



**Science  
around us  
2018-2021**



**Natural phenomena**



Malta



## **Rainbow**

A rainbow is caused by sunlight and atmospheric conditions. Light enters a water droplet, slowing down and bending as it goes from air to denser water. The light reflects off the inside of the droplet, separating into its component wavelengths--or colors. When light exits the droplet, it makes a rainbow. This sequences of colors gives us the characteristic pattern we're all familiar with, and that we learn from childhood through the use of mnemonic phrases. The colors of the rainbow are Red, Orange, Yellow, Green, Blue, Indigo and Violet.

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## **Aurora**

An aurora is a natural phenomenon which is characterised by a display of a natural colored (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.

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 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'.

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**Haze**

Haze is traditionally an atmospheric phenomenon in which dust, smoke, and other dry particulates obscure the clarity of the sky. It is the fog or mist that's caused by small particles in the air. There is often a haze hovering over the city of Los Angeles. Although the noun haze can describe any kind of misty or slightly obscured air, it usually refers to visible air pollution, rather than just fog.

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**Iceblink**

An Iceblink is the white light seen on the skyline, on the underside of clouds, coming about from the reflection of light off a field of ice.

The Ice squints were utilized by both the Inuit and Pioneers seeking out for the Northwest Section to assist them explore securely. The Cocteau Twins tune, Iceblink Good fortune is named for this phenomenon.

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### **The green flash sunset**

The green flash is a natural phenomenon that happens on sunset and sunrise and when conditions are right for an optical phenomenon to combine and create a mirage and the dispersion of sunlight. As the sun goes below the horizon the light is being dispersed through the earth's atmosphere like a prism. A green flash is present at every sunset, but it is too thin to be seen with the naked eye. Often a green rim changes to a green flash and back again during the same sunset. The best time to observe a green flash is about 10 minutes before sunset.

Greece





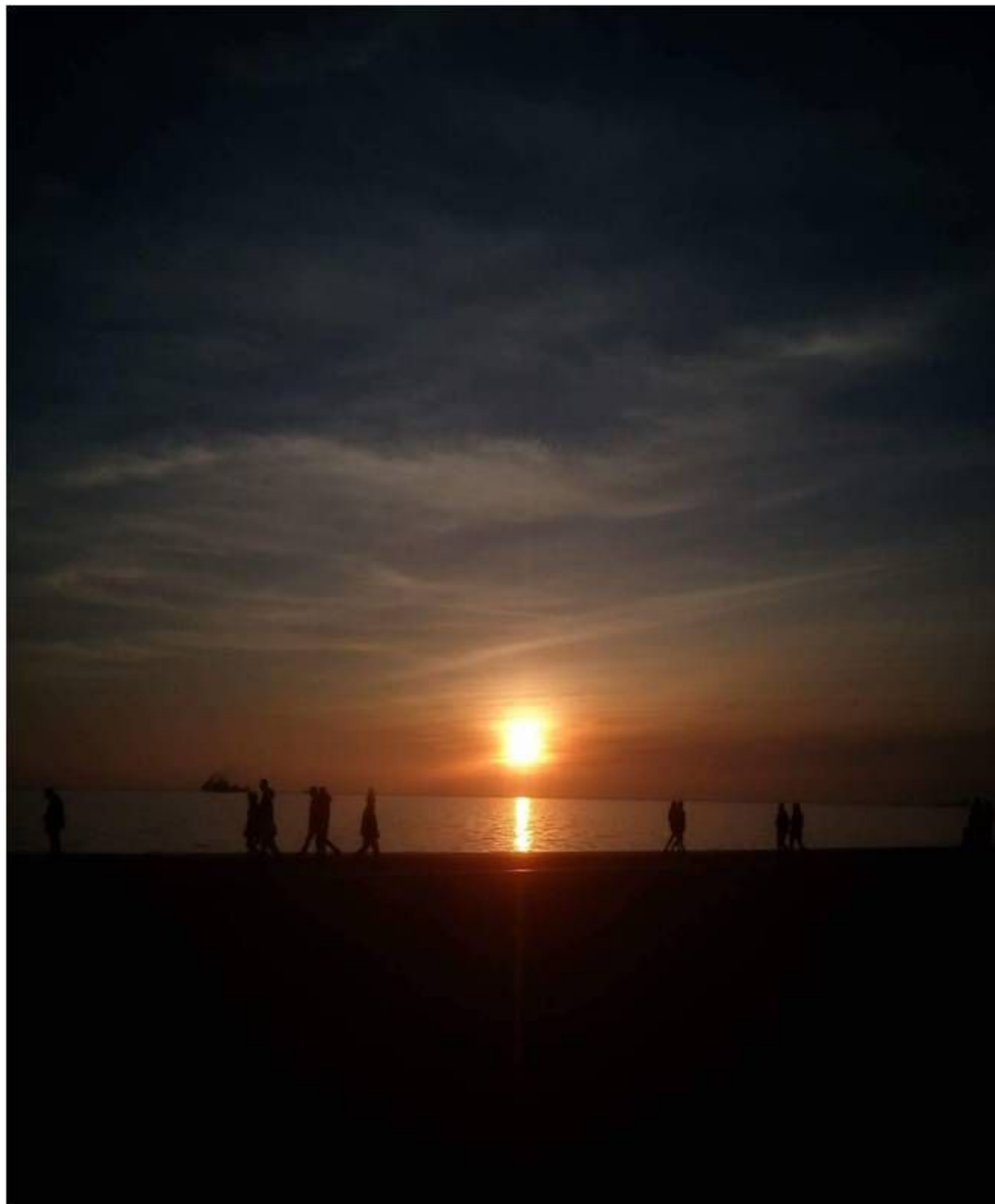
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### **Sunrays or sunbeams**

