

Electrical Charge



National Science Foundation
WHERE DISCOVERIES BEGIN

Electrical Effects

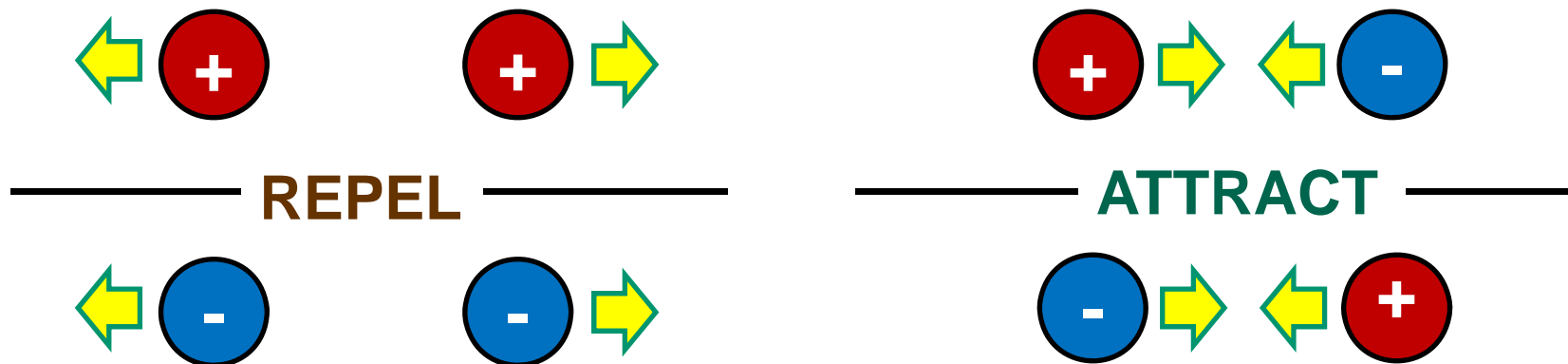
Electrical phenomena have inspired many special effects, such as the “Force” in Star Wars.



Electric Charges and Forces

There are two types of charge:

positive charges and **negative** charges



Like charges repel, opposite charges attract.

Electrons, Protons, & Atoms

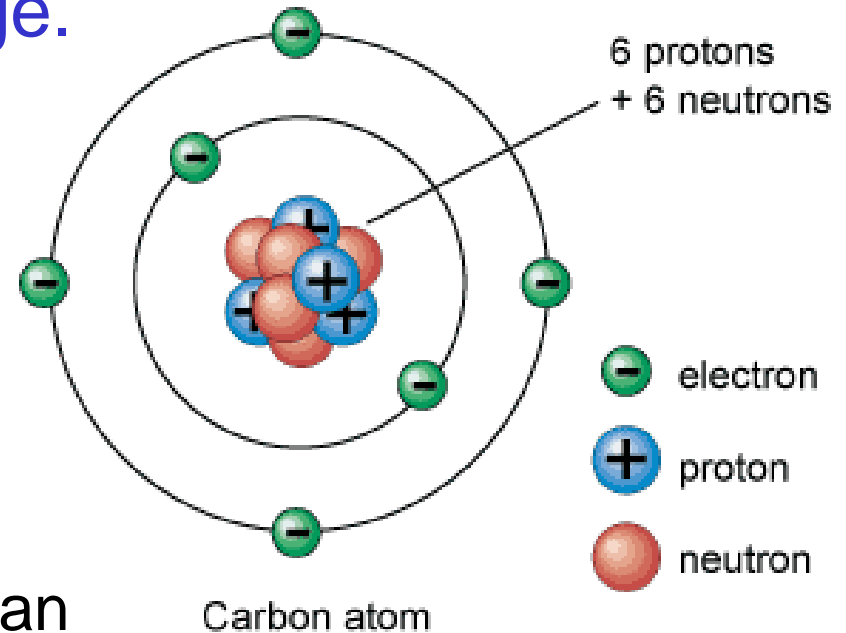
Electrons carry negative charge.

Protons carry positive charge.

