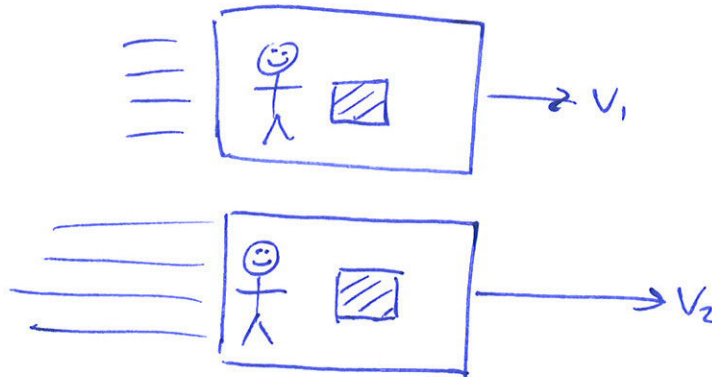


LAST TIME: Laws of mechanics same in all inertial reference frames

consequence: no way to measure "absolute" velocity via mechanical expt.



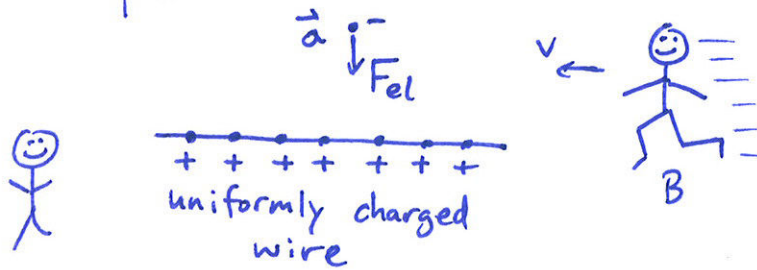
Same experiment  
+  
Same laws of mechanics  
"  
Same result.

Einstein's Principle of Relativity: "1st postulate"

The Laws of Physics are the same in all inertial reference frames.

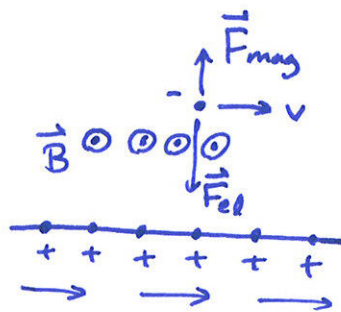
Look at electricity & magnetism:

example



A's frame: downward force on charge due to Coulomb attraction.

Analyze in B's frame with classical assumptions:



downward Coulomb force  
(same as before)

but: B sees current  
∴ magnetic field  
∴ magnetic force

$$\vec{F}_{\text{mag}} = q \vec{v} \times \vec{B} \text{ (upward)}$$

\* Different net force \*

BUT: observers at constant relative velocity agree on accelerations (LAST TIME)

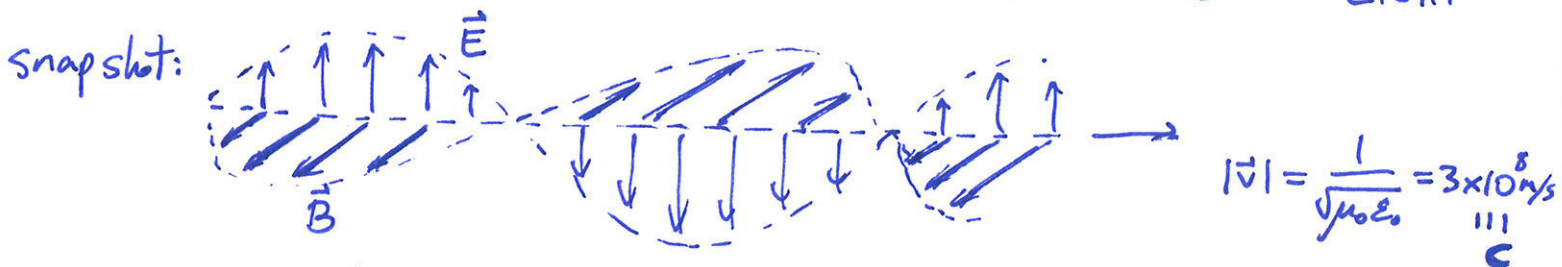
$$\vec{F}_B \neq m \vec{a}_B ?? \quad \text{would contradict relativity}$$

2 possibilities  $\begin{cases} \rightarrow \text{principle of relativity incorrect for E\&M} \\ \rightarrow \text{basic classical assumptions wrong.} \end{cases}$

CLICKER

More dramatic ~~example~~ example: electromagnetic radiation

MAXWELL: eqns of electricity & magnetism admit propagating wave solns for  $\vec{E}$  &  $\vec{B}$  without sources = LIGHT



speed of wave completely determined by eqns (i.e. indep of source).

P.O.R.  $\Rightarrow$  equations valid in every frame  $\Rightarrow$

speed of light (in vacuum) is  $c$  in any inertial frame

"2nd postulate"

CLICKER

Cannot be true with classical assumptions about time & distance.