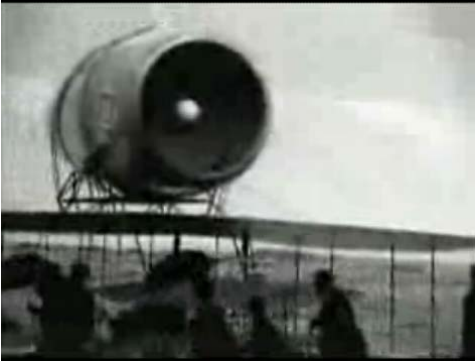

Warp Drives

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Univ. of S. Mississippi, Dept. of Physics &
Astronomy (Adj. Prof)

This is Imagination ?



This is Imagination !



What is warp drive ?

- Superluminal travel by warping space-time

Why do we want it ?

- Travel to the stars

What does it take ?

- Negative energy
Negative matter (**not antimatter**)

Negative Matter and Energy

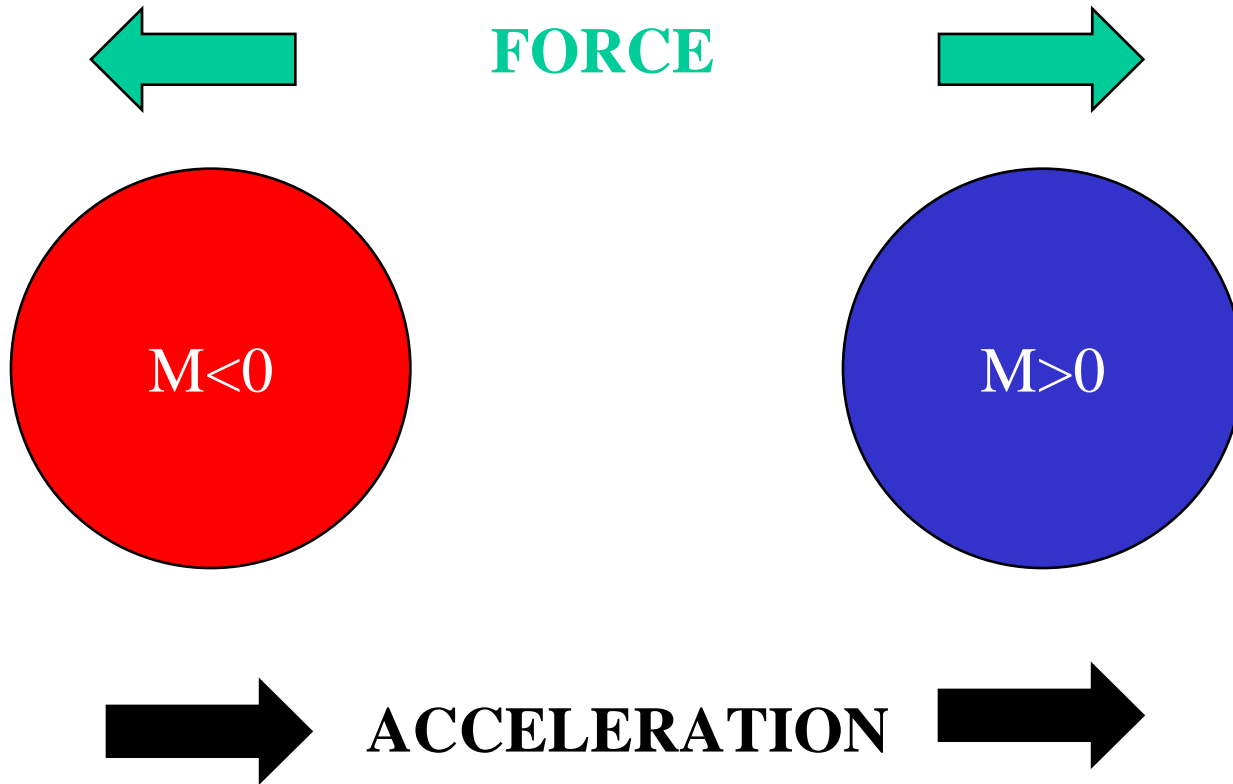
- Required for all “wormhole”, “warp-drive” solutions to Einstein’s equations
- Negative matter repels positive matter

$$F = -\frac{GMm}{r^2}$$

Attractive for $m > 0$, $M > 0$

Repulsive for $m < 0$, $M > 0$

Negative Matter “bootstrapping”



Does negative energy exist?

