

# Teaching Physics

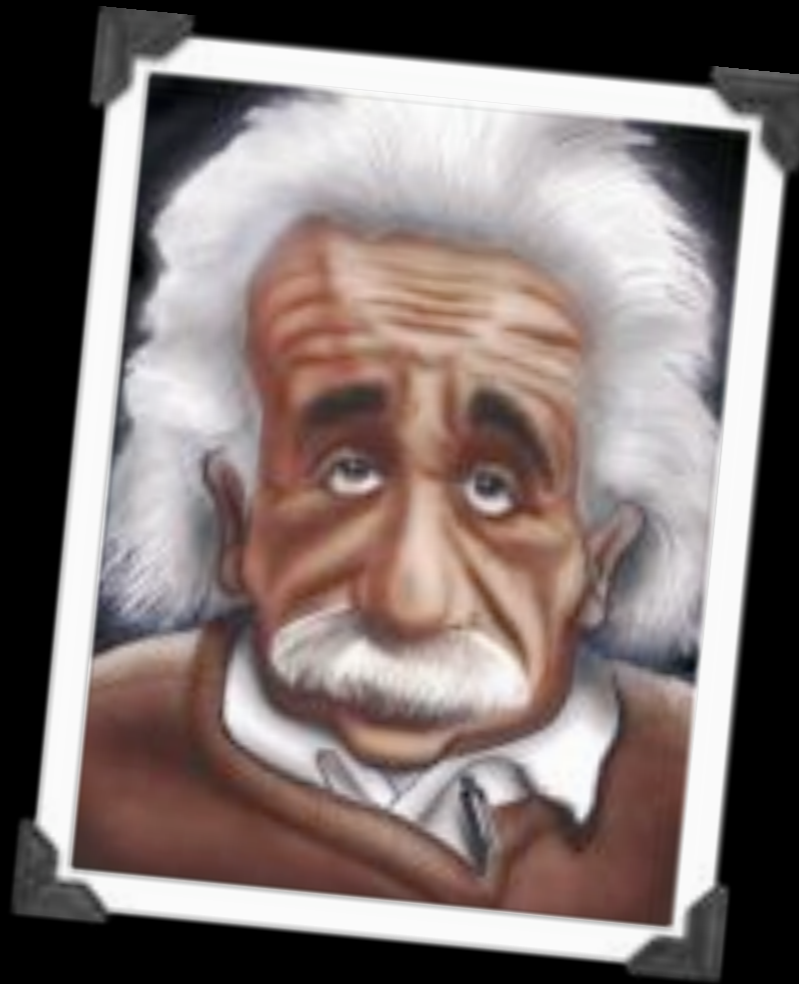
Tools that Teach,  
Engage & Connect



Carl Ahlers  
Prof Bunsen Science

“Everything should be made as simple as possible,  
but not simpler”

