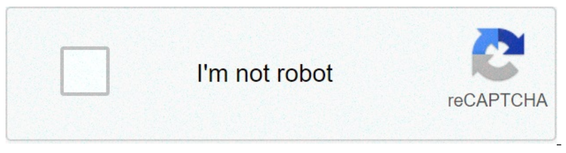

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Aurora borealis is the result of falling space debris

A solar flare with an eruptive prominence (photo by NOAA) Every eleven years the Sun reaches a period of maximum surface activity, known as the solar maximum. During this period, the Sun produces the greatest number of sun spots and associated phenomena, and generates intense "space weather". Very large solar flares and coronal mass ejections erupt from the Sun during the solar maximum, ejecting clouds of energetic debris toward Earth. When this material slams into our planet's upper atmosphere geomagnetic storms are created. The result of this solar activity can include potential hazards such as disruption of electronic communications and electrical power transmission. On the brighter side, a geomagnetic storm can trigger aurora borealis, or "Northern Light" displays, that might be visible in Maryland if the storm is strong enough. During periods of maximum solar activity, Marylanders have a better chance of viewing these spectacular light shows. In 2000 the Sun experienced a solar maximum. In October and November of 2001 several coronal mass ejections occurred, creating aurora displays visible in Maryland. If you missed these events, you can see photos from October 2001, November 2001, and August, 2002 at Spaceweather.com. Many Maryland residence were treated to a spectacular aurora display around midnight on November 8, 2004. A resident in northern Maryland reported that although she "... noticed it from about midnight until about 12:20 am, likely it began earlier, but the peak was in this time for my location in Northern MD (close to the Pennsylvania border in Street). There was an *intense* sea green pulsating cloud near the horizon, and vertical "beams" of green shading to pink up to a max of about 2/3 the way to full overhead!" Photos from November 2004's activity can be seen at the Spaceweather gallery. photo by University of Alaska Maryland is too far south to view most northern light displays, but they are occasionally visible. Viewing the aurora this far south, and with the amount of night-time light pollution in the urban regions, is difficult at best. The best anyone can do to predict northern lights is to follow events in the weather on the sun's surface, which is where auroras originate. A few of the many web sites that report solar weather are listed below. Spaceweather.com will send you an email notification when there is a potential for northern lights, if you sign up for this free service. There really is no "best place" for viewing. You need to find an area that has an unobstructed view of the northern sky, and you must be far away from urban and suburban night "light pollution." This means you should not be near a city, a mall, or other places that have a lot of bright lights at night. This tends to give the sky a background glow that obscures northern lights. Some good places would be in the mountains, public parks or ball fields far out in the country. If you watch the above web sites for predictions and are very lucky, you might see something. If you are in an area that is relatively dark at night (away from urban night light), look to the north. You might see the shimmering sheets, curtains and spires of multicolored, ionized gasses known as the Northern Lights. There are a number of web sites devoted to predicting the space weather and aurora activity, that can alert you to potential displays. For more information on aurora, see NASA's Astronomy Picture of the Day pages, and these informative sites: Compiled by the Maryland Geological Survey, 2300 St. Paul Street, Baltimore, MD 21218 This web page was prepared by Bob Conkwright, Division of Coastal and Estuarine Geology, Maryland Geological Survey. Please send comments on this page to Dale Shelton (dale.shelton@maryland.gov) NASA astronaut Christina Koch, an NC State graduate, snapped an incredible picture of a meteor shower from the International Space Station.The picture has received thousands of likes on Twitter.Can you see shooting starts from space? Turns out, yes! The first meteor shower of the decade and we were lucky enough to catch it from the @Space_Station along with the northern lights. This is a composite image of a few of the #quadrantids as they blazed into the atmosphere. pic.twitter.com/ETdMRK1d86— Christina H Koch (@Astro_Christina) January 6, 2020Meteor showers are caused when space debris enters Earth's atmosphere, disintegrating in fiery streaks.Koch's composite image shows some of the shooting stars as they streak into the atmosphere. The image also catches the green bands of the Aurora Borealis, or Northern Lights, which is a naturally occurring light display caused by solar wind.Koch's time in space has been record-setting. In December, she broke the record for longest single spaceflight by a woman. In October, she was part of the first all-female spacewalk.She is scheduled to remain in space for about 11 months, falling just shy of the world record of 15 months held by a Russian cosmonaut.SEE ALSO: Live from space: NC State graduate Christina Koch speaks to Durham studentsKoch grew up in Jacksonville, North Carolina and went to the North Carolina School of Science and Mathematics in Durham. Report a correction or typo Suggest a new DefinitionProposed definitions will be considered for inclusion in the Economictimes.comSpace-TechnologyDefinition: An aurora is a natural phenomenon which is characterised by a display of a natural-coloured (green, red, yellow or white) light in the sky. It is a light show which is caused when electrically-charged particles from the sun collide with particles from gases such as oxygen and nitrogen present in the Earth's atmosphere. Description: Aurora is sometimes referred to as 'polar light'. It is predominantly seen in the regions of high altitudes like the Arctic and Antarctic. An aurora is caused by the streams of electrified particles (which are emitted by the sun) trapped in the magnetic field of the earth. It is produced when this magnetosphere is disturbed by the solar wind carrying