Yes

Casimir Effect

Attractive force between 2 closely spaced conducting plates

Cause: Quantum Mech. ZPE (zero-point energy)

- a) ZPE stimulates $e^+ e^-$ pair production(p-p) in QM-vacuum
- b) plate spacing provides long-wave EM cutoff for p-p
- c) therefore fewer pairs between plates
- d) positive pressure pushing plates together
- e) interpreted as Neg. Energy Density (lower than vacuum)

You must have faith in ZPE

(Vanderwals force also explains)

-
- **Gravitational energy is itself negative!**

So there are multiple examples of negative energy, but these forms of energy cannot be “condensed” into negative matter.

Does WARP Drive violate physical law?

NO

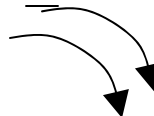
- **Energy is conserved : $E=0$**
- **Momentum is conserved: $P=0$**
- **SuperLuminal:**
 - **Possible because total mass = 0 (like photon)**

Warp factor follows Richter scale

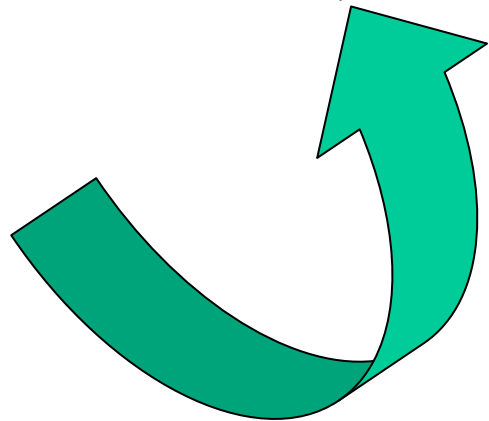
$$v/c = 10^{W-1}$$

How to “engineer” Warp Drive

$$ds^2 = f(r)dt^2 - f^{-1}(r)dr^2 - r^2d\theta^2 - r^2\sin^2\theta d\phi^2$$

$$\nabla^2\phi = \rho$$


$$G_{\mu\nu} = -\kappa T_{\mu\nu} = \rho u_\mu u_\nu + p(u_\mu u_\nu + g_{\mu\nu})$$



Shift right

**Garbage in,
choose $f(r)$**

Is resulting ρ, p sensible?

Alcubierre Warp Drive

$$ds^2 = c^2 dt^2 - (dx - v_s(t) f(r_s) dt)^2 - dy^2 - dz^2$$

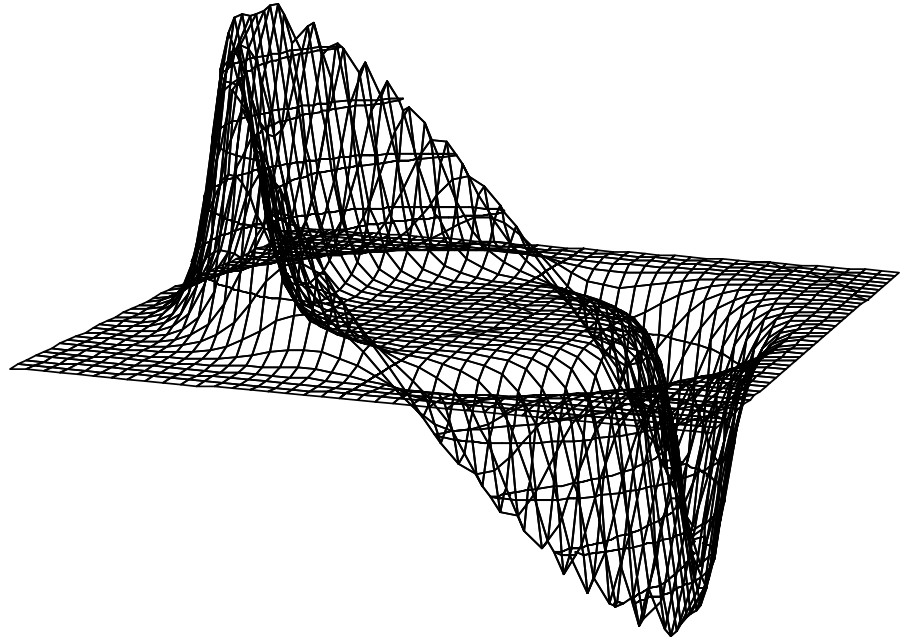
$$v_s(t) = \frac{dx_s}{dt}$$

$$r_s = \sqrt{[x - x_s(t)]^2 + y^2 + z^2}$$

$$f(r_s) = \frac{\tanh[\sigma(r_s + R)] - \tanh[\sigma(r_s - R)]}{2 \tanh(\sigma R)}$$

