

EMergence Lec 4
getting to the bottom of things

Whig history of Physics.

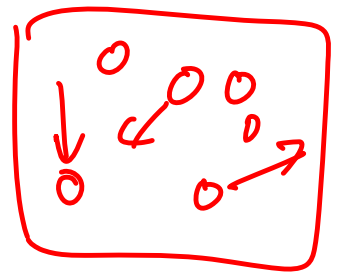
Greeks figured out ATOMS.

Democritus - original atomist.

Lucretius - Roman Poet.

- wrote about atoms
properties.

Atoms + the void -



No continuity between greek atoms
+ chemistry atoms.

Aristotle → "physics".

Real physics history starts with
Galileo. — falling bodies.

Isaac Newton 17th c.

laid the foundation of physics
"the paradigm"

FORCES as the cause of motion.

3 laws of Mechanics.

① Law of inertia — constant motion if no force

⇒ ② $F = ma$ — \uparrow change in velocity

③ "action + reaction"

CALCULUS — used to codify the "laws".

$F = ma \rightarrow$ differential Equation
"dynamical" " "

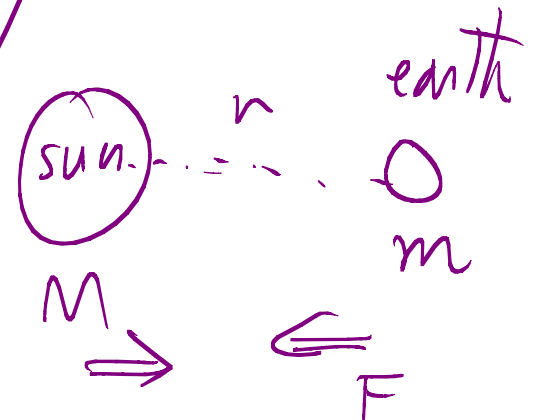
\rightarrow time as indep variable

$$m a = \frac{dV}{dt} = \frac{d^2x}{dt^2} = F \text{ etc.}$$

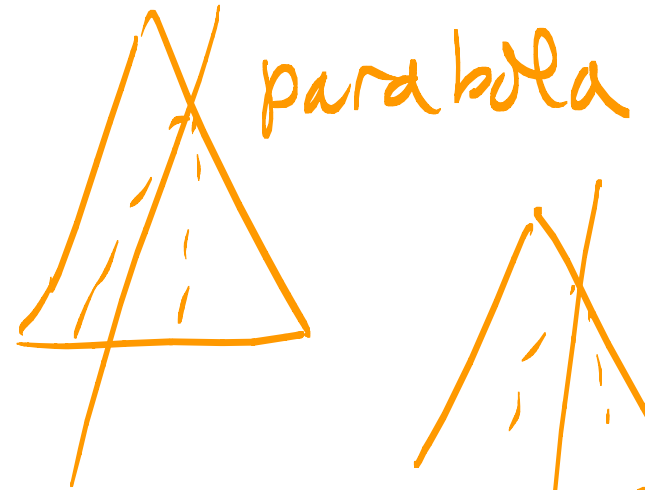
Newtonian Gravity

$$F = \frac{G M m}{r^2}$$

inverse square law



→ un reasonable beauty of maths
orbits are conic sections
from greeks!





area
of a sphere $\sim \frac{1}{r^2}$
distance "dilutes"
the force like $1/r^2$

$$F = \frac{GMm}{r^2}$$

← Newton's force F
is INSTANTANEOUS
when m is changed.

"action at a distance"

modify this "law" for
finite speed of light
⇒ Einstein's theory
of general
relativity