

How Northern Lights Could Change the World

Humans evolved to co-exist with solar weather—but the machines we've designed are not immune to a solar storm's electrical interference. They don't yet have defenses against the waves of radiation that come from the sun. Last year, during a routine SpaceX [satellite launch](#), an unexpected solar storm rolled in and downed around 40 Starlink satellites. In March 1989, [six million Quebecois](#) were without power after a solar storm hit the region. This same storm melted power transformers in New Jersey. How on Earth does this happen?

The electrical grid relies on transformer stations, beefy boxes that convert high-voltage power into something safe for your home. Severe solar storms interfere with the currents that pass through a transformer, effectively 'tripping' its power, the way you trip a breaker in an old apartment that can't handle having both the kettle and microwave going at once. Electronic waves/frequencies get messed up by solar weather, but what is solar weather?

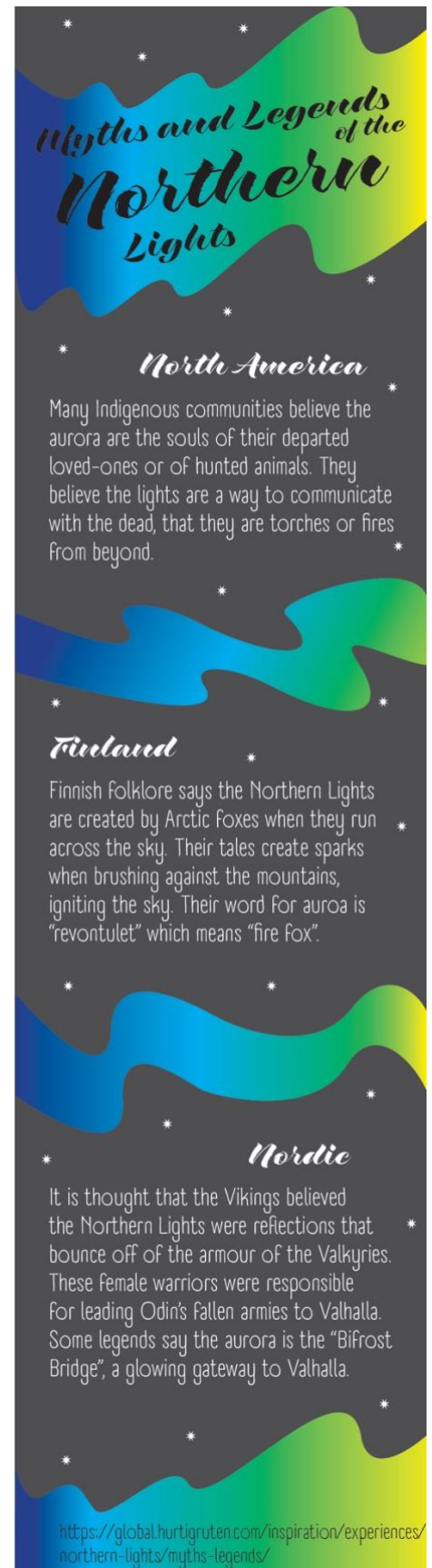
Solar weather is constantly spreading across the universe, and it's radiating from the sun—a super-hot ball of swirling hydrogen, helium, and plasma that spins around our galaxy. NASA Goddard scientist, Holly Gilbert, says the sun is “[beautifully dynamic](#)” with magnetic field lines that dance with each other. This dance starts at the center of the sun, where super-hot charged particles created by nuclear fusion result in constant motion and generation of powerful magnetic fields.

Arnad Choudhuri, from the Indian Institute of Science, [explains](#) how the power of these magnetic field lines is so intense, that the lines get squished and kinked, like a tangled, bent garden hose. Eventually, the pent-up energy bursts out of the sun from dark ‘sunspots’ and spews radiation and plasma out into the universe. Depending on the level of intensity, the waves of radiation and plasma become solar winds, solar flares, coronal mass ejections (CME), or solar hurricanes.

Thankfully, our magnetic field protects life on Earth from solar radiation. We call it the [magnetosphere](#). The magnetic field is generated by the kinetic energy from the planet's rotation against the rotation of the molten iron core at its center. So long as the planet spins, the energy field will be in a feedback loop, sustaining an invisible polarized shield that surrounds the Earth. Without this protective bubble, solar winds would erode our atmosphere, ending life as we know it.

You know the Northern Lights? They're just leftover sun plasma that spent 2-4 days hurtling through space at unimaginable speeds, until they wash over the Earth and blend with our magnetosphere. As the CME's wave attempts to escape the Earth's magnetism, it stretches outward like the [tail of a comet](#) until it snaps back like an elastic. The electrically charged plasma particles are drawn toward the poles, squeezing through layers of the magnetosphere until they fall through our atmosphere. This process creates breathtaking colours and patterns that have mystified humans for generations.

It wasn't until the invention of the telegraph that we realized the threat imposed by these phenomena. Back in 1859, auroras could be seen around the world, shining **so** brightly that the night turned into day. Telegraphs sparked and failed worldwide, wreaking havoc. We refer to this as the [Carrington Event](#) and it remains the most intense solar storm in recorded history. The city of Malmo, Sweden had its satellites, radio waves, and electrical grids blacked out by a CME in 2003. [This storm](#) also disrupted hundreds of flights and 59 per cent of NASA's space missions reported effects to their equipment.



An incredible [video](#) created by Kurzgesagt, a German scientific team of optimistic nihilists, explains the CME phenomena and how we're unsure how much damage a significant solar storm could cause. It's estimated that power could shut down for weeks to a year, which would be catastrophic. Rest assured, engineers are finding ways to 'solar-storm-proof' transformers and satellites. Scientists are diligently [watching the sun](#), giving us a heads-up in the event of a solar hurricane. The European Space Agency is also launching [Vigil](#) in 2025, a monitoring satellite that detects activity on the hidden side of the Sun.

Considering how heavily we rely on electricity, you'd think this threat would be common knowledge. The sun has an approximately 11-year cycle and, according to Nasa, the next [solar maximum](#) is expected in July 2025. Much of the sun, and the universe, remains mysterious. It's incredible to think how far we've come, yet human technology remains unexpectedly fragile.