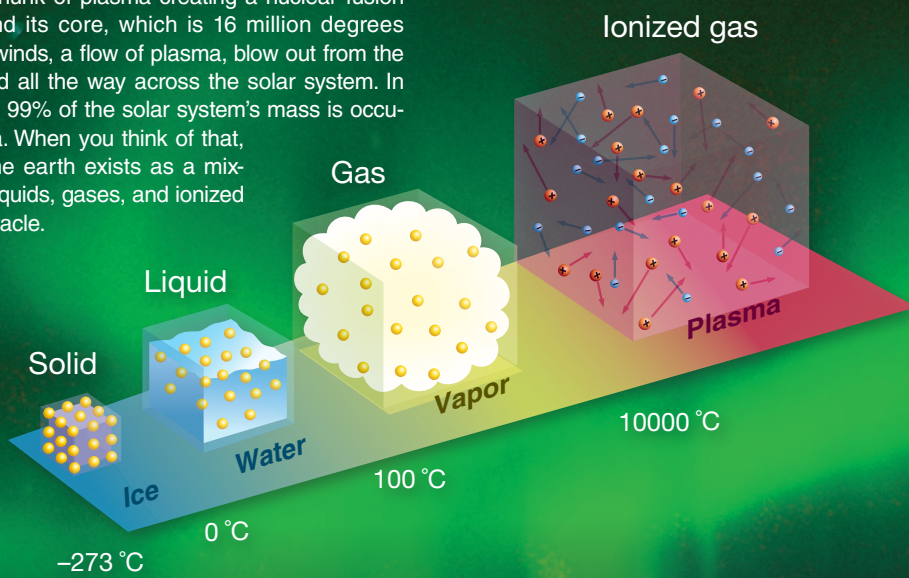


Why is most of the universe and most of the solar system made of plasma?

The sun is a chunk of plasma creating a nuclear fusion reaction around its core, which is 16 million degrees Celsius. Solar winds, a flow of plasma, blow out from the sun and spread all the way across the solar system. In fact, more than 99% of the solar system's mass is occupied by plasma. When you think of that, the fact that the earth exists as a mixture of solids, liquids, gases, and ionized plasma is a miracle.



Aurora is Plasma !

When solar winds collide against air molecules in the ionized layer overhead, this produces luminescence, or light, which causes the mysterious Aurora, also called Northern Lights and Southern Lights.

Lightning is Plasma !

When the air ionizes during a lightning strike, plasma is created.

Plasma TV

Plasma closest to you

Plasma light is present in everything from fire to various kinds of lights.

Ignition systems

What is plasma?

Plasma is a state that is created by heating up materials to a high temperature. When water is heated up, ice (solid) is changed into water (liquid), and then vapor (gas). These are called the three phases of matter. Now, what will happen to the vapor when it is heated up even more? The result is that the water molecules will be broken to atoms, and the atoms are split into ions and electrons. This phenomenon is called "ionization." The gases containing ions and electrons generated by this ionization are called ionized gas, another name for "Plasma." In plasma, low-mass electrons tend to have high temperatures (the average of their kinetic energy), and high-mass ions and atoms/molecules of gases tend to have low temperatures. Besides by heating up gases, plasma can be generated through high-speed collision of electrons with gases or by irradiating gases with intense light.

Creating the Future

Glimpses into the World of Plasma !

Plasma Propulsion

Plasma can enable space flight with a propulsion system that injects fuel which has been changed into plasma state.

Ecology and Health

Plasma helps to protect our environment and health by eliminating bacteria and dust, and decomposing toxic substances.

Disinfect

Sterilization Medical equipment can be disinfected with plasma.

Industrial Waste Disposal

Toxic substances can be decomposed with plasmas produced from water vapor.

Particle Beam Cancer Treatment

Irradiating cancer with the ions generated by plasma makes it possible to treat cancer without surgery.