*A. Einstein*

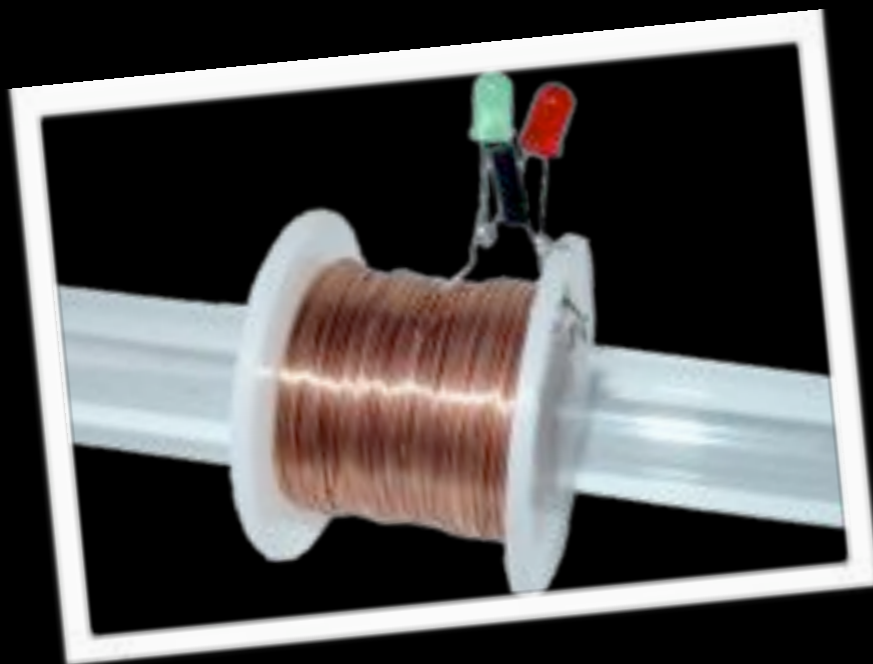


Exciting **classroom demonstrations** are the tools & platforms that deliver excitement to your classes but more importantly build the bridges between the **visual** and **abstract**.

# Electricity: Lenz's Law

The perfect lesson?

- \* One neodymium magnet
- \* One \$1 coin
- \* Aluminium / copper tube



- \* Enameled copper wire on reel (500 turns)
- \* Clear acrylic tube
- \* Two LEDs (terminals reversed)
- \* Cow magnet (alnico or neodymium)

- \* Faraday's torch



# Static Electricity

Separating charges & Using the Fun Fly Stick to demonstrate capacitor principles

Charges are created simply when two dissimilar materials in contact are **separated**



## Tribo-electric series

### Positive

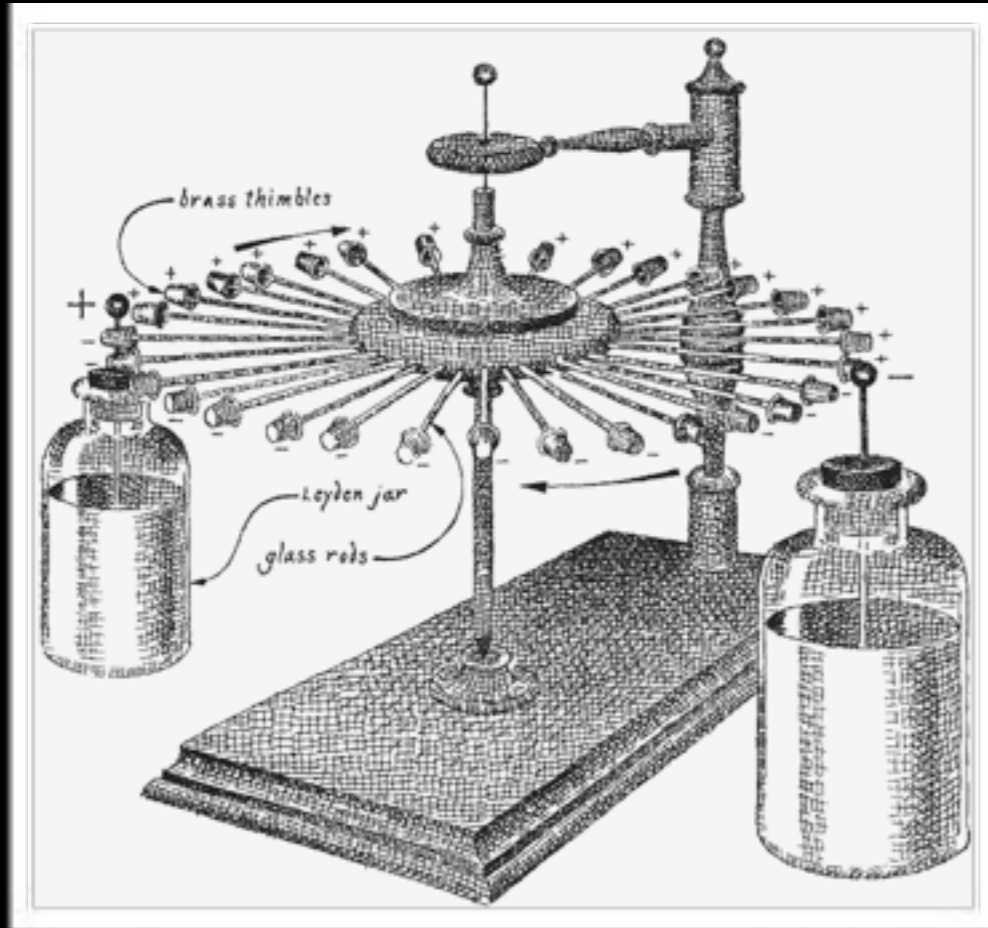
glass  
hair  
nylon  
wool  
fur  
silk  
paper  
cotton  
rubber  
copper  
polyester  
polystyrene  
PVC  
Teflon

