Moments

[insert funny™ here]

Moment of Inertia

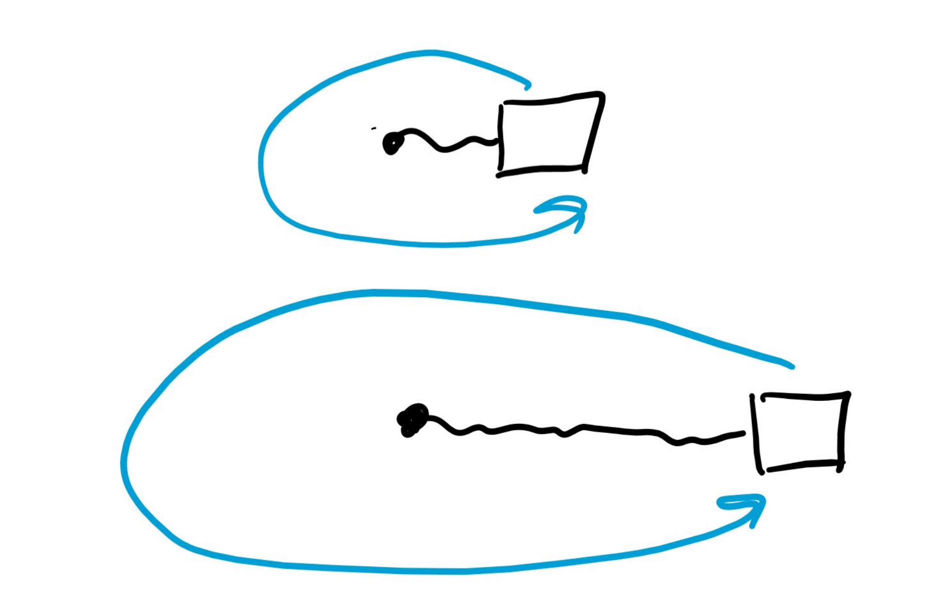
Spinning objects

Which is harder to spin:

A meter long rope with a weight tied to it

OR

A 2 meter long rope with the same weight tied to the end



"Spinny" mass

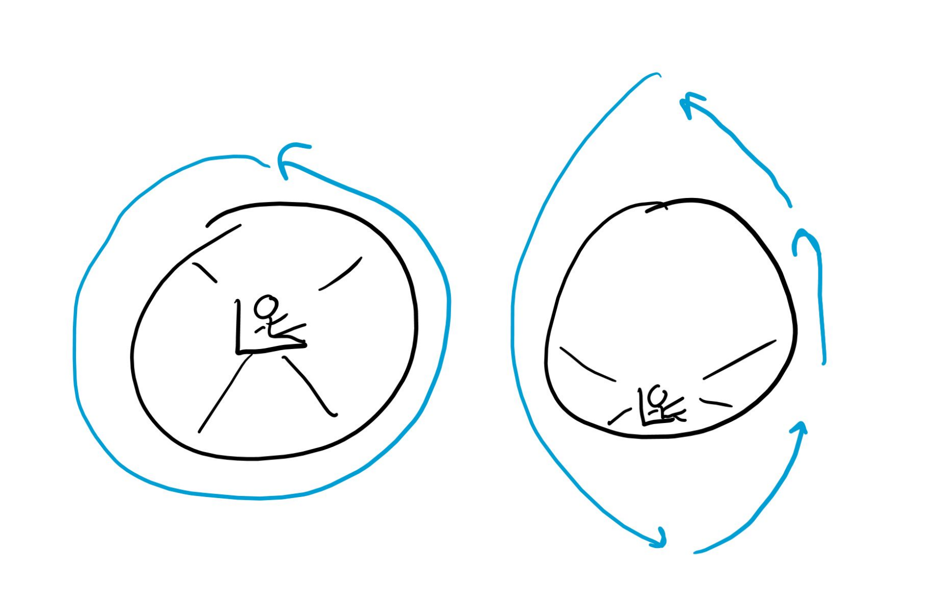
Mass tells us how hard something is to push (more mass, harder to push)

