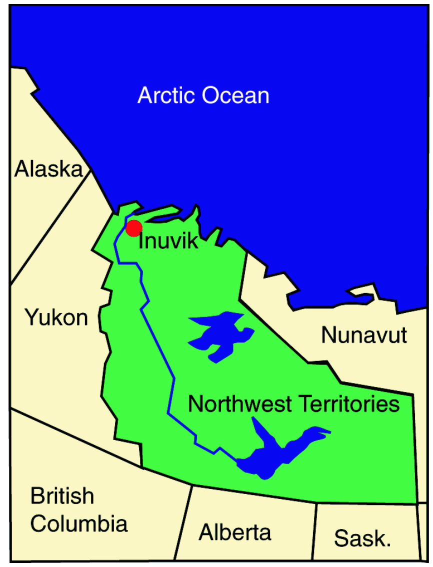
Long before the modern development of tinted glass and polarized plastic, northern peoples on Turtle Island, in Asia and Europe developed their own ways to protect their eyes from snow blindness. The most common method was the use of snow goggles.

These eye coverings were made from local materials which blocked light - leather, wood, bone or ivory. They were carefully shaped by carving or molding to fit the face of the user. The inside of the goggles was often covered with soot to reduce glare from the sun even further. They were held in place by a string, made from leather or plants, which tied around the head. Believe it or not, while the user only had two narrow slits to see through, the shape and cut of the slits sometimes worked to improve their vision.



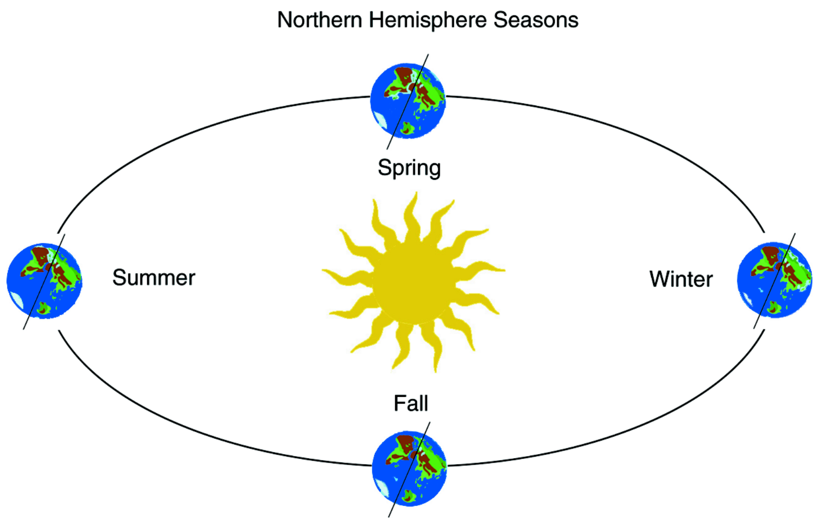
Community Profile

Inuvik, Northwest Territories



Way up in the NorthwestTerritories, on the East Channel of the Mackenzie River Delta, lies the first planned town north of theArctic Circle, Inuvik or ÒPlace of the People.Ó Home to more than 3400, it is a large community by Arctic standards with paved roads, a stoplight, cableTV, Internet service and even a cell phone network.

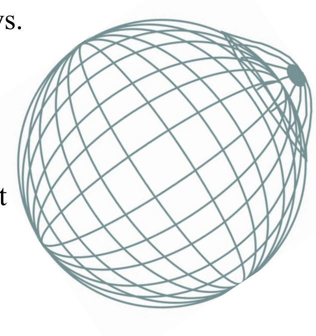
Inuvik was built from scratch in the 1950s. Because of its location in the fragile northern environment, many factors had to be considered in its planning and construction. One of the major challenges was the ground on which the town is built; much of Inuvik is pure ice or permafrost, if the ground is heated and the ice melts, Inuvik would collapse. So, buildings were built on piles of gravel 6-feet thick, and aboveground utilidors were used for water and sewage instead of underground piping. Another challenge to construction was the long Arctic winter.