In meteorological optics a ray of light that seems to radiate from the Sun is called a sunbeam or sunray. These shine through openings in clouds, between mountains, buildings or other objects and are separated by darker streaks. Although they seem to converge toward the sun, or spread out from it, they are actually parallel beams and the apparent convergence is just a normal linear perspective visual illusion. The air molecules or particles that are directly lit by sunlight scatter it, making it visible as bright rays of light, while the other shafts, in between, look shadowy.

Bibliography: <https://en.wikipedia.org/wiki/Sunbeam>

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### **Atmospheric refraction at sunrise and sunset**

When the Sun is low above the horizon, at sunrise or sunset, the sunlight has to penetrate through a longer distance through the atmosphere, scattering more blue and green light, because it has shorter wavelengths. Technically this is a type of light diffusion. Sunsets have brighter colours than sunrises because there are more particles in the evening air to scatter the red and orange hues.

When it is close to the horizon the Sun seems slightly flattened. This is due to refraction of the atmosphere, which depends on the density of the air, which varies with temperature and pressure. Refraction increases when the angle of elevation decreases, so it makes things appear higher in the sky than they really are and raises the apparent position of the bottom part more than the top, but does not affect the width. That is why the Sun seems “flattened” and larger. Of course the same thing also applies to the moon.

The refractive index is lower at higher altitudes because the pressure is lower. So light rays travelling through a longer distance through the atmosphere are refracted towards the Earth’s surface and makes the sun visible before it is geometrically above the horizon at sunrise or after it is below the horizon at sunset.

The same phenomenon shifts the apparent positions of stars when they are close to the horizon, or close to the Sun during an eclipse.

Bibliography: <https://en.wikipedia.org/wiki/Refraction>

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Lunar eclipse and  
Jupiter



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### **Lunar eclipse or blood moon**

When the Moon is aligned with the Earth and the Sun and the Earth is in between the two bodies, we may observe a lunar eclipse. This happens only if the Moon is full and moves into the Earth's shadow. It can occur about once every 6 months because of the  $5.4^\circ$  inclination of the Moon's orbit relatively to the Earth's ecliptic plane and often we have a solar eclipse two weeks before or after it (during a new moon). Lunar eclipses can be viewed from anywhere on the night side of the Earth and last up to nearly 2 hours, because the Moon's size is smaller in regard to the Earth's shadow. Unlike solar eclipses they are safe to view without any special eye-protection, because they are dimmer than a full moon.

