

2023 PNS Orientation

THE HITCHHIKER'S GUIDE TO THEORETICAL PHYSICS

Mar 30, 2023

Foundation of Physics

Experimental physics

Problem



Experiment



Solution

Theoretical physics

Problem



Newtonian
mechanics

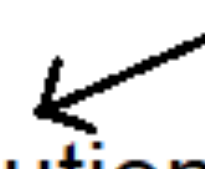
Lagrangians



Tensors



Integrals



Distributions



Hamiltonian

Group theory



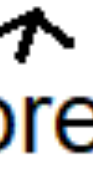
Perturbation
theory

Just a lot more
integrals

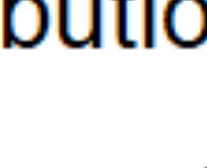
Use Mathematica

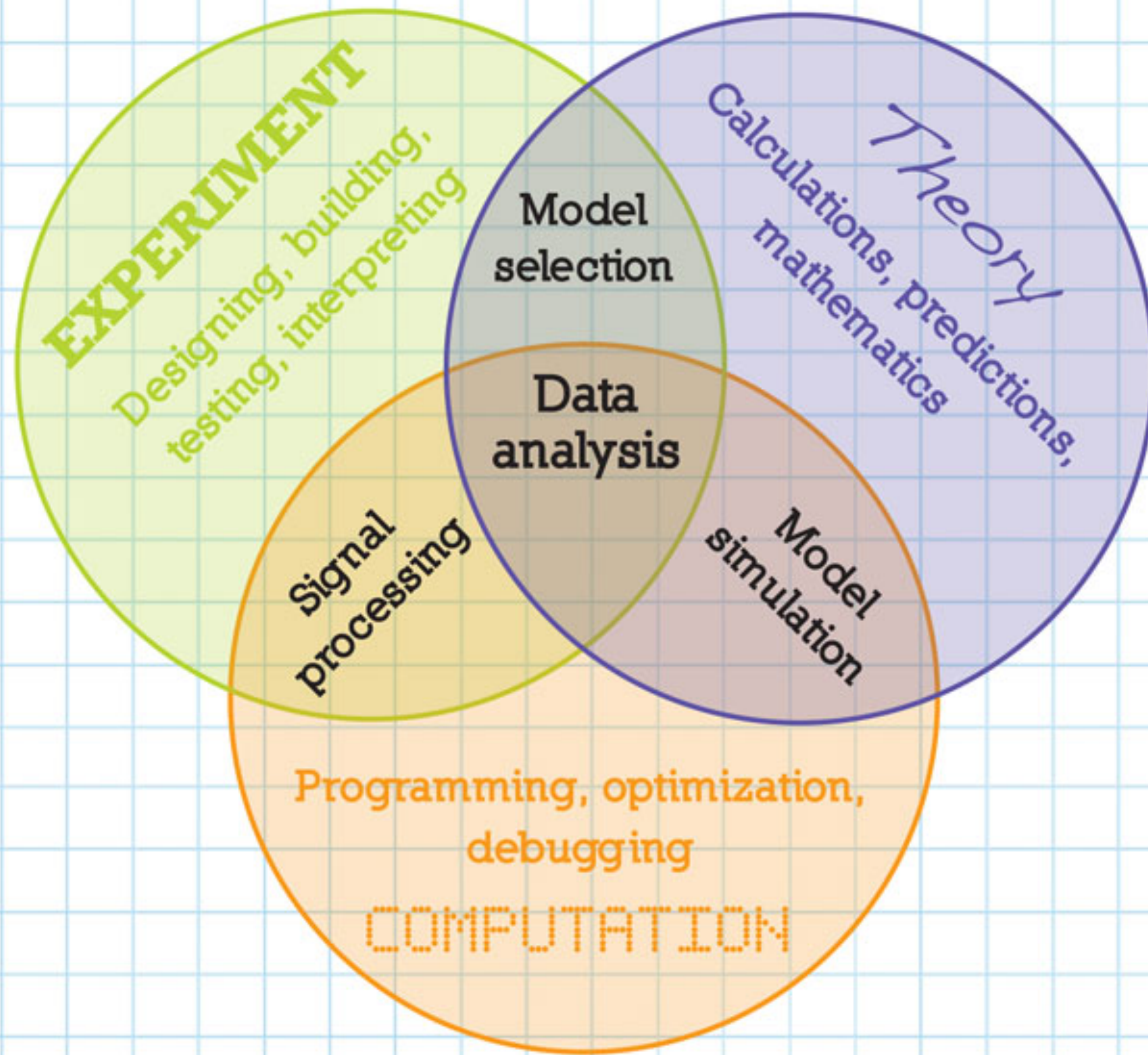


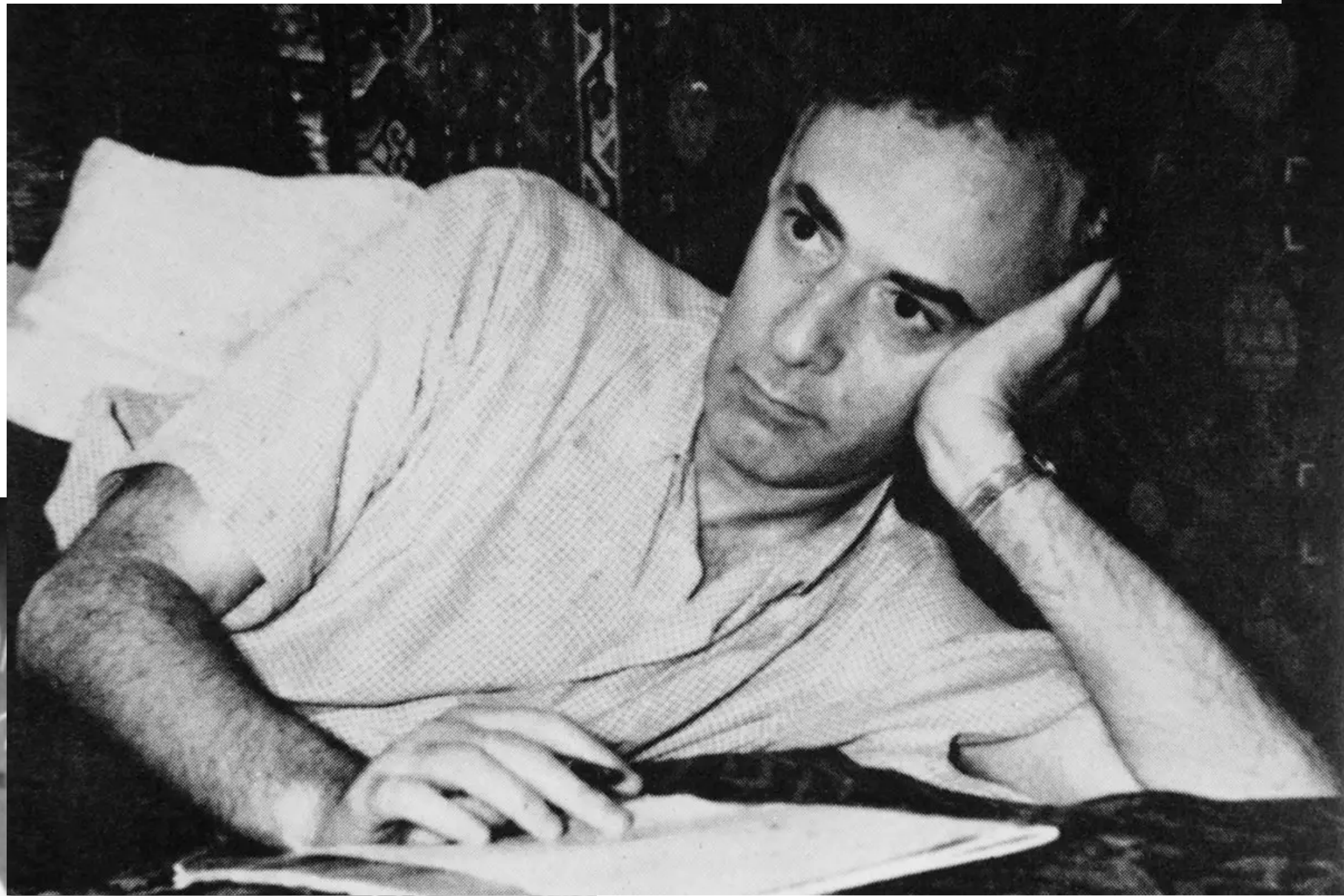
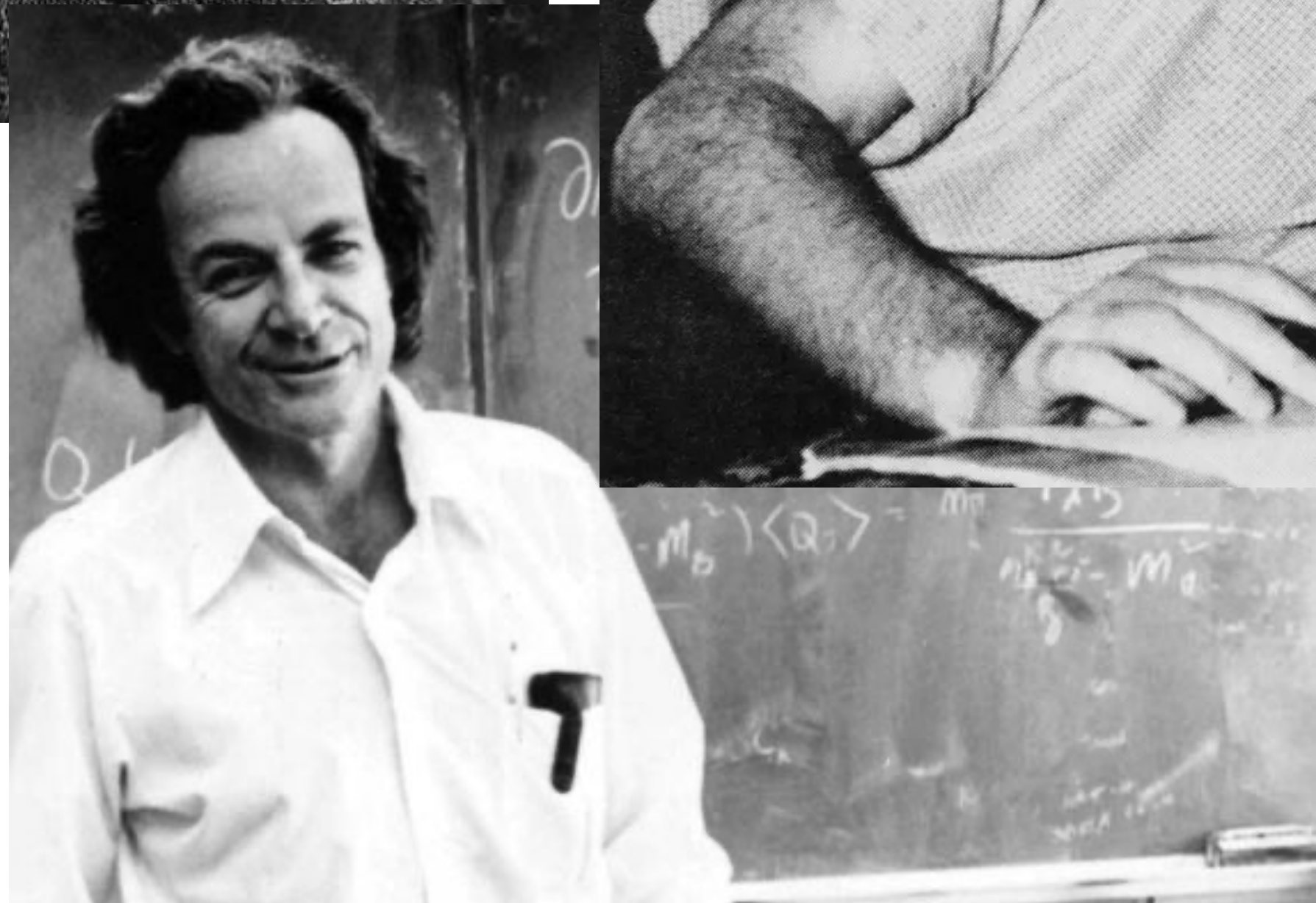
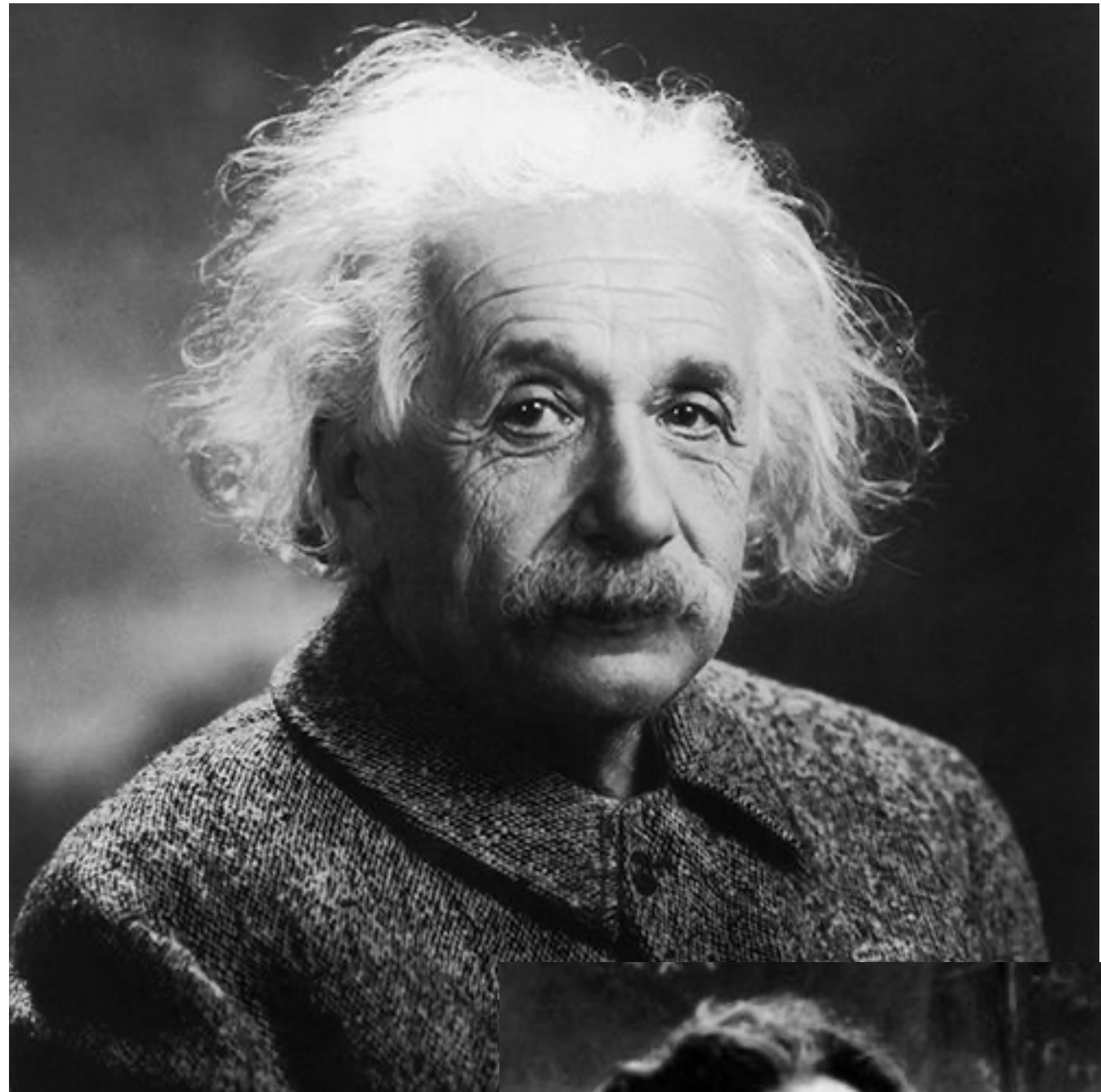
Suicidal
thoughts



