



Atomic Light Show

Atoms, the building blocks of matter, are constantly in motion, moving around at speeds that are thousands of miles per hour at room temperatures, and millions of miles per hour behind a supernova shock wave. In a collision of an atom with another atom, or with a free-roaming electron, energy can be transferred to the atom. This extra energy can then be released in the form a light wave.

Q: Where can we observe light emitted by atoms?

A: Here, there, and everywhere that atoms and electrons collide at high speeds, for example, in neon signs, in auroras, or in supernova shock waves.

Activity – Glowing Atoms

Core Concept: Collisions between particles can produce light.

Exhibit connections: Atoms Collide Panels 1-3

Materials: Electroluminescent wire, Plasma ball, image of glowing gases, image of Northern Lights, image of supernova remnant, images of elements

Background:

Electroluminescent wire (or EL wire) is a copper wire coated in a material called a phosphor. The phosphor glows when there is a current applied to it via a very fine copper wire wrapped around the outside. Different phosphor materials will glow different colors. This particular EL wire has an additional thin coating of blue plastic to give it its blue glow.

A plasma globe is a glass sphere filled with gases like neon and argon, with a high voltage electrode in the center. The glowing filaments are called an “electric glow discharge,” which is plasma (or ionized gas) that is formed when an electric current passes through the gasses inside the globe. The colors you see in the plasma globe are created when gas atoms are excited by the electricity and then become relaxed again. When the atom drops back down to its un-excited level, it releases light! The color of light depends on the type of gas. In this case, neon glows red and argon glows blue/lavender.



One of the best parts of a plasma globe is of course how it reacts when someone touches the surface of the glass sphere. This unfortunately has little to do with the glowing gas inside the globe and more to do with the flow of electrical charge generated by the high-voltage electrode. When a person's hand touches the sphere, that makes a much more attractive place for the electricity to flow than the open air. This phenomenon will go along better with the "electric discharge" demonstration!

Suggestions for introducing the activity:

The EL wire can be used to introduce the concept of an electric current causing a material to glow. While the glowing substance inside the wire is not gas, alternating electric current causes the atoms in the solid phosphor to collide, gain extra energy, and then release this energy as light. Ask visitors to examine the glowing wire. Notice that there is a continuous glow over the length of the wire, not many small points of light like in Christmas light bulbs or a "rope light" made of LEDs. Instead, the electric current from the battery pack is causing the material itself to produce light.

Now, introduce the concept of glowing gases. Ask visitors about glowing signs they've seen, and if they've heard of the Northern lights. It might come as a surprise that they are caused by many of the same principles! Gases like neon, or gases in the atmosphere, glow when their atoms collide with energized electrons, temporarily absorbing and then re-releasing that energy. This principle can be examined using the plasma globe.

Procedure:

Ask visitors to gather around the active plasma ball and observe the colors created by the strands of glowing gas. Can they find the red color created by neon? Or the blue/lavender color created by argon?

Discussion/ Questions for visitors to consider:

What would happen if different types of gases were inside the glass sphere? Each different gas emits colors that are characteristic of its atoms, so the colors would be different. Show visitors images of different glowing gases and of Northern lights. Can they guess what gases in the Earth's atmosphere are colliding with charged particles from the sun (solar winds) to produce these auroras? (They can check out the exhibit label to find out – oxygen glows red and green, nitrogen glows with a purple light).