Volume Expansion

Alcubierre Warp Drive



Bubble Velocity

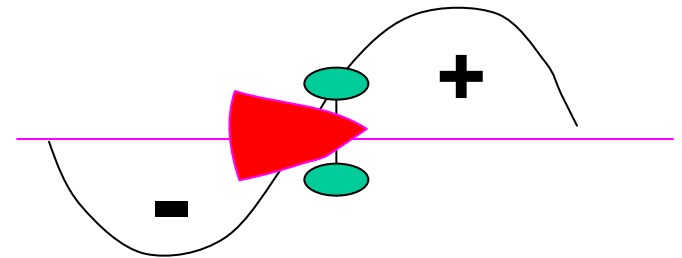
Propellantless Propulsion

**Otherwise known as “WARP DRIVE”
(Alcubierre Warp Bubble)**

**Requires stellar quantities of both + and - mass
Conserves momentum and NRG**

+ Mass attractive

- Mass density repulsive



WARP AWAY

Intermediate (realistic??) Alternative for Interstellar travel

Antimatter engine

Capability:

10kG antimatter will drive 4 tons propellant per ton payload to Alpha Centauri in 40 yrs at 0.1c

Engineering Issue: Create and store 10kG antimatter

What about wormholes ?

- “Forced” solutions of Einstein’s eqn’s
- No QM theory of gravity yet, but wormholes are of “Planck Length” dimensions--- 10^{-33} cm
- Holes connect: 2 points in time for fixed space (time-machine).
2 points in space for fixed time (superluminal travel - shortcut).
- To open hole to 1 meter requires
Neg. Energy = output of 10,000,000,000 stars for
1 year

NASA - BPP

Breakthrough Propulsion Physics

OBJECTIVES

Propellantless Propulsion

Lightspeed → Superluminal

Breakthrough NRG sources

Harry's Gambit

Classical Unification of Gravitation and Electrodynamics

- *Einstein tried and failed*
- *I employed the help of E. Schrödinger*

RESULTS: *A solvable theory based on TORSION of space-time rather than CURVATURE only.*

Gravity CURVES space-time
Electromagnetism TWISTS space-time

**An “Old Fashioned” Classically Unified Theory of
Gravitation and Electrodynamics with Experimental
Prediction and Test Program**

Harry I Ringermacher
(\$100,000. NASA contract 1999)

