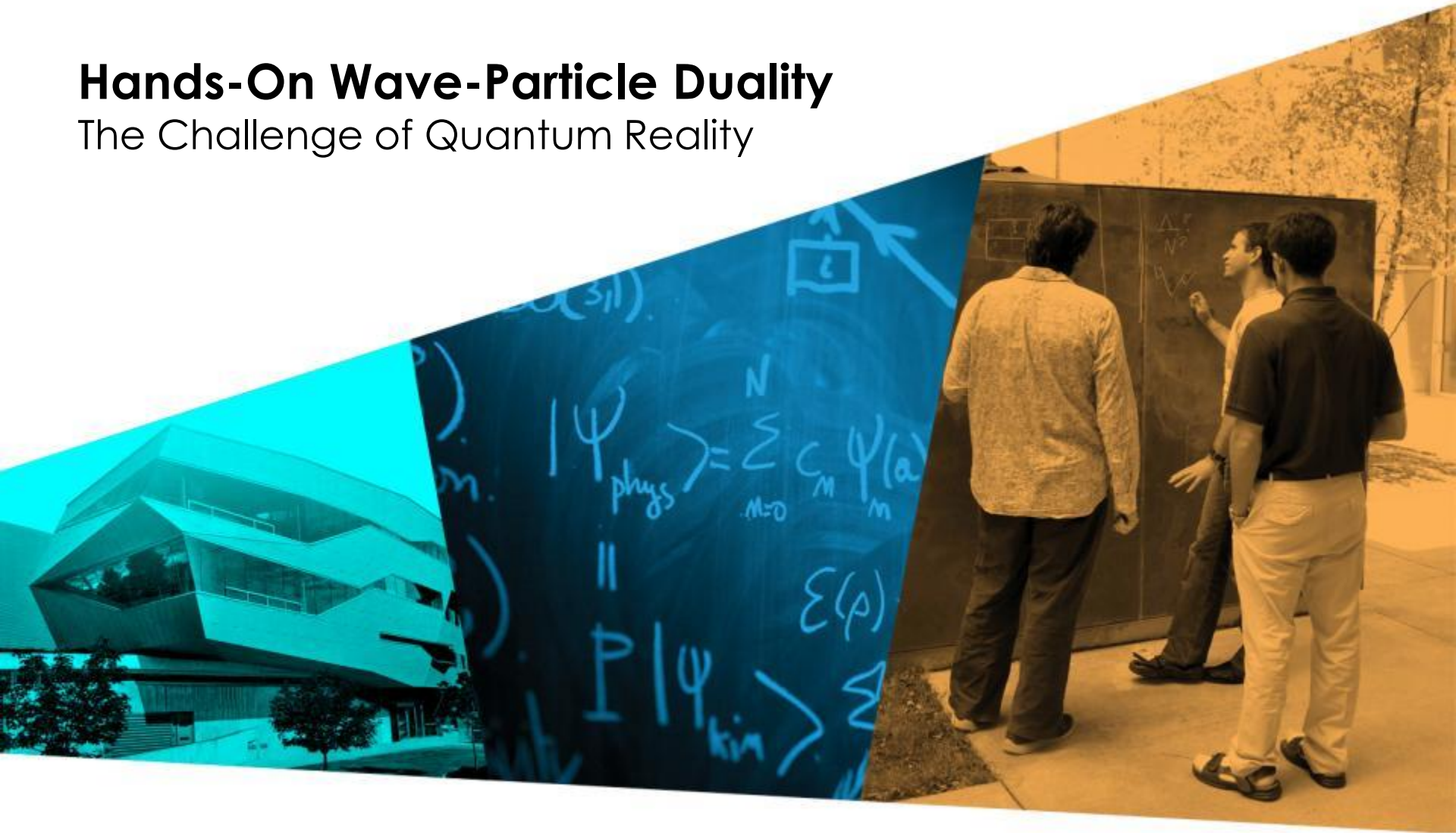


# Hands-On Wave-Particle Duality

The Challenge of Quantum Reality

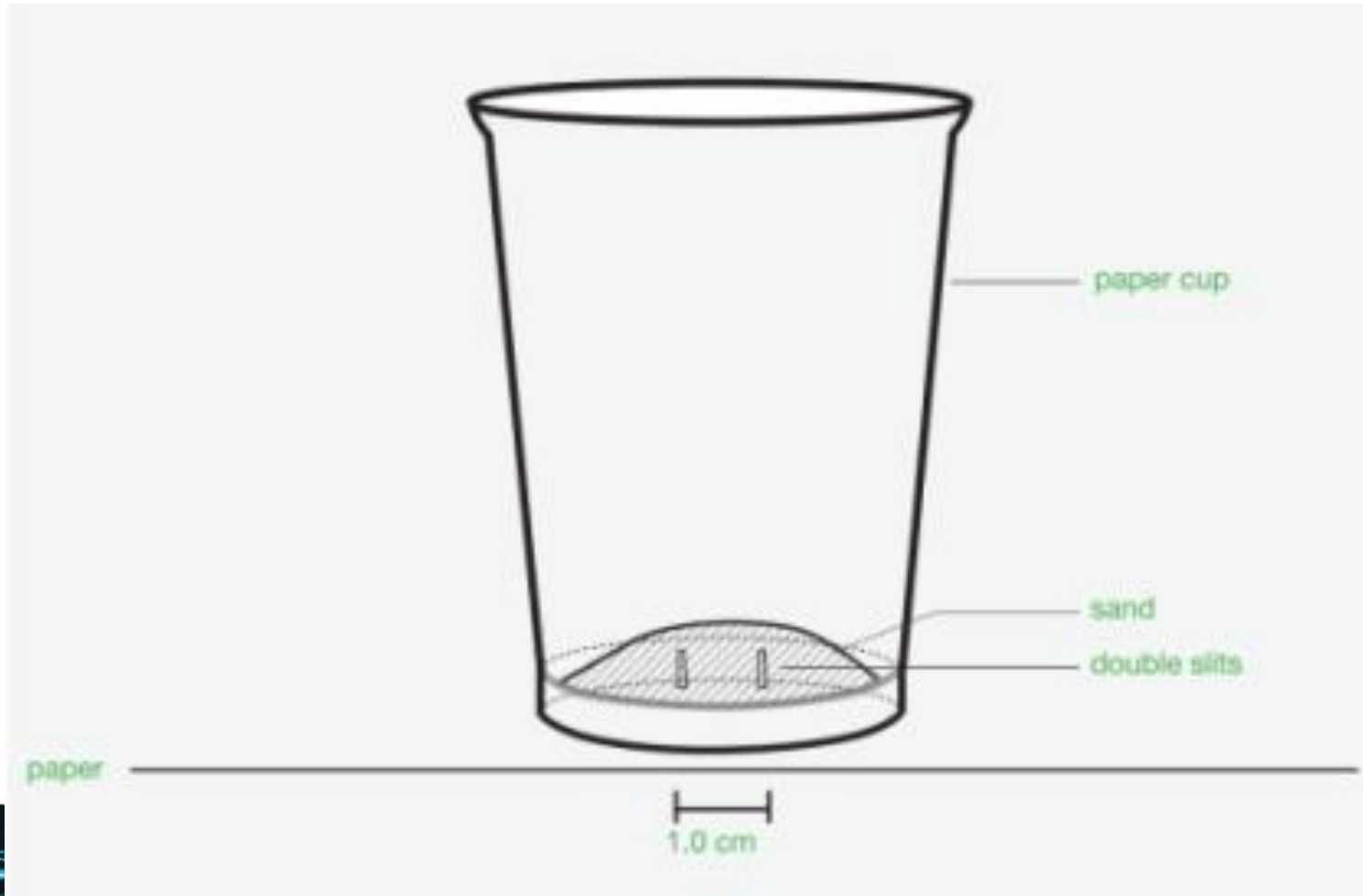


# Black Box

## Building and Revising Scientific Models



# Double Slit with Classical Particles (POE)



# Double Slit with Classical Particles (POE)

Using your white boards:

- Sketch your prediction,
- Provide **three (3) phrases** to explain why.