When we look at rotating objects, mass isn't enough to tell us how hard something is to spin

After all, if the mass is further, it's harder to spin

So we have I, which stands for "moment of inertia" which represents how hard it is to spin an object

Anytime we see "moment" that means spinning is involved



Torque

We said torque is the “spin” force

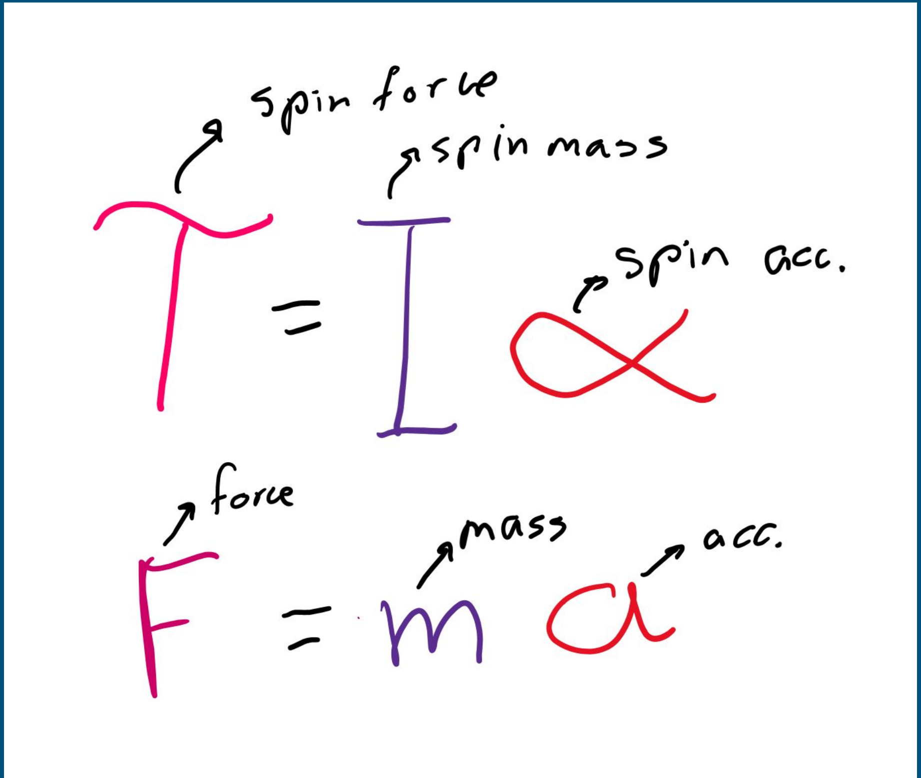
We know F = ma

So torque (τ or T) should equal “spin” mass times “spin” acceleration

Spin mass: I = mr^2

Spin acceleration: α = a/r

T = Iα = mr^2 * a/r = r * ma = r x F

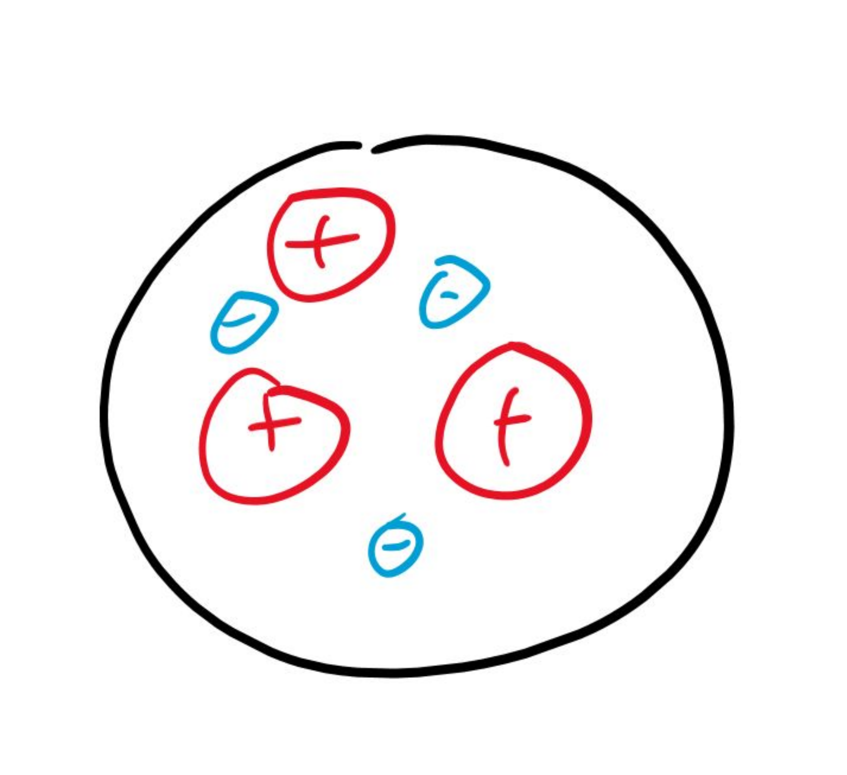


Electricity

Does electricity have to be a dipole?

Can we have a positive charge without a negative one?

What particles carry a single charge?



