

*In Principle*  
How principles shape physical theory

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DECEMBER 21, 2025

This one goes out to all the homies.

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## Chapter 1

# Classical Mechanics

### 1.1 Setup of classical mechanics

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Classical mechanics is the physics of the world as we experience it. Go on to explain how the world around us has a certain pattern of regularity, we will use these observations to formulate principles that later become axioms of a theory that we develop AKA, these axioms are the hypotheses of our scientific theory.

We notice that objects for example can be in different *places*. Two separate places are related by the intuitive notion of a *distance*.

#### Axiom 1.1: Distance

The **distance** is the measure of [...]. Should this be direction?

Although we could refer exclusively to the distance between objects, it would become extremely difficult to keep track of a collection of anything over a few. Hence, a useful trick is to set an *origin*: a point of no physical significance, but a reference point in space whose distance from all other points is the way in which *position* is defined.

#### Definition 1.1: Position

The position of any point is its distance from the origin. The vector that encodes position is labeled  $\mathbf{q} \in \mathbb{R}^3$ . The components of  $\mathbf{q}$  are called the coordinates.

Of course, we also know that things *happen*. Indeed, we have an intuitive notion of *after*.

#### Axiom 1.2: Chronology

There exists an order in which things happen. Should this be duration? Needs to be on equal footing as the space

#### Definition 1.2: Time

The definition of time. Once a temporal origin is chosen, the number that encodes the time is called  $t \in \mathbb{R}$ .

This is where there is a figure of some trajectory... this also serves as inspo for what comes next

**Axiom 1.3: Determinism**

**Axiom 1.4: Causality**

**Axiom 1.5: Locality**

Notion of a classical trajectory

**Corollary 1.1: Equation of Motion**

change color to match the axioms.

**Axiom 1.6: Galilean invariance**

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## 1.2 The functional approach

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## 1.3 The equations of motion

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### 1.3.1 Free particle

### 1.3.2 Interacting particle

# Bibliography

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