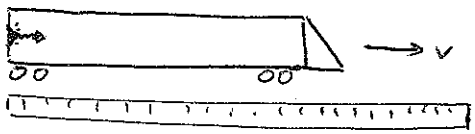
LAST TIME: The Principle of Relativity (P.O.R.)

Laws of physics same in all inertial reference frames

⇓

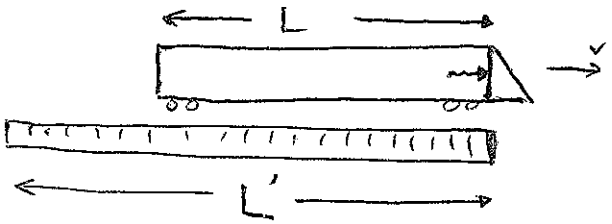
speed of light = c in all inertial frames

$t = 0$



light leaves back of train

$t = T$



light reaches front of train

$$\text{Speed} = \frac{\text{distance}}{\text{time}}$$

train's frame: $\frac{L}{T}$

track's frame: $\frac{L'}{T}$

(with conventional assumptions) cannot both be c!

If P.O.R. correct: observers cannot agree on times and/or distances.

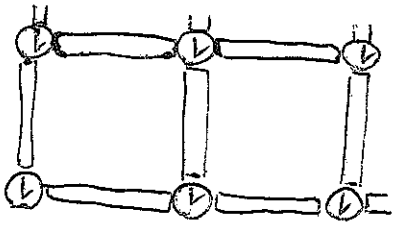
More conservative: ~~postulates~~ P.O.R. incorrect for E&M.

- there is a special frame of reference where Maxwell's eqns hold (frame of "ETHER" = hypothesized medium for light propagation)
- observers moving relative to ether would measure different speed of light.

Michelson-Morley experiment (& later ones): same speed of light in all frames.

From now on: assume postulates are true.

In any given frame: observers set up rulers & clocks to measure positions & times of events



→ synchronize clocks using light pulses.

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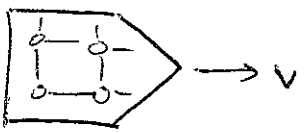
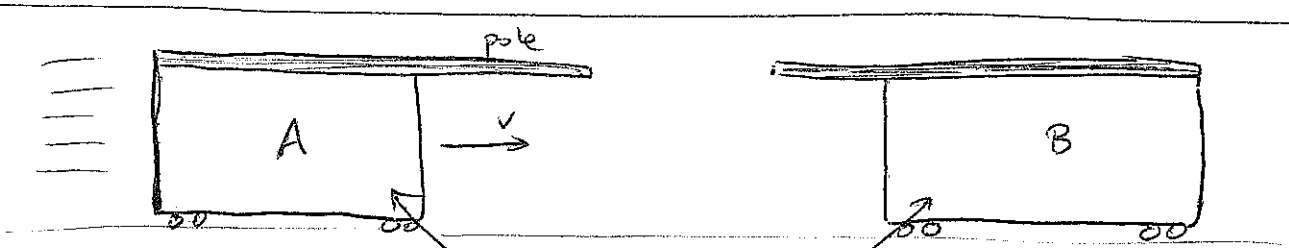
For each event: can assign coords (x, y, z, t)



How are measurements in different frames related?

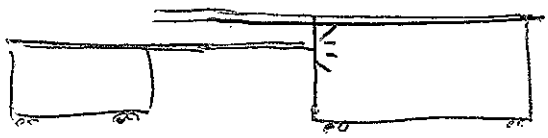


CLICKER

identical trains.

Important fact #1: observers agree on transverse distances (i.e. perpendicular to relative motion)

IF fixed train sees moving train as shorter, pole A will go below pole B & make hole in train B.



BUT: This violates relativity, since we could have said A is fixed, B is moving.

∴ Really, poles collide & each train measures other train to be same height.