

# Wave-length

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21 September 2009

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## 1 introduction

Wave-length proposes an open exploration of the physical characteristics of various wave phenomena: sound, light and radio, with the latter two encompassed under the heading of electromagnetism [EM]. Wavelength in all instances has a direct relationship to oscillation and thus frequency, to resonance and to any form of change in time and in space. In the case of radio waves, wavelength is translated into a highly physical architecture of antennas, dishes and arrays approximating patterns of reflection and refraction.

Whispering galleries and sound mirrors provide inspiration in the audio realm. These fields can also be mapped to the microscopic, with diminishing wavelengths, microwaves, leading into a light which literally colours perception. Wave-length acts as a guiding principle of scale and measure with detection or exploration determined by the quasi-scientific expansion of sensory apparatus.

The wave-length workshop will explore both sound and EM phenomena from a spatial perspective: the construction of a landscape of antennas, oscillators and detection or measurement devices using simple materials. The workshop will close with a final performance from participants.

## **2 activities**

... include physical wave transitions, waveguide antennas, cymatics, coils and self-made speakers, spark gap transmission, iron ore saturation and magnetic fields in pottery, wave generation circuits, magnetometers, electrometers, amateur radio telescope, geophysical archaeology.

## **3 schedule**

### **3.1 day 1: demonstrations of phenomena:**

#### **3.1.1 static amber, compass(magnet, electricity), spark gap iron filings,**

leyden jar, magnet field, magnetometer, electrometer, wave (detection, amplification, generation), oscilloscope (with fm radio and freq gen), baudline

#### **3.1.2 building: detector (op27), magnetic field generator/oscillator.**

[detector - + and - 10k on pin3(+) , 2/3 coil, 6->2 1M, 6 as out->cap]

## **3.2 day 2: wave transitions (cymatics, detection->sound, laser modulation of sound)**

### **3.2.1 oscillation and feedback (pipes, boxes)**

### **3.2.2 light->sound (laser, transformer, photodiode amp, solar panels)**

### **3.2.3 sound wave->light (laser on speaker???)**

### **3.2.4 cymatics**

### **3.2.5 lower frequencies/coils**

## **3.3 day 3: geophysics-radio telescope-antennas, earth antenna, open construction, home-made components**

### **3.3.1 rocks-galena-diode, geophysics**

### **3.3.2 natural radio phenomena**

field trip

### **3.3.3 open construction(electricity, lasers->solar panels, coils, feedback)**

## **4 parts, equipment, materials**

### **4.1 take**

parts for VLF and for wave generation (4093,40106, extra caps etc.), magnetometer, magnets/speakers, large and small lasers/mirror, solar panels, photodiodes and amp, spark gap, cymatics materials, compass, minerals, piezos and loudspeakers, light dep res, fluxgate magnetometer[non], gold leaf, VLF receiver, Leyden jar materials, frequency generator and white noise box

### **4.2 to get there:**

foil, speakers, check amplifier, trays and dishes, corn starch, milk, boxes, sand, blu tack, thread, foil, batteries, cotton bud, old HDs, bar magnets, fur

### **4.3 books and articles:**

geophysical archaeology, all about waves, grand design, sci-am articles

## 5 notes/questions

[http://en.wikipedia.org/wiki/Magnetic\\_field](http://en.wikipedia.org/wiki/Magnetic_field)