# Double Slit with Classical Particles (POE)



Classical particles...  
collide  
localized



# Double Slit with Classical Waves (POE)

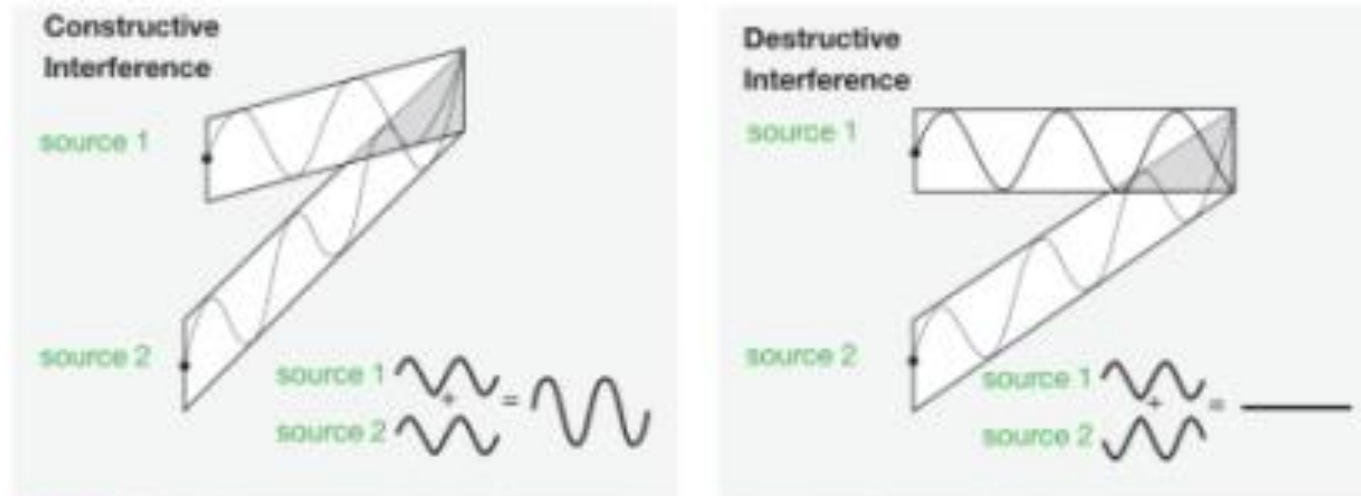
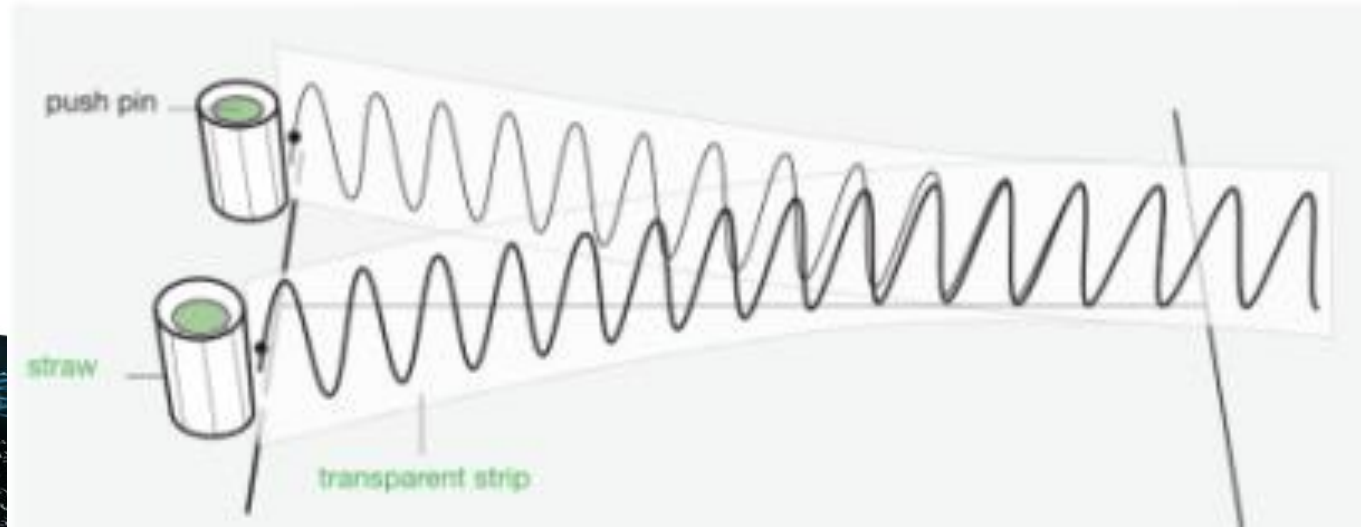