### Negative



Leyden jar

# Electrostatic Motor



[www.profunsen.com.au](http://www.profunsen.com.au) → Downloads → Electrostatic Motor



+



=



# Magnetic / Gravity Accelerators

## Magnetic Potential Energy



Correlations between the two systems:

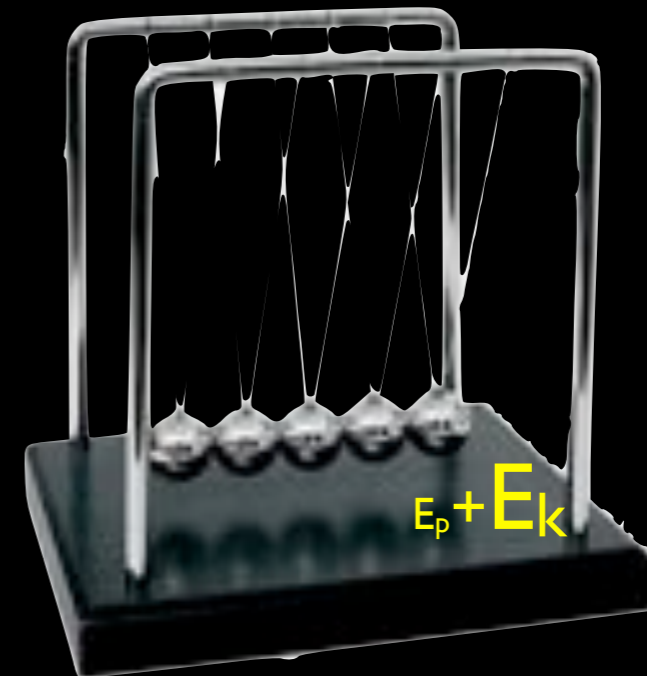
Assumed elastic collision: energy conserved = momentum conserved

Large kinetic energy at collision is sufficient to release last ball (weakest attracted) but with magnetic accelerator  $E_k$  increases due to additional gain in Magnetic  $E_p$

## Magnetic Accelerator

$$E_p \propto 1/r^2$$

## Gravitational Potential Energy



$$E_p + E_k$$

## Newton's Cradle

$$E_p \propto h$$

## AstroBlaster

Bottom 3 balls impart their E on red ball. With small mass it has to have a much larger velocity: Momentum =  $mv$



