Hi all,

Just thought I would write up the instructions for making a very sensitive jam jar magnetometer. The plans are based on instructions found on the internet, but it was so long ago, I can't remember from which site.

These plans will make a very very sensitive magnetometer. This magnetometer will go crazy if someone downstairs sets up an ironing board, or if a car drives near your house (within 50m or so!). If the car parks, the local magnetic field is permanently displaced and the magnet will not return to its original position until the car leaves. Turning a TV off nearby causes it to move a lot. Sometimes you will see unexplained magnetic activity. It will also show fluctuations in the earth's magnetic field which are most obvious during geomagnetic storms.
How to make a very sensitive jam jar magnetometer by Robert Cobain

The ingredients needed are as follows,

1. A plastic jam jar! I have used a glace cherry pot. The jar needs to be plastic so you can make a small hole in the bottom.

2. Two small, identical Neodymium magnets. Neodymium magnets are the strongest magnets you can get. There are two places to find such magnets. First, is inside quality headphones. Taking out the magnet means destroying the headphones but these are where the strongest neodymium magnets are found (400 kJ/m³ in some cases). Second place to get neodymium magnets is www.maplin.co.uk. The magnets I have are from a set of sony headphones that cost £25 (Went deaf in one ear, no need for stereo!). The reason why two are needed is so that you can clamp the thread between them.

3. A small mirror. The mirror is used to reflect the laser light onto a wall. Such mirrors can be found in numerous ladies beauty products, mascara, foundation, whatever that stuff is.

4. Some acetone. This can be found in the local chemists. This is to remove the coating at the back of the mirror.

5. Some very fine nylon thread. The type of thread I am talking about here is very very thin but quite strong. It can be found in the 'rope' of those gift bags you get, also in some fake Santa beards.

6. A laser pointer. It is important to use a simple laser pointer as found in a gift shop rather than a strong 5mW one, as powerful lasers will overheat and blind you etc.

7. Blu tack for securing the thread

8. A cotton bud made from plastic tube.

9. Rubber glue as found in bicycle repair kits.

10. A copper or gold coin. The coin is used to dampen the movements of the magnets. I am using a gold half-sovereign.

11. Something to hold the laser in place. I have used polystyrene to make a mounting. A peg or elastic bands can be used to hold the laser on button.

Once you have got everything together you need to prepare the jam jar. Drill or melt a cotton bud tube sized hole into the middle of the top (the cap) and bottom of the jar.

Cut two 1cm long pieces of cotton bud tube and put each into the two holes you just made, hopefully it will be a snug fit, if not use something else to fill the gap, like a cork. The fine thread will go through these tubes and secured by blu tack at each end.

Cut a circular hole the same size as your coin in the side of the jar, half way between the top and the bottom.

Next we are ready to make the heart of the magnetometer, this is the fiddly bit.
How to make a very sensitive jam jar magnetometer by Robert Cobain

A mirror is a piece of clear glass with a reflective coating. If you used the mirror as it is for reflecting the laser light, you would have problems with refraction as the light passed through the glass and it would be hard to get a reading of the magnetic field movements. For this reason we need to reveal the naked silver surface of the mirror. On the back side of the mirror will be a greybrown coating. Removing this will reveal the surface of the mirror. The acetone will dissolve this coating. Once the coating is removed cut (using pliers or something and wear glasses!) the mirror into two small square pieces, the same size as the magnets.

Take a length of the fine nylon and stretch it out on your desk. Use the magnets to clamp onto the middle of the thread. This is easier said than done as the magnets are so strong the will slam (wear glasses, the magnets can disintegrate!) together and chuck off the thread. Once you've got the thread going between the two magnets take the two small pieces of mirror and glue (glass) back to back just above or below the magnets. Use the rubber glue as this will not melt the fine thread and can be easily taken apart if you make a mistake.

Once you've got this set up which might take a while, thread the nylon through the bottom and tops of the jar, through the cotton bud tubes. Secure the thread at each end with blu tack and screw on the lid. Adjust the thread until the magnets and mirrors hang in the middle and so that the thread is tense.

Make a mount to hold the coin by making a roll of stiff card, like a business card and push into the hole you made in the jam jar. The idea is that the face of the coin is a few cm from the magnets and can be pushed in and out to adjust the damping effect.

At this point you are almost ready to go. You'll be glad after all that! You need to find a place which doesn't have much metal around or magnetic disturbances (easier said than done!!) and using a mount, point the laser at the mirrors. Hopefully the laser will reflect off the mirrors onto a nearby wall, from where you can see a dot that will move at the slightest magnetic disturbance. The magnets will automatically align north-south. During a magnetic storm, the light on the wall will appear to drift, over the space of several minutes or hours back and forth. For example, in my room with the wall a couple of meters away it appeared to move over the space of 30-40cm. This was during strong storms a few years ago.

If the light keeps jumping about too much (due to being so sensitive!) dampen the movements by pushing the coin closer.