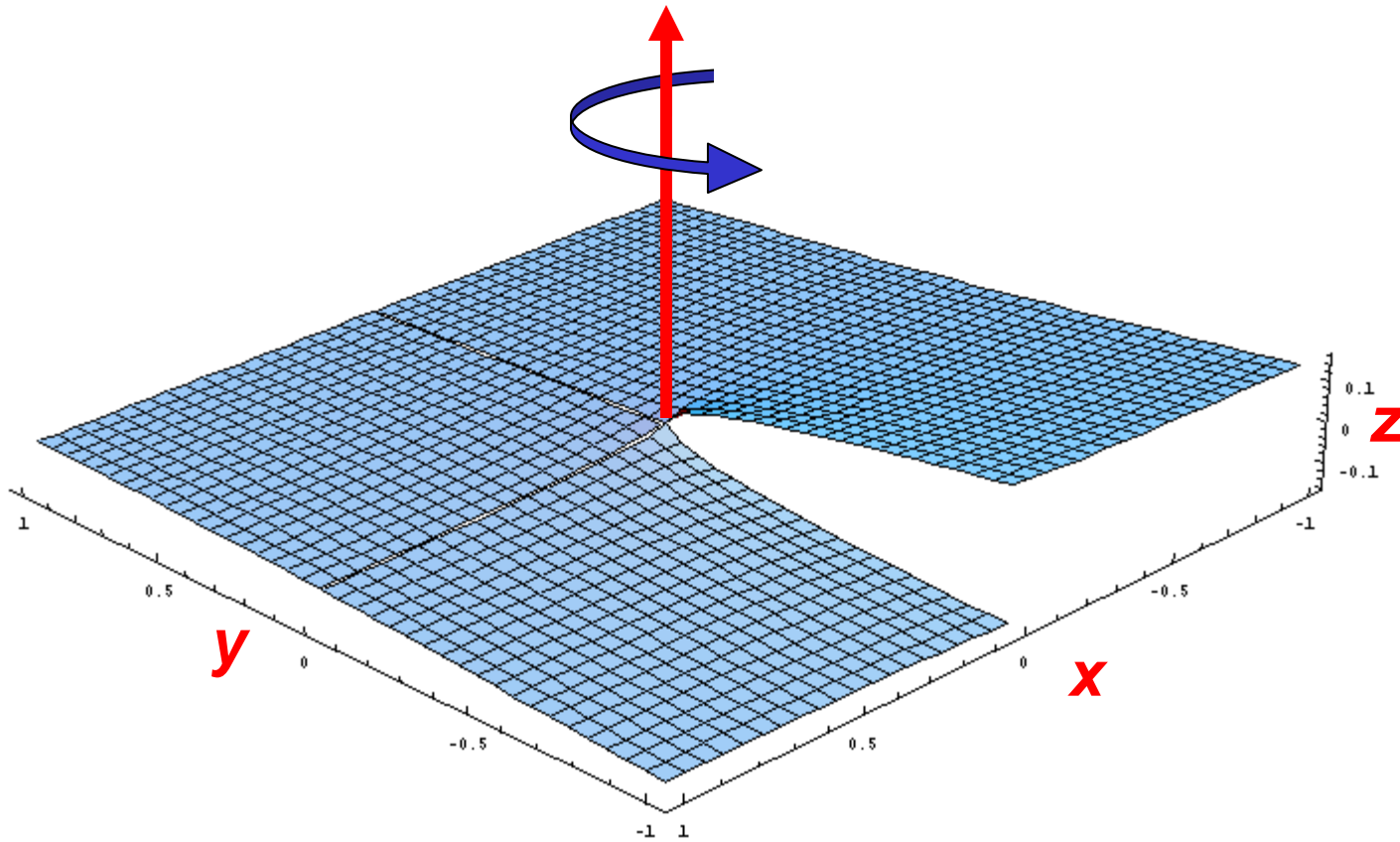
Project Team

Harry Ringermacher, Team Leader

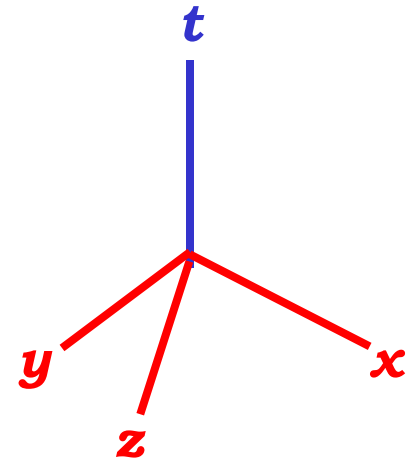
Mark Conradi, Washington University

Brice Cassenti, United Technologies Research Center

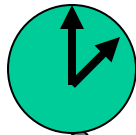
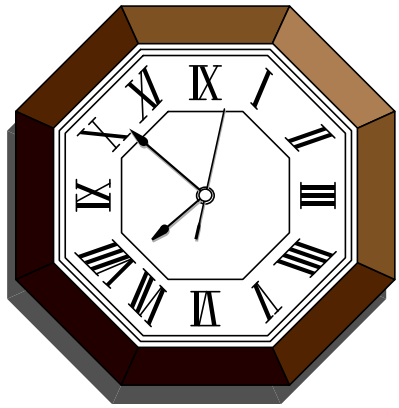
2-D Surface With Torsion



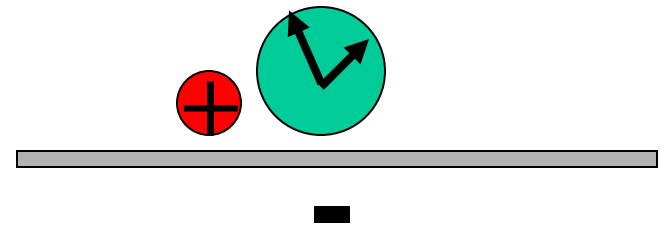
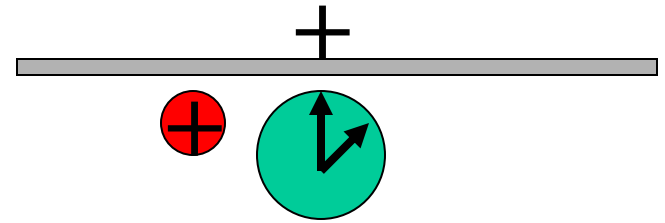
Dislocation in a crystal