Just more
integrals







What Theoretical Physicists Do?

Explained by theory A!

Experimental data

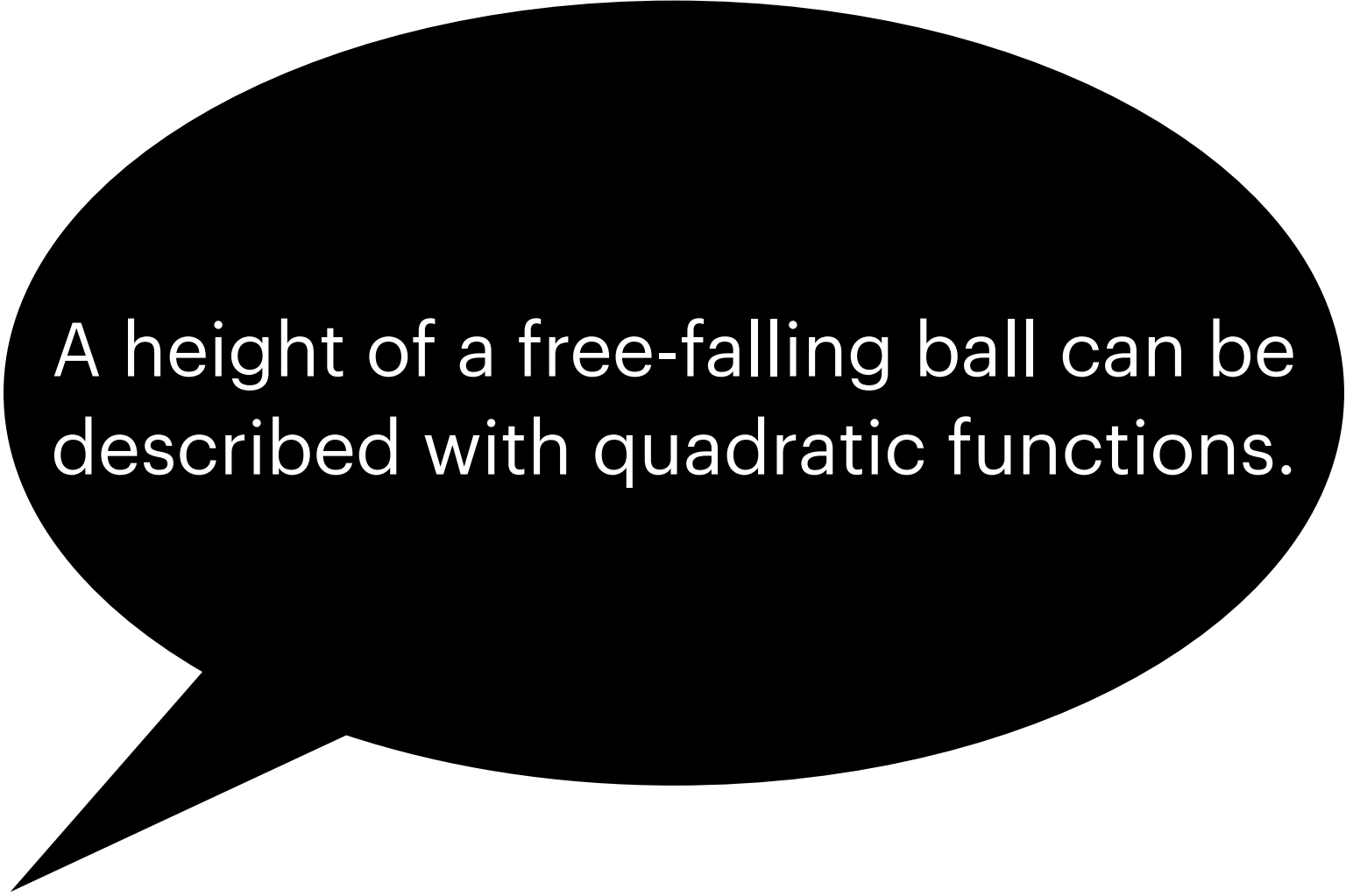
Experimental
data

Experimental
data

Experimental
data

Experimental
data

Not All Predictive Models are Said to be ‘Theory’



A height of a free-falling ball can be described with quadratic functions.

