Alien Detector

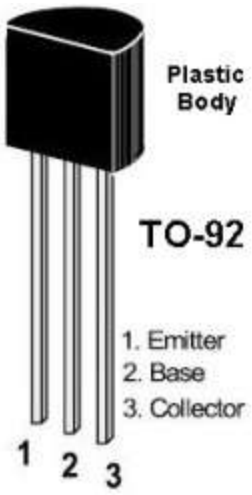
Overview: This experiment is for advanced students. This simple circuit can detect electric fields. Remember the electroscope experiment? This is an electronic version of it! After you've build one, hand it to your friends and announce that you've just been told there's an alien presence in the room, and challenge them to try to figure out where the aliens are hiding. (Let them know that aliens, like kids, never stay in one place either.)

What to Learn: This detector finds areas of positive charge, and is so sensitive that you can go around your house and discover pockets of static charge… even from your own footprints!

Materials

- 9V battery
- 9V battery clip with two wires (Radio Shack part #270-325)
- MPF 102 (Radio Shack part #276-2062)
- LED (any regular LED works fine, or Radio Shack part #276-012 is a great choice, because it will light up in both directions in case the kids hook it up backwards)
- 3 alligator clip leads (Radio Shack Part #278-1156)

Lab Time



1. Hold the MPF 102 transistor (image at left) with the flat side facing you. Be very careful with these, as it's easy to snap off the little wires, or zap them with too much heat or static which kills them. Here's how you identify the parts:
    a. Pin #1 is the one on the left, also called the *emitter* or *drain*.
    b. Pin #2 is in the middle, called the *base* or *source.*
    c. Pin #3 is on the right side, called the *collector*, or *gate.*
2. Gently spread apart the three leads into a W-shape, so you can get in there with alligator clips.
3. Bend the *gate* (pin #3 on the right side) upward. This is going to be your antenna, and will not be connected to anything. You can solder a longer wire if you're mounting it in a soapbox if needed.
4. Connect the *source* (middle lead) to an alligator clip lead. The other end of your alligator wire connects to the positive (red) wire of the battery clip.
5. Separate the two wires on the LED into a V shape so you can slip on alligator clip leads without them touching each other.
6. Connect the *drain* (pin #1 on the left side) to one of the LED wires using a second alligator clip wire.
7. Using the third alligator clip lead, connect the other LED wire to the black wire on the battery clip. Make sure the alligator clip lead is connected to the metal, not the insulation part of the wire. It's easy to have it connected on the last bit of the insulation, which raises it up a little and doesn't make metal-to-metal contact between the alligator jaws and the wire. Take your time and do it right.
8. Check all connections twice by repeating steps #1-9. Double-check *before* powering up.
9. Carefully insert the 9V battery into the battery clip. The LED should light up.
10. If the LED is dark, try running a plastic pen through your hair and waving the pen at the antenna gently. The LED should light up.

11. ***Do not touch the antenna!*** This will zap the circuit and fry the transistor, and then you will have to start all over. You can increase the antenna sensitivity by dangling an extra wire (like an alligator clip lead) to the end of the antenna.
12. Now walk around the room and find those aliens! And then fill out the worksheet.

If the detector doesn't work:

1. If it doesn't work, switch batteries with someone to see if you've got a good power source. It doesn't take much to power this circuit.
2. If it still doesn't work, disconnect everything and start over! You might have something not connected right.
3. If it *still* doesn't work, switch out your alligator wires for new ones. Sometimes there's a break between the wire and the alligator head, which breaks the circuit open.
4. If you're still reading this, my guess is that it STILL doesn't work… which means a couple of things:
    a. It's too humid. If you can't get a balloon to make your arm hair stand up, it's too humid for this experiment. You'll have to try this on another day, or close the doors and crank on t he heat.
    b. Transistor is connected wrong, so go through steps #1-9 again.
    c. Transistor is burned out, so grab a new one.

Alien Detective Table

Area/Object Tested	LED Light Up?	Comments
Ran a pen through my hair	*Yes!*	*Aliens might be on the pen or in my hair. Further testing needed on the different areas of my head.*
Near a tree / bush / living plant		
Near the ground (where specifically did you test?)		
Charged balloon on my hair		
Charged foam plate with wool		

Reading

This simple FET circuit is really an electronic version of the electroscope we built in a previous lesson. This "Alien Detector" is a super-sensitive static charge detector made from a few parts from Radio Shack. I originally made a few of these and placed them in soap boxes and nailed the lids shut and asked kids how they worked. (I did poke a switch and the LED so they would have some help as they figured it out.)

After you've made your charge detector, turn it on and comb your hair, holding the charge detector near your head and then the comb. You'll notice that the comb makes the LED turn off, and your head (in certain spots) makes the LED go on. So it's a positive charge static detector… this is important, because now you know when the LED is off, the space you're detecting is negatively charged, and when it's lit up, you're in a pocket of positively-charged particles. How far from the comb does your detector need to be to detect the charge? Does it matter how *humid* it is? You bet!

You can take your detector outdoors, away from any standing objects like trees, buildings, and people, and hold it high in the air. What does the LED look like? What happens when you lower the detector closer to the ground? Raise it back up again to get a second reading… did you find that the earth is negative, and the sky is more positive?

You can increase the antenna sensitivity by dangling an extra wire (like an alligator clip lead) from the end of the antenna. Because thunderstorms are moving electrical charges around (negative charges downwards and positive charges upwards), the earth is electrified negatively everywhere. During a thunderstorm, the friction caused by the moving water molecules is what causes lightning to strike! (But don't test your ideas outside in the wide open while lightning is striking!)

Exercises

1. When the LED is on, what do you think it means?
2. Does the LED turning off detect anything?
3. Do aliens like humidity?
4. How does this alien detector really work?

Answers to Exercises: Alien Detector

1. When the LED is on, what do you think it means? (It detects a positive charge region.)
2. Does the LED turning off detect anything? (Yes – a negative charge region.)
3. Do aliens like humidity? (No – this experiment doesn't work in high humidity.)
4. How does this alien detector really work? (It's a positive charge static detector… this is important, because now you know when the LED is off, the space you're detecting is negatively charged, and when it's lit up, you're in a pocket of positively-charged particles.)