# Magnetism

Magnetism balances gravity

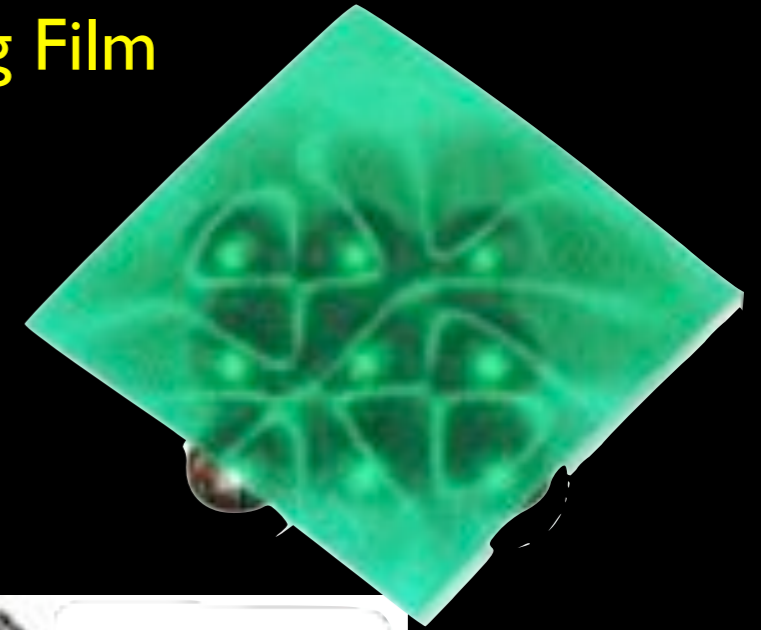
## Levitron



Spins stable in the range: 18 to 35 rps  
“The Best new Science Toy in a generation”  
American Association of Physics Teachers