Not All Predictive Models are Said to be ‘Theory’

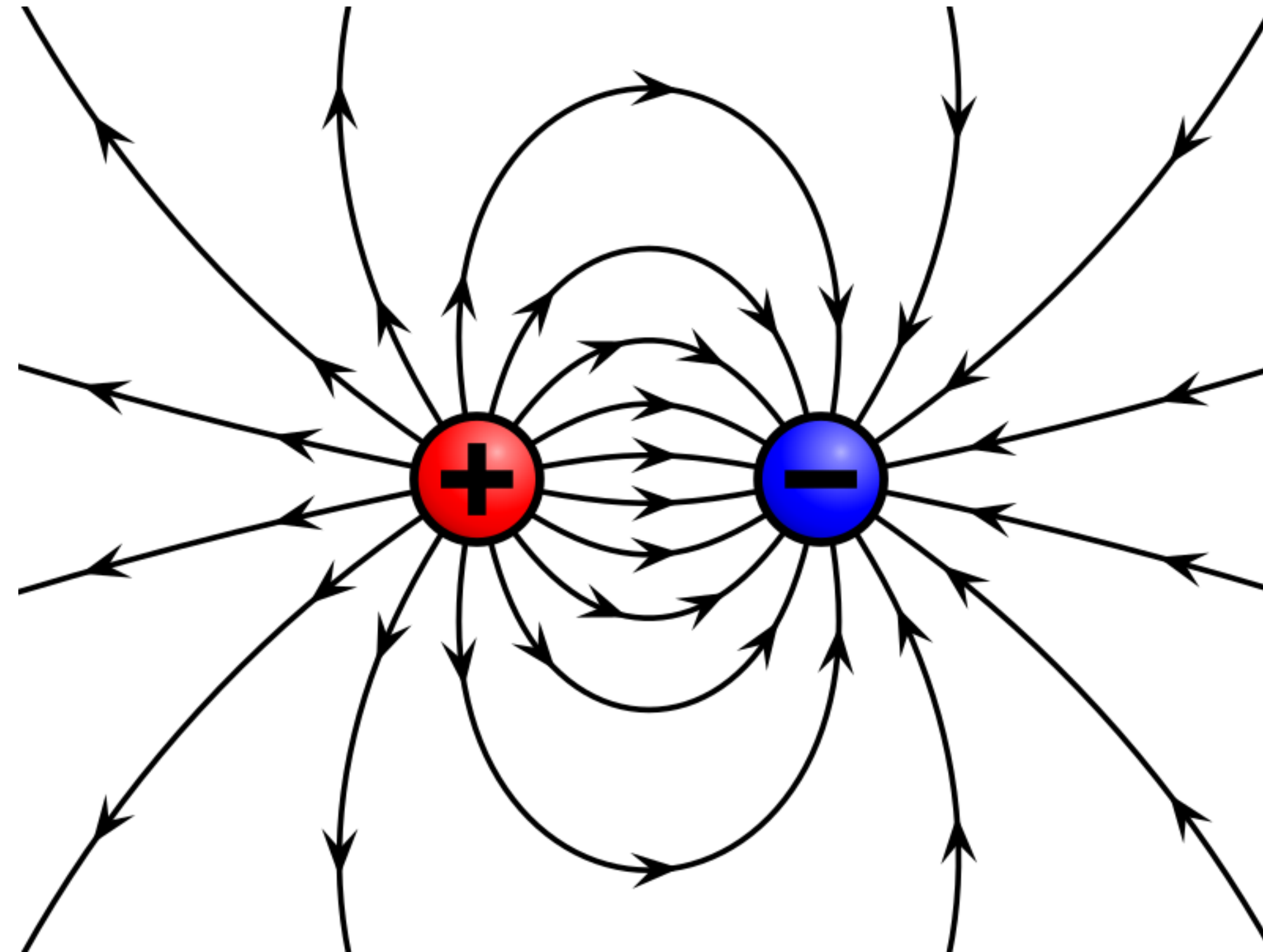
- General
- Forms a consistent closed system

Not All Predictive Models are Said to be ‘Theory’

- Newton’s Law of Motion 1: If a body is at rest or moving at a constant speed in a straight line, it will remain at rest or keep moving in a straight line at constant speed unless it is acted upon by a force.
- Newton’s Law of Motion 2: The time rate of change of the momentum of a body is equal in both magnitude and direction to the force imposed on it.
- Newton’s Law of Motion 3: When two bodies interact, they apply forces to one another that are equal in magnitude and opposite in direction.

