In classical nonrelativistic mechanics

- space is taken (postulated) to be $\mathbb{R}^3$ –
  – a particle has $\vec{r}=(x,y,z)$

- time is a parameter, t, used to measure duration; unit of time defined via some "standard clock" be it  a sand clock

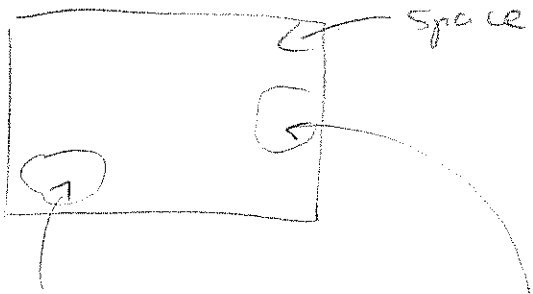
or the ω^{-1} of some transition in Cesium...

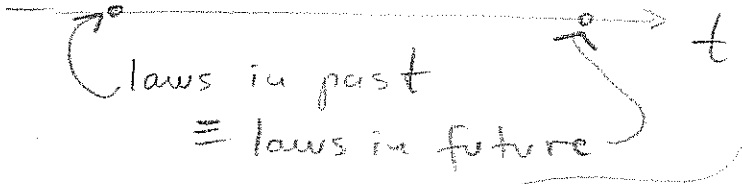
- space & time are "absolute" – exist as an arena for events to unfold

- both space & time are homogeneous

- space is, isotropic

$\mathbb{R}^3 \times \mathbb{R}^1$
space ($\vec{r}$) time (t)

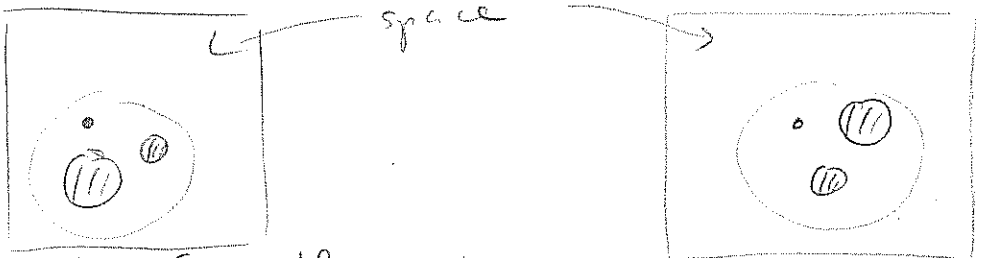




physical laws here ≡ laws here

("laws" = "eqns of motion" = E-L eqns !)

isotropic:



three bodies oriented differently wrt space ≡ same laws govern them

An inertial frame is one which is

("frame" = coordinate system)

in relative uniform motion w.r.t. absolute space

(speed $v \in (0, \infty)$ ← no upper limit)

Galilean principle of relativity:

≡ "laws of physics are identical in two inertial frames"

(eqns of motion) — any

or "Newton's laws hold in all inertial frames"

(most common way of phrasing it)

(this class)

↓ further developments

E&M, Lorentz, Einstein (Special relativity): • limit on v: $v < c$

• time is NOT absolute

⟹ "spacetime" $\mathbb{R}^{3,1}$

↓ Einstein (General Relativity): matter & spacetime are inextricably linked - matter influences spacetime & v.v.

(properties of)

↓ Quantum Gravity (string theory ...): spacetime "emergent" ---