

# Title: The Double-Slit Experiment: Wave-Particle Duality

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## 1. Introduction

The double-slit experiment demonstrates the strange behavior of quantum particles (e.g., electrons or photons). It shows that particles can exhibit both **wave-like** and **particle-like** properties depending on how they are observed.

## 2. How It Works

- A beam of particles (e.g., light or electrons) is fired at a barrier with two narrow slits.
- Behind the barrier, a detector screen records where the particles land.

### Classical Expectation:

If particles behave like tiny bullets, they should pass through one slit and create two distinct bands on the screen.

### Quantum Reality:

Instead, an **interference pattern** (alternating bright and dark bands) appears, as if the particles are waves interfering with themselves.

## 3. Key Observations

- **Wave-Particle Duality:** Particles act as waves when unobserved but collapse into particles when measured.
- **Observer Effect:** The act of measuring which slit a particle passes through destroys the interference pattern.

## 4. Implications

- Challenges classical physics.
- Foundation for quantum mechanics.
- Suggests reality is probabilistic until observed.

## 5. Quote to Test NLP

*"Not only is the universe stranger than we imagine, it is stranger than we **can** imagine."* — J.B.S. Haldane