Electrons are loosely
bound to atoms

Protons are tightly locked
within the nucleus.

Objects are usually neutral but can
easily gain or lose electrons to
become charged.



Charging by Friction/Contact

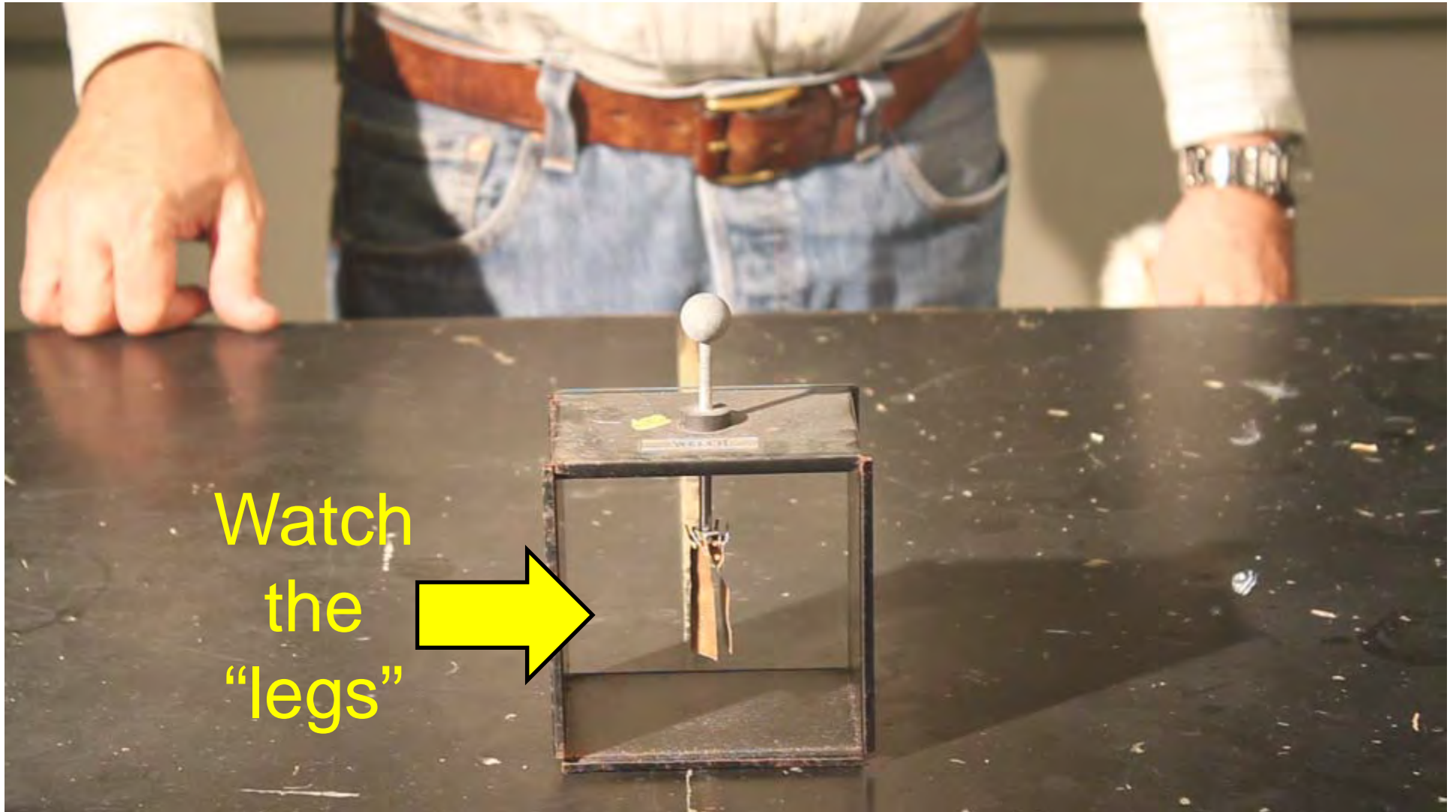
Electrons move easily so an object can become charged by rubbing, such as:

- Brush your hair with a plastic comb.
- Walk across a carpet with plastic-soled shoes.