During a total lunar eclipse the Moon seems red, because the light reflected from its surface is refracted by the Earth's atmosphere, excluding blue and green hues due to Rayleigh scattering and letting only the reddish tones pass through and reach the Moon's surface.

The term "blood Moon" is not scientifically recognized, but it has two explanations. One is due to the reddish colour of the Moon during a total eclipse and the other is connected to religion. In the Bible, in the Book of Joel and the Book of Revelation the "moon turning to blood" is claimed to herald the Second Coming of Christ.

Bibliography: [https://en.wikipedia.org/wiki/Lunar\\_eclipse](https://en.wikipedia.org/wiki/Lunar_eclipse)

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## **Fog**

Fog looks like a low-lying stratus cloud, it consists of tiny ice-crystals or water droplets which are suspended in the air, very close or at the Earth's surface and the moisture which composes it often generates from moist ground, marshes, a lake or the sea. It reduces visibility to less than 1 km and usually occurs when the relative humidity is near 100%. A light fog is called a mist, but if the relative humidity is less than 95% it is called a haze. It resembles a stratus cloud because it tends to form when a stable cool air mass is trapped underneath a warmer air mass and the difference between dew point and air temperature is above 2.5°C. We have different types of fog depending on how the cooling that caused the condensation occurred:

***Radiation Fog***

***Ground Fog***

***Advection Fog***

***Evaporation / Steam Fog***

***Precipitation / Frontal fog***

***Freezing Fog***

***Ice Fog***

Bibliography: <https://en.wikipedia.org/wiki/Fog>

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## **DISPERSION**

*Dispersion is a term used to describe the phenomenon in which phase velocity of a wave depends on its frequency. It usually refers to light or other electromagnetic waves, but can also refer to acoustic waves (sound), seismic waves (earthquakes), gravity waves (ocean) and telecommunication signals (along cables or optical fiber).*

*An important consequence of dispersion in optics is the spectrum of different colours produced by white light passing through a dispersive prism. The "rainbow" effect we see is due to the change in the angle of refraction of the different colours in white light.*

*Another familiar consequence is chromatic aberration in lenses. Compound achromatic lenses are designed, using the glass's dispersion, to cancel this effect as far as possible.*

*In telecommunications and similar applications, the propagation of "pulses" is more important than the absolute phase of a wave, which means that only group-velocity dispersion matters.*

*Bibliography: [https://en.wikipedia.org/wiki/Dispersion\\_\(optics\)](https://en.wikipedia.org/wiki/Dispersion_(optics))*

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### **Mould**

They can be harmful to humans and animals. Mould spores can cause allergic reaction, pathogenic moulds can grow inside a body and mycotoxins produced by moulds can cause diseases if they are inhaled or ingested. But they also play an important role in food science (production of various foods and beverages) and biotechnology (production of antibiotics, enzymes and pharmaceuticals) as well as medicine (since many moulds inhibit the growth of other microorganisms).

Like all fungi they are heterotrophic and derive energy from the organic matter they live on. They secrete hydrolytic enzymes which degrade complex biopolymers into simpler substances so that they can absorb them. Certain species can survive severe cold, highly acidic solvents, anti-bacterial soap and even jet fuel.

Greece





*Greece*

## **Flames**

A flame is the visible part of fire and it is a mixture of reacting gases and solids (primarily oxygen, nitrogen, carbon dioxide and water vapour), which emit infrared and visible light. Ultraviolet light emission is also possible, as the frequency spectrum depends on the chemical composition of the material that is burnt and the products of the intermediate reaction.

Flames are produced at the point of the combustion reaction which is called ignition. Photons are emitted by de-excited atoms and molecules in the gases and some black-body radiation is emitted from the soot, gas and fuel particles. In cases of incomplete combustion of gas, or the burning of wood or other organic matter, solid particles (soot) produce a red-orange glow with a continuous spectrum. When we have complete combustion of gas the various electron transitions in the excited molecules formed in the flame emit single-wavelength radiation giving the flame a dim blue colour.