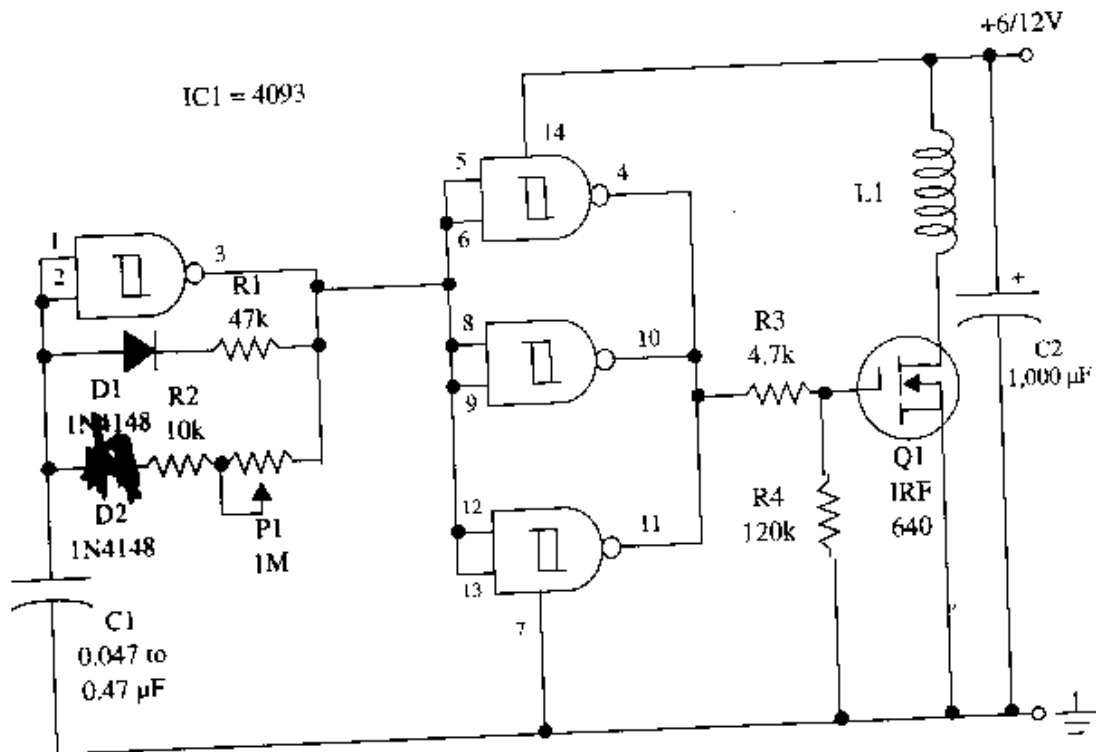
Hertzian dipole and capacitance

Maxwell's displacement current

magnetic field -> current (experiment - test with drehspeul/click)

## 6 notes/experiments to prepare

### 6.1 magnetic field generator:



**Figure 98** Magnetic field generator.

### 6.2 coherer:

<http://home.earthlink.net/~lenyr/coherer.htm>

### 6.3 various magnetometers/electrometers (one with nulling, simple leaf one)

#### 6.3.1 Jam jar magnetometers:

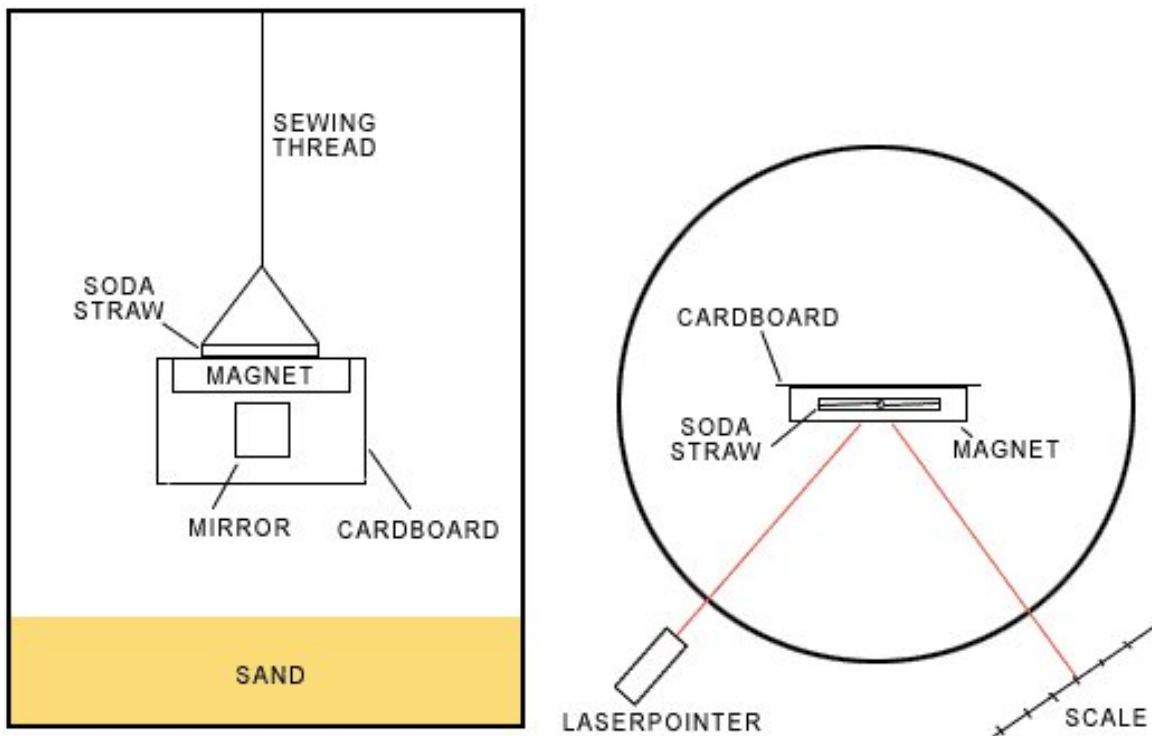
- Links:

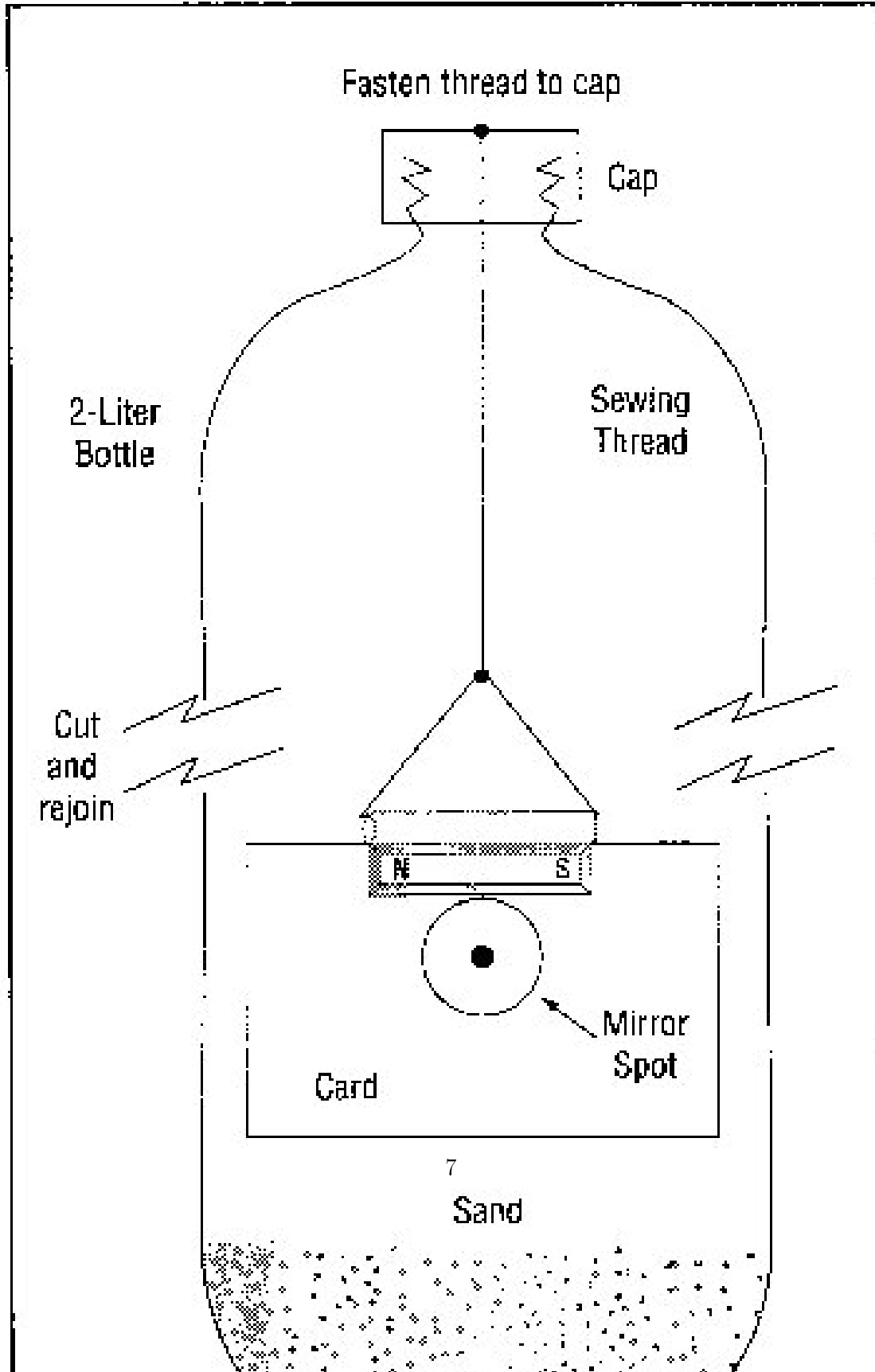
<http://www.1010.co.uk/org/geophysics.html>