Plasma Medical Care

Someday we might stop bleeding and heal wounds by irradiating them with low-temperature plasma or painlessly protect teeth from cavities.

Medical Tools

Medical tools can be coated with plasma so the body won't reject them.

Water and Air Purification

We can purify water and get rid of toxic substances by stimulating chemical reactions with the ozone generated by plasma.

Electrostatic Precipitation

Static electricity can prevent air pollution by removing dust.

Fluorescent lights

H₂

He

N₂

Ne

Hg

Car headlights

Prehistoric humans used plasma

The first plasma to be used by mankind was fire. By evolving past apes and mastering fire, we were able to create human life-styles and civilizations.

5000°C!?

Plasma can be used to heat up materials to extremely high temperatures. A high temperature of thousands degrees can be produced by accelerating electrons and ions in plasma state in the electric field.

Welding

Plasma can melt and join metals such as steel beams.

Glassification

This is the melting of radioactive waste into molten glass and then hardening it for storage.

Alloys and Steel-making

New mixtures of metal, or alloys, can be produced by melting and mixing various metals in high-temperature plasma.

Microwave Discharge Plasma

This is a plasma produced by microwaves, which are also produced in your kitchen's microwave oven.

Nano technology

Computer devices such as personal computers and cell phones are based on nanotechnology—plasma is indispensable for nanotechnology processing.

Cutting Work

Plasma enables fine hole processing by removing surface particles.

Heaping Work

By heaping up particles, plasma makes thin-film technology possible.

Modern Alchemy

Plasma can be used to produce diamonds.

Solar Batteries

Plasma can enable production of thin-film solar battery that changes solar energy to electric energy.

Surface Finishing

Soft and lightweight tools can be hardened by finishing the surface with a coat of plasma.

Electrostatic Coating

Electrostatic coating makes sure you can coat a surface evenly and cleanly.

Semiconductors

Plasma is also used to produce super-thin electronic circuits thickly stacked in semiconductors.

Copy Machines

Plasma is used to produce images by charging sprayed micro-sized particles.

Nano World Created by Plasma

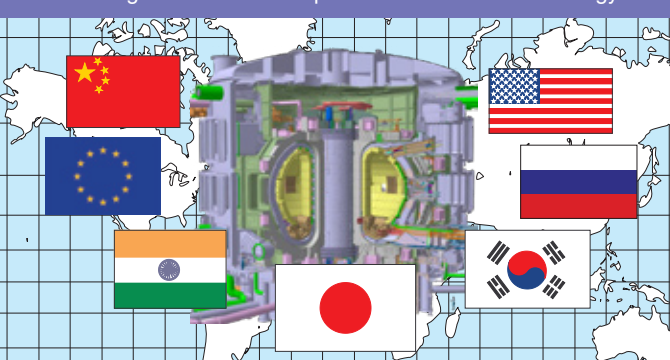
Plasma enables production of extremely small things only 1/1000 as wide as a human hair.

Manmade Sun

The same fusion energy as the sun can be made on the earth. Fusion energy is expected to be the ultimate future energy.

ITER Project and Broader Approach Activities

Japan and Europe, etc. are promoting large-scale projects such as ITER Project by concentrating the wisdom of people around the world through international cooperation to realize fusion energy.



The leading fusion energy experiment devices in Japan



Why is plasma useful?

In a plasma state, electrons, ions, and atoms/molecules of gases usually have different temperatures. Even in low-temperature plasma, some of the light-weight electrons are flying around at high speeds, so they can collide with atoms and molecules of gases. As a result, in a plasma state, chemical reactions, which usually happen at high temperatures, can occur even at low temperatures. Plasma can also emit various lights such as ultraviolet or visible light. By using this characteristic, bright illumination can be produced from plasma. As you can see, using of plasma can accomplish things that would be impossible with solids, liquids, or gases. There are high expectations for using plasma for different purposes in various areas such as energy, the environment, nanotechnology, semiconductors, medical care, and biotechnology.

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