the charged particles. Auroras are seen in latitudes of around 70 degrees. They generally occur in a band known as 'auroral zone'. The auroral zone is 3 to 6 degrees wide in latitude. It lies between 10 and 20 degrees from the geomagnetic poles. This is visible quite clearly during the night. Auroras can sometimes be seen at latitudes below the actual auroral zone. Auroras can appear in various forms like streamers, patches, arcs, scattered light, diffused light etc. The brightest and the most distinctive of all forms of auroras are the ones which are curtain-like in the shape of an arc, extending in the east-west direction. This natural light effect is known as 'aurora borealis' in northern altitudes, while the effect in the southern latitudes is known as 'aurora australis'. (Auroras that occur in Northern hemisphere are known as aurora borealis and auroras that take place in Southern hemisphere are known as aurora australis.) Aurora borealis is also known as 'Northern lights'. Similarly, aurora australis is also known as 'Southern lights'. By Jonathan AmosBBC Science Correspondentimage captionArtwork of EISCAT_3D: The Northern Lights are a benign consequence of space weatherThe UK is to contribute to a sophisticated new radar system in the Arctic to study "space weather".This phenomenon describes the effects on Earth's wider environment as it is constantly bombarded by particles and magnetic energy from the Sun.The impacts can damage satellites and even disrupt electricity grids. The radar, to be built across Norway, Sweden and Finland by the European Incoherent Scatter Association (EISCAT), should come online in 2021.The international organisation already operates radar facilities in the far north, but the new technology is regarded as a big step forward in capability."This is the next generation," said Dr Andrew Kavanagh, a EISCAT member scientist working with the British Antarctic Survey (BAS). "The system will look like a flat field of antennas, much like some of the big radio astronomy telescopes such as LOFAR and SKA. We will be able to do a lot more with this new system - looking at large parts of the sky simultaneously. A 3D view of the sky."image captionSome of the Sun's eruptions head straight for EarthBritain is paying £4-6m of the £63m total cost. The participation will give the nation's researchers working in the field of solar-terrestrial physics access to the radar data when it becomes available. The Sun perpetually billows clouds of magnetic energy and plasma (a gas of electrically charged particles) in all directions. But often great eruptions of this emission are directed straight at Earth. When these interact with our planet's own magnetic field and atmosphere, they set off all manner of disturbances.The Aurora Borealis is one such consequence, as particles are accelerated downwards to collide with air molecules to produce colourful curtains of light in high-latitude skies. But there are more concerning interactions that can lead to upsets in spacecraft electronics, drop-outs in radio communications, and surges in power networks on the ground.There is even some evidence that the magnetic disturbance from solar storms can confuse the "biological compass" whales use to navigate the oceans resulting in their stranding. The concerns have led the UK government to put space weather on the National Risk Register.A London Economics analysis earlier this year found that losing access to the GPS satellite-navigation service for a period of five days would cost the British economy more than £5bn.image captionThe British Antarctic Survey hopes soon to resume operations at HalleyThe new radar system will be set up at Skibotn in Norway, near Kiruna in Sweden, and near Kaaresuvanto in Finland. Skibotn will have a transmitter and receiver array, while the two other locations will have receiver arrays.The technology will enable scientists to probe in detail the ionosphere - the region of the Earth's upper-atmosphere that ranges from about 70km to 1,000km in altitude. It will sample the electron concentration and temperature, and the ion temperature and velocity at various heights along the radar beam direction.Dr Kavanagh explained: "We will have digital beam-forming and steering, which means in practice that we can generate multiple beams looking in multiple directions, so that we can cover a volume of the sky rather just look at what we like to call a pencil beam."Some of the interactions can stimulate currents that then heat the high atmosphere. This is a particular interest for some UK scientists. The heating can alter the density of air molecules at altitudes where low-orbiting satellites move. This perturbs their trajectory ever so slightly. And by the same token, it also changes the path of redundant hardware, or "space junk", speeding up or slowing down the time it takes for this material to fall back to Earth.image captionArtwork: Space junk poses a collision threat to active satellitesProf Duncan Wingham is chief executive of the Natural Environment Research Council (Nerc), which holds the UK membership of EISCAT.He said: "EISCAT_3D will give us a 3D picture of interactions between space weather and our upper atmosphere with a detail we've not seen before, giving us answers to questions researchers have about the impacts of space weather on the upper atmosphere. "We need this information to reduce the risks posed by space weather on our communications systems, satellites and power grids, which we all rely on."The British Antarctic Survey does much of its space weather research at the other end of the globe, at its polar bases Rothera and Halley.The latter was recently evacuated because of developing cracks in the ice platform on which it sits. This meant Halley's space weather instruments had to be turned off, breaking their data contribution to the forecasting models produced by scientists.Dr Kavanagh said BAS hoped to get this equipment back up and running soon, adding that there was a plan for the future which would allow instruments to be operated remotely should Halley have to shut down again. British Antarctic SurveyGPSSpace explorationArcticNorthern