Red Shift - time effects

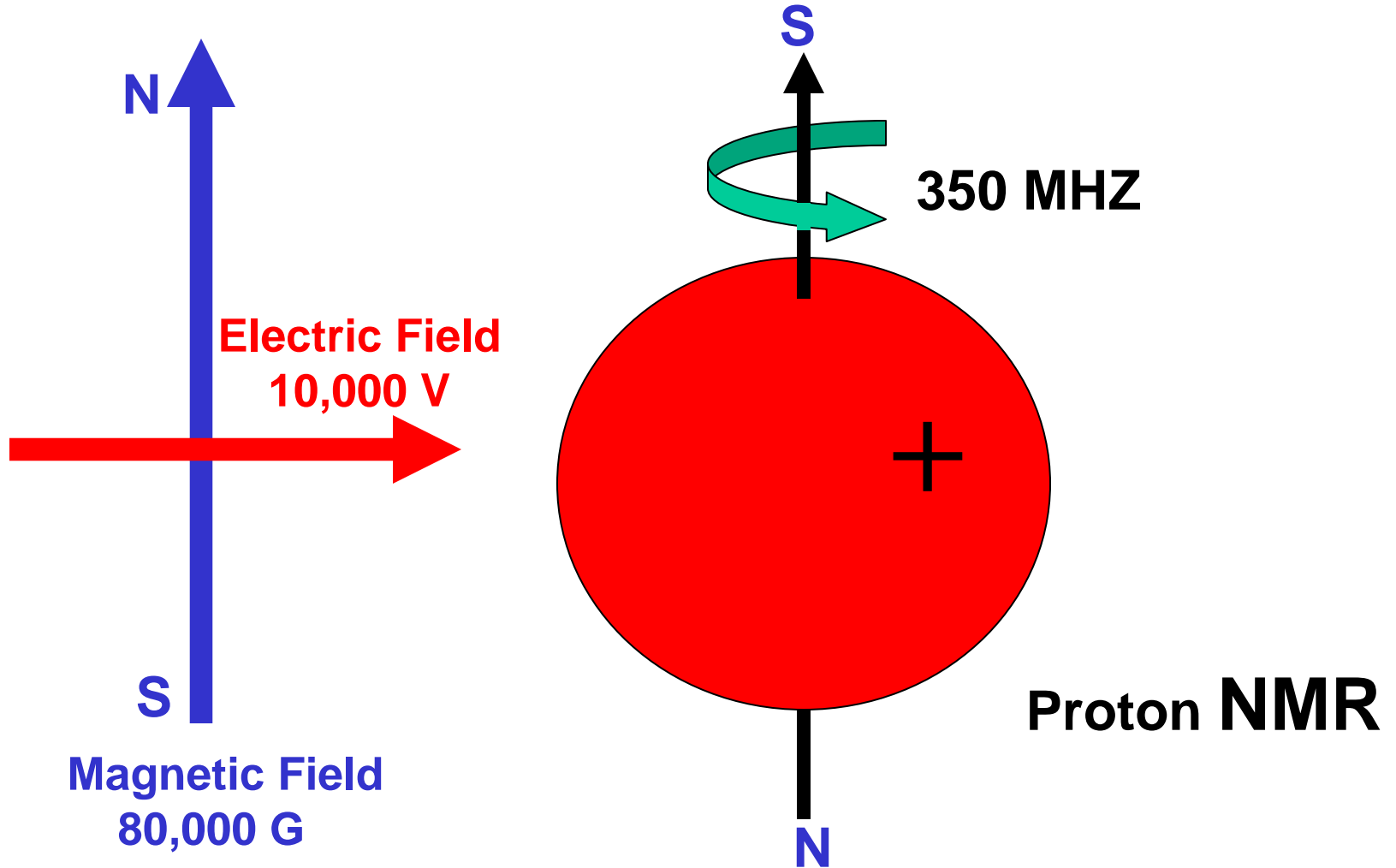


Gravitational



Electrostatic

Internal “Spin Clock”



