The journey to magnetic monopoles

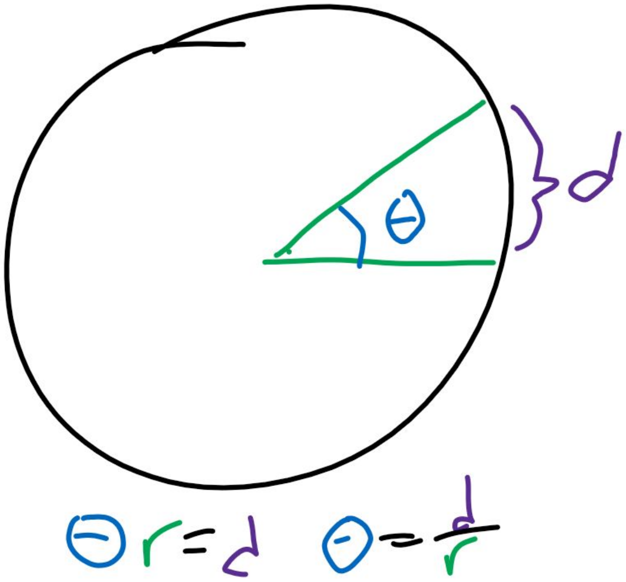
Idk what I’m doing pls send help

Angular quantities

The number of radians traveled in a circle is calculated by d/r where d is the distance traveled along the circle and r is radius.

This has units m/m, or 1.

Angular acceleration thus has units 1/s^2.



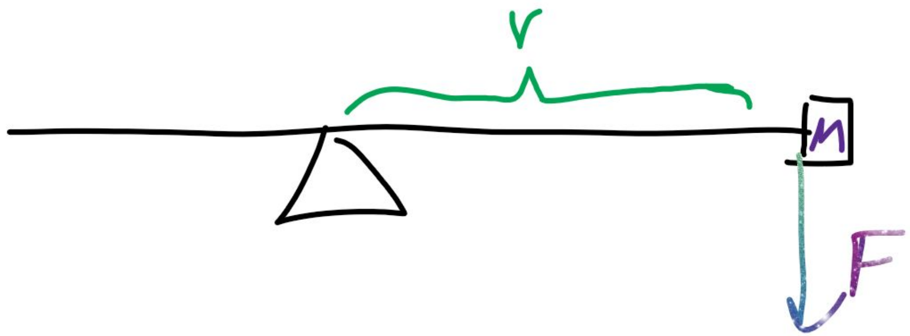
Torque

Torque is r x F, or the distance from the pivot crossed with the force.

The units here are mN.

Define “moment of inertia” I such that T = Ia where T is torque and a is angular acceleration.

I must have units kgm^2, so we can define I as mr^2.



Gauss's laws:

Electric

$$\oint E \cdot dA = \frac{Q}{\varepsilon_0}$$

Magnetic

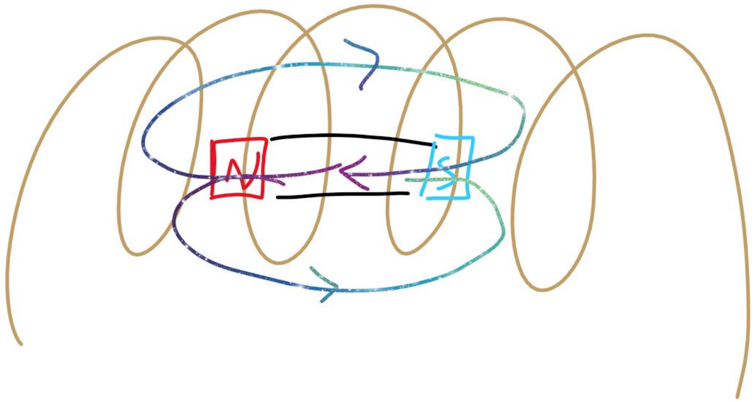
$$\oiint \vec{B} \cdot d\vec{A} = 0$$

$$\nabla \cdot B = 0$$

Faraday's law

When the magnet is moving, we can have a change in magnetic flux, but as soon as motion stops, flux returns to 0.

$$\mathcal{E} = \frac{-d\Phi_m}{dt}$$

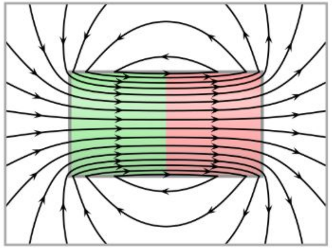


Two more fields

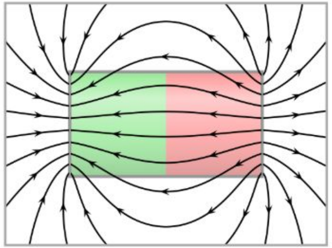
When magnets are close to objects that emit a magnetic field, these can induce currents within the material.

