

School of Basic and Applied Sciences

Course Code : MSCP6001

Course Name: ELECTRODYNAMICS

Quantum Mechanics

Topic: Why Quantum Physics?



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Program Name: M.Sc. Physics

School of Basic and Applied Sciences

Course Code : BSCP3001

Course Name: QUANTUM MECHANICS

Introduction

- ❖ Need of quantum mechanics
- ❖ Meaning of absoluteness
- ❖ Definition of size (Big vs. Small)
- ❖ Origin of theory

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Why Quantum Physics?

- ❖ **Classical mechanics** (Newton's mechanics) and Maxwell's equations (electromagnetics theory) can explain **MACROSCOPIC** phenomena such as motion of billiard balls or rockets.
- ❖ **Quantum mechanics** is used to explain microscopic phenomena such as photon-atom scattering and flow of the electrons in a semiconductor.
- ❖ **QUANTUM MECHANICS** is a collection of postulates based on a huge number of experimental observations.
- ❖ The differences between the classical and quantum mechanics can be understood by examining both
- ❖ **The classical point of view**
- ❖ **The quantum point of view**

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Absolute Size

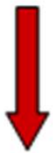
Basic Concepts

Absolute Size

The Superposition Principle

Size

Classical Mechanics



Relative

What does relative vs. absolute size mean?

Why does it matter?

Quantum Mechanics

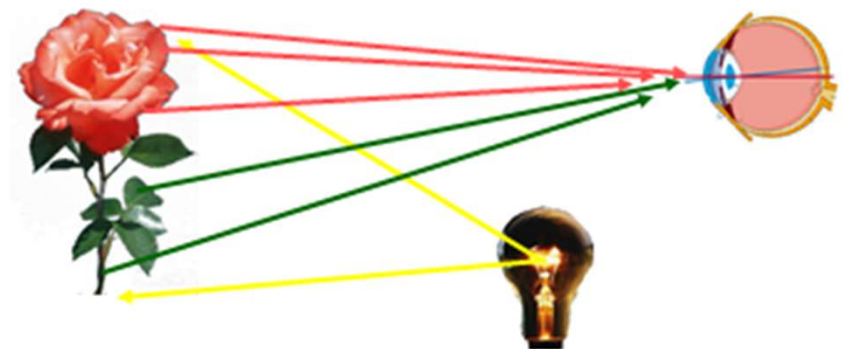


Absolute

Why does the definition of size matter?

To observe something, must interact with it.

Always true - in classical mechanics
in quantum mechanics



Light hits flower, "bounces off."

Detect (observe) with eye, camera, etc.

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Definition of Big and Small

Definition of Big and Small

(Same for classical mechanics and quantum mechanics.)

Disturbance caused by observation (measurement)

negligible → object big
non-negligible → object small

Classical Mechanics

Assume: when making an observation
can always find a way to make a negligible disturbance.
Can always make object big.

Do wrong experiment → object small.
Do right experiment → object big.

Observe wall with light → big.
Observe wall with billiard balls → small.

Implies – Size is relative. Size depends on the object and your experimental technique.

Nothing inherent.

Quantum Mechanics Size is absolute.

Quantum Mechanics is fundamentally different from classical mechanics in the way it treats size.

Absolute Meaning of Size

Assume: "There is a limit to the fineness of our powers of observation and the smallness of the accompanying disturbance, a limit which is inherent in the nature of things and can never be surpassed by improved technique or increased skill on the part of the observer."

Dirac

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QM was developed in order to explain physical phenomena which were not consistent with classical physics.



Max Planck



Albert Einstein



Niels Bohr



Werner Heisenberg



Erwin Schrödinger



Max Born



Louis de Broglie



Paul Dirac



Richard Feynman

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