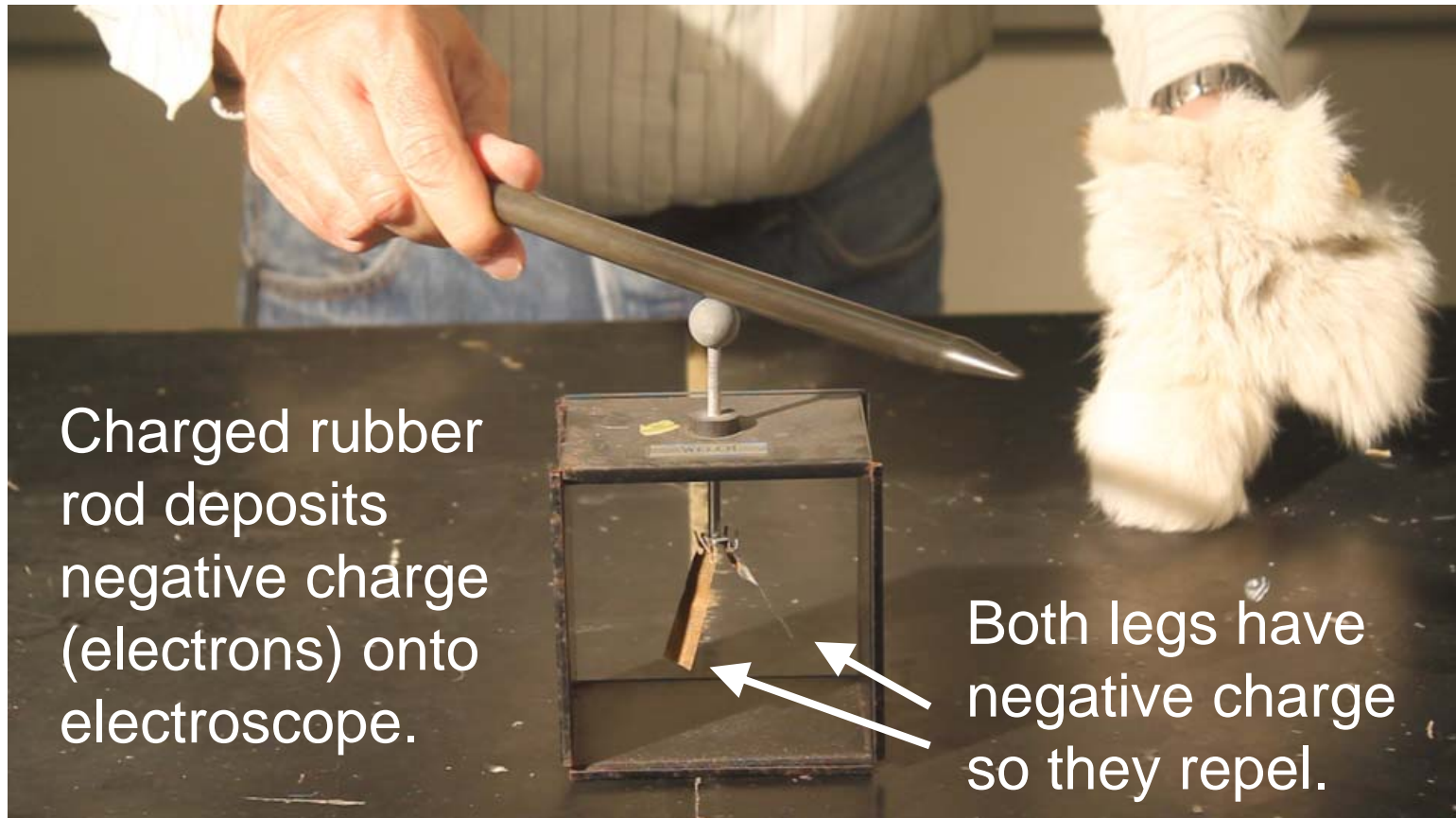


This is called the *triboelectric effect*.