## Magnetic Viewing Film

Micro-capsules with nickel flakes suspended in oil



## MagnaBalls

216 neodymium magnets,  
each upholding 225 g

# Air Pressure



Atmospheric  
Pressure  
Mat



A syringe as vacuum chamber  
using vacuum stoppers

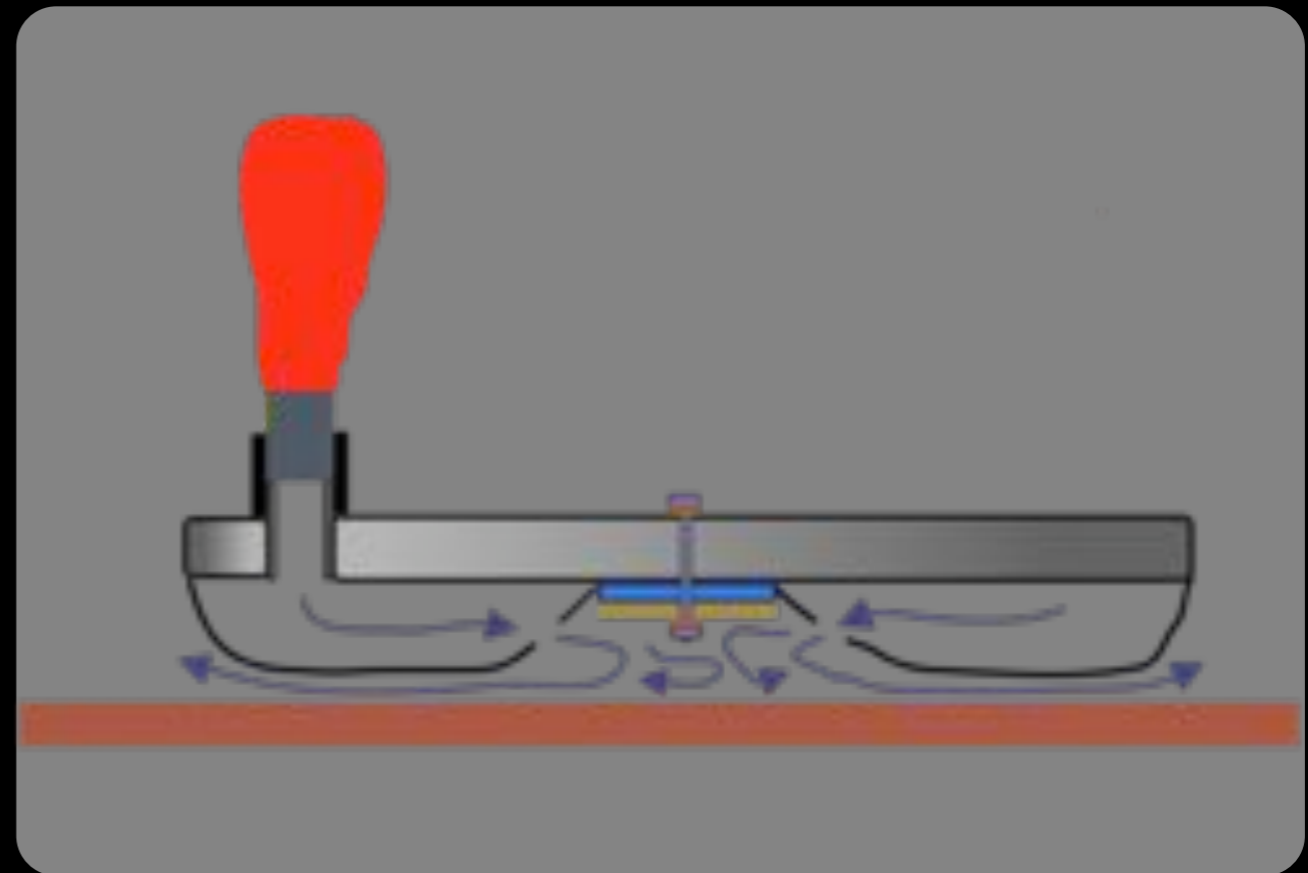
## Pressure pumper kit

Demonstrate that air has mass  
Show adiabatic expansion of air  
Show  $P$  vs  $T$  relationship  
Cloud formation



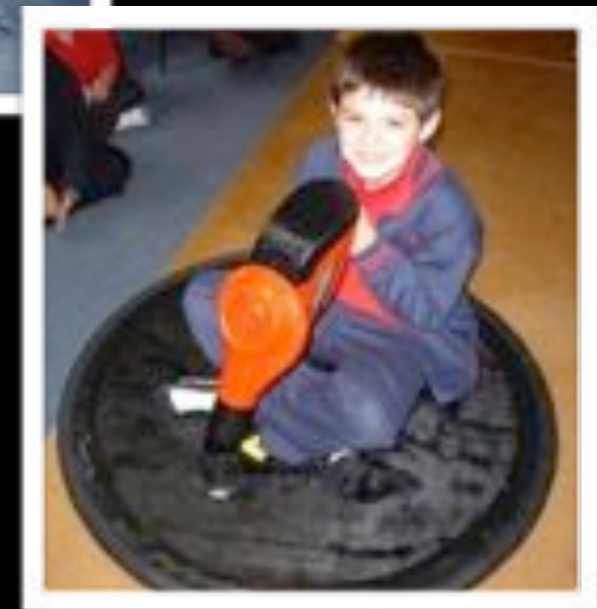
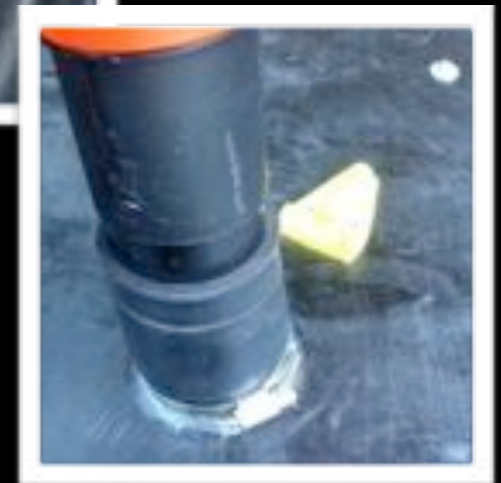
# Air Pressure & Newton's Laws

Build your own hovercraft and make students float on air!



With the hovercraft you can vividly demonstrate the First Law, accelerate different masses or apply variable forces (Second Law) and easily illustrate the Third Law's action-reaction pairs.