Figure 2. Recall the constructive interference and destructive interference of classical waves.



# Double Slit with Classical Waves (POE)

Using your white boards:

- Sketch your prediction,
- Provide **three (3) phrases** to explain why.



# Double Slit with Classical Waves (POE)



Classical waves...  
interfere  
non-localized

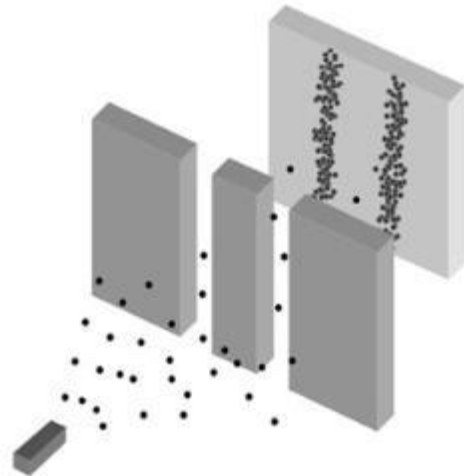




# Summary

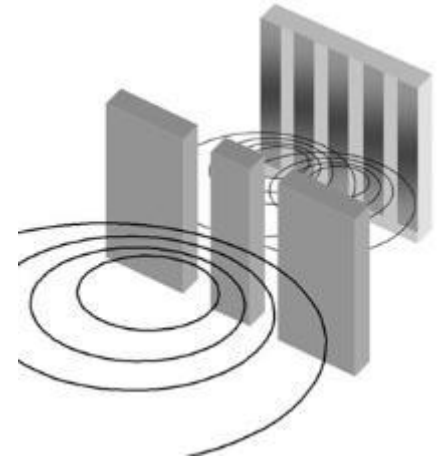
## Particles

- Localized
- One place at a time
- Can bounce off other particles



## Waves

- Non-Localized
- Spread out
- Can pass through other waves



# Electrons Through the Double Slits

What model do you think the your students' will believe the electron will follow?