The glow of a flame is complex and the dominant colour changes with temperature. The flame is white or yellow where it is hottest, then orange above that and then red as it keeps getting cooler. No combustion occurs above the red region, so there we have the black smoke, which is the uncombusted carbon particles.

But flames can also be produced by other combinations, like hydrogen burning in chlorine, or hydrogen and fluorine, or nitrogen tetroxide and hydrazine, which all produce pale blue flames. Whereas boron and its compounds emit an intense green flame when they burn and that is why it is called a "green dragon".

France



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### **Lightning bolt**

Lightning bolt often occurs during a storm. Thunderstorms form in cumulonimbus, these are the biggest clouds among all, they can be several kilometers wide and tall (up to 18km). Les Cumulonimbus are made of micro droplet, steam and also crystal ice due to the height. The storm occurs when a mass of hot air rise in the atmosphere, condenses and become a cumulus. When the temperature of the cumulus decrease, the steam turns into a micro droplet while it creates heat. The cloud's temperature being higher than the atmosphere's temperature, cumulus raise and become a cumulonimbus by growing up. The lightning bolt is a phenomenon of electrostatic discharge that happens when a lot of static electricity has accumulated in an area with storm clouds. The top of the cumulonimbus is positively charged and the bottom negatively. Charges attract themselves and the electric potential can reach 10 to 20 million volt. To stop this unbalanced of potential, plasma is produced on the path of the electric discharge; this phenomenon creates the lightning bolt and the thunder. Lightning bolt quickly spread in the air. Thunder is an explosive dilation of air molecules heat up by the lightning, then it spread slowly in the air (about sound velocity but it can change according to the temperature). While the lightning spread it heats gas of the atmosphere (to 30 000 °C about 5 times the sun's temperature) and ionize them. This brutal change of temperature creates conductor plasma which creates lightning. The color of the electric arc can vary according to weather, the distance of viewing and molecules in the atmosphere. In case of dry weather, lightning will be white, with rain it'll be red, with hail it'll be blue and yellow when there are a lot of particles.

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### **Sunset**

About the colors of the sunset : The earth's atmospheric layer acts as a filter for sunlight before it reaches the earth. The air molecules will diffuse the seven colors of the rainbow that make up this light. To each color corresponds a different wavelength whose diffusion is affected by the thickness of the atmospheric layer to cross. This varies with the angle that the rays make with the surface of the earth. But the atmospheric layer to cross is never as thick as when the sun goes down. The distance to travel is then difficult for low wavelengths. The place is thus free for the longest, red and orange colors.

About the sea of clouds: The term "sea of clouds" comes from the observation at the altitude of a large area of low cloud. A sea of cloud can be observed often in winter when conditions are high pressure with little wind and the establishment of thermal inversion. Humidity in the plains stagnates with low ground temperatures condensing the air and higher temperatures at altitude. With the cold and humid air on the ground being heavier than the soft and dry air at altitude (thermal inversion), the clouds cannot rise. They, therefore, find themselves "stuck" in the plains and the valleys, resulting in clear and mild weather at altitude where we can observe this cloudy expanse that looks like a sea. In the plains, this sea of clouds would be more like a pea puree very far from the spectacle offered at altitude.

France



*Rime ice*

France

## **Frost**

**Frost forms** when supercooled (under 0 degrees Celcius) water liquid droplets freeze onto very cold surfaces, like trees during the night. When they make contact, the droplets instantly freeze and create ice crystals, like snow. Moreover, the wind pushes the water droplets on one side of the tree branch which creates this kind of effect. Frost is also a weather form. There are two forms of frost, the hard one and the soft one. this two types are less dense than ice. **Hard frost** is a white ice that forms when the water droplets in fog freeze to the outer surfaces of objects. It is often seen on trees on top of mountains and happens a lot in winter when low-hanging clouds cause freezing fog. This fog freezes facing the wind on the side of tree branches, buildings, or any other solid objects, usually with high wind velocities and air temperatures between  $-2$  and  $-8$  °C. **Soft frost** is a white ice deposition that forms when the water droplets in freezing fog or mist freeze to the outer surfaces of objects, with calm or light wind. The fog also freezes usually to the windward side of tree branches, wires, or any other solid objects. Soft frost is similar in appearance to hoar frost; but whereas frost is formed by vapour (of fog, or cloud) first condensing to liquid droplets and then attaching to a surface, hoar frost is formed by direct deposition from water vapour to solid ice.

