DIY SUN SCIENCE

Solar Convection

What causes Solar granules on the Sun?

Description

Use hot and cold water to see how fluids at different temperatures move around in convection currents.

Age Level: 10 and up

Materials

- Loaf pan-sized glass or clear plastic container
- Blue food coloring
- Red food coloring
- Access to tap water
- Two drinking cups of equal size
- Handful of ice cubes
- Two spoons
- Strainer

A rectangular glass baking dish or clear plastic food storage container, roughly 7 cm deep or greater, works well for this activity.

Time

Preparation: 5 minutes
Activity: 10 minutes
Cleanup: 5 minutes

Safety

Be careful not to spill the colored water you prepare. Be very careful with hot water to avoid burns.

Step 1

Pour tap water into the large container, then let the water come to room temperature. Fill the container to about 2 cm from the top.

Step 2

Fill one cup with ice, then add cold water up to the top of that cup. Place 10 drops of blue food coloring into the water and carefully mix with a spoon. Pour the blue water and ice through a strainer to retain only the blue water.

Step 3

Fill the other cup halfway with hot tap water. Place 10 drops of red food coloring into the cup of hot water and mix with a spoon.

Tip

So that there is an equal volume of hot water in one cup and cold water in the other, the cup of hot water is only filled halfway.

Step 4

Have a friend help you. At the same time, one of you should slowly and carefully pour the hot red water into one side of the large water-filled container, while the other slowly pours the ice cold blue water into the opposite side.

Step 5

From the side of the container, watch the red and blue water to see how the colors move around in the larger container of water. Do both the red hot water and blue cold water move in the same way?

Tip

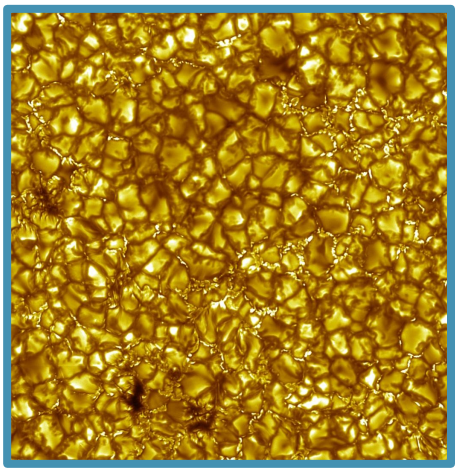
Watch the water in the container for about 2 minutes. Use your device's camera to take images of the water every 10 seconds, so you can go back later and see how the colored water moved.

What's Going On?

You should have seen the hot red water stay towards the top of the container, while the cold blue water sank towards the bottom. Hot water is less dense than the surrounding water, so it tends to float up and stay towards the top. Cold water is denser, so it tends to sink down. This process, called convection, tends to spread heat out evenly within the container full of water, so that one area does not stay colder or hotter than the surrounding water.

Convection in the Sun

This same convection process occurs in the Sun. The Sun's core is hotter than its outer layers. Hot plasma rises from the core toward the surface, where it cools and sinks back towards the core. This process forms convection cells that we see as Solar granules. (Remember the sprinkles you put on your Sun Cookies? Those represent Solar granules.). The lighter color in the granules is the Sun's hot plasma that has risen to the surface. The dark areas are where the plasma has cooled and is falling back towards the core. These Solar granules are usually about 1,000 km wide and can last less than an hour.



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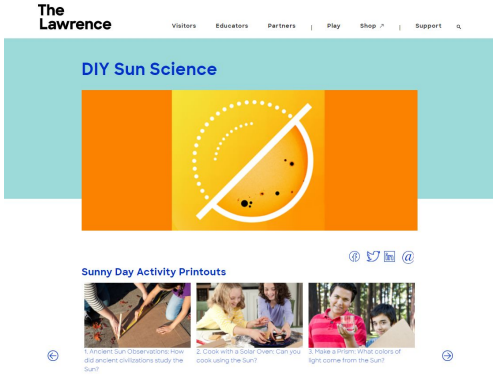

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Credits

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Slide 9, Vasco Henriques, Swedish 1-m Solar Telescope, Institute for Solar Physics.

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