How much is caused internally?

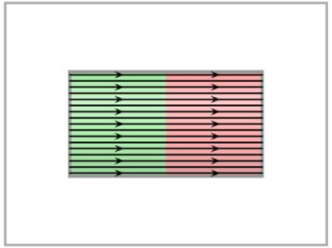
By the external field?



$\vec{B}$



$\vec{H}$



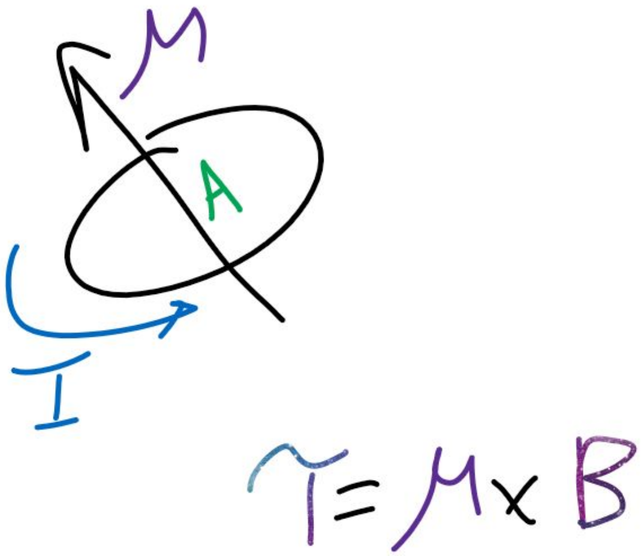
$\vec{M}$

M field

Magnetization.

How much is internal.

The density of the magnetic moments in the object. (Aka, total magnetic moment divided by volume.)



H field

Magnetic field strength.

The stuff that isn't internal is external. . .

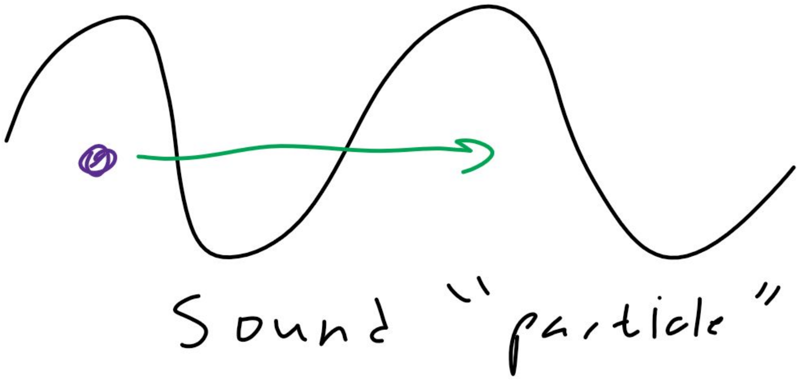
$$B = \mu_0 (H + M)$$

$$B = \frac{H}{\mu_m}$$

Emergent properties

Phenomena simulated as “particles.”

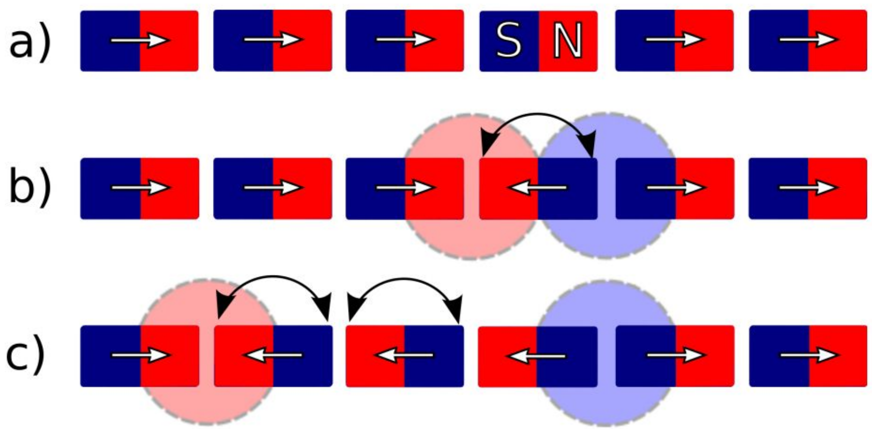
Phonons.



Dirac chains

There are H sinks and M sinks at the colored regions.

This causes these “isolated” regions of north and south poles.



Gauss's law?

Time to make some edits!

Units	Equation
cgs units[7]	$\nabla \cdot \mathbf{B} = 4\pi \rho_{\mathrm{m}}$
SI units (weber convention)[8]	$\nabla \cdot \mathbf{B} = \rho_{\mathrm{m}}$
SI units (ampere-meter convention)[9]	$\nabla \cdot \mathbf{B} = \mu_0 \rho_{\mathrm{m}}$