Theory Contains Philosophy

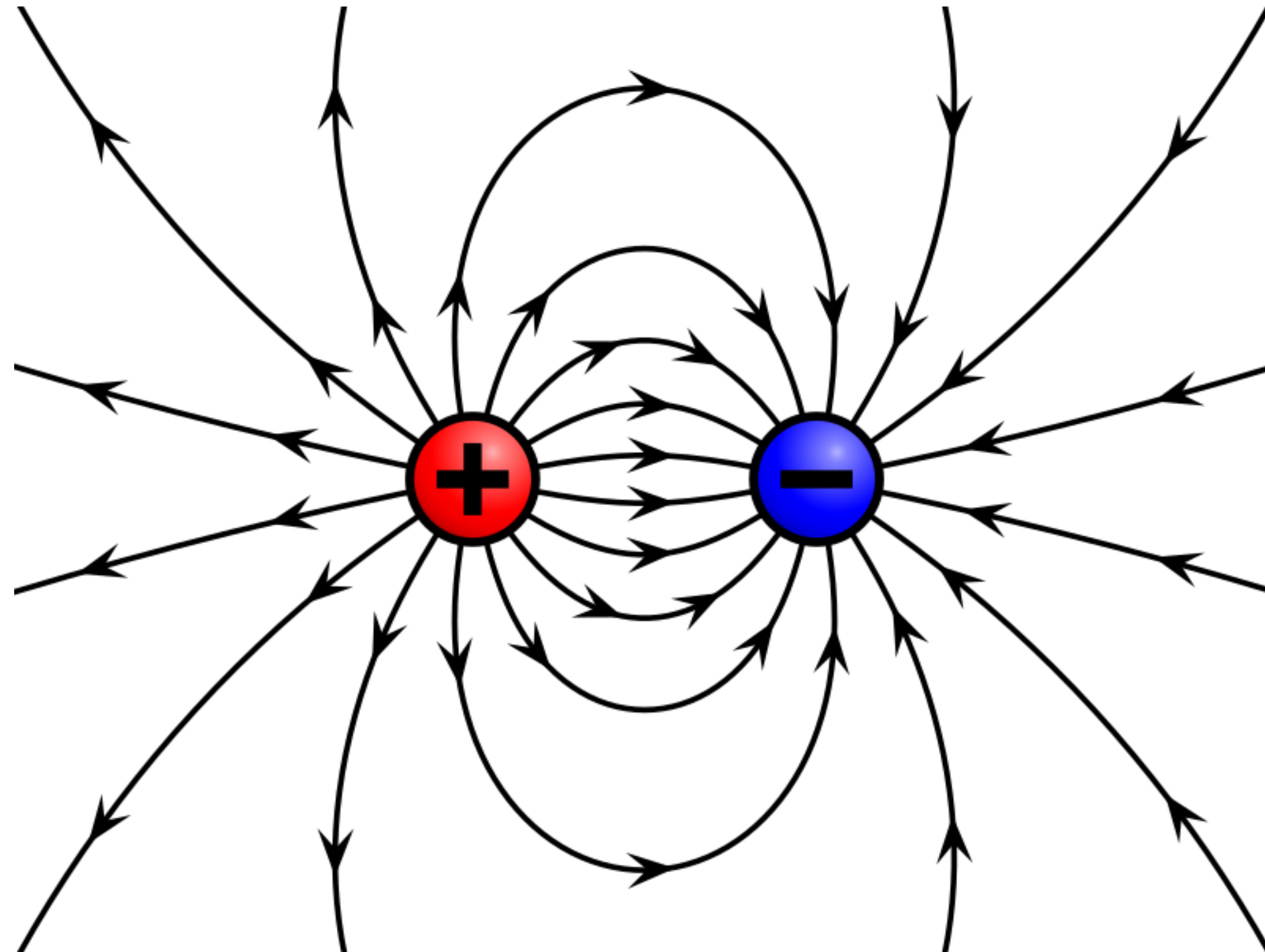
Theory Contains Philosophy



Action at a distance
: Charges can be affected
directly, not necessarily
touched.

Individual charged
affected by touched field.
Interaction 'transmitted' by
a field.