<http://www.regulusastro.com/regulus/papers/magnetometer/index.html>

<http://www.britastro.org/aurora/jamjar.htm>

- This one: <http://www.eaas.co.uk/news/magnetometer.html>



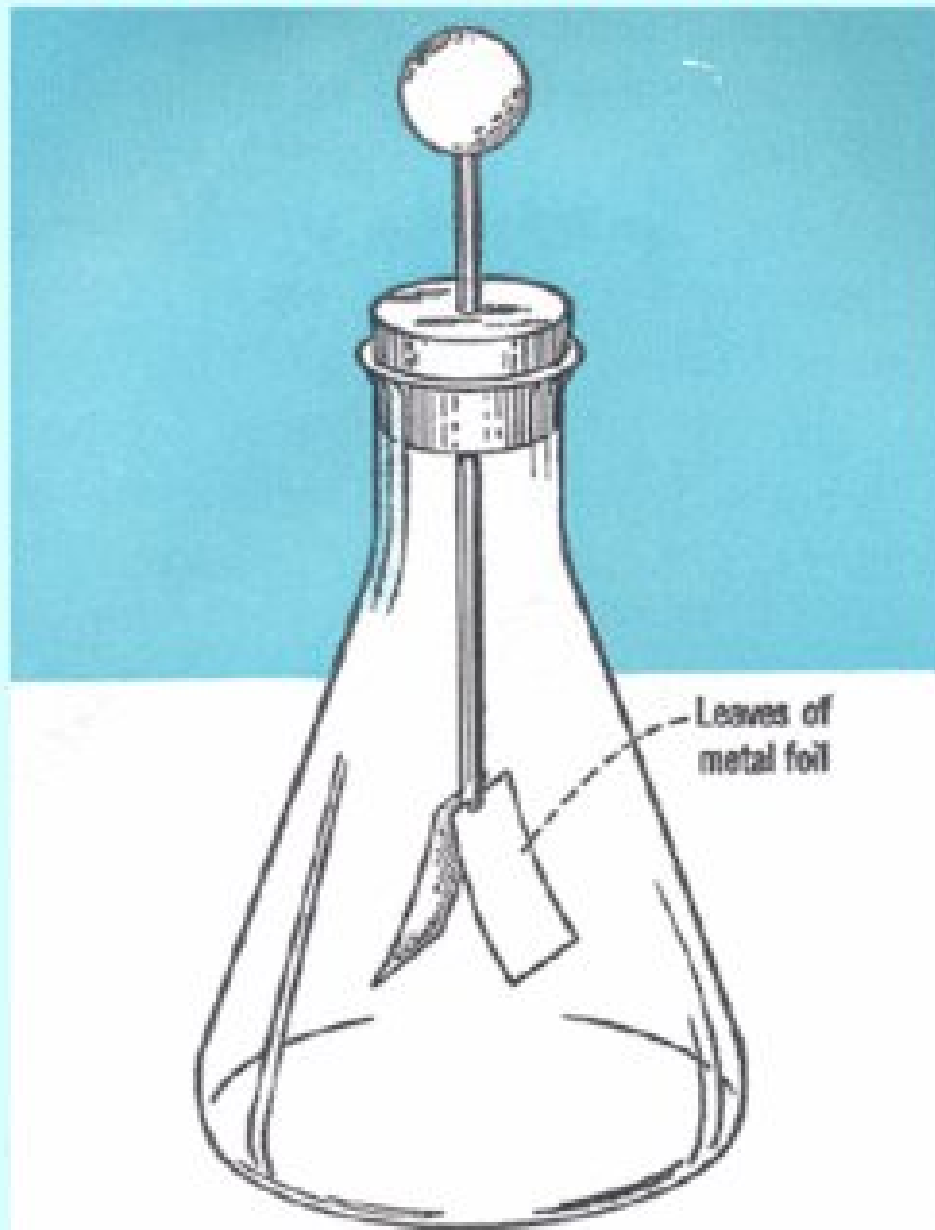


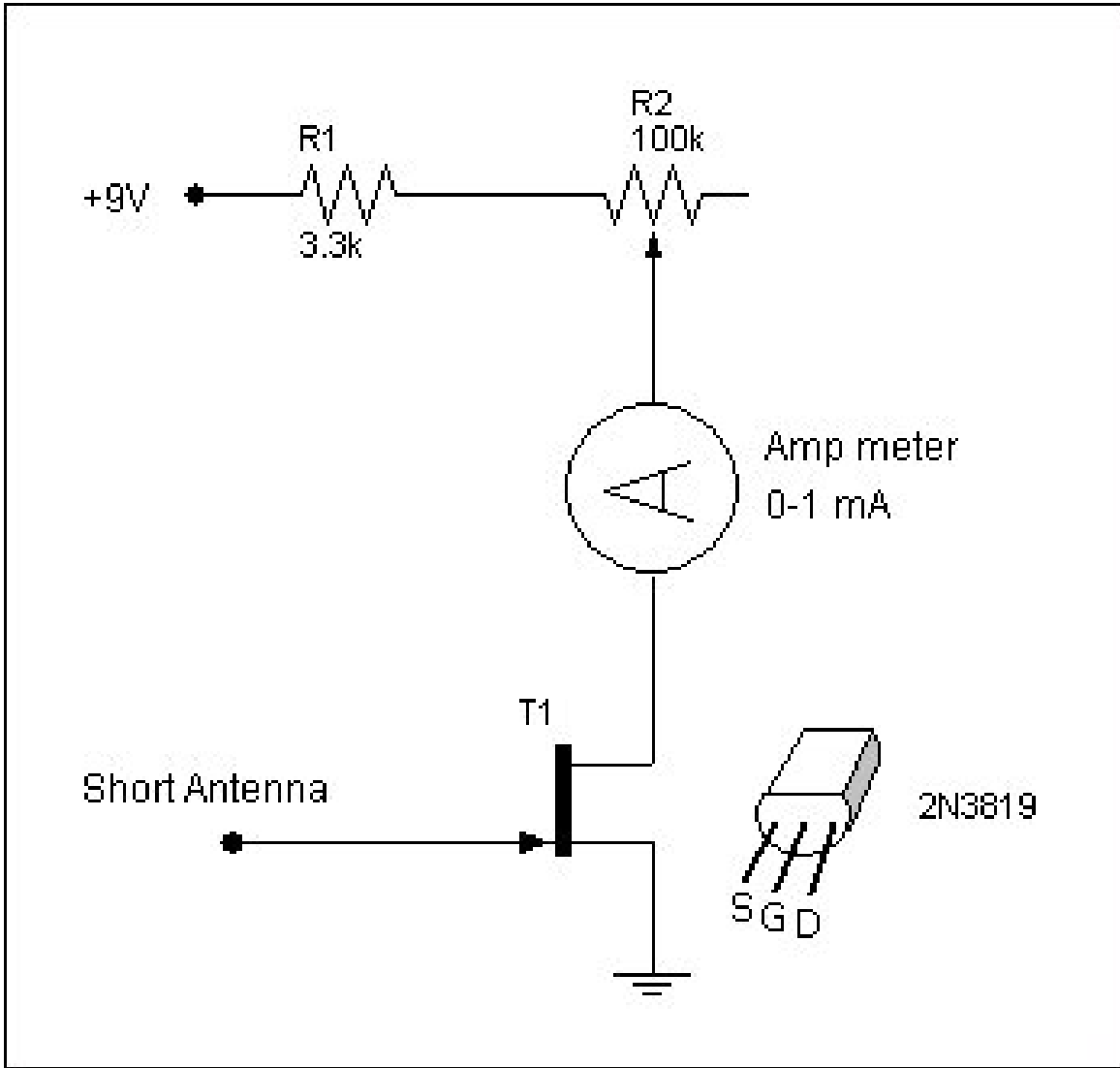




6.3.2 Electrosopes/Electrometers (gold leaf, coil and others - measuring charge/potential):

## The Electroscope Detects Electric Charge





- Links:
- leaf of foil/gold: <http://www.schoolinyourhome.com/science/electroscope.htm>

<http://www.sciences.univ-nantes.fr/physique/perso/maussion/statelec/PagesEngl/Electrosc.html>