France





## France Rainbows

The rainbows are created with the phenomenon of refraction and reflection. There are two conditions for the creation of a rainbow; it must have been raining before for water droplets in the atmosphere. And the sun must appear. First, the sun rays are white light. The white light is composed of all the colors of the visible light (red, orange, yellow, green, blue, indigo and purple). Water droplets serve as a prism but not like a mirror. They decompose the white light in a spectrum of different colors: it is the refraction. The white light is divided into all the different colors because the different colors don't have the same refractive index. For example, the red color has a refractive index of  $42,5^\circ$  and the purple one has a refractive index of  $41,6^\circ$ .

When the white light touches the side of the water droplet, the different colors are reflected and left again the water droplet with the same refraction index: it is the reflection. Generally, a rainbow is composed of two bows. The primary rainbow and the secondary rainbow. Often, the latest is less bright. It's created by a double reflection of the light inside the water droplets. Since there are two reflections, the colors are upside down. Between the two bows there is the " Alexander's Dark Band" which is a part of the sky less bright. Usually, a rainbow is round because the water droplets have a spherical shape. But we only see a semicircle because there is the horizon. But if we take the plane, we can see an entire rainbow. Finally, people never see the same rainbow because it depends on the movement of the water droplets, the position of the sun and the observer. If someone is standing somewhere else, he will see another rainbow whose white light is reflected by

Iceland

19/2/2019 18:30



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Iceland

### **Ebb and Flow**

Ebb and Flow (also called ebb flood and flood drain) are two phases of the [tide](#) or any similar movement of water. The ebb is the outgoing phase, when the tide drains away from the shore; and the flow is the incoming phase when water rises again.

Iceland



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### **Volcanoes**

On the 19th of March 2021 an eruption started in Geldingardalir, near Fagradalsfjall in the peninsula of Reykjanes. There had been around 34.000 earthquakes over a period of three weeks before the eruption, which finally happened on a Friday night. In these pictures you see some of the first responders from Snæfellsbær during their volunteer work in the area.

Poland







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### **Rime**

Rime is formed by sudden freezing of very small, supercooled water droplets (fog or clouds) on chilled surfaces (e.g. on tree branches, telecommunication cables, fence nets) and sometimes increases to a considerable thickness on the side, from which moist air masses come.

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### **Hoarfrost**

Hoarfrost is a thin layer of ice on a solid surface, which forms from water vapour in an above-freezing atmosphere coming in contact with a solid surface whose temperature is below freezing and resulting in a phase change from water vapour (a gas) to ice (a solid) as the water vapour reaches the freezing point. In temperate climates, it most commonly appears on surfaces near the ground as fragile white crystals; in cold climates, it occurs in a greater variety of forms. On a calm, clear night, ice crystals may attach to grass, leaves, and branches.

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### **Snow**

Snow comprises individual ice crystals that grow while suspended in the atmosphere—usually within clouds—and then fall, accumulating on the ground where they undergo further changes. It consists of frozen crystalline water throughout its life cycle, starting when, under suitable conditions, the ice crystals form in the atmosphere, increase to millimeter size, precipitate and accumulate on surfaces, then metamorphose in place, and ultimately melt, slide or sublimate away.

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### **Fog**

Fog is a visible aerosol consisting of tiny water droplets or ice crystals suspended in the air at or near the Earth's surface. Fog can be considered a type of low-lying cloud usually resembling stratus, and is heavily influenced by nearby bodies of water, topography, and wind conditions.