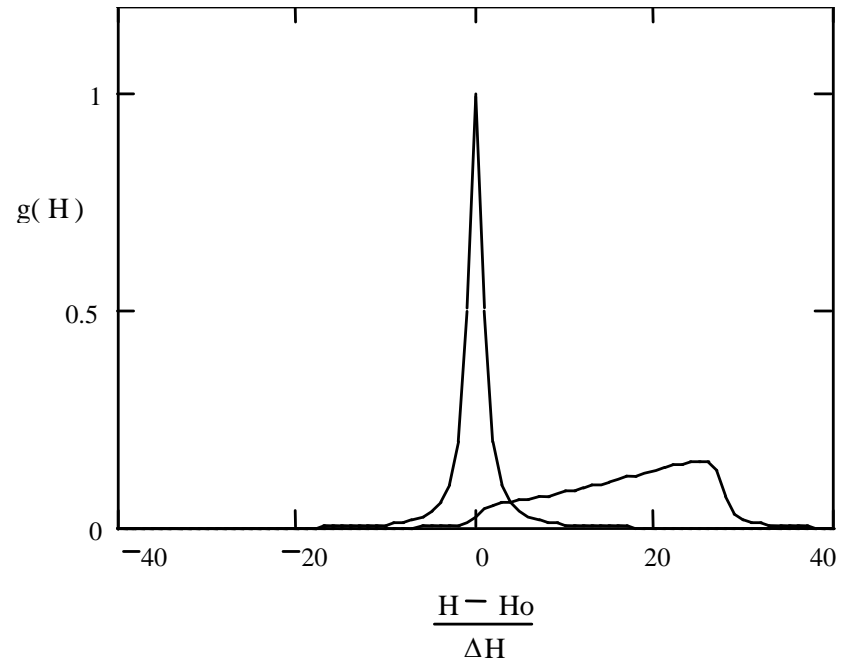
Example prediction of NMR line change dependent upon voltage in the theory.

$$\frac{d\tau(R)}{d\tau(r)} = 1 + 2\kappa(\varphi_2 - \varphi_1) = 1 + 2\kappa\Lambda \ln \frac{R}{r}$$

$$\omega(r) = \omega(R) \left(1 + 2\kappa\Lambda \ln \frac{R}{r} \right)$$

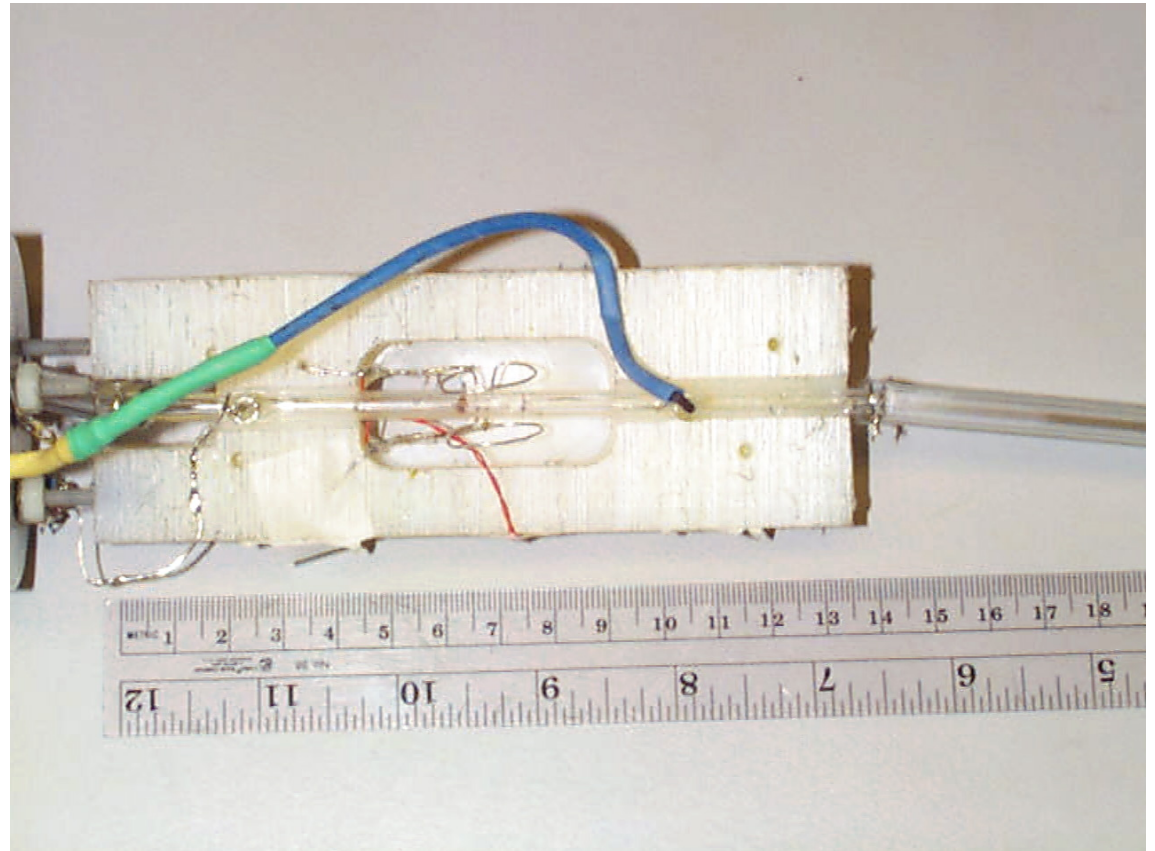
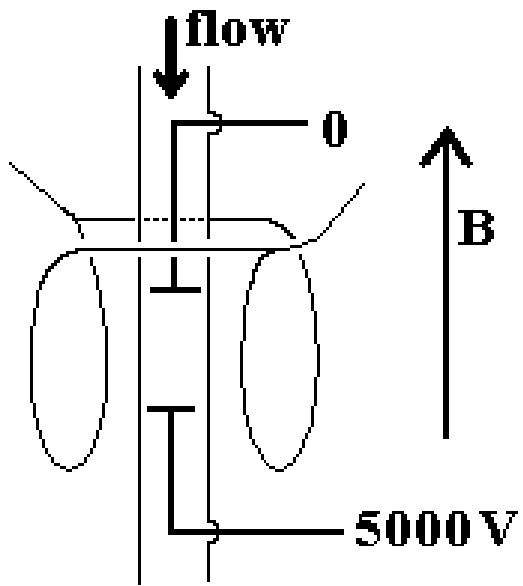
$$\omega = \gamma H$$