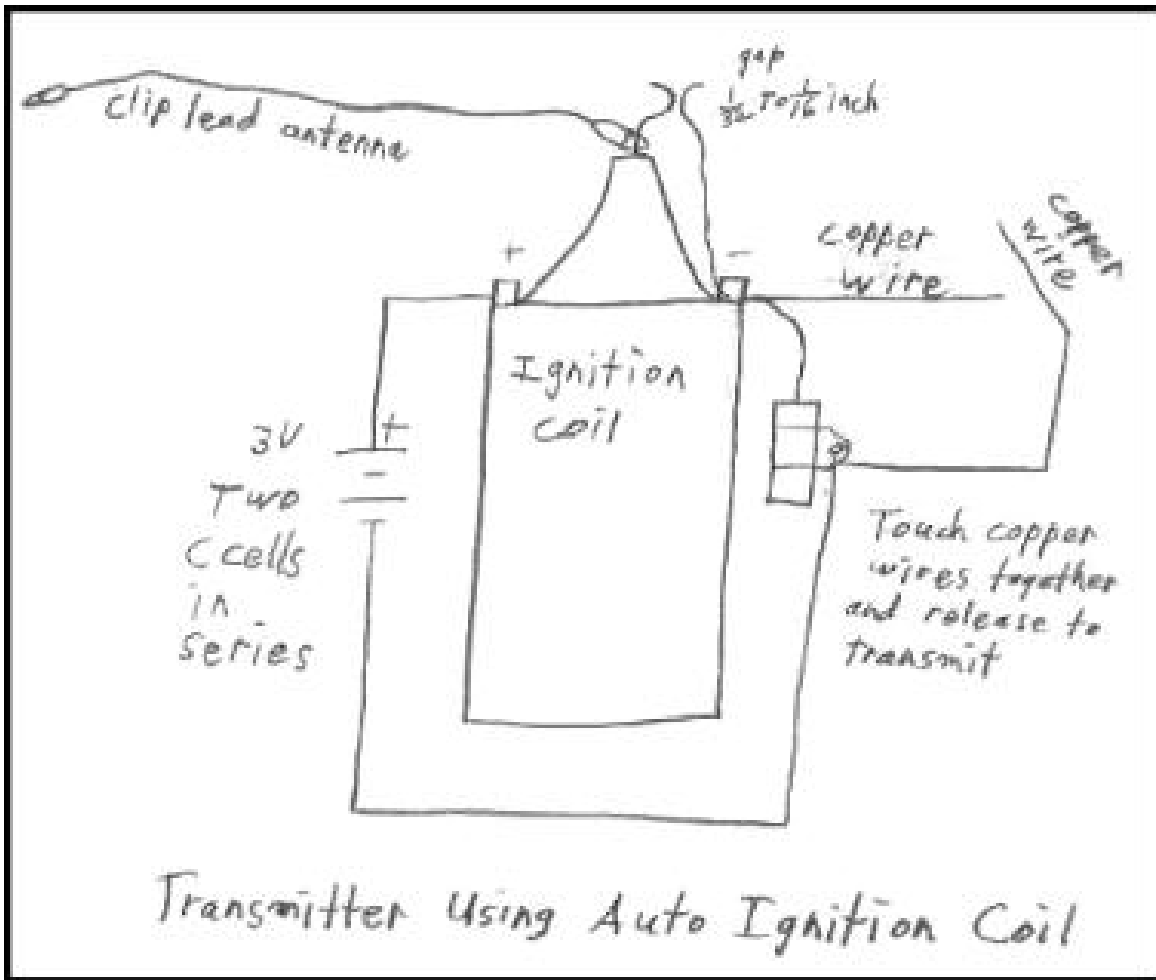
<http://www.amasci.com/emotor/chargdet.html>

FET: <http://www.vk2zay.net/article/9> (also use 2n3819 with source as audio lead)