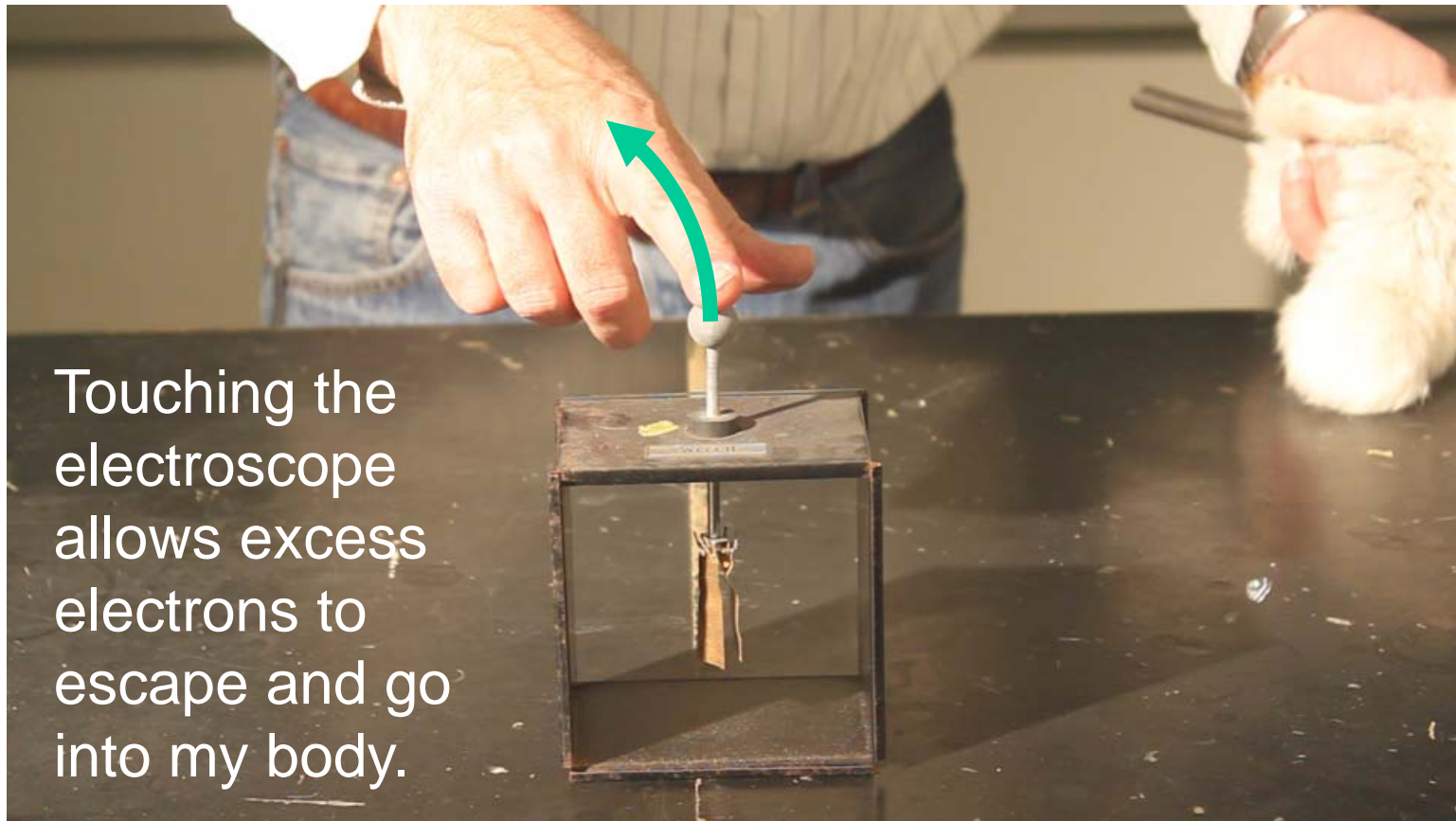
Electroscope



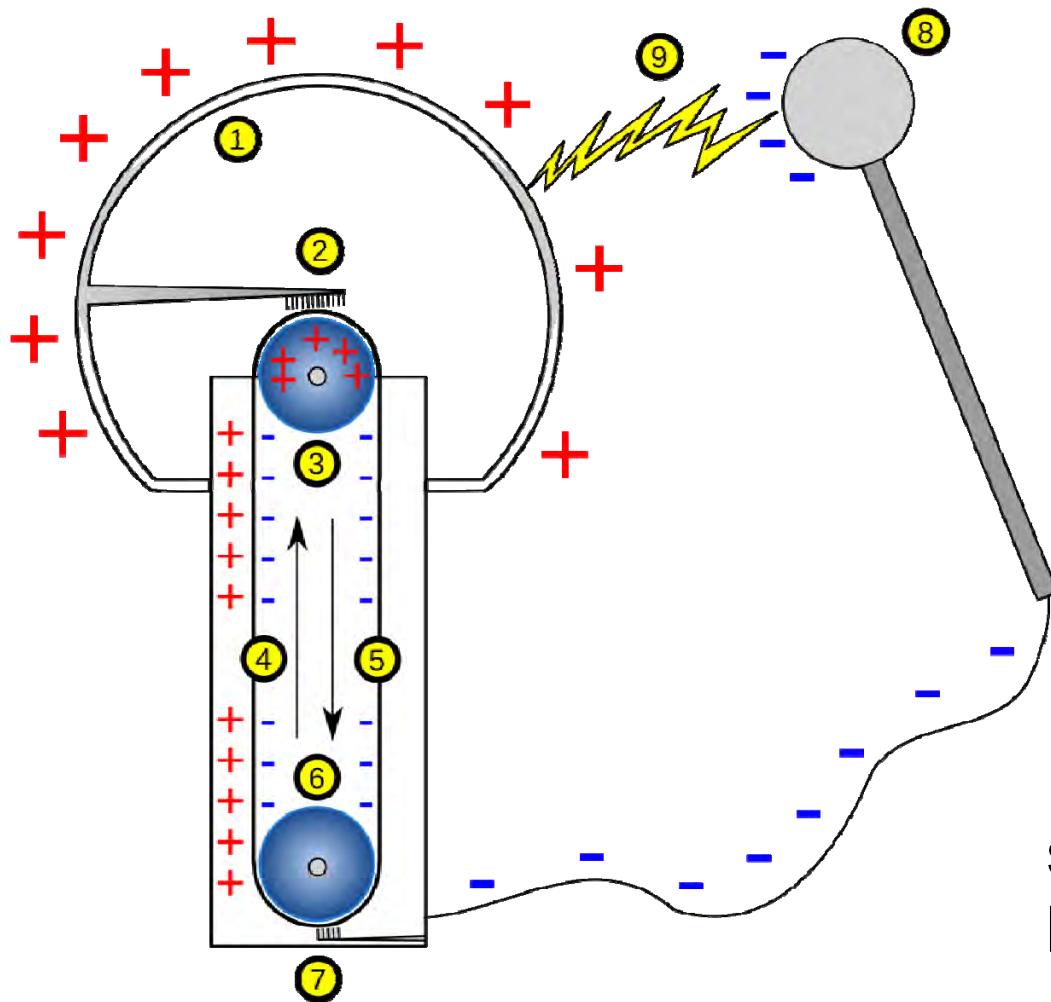
Electroscope



Electroscope



Van de Graaff Generator



Van de Graaff deposits large quantities of excess charge on its globe.

Electrical sparks send charge between globe and discharge wand.