[www.profbunsen.com.au](http://www.profbunsen.com.au) → Downloads → Hovercraft



# Light

A diffraction grating is simply a screen made up of very narrow slits (500 slits/mm)

## Spectrum



Single-axis glasses



Multi-axis glasses



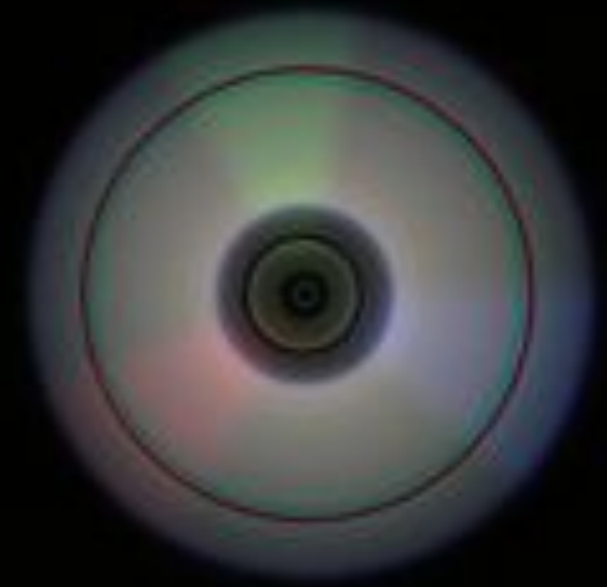
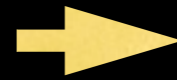
## Pringles Tube Spectroscope



## Polarizing Filters

Demonstrate the polarized nature of light from TV & computer screens  
Identify optic active materials that will rotate polarized light

# Light

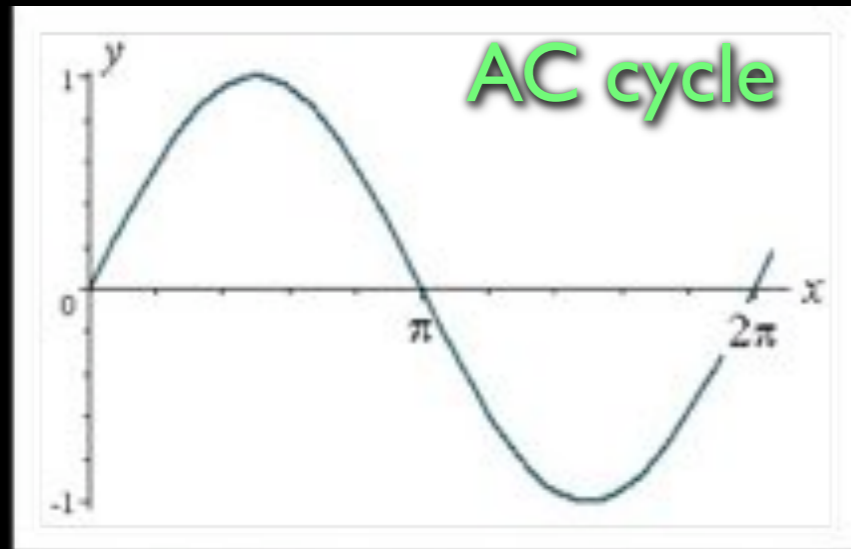


Additive Emission Colour Model → TV, computer, LCD  
RGB Model

Persistence of Vision



# AC vs DC



## Audible AC indicator



Solar panel +  
amplified speaker



## Visual AC indicator

Bi-coloured LED +  
Resistor +  
6 - 12V AC adaptor

# Light: Amplitude Modulation

## Photo Phone Kit

Transmitter:  
torch & iPod

Receiver:  
solar panel & amplified speaker  
(pre-amp is optional)



Amplitude modulation

Thanks for attending this session.  
May you experience many fulfilling  
hours in your classrooms & labs!



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