Long list of demonstrations: <http://scripts.mit.edu/tsg/www/list.php?letter=H>

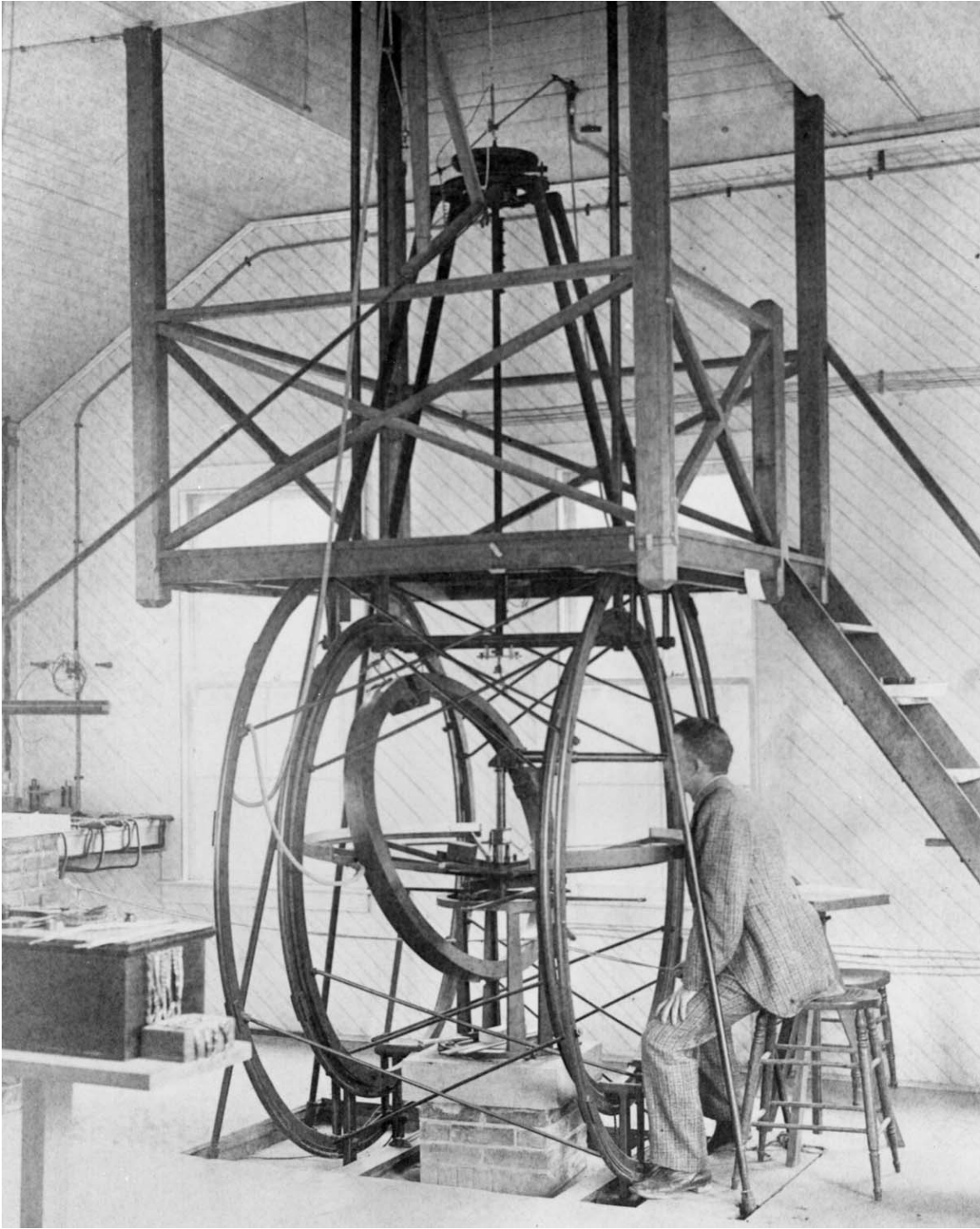
Van de graaf coke can: <http://www.vk2zay.net/article/8>