The Earth spins on an imaginary axis which runs through the middle of the planet from south to north. The axis doesnÕt run straight up and down but is tilted at an angle of 23.5 degrees. So, as the planet makes its yearly orbit around the sun, there are parts of the year when the North Pole points towards the sun and parts of the year when it points away from the sun. The tilt of the axis is what gives us our changing seasons.

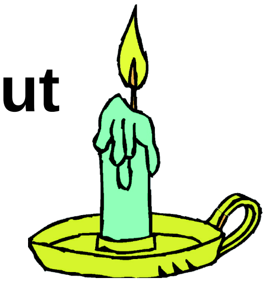
From March through September, the North Pole tilts towards the sun, and more light reaches the northern hemisphere than the southern hemisphere. At the equator, people get 12 hours of day light and 12 hours of night, but the farther north you go, the more daylight you getAt really high latitudes the sun stays in the sky and does not set, sometimes for many days. Inuvik is so far north that its mid-summer ÒdayÓ lasts 57 days from mid-May through mid-July.

When the North Pole tilts away from the sun, days in Inuvik get much shorter In the winter, between late November and early January , the town does not see the sun for 57 days. Two months without sunlight is a long time, so every year the residents of Inuvik gather together to welcome the sun back with a Sunrise festival which includes fireworks, a bonfire and other activities. When the sunlight appears briefly arou 2P.M. it is welcomed by drums, singing and dancers. The average temperature on the day the sun rises is usually around Ð30 degrees Celsius, so if you decide to visit Inuvik to help celebrate the Sunrise Festival you might want to pack your woolies.



Some of the information in this article is from http://www.yukoninfo.com/inuvik/inuvik.htm.

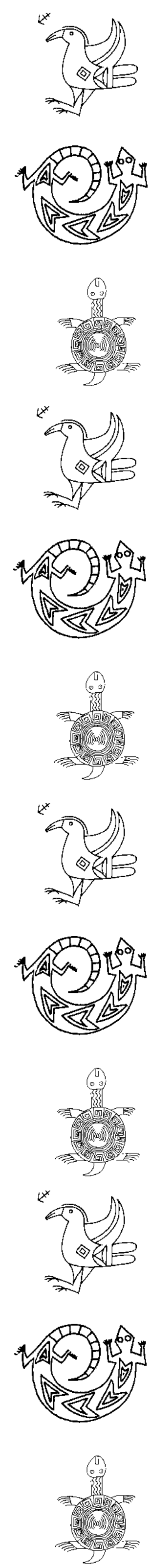
Fun facts and things to think about



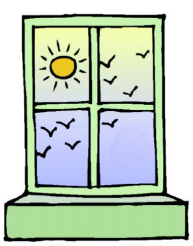
More light please
People have been lighting up the night for thousands of years. While most lamps today are powered by electricity, the very first lamps were powered by animal fat. On Turtle Island people used rendered fat from caribou, moose and bear, or oil from whale, seal and walrus depending on where they lived. The oil or fat was held in a carved stone or seashell container and burned through a wick made from some absorbent material such as moss or arctic cotton grass.

Thousands of candles can be lighted from a single candle, and the life of the candle will not be shortened. Happiness never decreases by being shared.

- Buddha

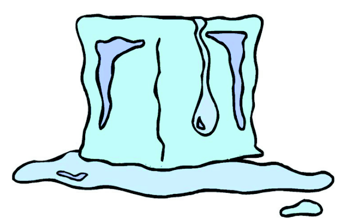


Faster than a speeding bullet
No, not Superman, light. In the vacuum of space light travels at exactly 299,792,458 m/s, and that's pretty much as fast as it can go. When light hits other substances it slows down. In air, for instance, light travels almost 90,000 m/s slower than in vacuum. Of course, that's still 299,702,547 m/s.