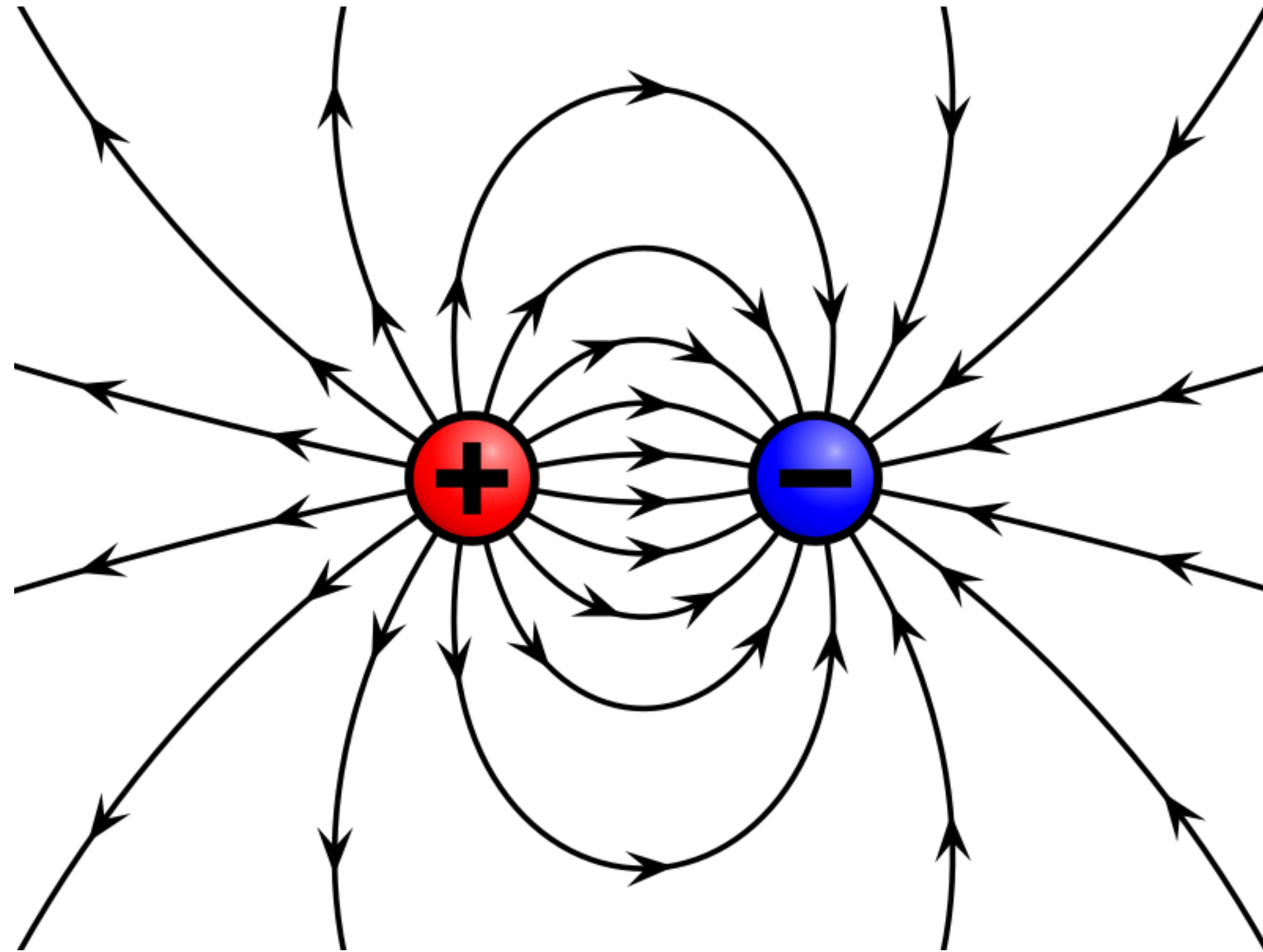
Theory Contains Philosophy



Field is more essential
object.

Potential is more essential
object.

Theory Contains Philosophy



Field is no more than
mathematical tool for
treating interactions

Field itself is a physical
object

**A physical essence may be
nothing more than a form of
mathematics that describes it.**

