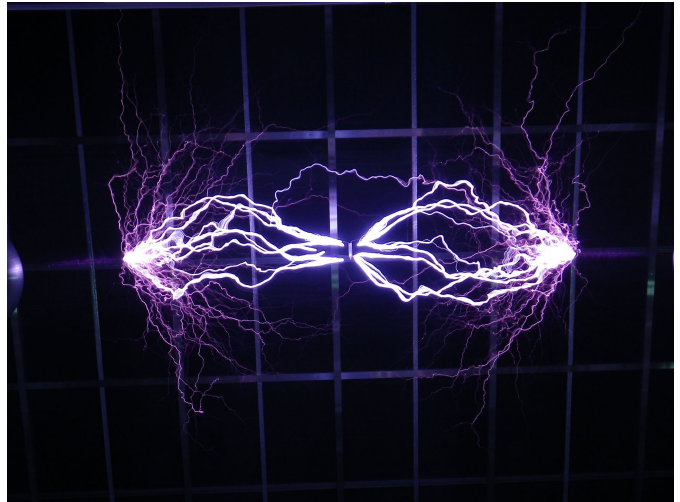


■ Purpose of Exhibition

We will show you an intense electric spark that makes a 'roaring' sound. Along with this intense experience, we would like you to see how an electric discharge phenomenon happens.



■ Additional Knowledge

<Tesla Coil>

The two very high towers are called Tesla Coils. A Tesla coil is a high-frequency and high-voltage generator, which was invented by Nikola Tesla (1856-1943). In the exhibition, electricity accumulated in a condenser with 15 thousand volts is discharged with a spark gap. When transmitting the electricity into the first coil, approximately 1.2 million volts are generated in the second coil with very high turn ratio. Placing the two coils close together and transmitting alternating current into the first coil, electricity is conveyed also into the second coil. At this point, depending on the turn ratio of the coil, the voltage produced in the second coil can be changed. A device like this is termed as a transformer, which can be found very easily all around us: primarily in AC adapter for computers and transformers on electric poles. One of the Tesla coil's primary characteristics is that the turn ratios of the first coil and second coil are ultimately different. Although a transformer usually has an iron core in the coil, Tesla's coil has nothing in it: it is an empty core.

But Tesla coils are still incomprehensible in many ways. For example, the principle, which is intricately combined with terms and conditions about resonance and travelling waves that cannot be explained with ordinary transformer principles is applied, and high voltages are generated.

In this exhibition, although experiments are carried out by two Tesla coils, this is to show you greater electric discharge. It is not that two coils are always necessary, just one coil can be used. Additionally, a small one used to be often favored for an oscillation circuit for a radio at the beginning.

<Electric Discharge, Lightning, and Spark>

The spark emitted from a Tesla coil is the same as lightning. In both of these, electricity is transmitted in the air. Air does not usually allow electricity to convey. But when very strong voltage is applied, electricity is transmitted. Gas particles in the air, which are on the path for electricity, are ionized by electrons accelerated with high voltage and emit light. Although both the spark and lightning are bluish purple, this is due to the colors of nitrogen and oxygen molecules consisting of air. When sparked in other gases, the color of lightning

becomes different. Both static electricity from the Tesla Coil and thunder from lightning produce loud noises. Heat from the electricity of lightning exponentially increases the temperature of the surrounding air. This causes the rapid expansion of air surrounding the lightning bolt, generating a loud sound.

<Tesla Coils and Nikola Tesla>

Nikola Tesla sought to build up a "World System" with Tesla coils. The world system indicates telegraph, telephone, photo transfer, and power transmission by radio. Currently, information exchange by radio is part of our daily life. But it was only proved by experiments that radio waves existed at that time (1888). At a time when there was no radio communication, Tesla had already had an idea for connecting the world with radio. He succeeded in sending and receiving radio waves over a short distance and invented basic principles for radiotelephones and radios. Furthermore, it is said that if he had concentrated only on his research about radio communication, the long_distance radio communication crossing the Atlantic Ocean by Marconi (1901) and the start of radio broadcasting (1906) would have been his only feats. However, because he continued working on the construction of the world system, including radio transmission, he could not be honored. His dream of radio transmission has not yet been realized, even today. But research has been carried out on a system in which electricity is produced in space and is then conveyed to earth. <Nikola Tesla> His name is used in the unit of magnetic flux density "T" (Tesla). During his lifetime, Tesla was as well-known as the inventor Thomas Edison, but compared to Tesla's feats, Edison's have not had as significant an impact. Not only the basic invention of radio communication, but also Tesla's inventions, play a significant role in electricity that we use. There are two types of flows in electricity: direct current and alternating current. The electric appliances around us operate on "Alternating Current". It was also Tesla that developed a motor actuating with alternating current and an alternating current generator. Tesla's alternating current was bought for high royalties by Westinghouse Electric. Consequently, a heated competition called "War of Currents" broke out between Westinghouse Electric,



Electric Discharge Lab

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which planned to carry out the power transmission from power plants with alternating current, and Edison, who had already started direct current power transmission. In order to show the dangers of each electric current, even an electric chair was made. Currently, power transmission is implemented with alternating current.

Article by Yoshitaka Yamada, curator
