

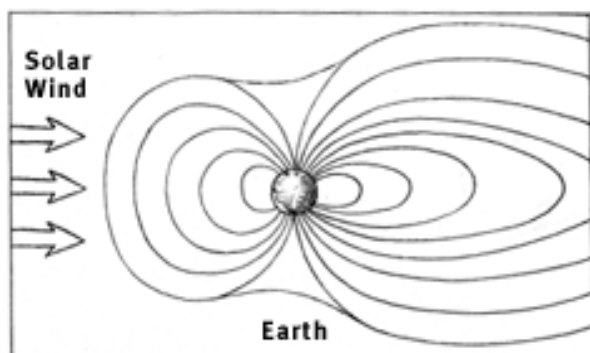
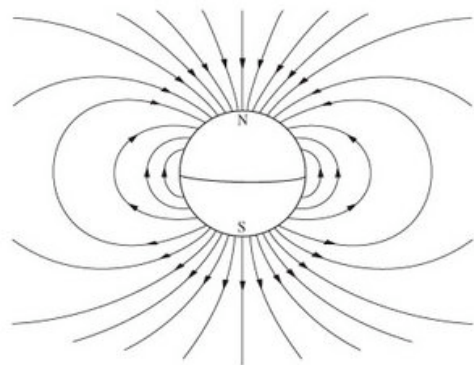
# Spotting magnetic storms

**News alert! The Earth's magnetic field CHANGES SHAPE!**

Yes, it's true. The Earth's magnetic field doesn't always look the same. You may have seen a picture of the Earth's magnetic field looking like this:

But did you know that the Solar Wind, which streams from the sun at 100s of kilometres every second (that's a million miles per hour), squashes the Earth's magnetic field, so that it looks like this

:



You can see this happening, if you measure the direction of the magnetic field. If you are very lucky, you might see it changing very dramatically, and that is a sign that an aurora could be happening!

# How to make and use your own magnetic storm spotter

The magnetic storm spotter is a very simple piece of equipment. It measures changes of the magnetic field at the Earth's surface.

## Equipment

A clear (and clean!) plastic 2-litre pop bottle with its label removed and a plastic lid

Thread

A bar magnet shorter than the width of the bottle

A small craft mirror, mirrored sequin or piece of mirror-card

A piece of card

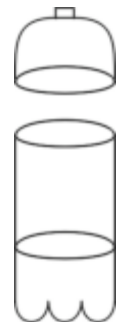
Rice to stop the bottle falling over

A drinking straw

Sticky tape, scissors, glue and blu-tac

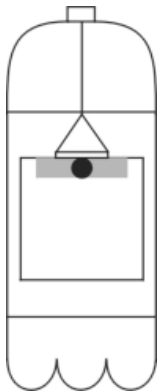
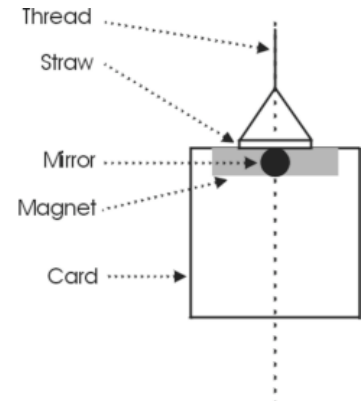
## Instructions

- Carefully cut around the pop bottle to remove the top 1/3.
- Fill approximately the bottom 1/3 of the bottle with sand or rice.
- Cut the straw slightly shorter than the magnet and stick it to the magnet using glue or sticky tape.
- Cut a 50cm length of thread and thread this through the straw.
- Make a triangular loop of this thread keeping the long piece of thread attached to this triangle.

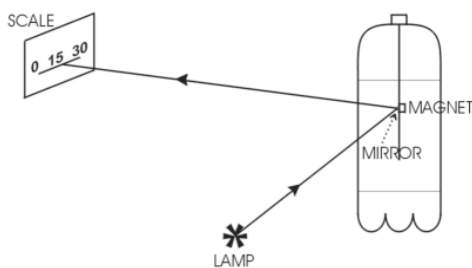


## Spotting magnetic storms

- Cut a rectangular piece of card. It must be able to move freely within the bottle when hanging vertically. Use glue to stick the magnet to the middle of the top edge of this.
- Stick the mirror to the middle of the other side of the magnet. Make sure this is in line with the thread from which the magnet is hanging.
- It is important to make sure that the magnet hangs horizontally. If the magnet isn't quite horizontal stick a small piece of blu-tac to the cardboard to rebalance it.



- Make a small hole in the centre of the bottle top and screw the top back on.
- Feed the thread through the hole and adjust the length of the thread so that it does not scrape on the sand. Also, the mirror should be at least 2cm below the cut edge of the bottle. Secure the thread to the top of the bottle to stop it slipping. Use sticky tape or glue, or tie the thread to a matchstick laying across the hole.
- Tape the top of the bottle to the bottom.



### Now you have a magnetometer ready to use!

You now need to reflect a narrow light source off the mirror and onto white card. This should be 1-2m away from the bottle. The angle between the lamp and the mirror should be between 10 and 20°.

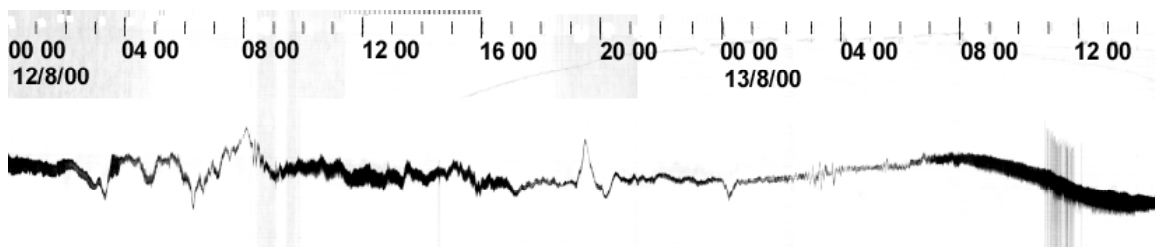
You can mark where you see the light on a scale on the card (or along a metre rule). Mark the position of the light spot every one-two hours. You should see the spot moving during the day. If the spot moves a lot – you may be observing a magnetic storm. **Beware metal objects and trains!**

If you think there might be an aurora, then look north in the sky, and see if you can see any strange lights. Or you could visit Aurorawatch to see if they think there will be an aurora tonight. <http://www.dcs.lancs.ac.uk/iono/aurorawatch/>

## What to look out for

You will find that some days are quiet and some are busy. If you can leave the detector running for a long period of time (tens of hours) then you will start to notice a regular daily cycle which is due to the Earth's rotation causing the detector to go through the squashed (sunward) side and extended (night-time) side of the Earth's magnetic field once a day. You will see that the bottom of the dip in the signal is around midday, when the Sun is directly south, so at this point the Sun switches from being on the east side to being in the west.

On a busy day your results will be all over the place with troughs and peaks. A scanned in version of the plot from a pop-bottle detector is shown below.



If you want to see some results from a magnetometer at Lancaster University see <http://www.dcs.lancs.ac.uk/iono/aurorawatch/detectors/results.html>