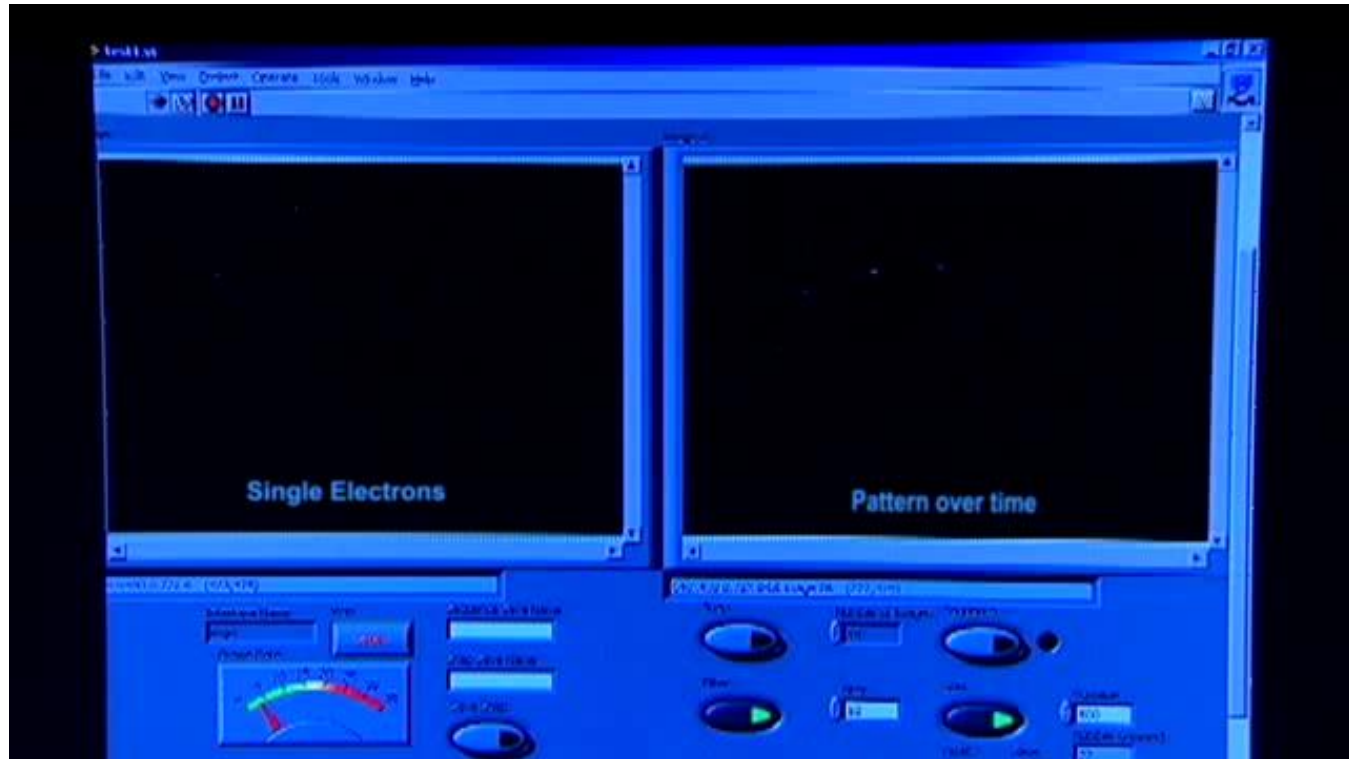
What should happen if we pass electrons through the two slits?

