Physics in the Sink: Dancing Water

The kitchen sink is a good place to wash dishes, rinse out empty soup cans and soak crusty bowls, but it’s also a great place to investigate one of the coolest forces of nature – electrostatics. Here’s how.

What you Need
a kitchen (or bathroom) sink
plastic comb
some wool or a paper towel

What to Do
Turn on your kitchen sink so that a small, steady stream of water is flowing. Rub the comb with the wool (or paper towel) for about 10 seconds. Then, set the wool aside and bring the comb near the stream of water, but don’t let the comb touch the water. Note what happens to the stream. Wiggle the comb around and watch the stream. Then, try touching the water with the comb, what effect does this have? You might want to experiment with multiple combs – how well can you manipulate the stream of water?

What’s Going On?
A water molecule is a negatively charged oxygen atom and two positively charged hydrogen atoms. The attraction between the negatively charged comb and the positively charged hydrogen atoms is so strong that you can control the stream by moving the comb.
The atoms in the plastic comb and wool both have electrons, but the comb holds onto its electrons more tightly than the wool does. How tightly an object holds onto its electrons depends on the material the object is made from and is called the level of electron affinity. When you rub the comb with the wool, some of the electrons from the wool are transferred to the comb. This gives the comb an overall negative charge.

Water molecules are polarized; one side of the molecule has positively charged hydrogen atoms and the other side has a negatively charged oxygen atom. When you bring the negatively charged comb near the water molecule, it repels the negatively charged oxygen atom and attracts the positively charged hydrogen atoms. This electrostatic attraction is strong enough to pull the hydrogen atoms toward the comb and bend the stream by a noticeable amount. (picture of a water molecule with charges)

Try This! Try rubbing the comb for shorter or longer than 10 seconds. Does this affect the strength of the attraction? Try changing the temperature of the water. Does it make any difference? Try charging objects other than the comb. Which ones hold charge and are able to manipulate the stream?

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