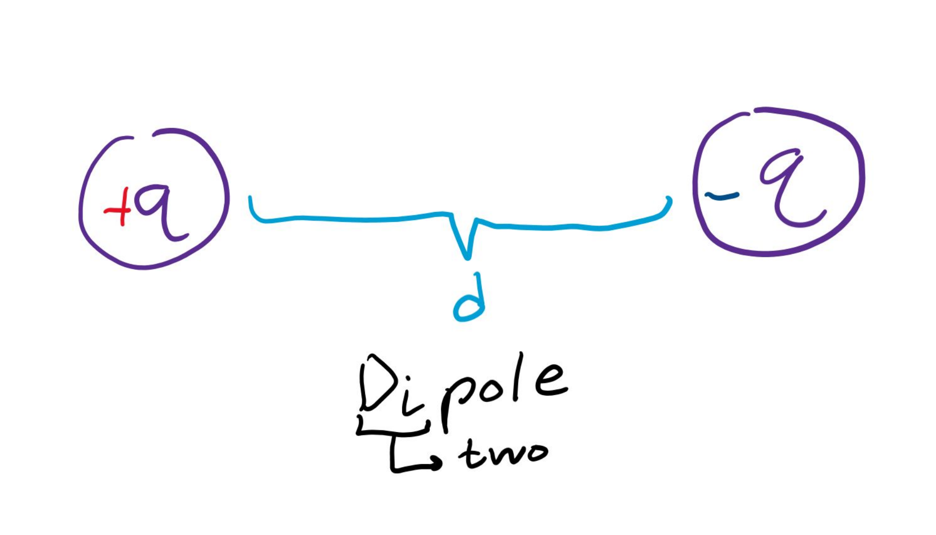
Electric moment

Calculated as q * d, represented as p

q is the charge and d is the distance between charges

Electric acceleration we said was E

T = p x E



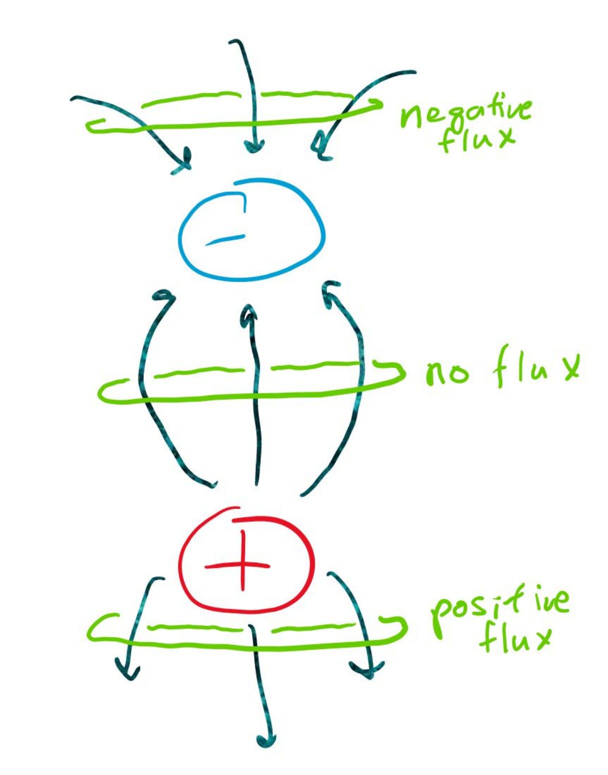
Flux

Flux is how much stuff is “coming out” or “going in” a some enclosed surface

Water leaking out of a bottle is flux because we have water going out of a water bottle

Positive charges emit electric flux