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### **Condensation trail (contrail)**

Contrails or vapour trails are line-shaped clouds produced by aircraft engine exhaust or changes in air pressure, typically at aircraft cruising altitudes several miles above the Earth's surface. Contrails are composed primarily of water, in the form of ice crystals. The combination of water vapour in aircraft engine exhaust and the low ambient temperatures that exist at high altitudes allows the formation of the trails. Impurities in the engine exhaust from the fuel, including sulfur compounds provide some of the particles that can serve as sites for water droplet growth in the exhaust and, if water droplets form, they might freeze to form ice particles that compose a contrail. Their formation can also be triggered by changes in air pressure in wingtip vortices or in the air over the entire wing surface.

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### **Tyndall effect**

Tyndall effect is a physical phenomenon, in which light is scattered by particles in a colloid or in a very fine suspension to form a characteristic light cone. If a beam of light passes through a colloidal solution, it becomes visible in the form of so-called Tyndall's cone due to bending of the rays on the particles of the dispersed phase. The bigger is the difference between the refractive index of the dispersed phase and the dispersion medium, the greater is the intensity of this phenomenon. It also depends on the length of the scattered wave - the shorter it is, the more strongly it is scattered.

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### **Halo**

Halo is the name for a family of optical phenomena produced by light (typically from the Sun or Moon) interacting with ice crystals suspended in the atmosphere. Halos can have many forms, ranging from coloured or white rings to arcs and spots in the sky. Many of these appear near the Sun or Moon, but others occur elsewhere or even in the opposite part of the sky. Among the best known halo types are the circular halo, light pillars and sun dogs, but many others occur; some are fairly common while others are very rare.

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### **Dew**

Dew forms as temperatures drop and objects cool down. If the object becomes cool enough, the air around the object will also cool. Colder air is less able to hold water vapour than warm air. This forces water vapour in the air around cooling objects to condense. When condensation happens, small water droplets form, and it's dew.

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### **Reflection**

Reflection is the change in direction of a wavefront at an interface between two different media so that the wavefront returns into the medium from which it originated. Common examples include the reflection of light, sound and water waves. The law of reflection says that for specular reflection the angle at which the wave is incident on the surface equals the angle at which it is reflected. Mirrors exhibit specular reflection.

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### **Iridescence**

Iridescence is the phenomenon of certain surfaces that appear to gradually change colour as the angle of view or the angle of illumination changes. Examples of iridescence include soap bubbles, feathers, butterfly wings and seashell nacre, as well as certain minerals.

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### **Afterglow and foreglow**

An afterglow is a broad arch of whitish or pinkish sunlight in the sky that is scattered by fine particles, like dust, suspended in the atmosphere. An afterglow may appear above the highest clouds in the hour of fading twilight or be reflected off high snowfields in mountain regions long after sunset. The particles produce a scattering effect upon the component parts of white light. The opposite of an afterglow is a foreglow, which occurs before sunrise.

Finland





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### **Midnight sun**

Earth's axis is tilted. As the result, the length of daytime is relative to the positions of the earth and the sun. In summer, daytime extends when going north. Daytime can extend to 24 hours, with the sun above the horizon even at night. This effect lasts longer the more north you are.

*Finland*







Finland

### **Ice balls**

The waves have moved the small rocks along the seabed and the ice has started to gather around the rocks. Another option is that ice balls form from pieces of larger ice sheet which then get jostled around by waves. The waves make them rounder and the ice balls can grow when the sea water freezes onto their surfaces.

Finland





Finland

### **Northern lights**

As the solar wind approaches the earth, it causes a distortion in our magnetic field and some particles are deflected away from us. Some of them escape into our atmosphere around the magnetic poles. Incoming particles react with atoms and molecules and become "excited". Atoms and molecules release light as they calm down.

Finland





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### **Spring**

Spring starts when the average temperature of the day is permanently above 0 °C, or from March equinox when daytime is equally long in every part of the world. In spring the ice and snow start to melt and the plants are getting back to alive.

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### **Winter**

Winter starts when the average temperature of the day is permanently below 0 °C. The all-time lowest temperature in Finland is -51,5 in January, 1999. During the polar night, the shortest daylight in central Finland is about 4 hours, gradually getting longer towards the spring.



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