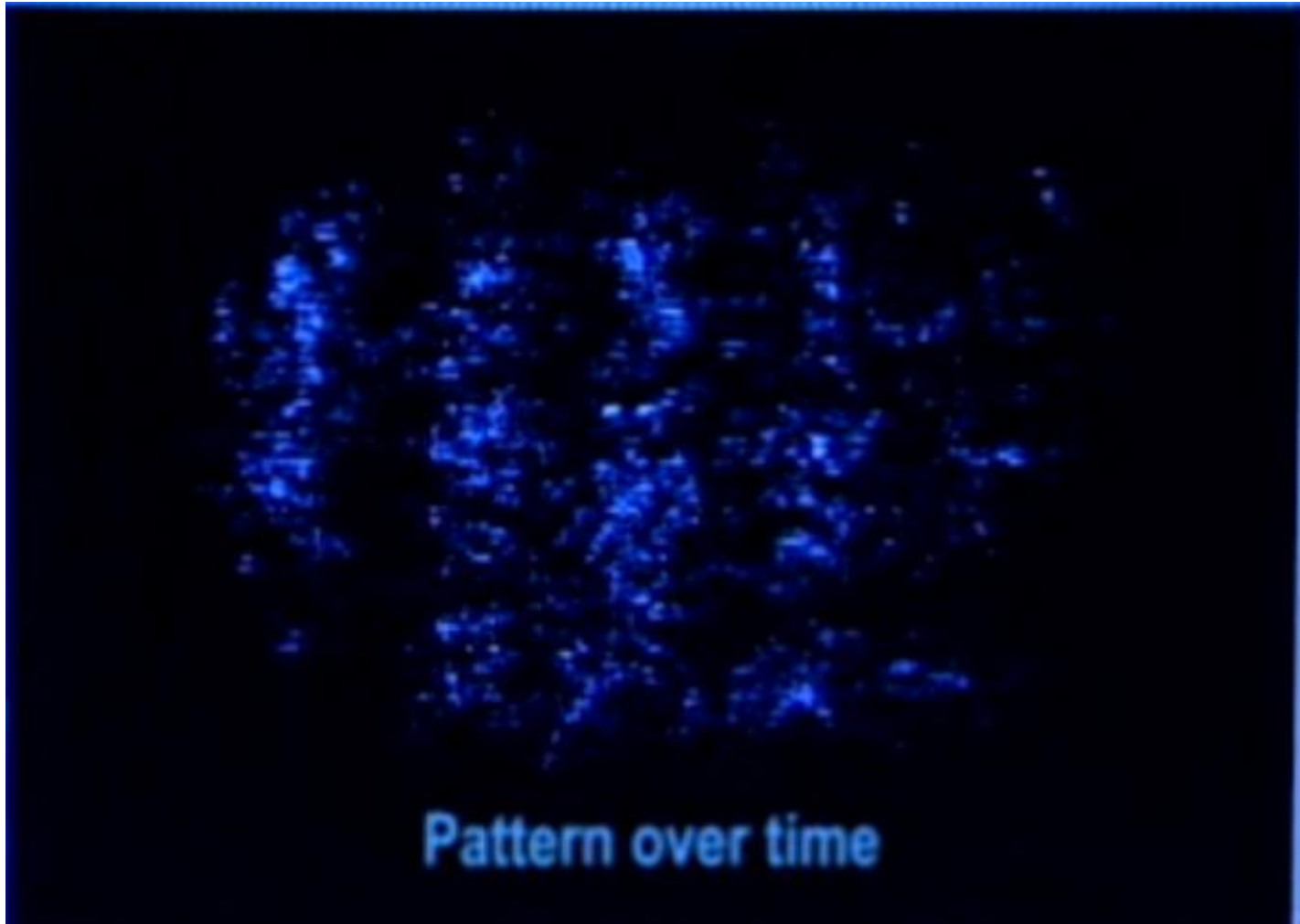


# Double Slit with Electrons



# Double Slit with Electrons

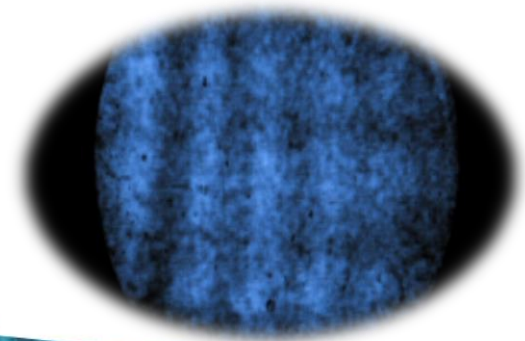
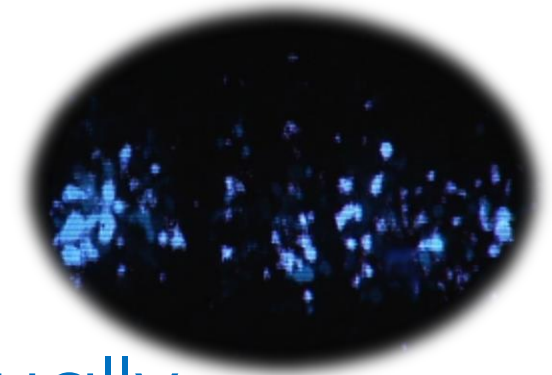