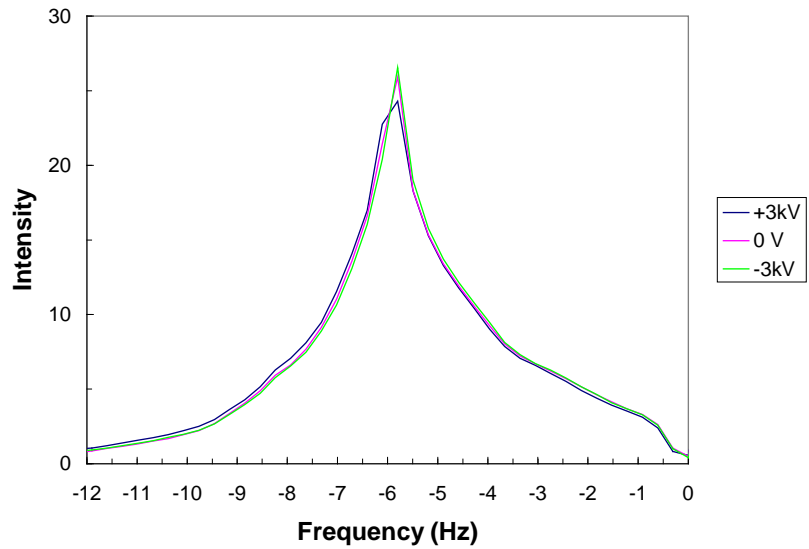
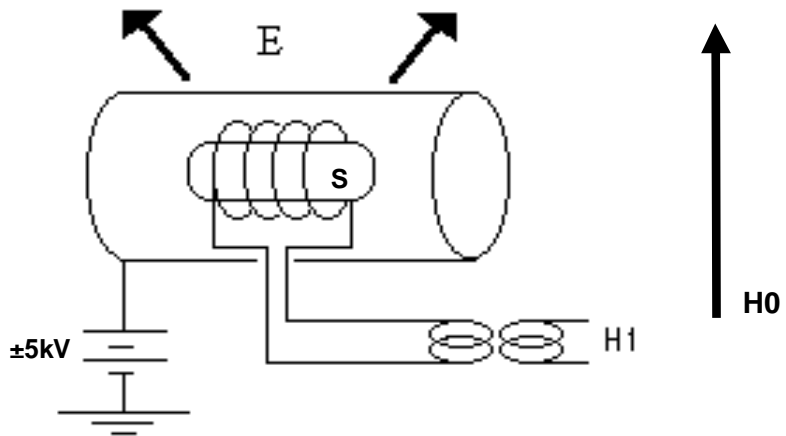
$$H(r) = H(R) \left(1 + 2\kappa\Lambda \ln \frac{R}{r} \right)$$



