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" e.g. a sand clock or the $\Delta t^{-1}$ 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

\[ \mathbb{R}^3 \times \mathbb{R}^1 \]

- Laws in past $\equiv$ laws in future

  \[ \begin{array}{c}
  \text{physical laws here} = \text{laws here} \\
  \text{"laws" = "equations of motion"} = E = \mathbf{F}, \text{e.g.} \\
  \end{array} \]

- Isotropic:

  Three bodies oriented differently wrt space $\equiv$ same laws given them
An inertial frame is one which is
("frame" = coordinate system)
in relative uniform motion w.r.t. absolute space.

Galilean principle of relativity:

≡ "laws of physics are identical in two inertial frames
(eqs. of motion"

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

(most common way of phrasing it)

This class †

Further developments

Einstein, Lorentz, Einstein: no limit on \( v \) : \( v < c \)
(Special Relativity)

⇒ "spacetime" \( \mathbb{R}^{3,1} \)

Einstein
(General Relativity)

: matter & spacetime are
inextricably linked - matter
influences spacetime & v.v.

Quantum Gravity,
(String theory...): spacetime "emergent"