Negative charges suck in flux



Gauss's law electricity

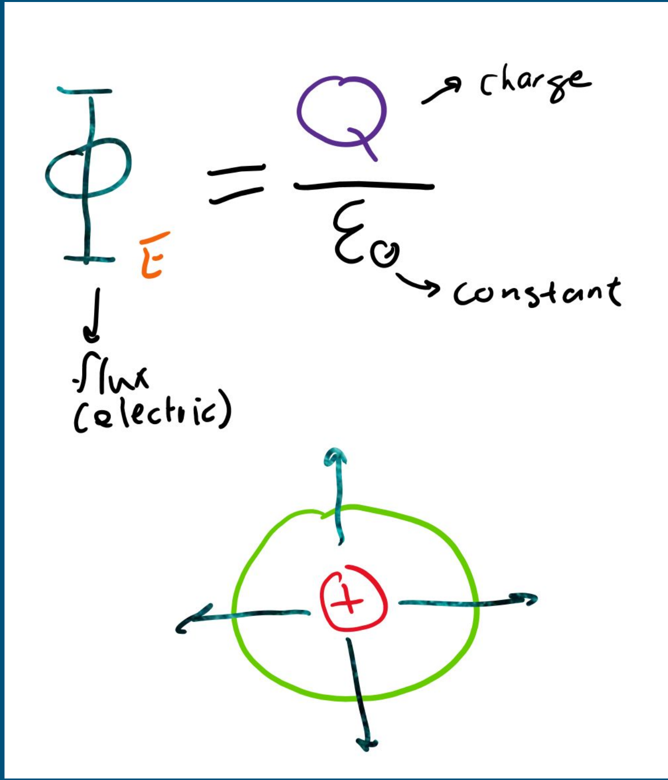
Let's say we have a bottle with one proton

AND

A bottle with two protons

Which has more 'flux'?

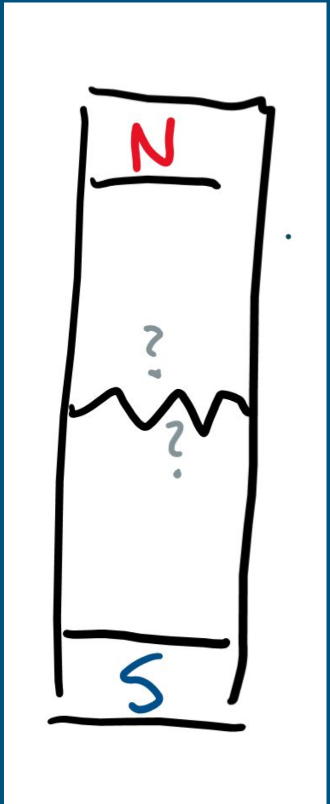
Flux is proportional to amount of charge enclosed in the surface



Magnetism

Do magnets have to be dipoles?

Can you cut a magnet so you only have a north end and not a south end?