Van de Graaff Generator

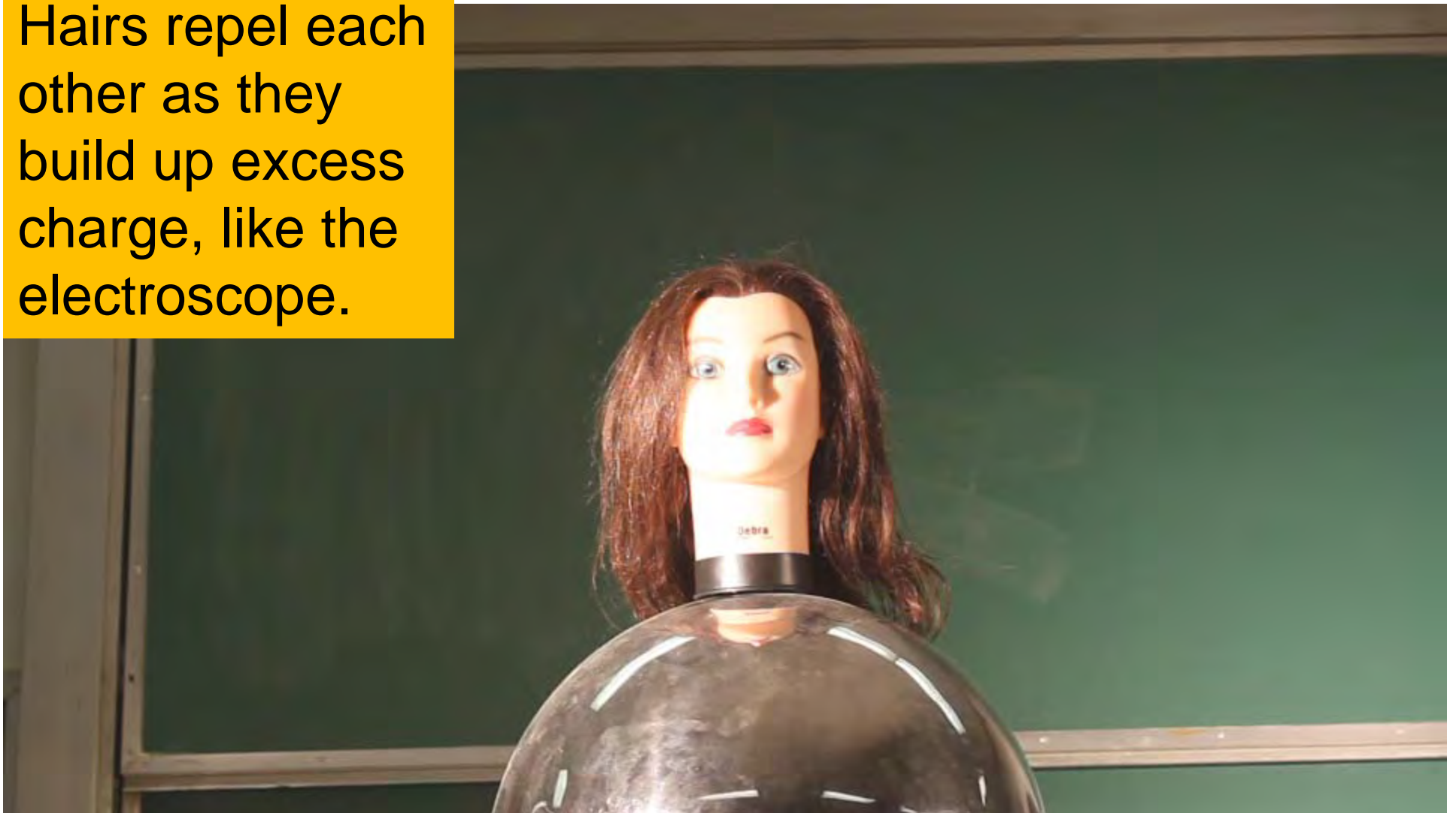
Without the discharge wand the sparks can hit my hand, which is painful but not lethal.

500,000 Volt
Van de Graaff



Van de Graaff Generator

Hairs repel each other as they build up excess charge, like the electroscope.