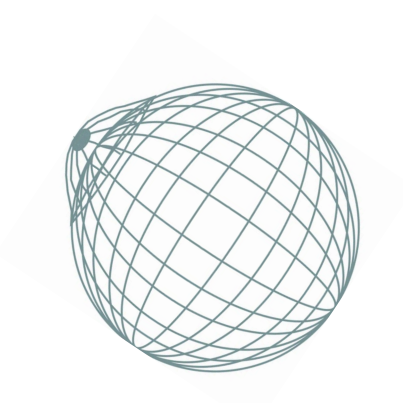


speed of light in glass:
199 861 638 m/s

speed of light in water:
225 407 863 m/s



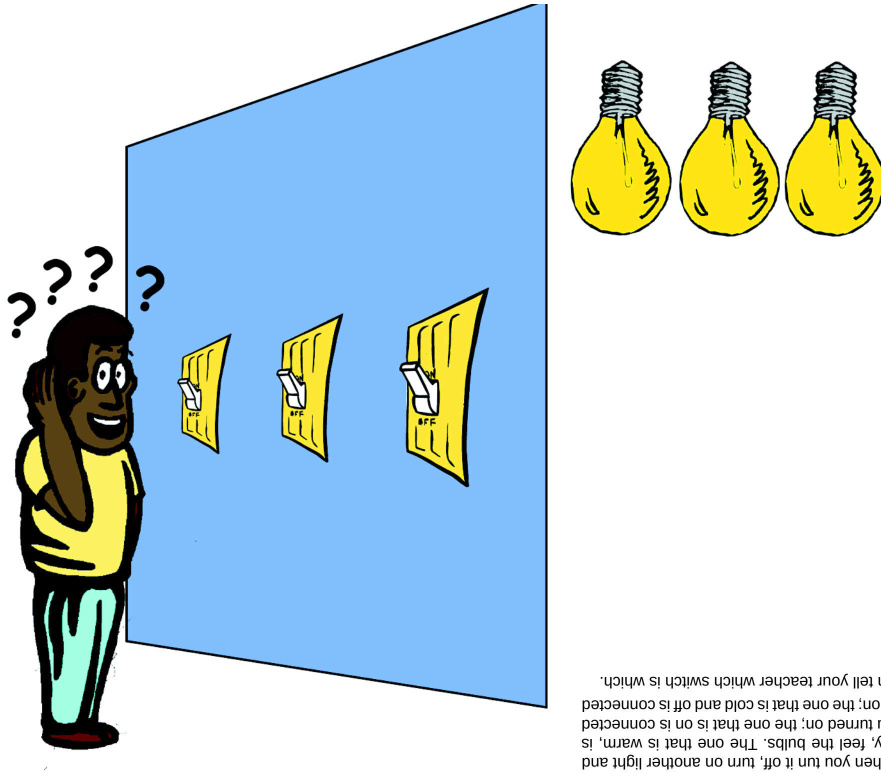
speed of light in ice:
228 849 204 m/s



Did you know…
…we see rainbows only when light gets bent as it passes through raindrops?

Which switch is which?

Outside your classroom there are three switches. Inside the classroom are three lights with incandescent light bulbs. There is no way to see inside the classroom from where the switches are. Your teacher asks you to figure out which switch is connected to which bulb. She tells you that you may turn the bulbs on and off as often as you want for as long as you want, but you may only enter the classroom once. How do you figure out which switch controls which bulb?



Based on a puzzle found at http://donsbulbs.com/b/extras/puzzles.html.

Solution: The key here is knowing that incandescent light bulbs produce heat. You should switch on one light for about one minute. Remember which switch you used to turn it on. When you tun it off, turn on another light and go into the classroom. Carefully, feel the bulbs. The one that is warm, is connected to the first switch you turned on; the one that is on is connected to the second switch you turned on; the one that is cold and off is connected to the third switch. Now you can tell your teacher which switch is which.

All about us

Native Access provides culturally relevant learning opportunities in science, math, engineering and technology to Aboriginal students and their teachers across Canada.

Established in 1993, the projectÕultimate goal was to increase the representation of Aboriginal peoples among the the ranks of practicing engineers and scientists in Canada.

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