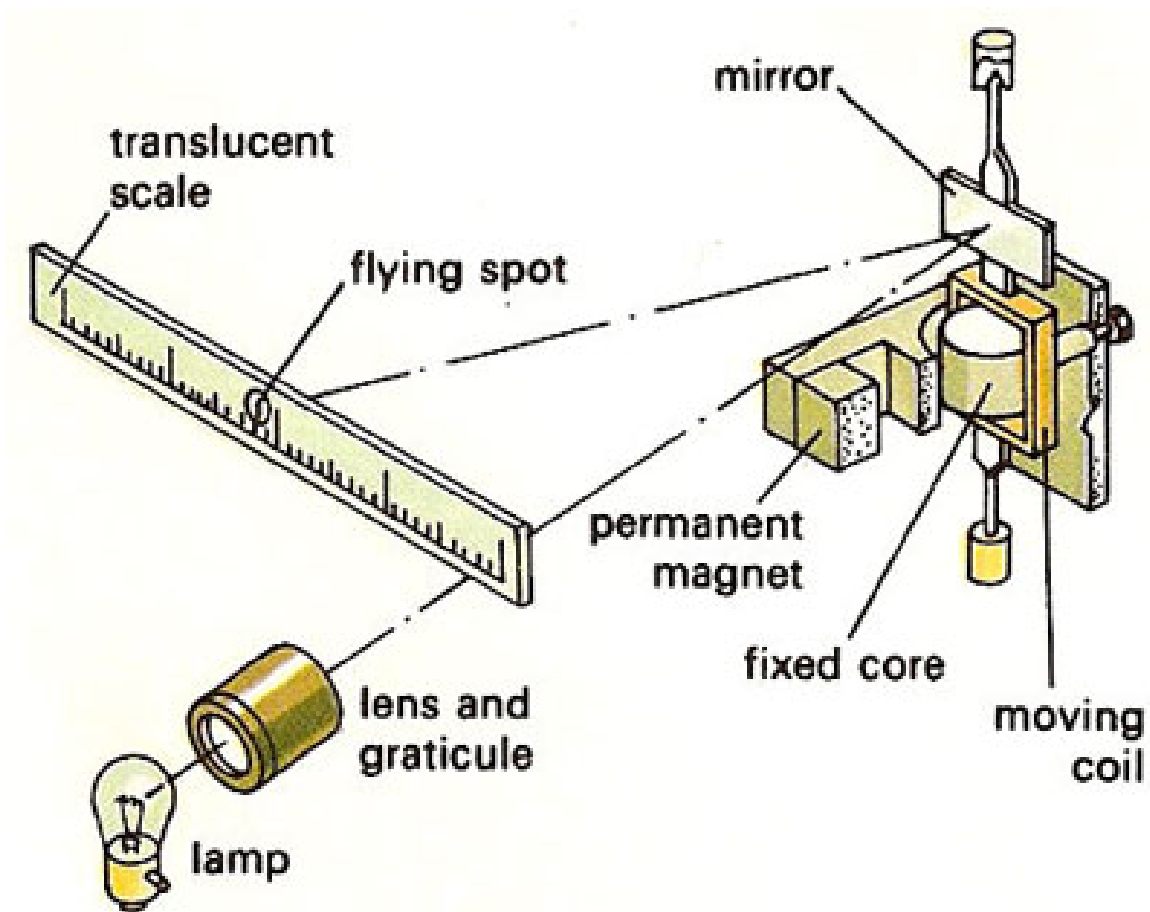
- spark gap (+ find materials for) - best with 3xAA and tiny gap with wire:



### 6.3.3 Galvanometer: current

[1886 - Cornell]





used in hard drive/ coil above compass needles  
 Using a compass: <http://madlabs.info/galvanometer.shtml>

#### 6.3.4 laser modulation

(laser power is on W close line of transformer - works well with OP37 and LPT80 diodes (just with feedback resistor)

#### 6.3.5 photo diode circuits

(try with straight op27 circuit) DONE - could be improved but...

### **6.3.6 frequency generators(2606 or schmitt)+power amp**

### **6.3.7 sound and wavelength - destructive interference//half wavelength apart:**

sound cancellation: <http://www.allaboutcircuits.com/vol6/chpt4/11.html>

### **6.3.8 cymatics:**

[http://www.rmcybernetics.com/projects/DIY\\_Devices/homemade\\_cymatics\\_display.htm](http://www.rmcybernetics.com/projects/DIY_Devices/homemade_cymatics_display.htm)

<http://www.instructables.com/id/Mechanical-Wave-Driver-for-Chladni-Plate/>

### **6.3.9 notes**

//possible - interference patterns and water waves

antenna, dipole, standing wave, water, light, refraction, coils and interference, standing wave, piezo, frequency counter, ultrasound

## **6.4 leyden jars and other experiments**

<http://www.alaska.net/~natnkell/leyden.htm>

## **6.5 links:**

[http://www.physics.upenn.edu/courses/gladney/phys151/lectures/lecture\\_apr07\\_2003.shtml](http://www.physics.upenn.edu/courses/gladney/phys151/lectures/lecture_apr07_2003.shtml)

<http://home.earthlink.net/~lenyr/coherer.htm>

<http://www.allaboutcircuits.com/vol6/chpt4/11.html>

[http://sci-toys.com/scitoys/scitoys/light/cd\\_spectroscope/spectroscope.html](http://sci-toys.com/scitoys/scitoys/light/cd_spectroscope/spectroscope.html)

Demonstrations: <http://webapps.lsa.umich.edu/physics/demolab/Content/FeaturedDemos.aspx?id>

More demonstrations: <http://jedlik.phy.bme.hu/~hartlein/www.mip.berkeley.edu/physics/noteindex>

MIT Lectures: <http://web.mit.edu/smcs/8.02/>

Homemade component links: [http://blog.makezine.com/archive/2009/04/lost\\_knowledge\\_homemade](http://blog.makezine.com/archive/2009/04/lost_knowledge_homemade)

Spectroscope/diffraction grating: [http://sci-toys.com/scitoys/scitoys/light/cd\\_spectroscope/spectro](http://sci-toys.com/scitoys/scitoys/light/cd_spectroscope/spectro)