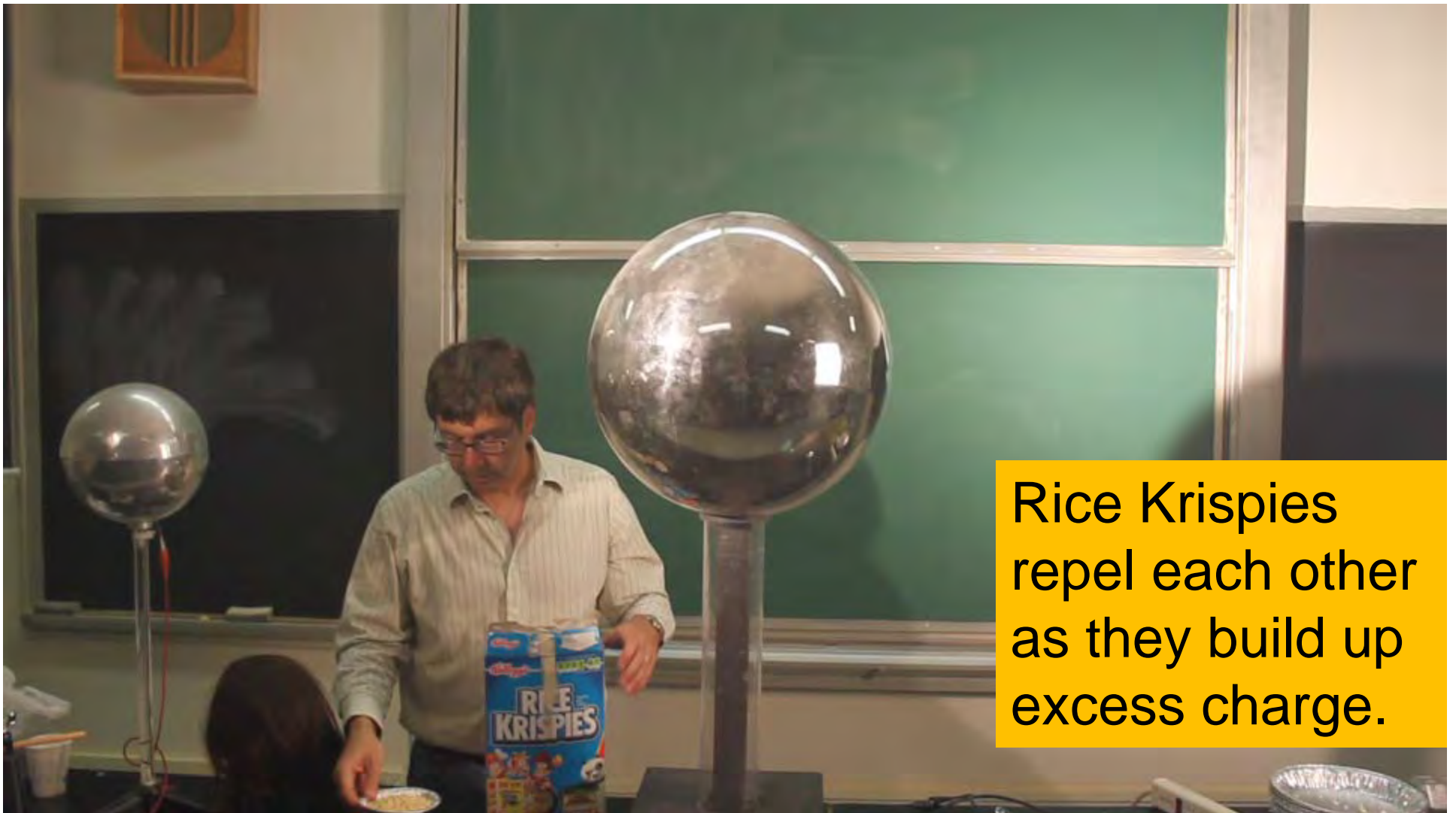


Van de Graaff Generator



Pie plates repel each other as they build up excess charge.

Van de Graaff Generator



Electric Potential

Electric potential indicates energy *per charge*,
like temperature indicates energy *per molecule*.



Safe because *total* amount of energy is small.

Summary

- Atomic particles (protons and electrons) carry positive and negative electrical charges.
- Like charges repel while opposites attract.
- In general objects have equal + and – charge.
- Electrons move easily so objects may become charged by frictional contact.
- Van de Graaff generator's dome can collect charge and raise it to a very high potential.
- Electrical potential (volts) indicates energy per charge, similar to temperature which indicates energy per molecule.