Flow Probe (Benzene)

Showing NMR coil and HV electrodes

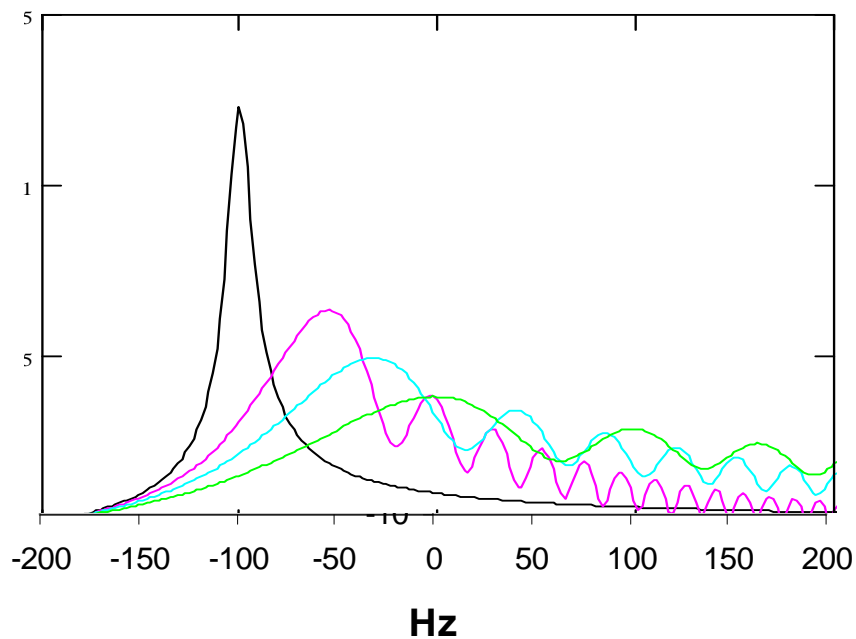




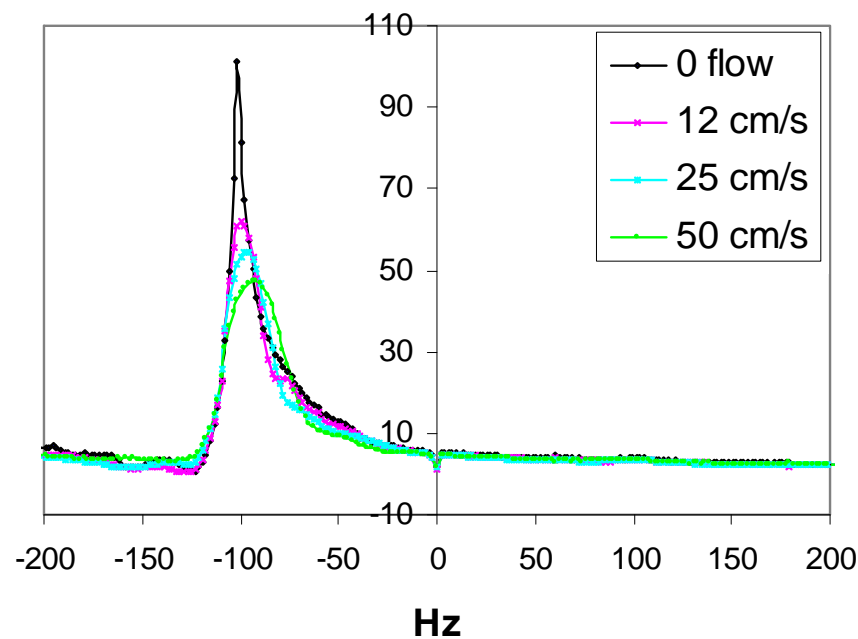
Group, Probe, Magnet



Predicted Lineshapes vs. Observed



Predicted shift vs. flow
5000V



Observed shift vs. flow
5000V

Results of Proton NMR experiment

There was no effect on the proton's clock to 1 ppB.

Reason was that experiment did not measure the proton's isolated clock, but rather the proton's clock within a neutral hydrogen atom.