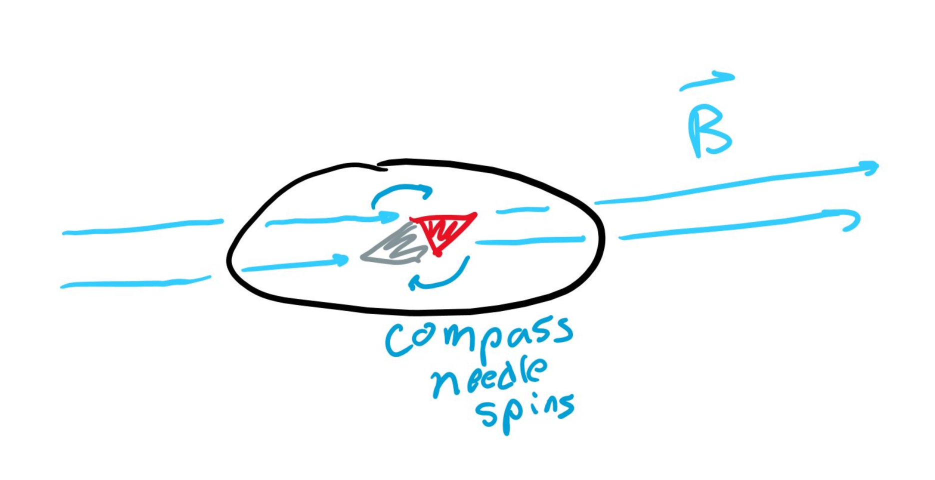
Magnetic moment

We can't exactly measure the distance between "magnetic charges" because there isn't one proton or one electron to contribute charge

Let's just call the dipole moment m

Magnetic acceleration we said was B

T = m x B

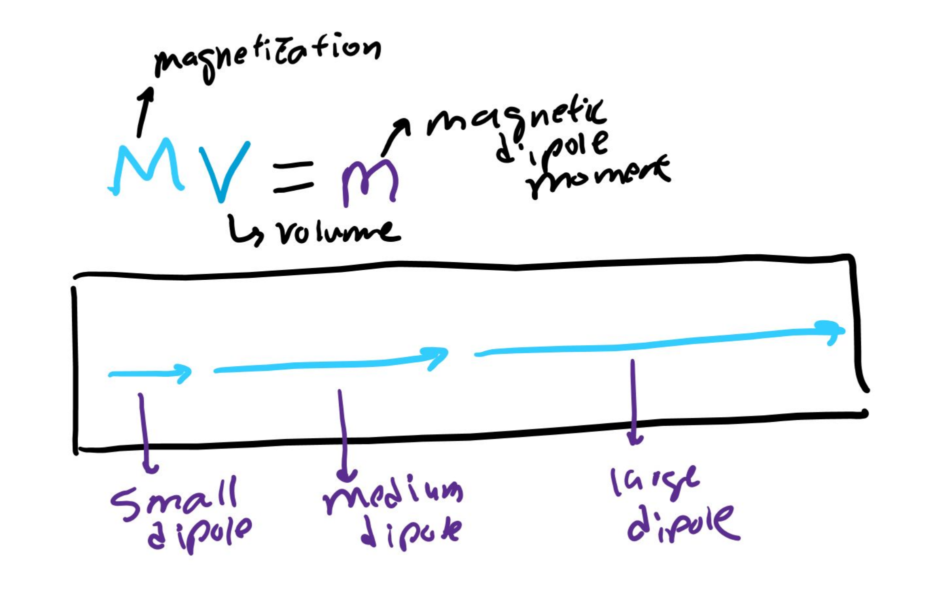


How to find m?

We can measure M, the magnetization of an object

If the object is “magnetized” over a larger volume, we have more dipole moment

M * V = m



Gauss's law magnetism

For every north we enclose, we also have to enclose a south

Net amount enclosed is 0

Thus, flux is always 0

If magnetic monopoles existed, then flux would not always be 0