

## Dry Ice Comet Demonstration

Comets are composed of frozen water and gases, dust and rock, and a variety of organic materials. Heating from our Sun vaporizes frozen gases and water on the surface of comets. Solar wind sweeps the dust and gas of the coma into trailing tails. Because the solar wind always flows outward from our Sun's surface, the tails always point away from our Sun no matter what direction the comet is moving in its orbit. This means that the tails can be in front of the comet as the comet moves away from our Sun on its return to the outer part of its orbit.

**Comet tails increase in length as the comet gets closer to the Sun.**

This activity will introduce children to the structure of comets and the interactions between comets and our Sun. This demonstration provides a visual model of comets, particularly illustrating how the length and direction of a comet's tail varies in relationship to the comet's location relative to our Sun. It also helps the children gain a better understanding of the composition of comets.

**This demonstration uses dry ice and should be conducted by an adult facilitator. Adult supervision is required at all times!**

### What You Need:

- ☞ 5 pounds of dry ice
- ☞ Mallet
- ☞ Eye protection
- ☞ Thick work gloves or insulated rubber gloves
- ☞ Plastic bowl - large
- ☞ Paper grocery bag
- ☞ 13 gallon garbage bag
- ☞ Pie pan or flat tray
- ☞ 1 liter (34 ounces) of water
- ☞ 1 cup of soil
- ☞ Dash of ammonia
- ☞ Dash of alcohol
- ☞ Dash of dark corn syrup
- ☞ Hairdryer with a low or cool setting
- ☞ Strong flashlight

### What to Do to Create Dry Ice Comet:

**Caution: Do Not Touch Dry Ice Without Protective Gloves**

- ☞ Put on safety glasses and gloves. Ask the children to maintain a safe distance while still being able to see the demonstration.
- ☞ Put the dry ice into the paper grocery bag and crush it to a fine-grained consistency using the mallet. (The finer the texture, the better.)
- ☞ Line the large plastic bowl with the plastic garbage bag.
- ☞ Pour the following liquid ingredients into the garbage bag: half of the water, ammonia (warn the children about the strong smell!), alcohol, and the corn syrup. Next, add the soil.
- ☞ **Explain that each of the materials mixed into the model represents the actual components of comets – different types of ices, rock and dust, ammonia, organics - in somewhat realistic amounts.**

### What to Do to Create Dry Ice Comet (cont'd):

- ☞ Carefully add in half of the crushed dry ice and mix well with other ingredients by kneading the outside of the garbage bag.
- ☞ **The dry ice will create a cool, cloudy vapor that is safe to touch. This vapor cloud represents the outgassing of the comet that forms the coma and gas tail as a comet approaches our Sun.**
- ☞ Add in the rest of the dry ice and mix well by kneading the outside of the garbage bag.
- ☞ Add in the rest of the water. It may be necessary to add a bit more water if the comet ball does not stick together.
- ☞ The water/dry ice slush will start to thicken as the dry ice freezes the water.
- ☞ Close the garbage bag around the comet and shape it into a ball.
- ☞ Carefully remove the comet ball and place it in the pie pan or tray.

### What to do for the Demonstration:

- ☞ Holding the flashlight and hairdryer "Sun" (on low or cool setting) next to each other, point them toward the comet model from about 18 inches away. Turn out the lights to create a more dramatic visual effect. Move the hairdryer closer and farther from the dry ice ball.
- ☞ **The flashlight represents our Sun and the hairdryer represents the solar wind.**
- ☞ **Potential Misconception Alert: Make sure the children understand that our Sun does not "blow" a wind, but that the solar wind is instead a stream of particles, constantly coming from our Sun, that exert a very small pressure on matter.**
- ☞ Ask a few children to hold the flashlight/hairdryer "Sun." Holding the comet with gloves, walk in an ellipse around the "Sun." Comets trace long elliptical orbits around our Sun. The children will need to keep the hairdryer and flashlight aimed at the dry ice throughout your orbit, but they should stay in the same spot. Make sure to walk far enough away so there is no effect from the blow drier. Far from the Sun, comets do not have tails.
- ☞ Ask the children to focus on the changing orientation of the comet's tail relative to the Sun throughout the orbit. No matter where the comet is, the tail always points away from the Sun – so sometimes the tail "follows" the comet, and sometimes it is ahead of the comet! Prompt the children to notice how the tail is longer when the comet is close to the Sun and that it gets shorter and shorter as the comet moves away from the Sun.