Lights Applications 11/01/2021 1801 views 69 likes Thousands saw bright lights in the sky over the Pacific Northwest Thursday night. Across Washington and northern Oregon, a streak of slow-moving bright lights moved across the sky.Chief Meteorologist Morgan Palmer has confirmed this "space junk" is the second stage of a SpaceX Falcon 9 rocket breaking up upon re-entry into the earth's atmosphere. The rocket stage was part of the March 4 launch of the SpaceX Starlink satellite internet system. It burned up upon re-entry after 22 days in orbit. Palmer says it appears to have entered the earth's atmosphere later than scheduled, bringing the sighting of the fiery re-entry over the Northwest instead of over the north Pacific Ocean.He says most of the time, rocket debris like this completely burns up as it re-enters the atmosphere, but there is a slim chance there was some debris that could make it to the ground. No reports of that have been received yet."Meteors would generally be moving much faster as they burn up," Palmer said.The National Weather Service also received calls about the mysterious object at about 9 p.m."Upon further investigation, we've received unofficial information that this is debris burning up in the atmosphere from the Falcon 9 second stage launch that failed to deorbit properly," NWS officials said.Viewers in Aberdeen, Federal Way, Renton, Whidbey Island and Bremerton called KIRO 7 and reported seeing the debris.NWS officials also said they have not heard any impacts across Western Washington.Cox Media Group Last updated: March 21, 2021 On Jan. 4, 2019, at 4:37 a.m. EST the CAPER-2 mission launched from the Andøya Space Center in Andenes, Norway, on a 4-stage Black Brant XII sounding rocket. Reaching an apogee of 480 miles high before splashing down in the Arctic Sea, the rocket flew through active aurora borealis, or northern lights, to study the waves that accelerate electrons into our atmosphere. CAPER-2, short for Cusp Alfvén and Plasma Electrodynamics Rocket-2, is a sounding rocket mission -- a type of spacecraft that carries scientific instruments on short, targeted trips to space before falling back to Earth. In addition to their relatively low price tags and quick development time, sounding rockets are ideally suited for launching into transient events -- like the sudden formation of the aurora borealis, or northern lights. For CAPER-2 scientists, flying through an aurora provides a peek into a process as fundamental as it is complex: How do particles get accelerated throughout space? NASA studies this phenomenon in an effort to better understand not only the space environment surrounding Earth -- and thus protect our technology in space from radiation -- but also to help understand the very nature of stars and atmospheres throughout the solar system and beyond. "Throughout the universe you have charged particles getting accelerated -- in the Sun's atmosphere, in the solar wind, in the atmospheres of other planets, and in astrophysical objects," said Jim LaBelle, space physicist at Dartmouth College in Hanover, New Hampshire, and principal investigator for the CAPER-2 mission. "An aurora presents us with a local laboratory where we can observe these acceleration processes close at hand." Technically, the CAPER-2 team is interested in what happens just before an aurora starts glowing. Electrons, pouring into our atmosphere from space, collide with atmospheric gases and trigger the aurora's glow. Somehow, they pick up speed along the way. "By the time they crash into our atmosphere, these electrons are traveling over 10 times faster than they were before," said Doug Rowland, space physicist at NASA's Goddard Space Flight Center in Greenbelt, Maryland, who also studies particle acceleration. "We still don't understand the fundamental physics of how that happens." The CAPER-2 team focused on a special kind of aurora that forms during the day. Unlike the nighttime aurora, the daytime aurora is triggered by electrons that stream in directly from the Sun -- and we know far less about them. "There's been a huge amount of research done on the regular nighttime aurora, but the daytime aurora is much less studied," said Craig Kletzing, space physicist at the University of Iowa in Iowa City and coinvestigator for the mission. "There are good indications that there are some similarities and there are also some differences." The team is focusing on how the electrons that create daytime auroras are jostled around by waves, in ways that may or may not differ from nighttime auroras. Two kinds of waves are of special interest, and have opposite effects. Alfvén waves, named after Swedish Nobel laureate Hannes Alfvén who first predicted their existence in 1942, are thought to accelerate the electrons. These huge waves -- measuring tens to hundreds of miles long from peak to peak -- propagate along Earth's magnetic field lines, whipping electrons to and fro. On the other side are Langmuir waves, which are generated by the electrons themselves -- a process that steals some of the electrons' energy and slows them down. CAPER-2 will carry a high-resolution wave-particle correlator to measure them, the first sounding rocket mission to do so for the daytime aurora. "This is very data-intensive," said LaBelle. "It's unique to sounding rockets to be able to look at this mechanism in this level of detail." For the launch, the CAPER-2 team traveled to northern Norway, one of the few places that can put a rocket within range of the daytime aurora. Every day, northern Norway rotates under an opening in Earth's magnetic field known as the northern polar cusp, where particles from the Sun can funnel into our upper atmosphere. Meeting the aurora right where they form is the best way to understand physical processes that are far too large to replicate in a lab. "It's a kind of natural laboratory," LaBelle added. "We take our experiment to two different environments, where the variables are different, and then test the theory and answer the questions." Story Source: Materials provided by NASA/Goddard Space Flight Center. Note: Content may be edited for style and length.