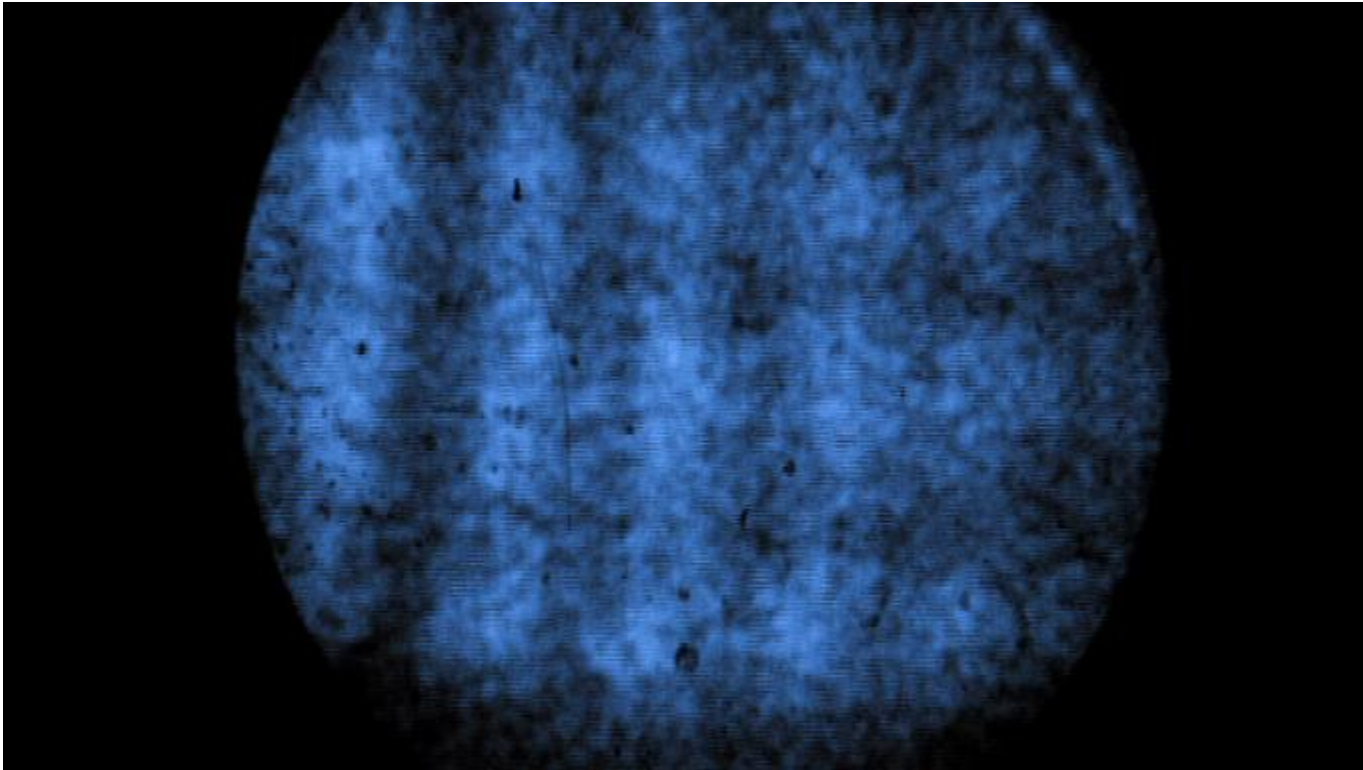
# Wave-Particle Duality

Electrons ...

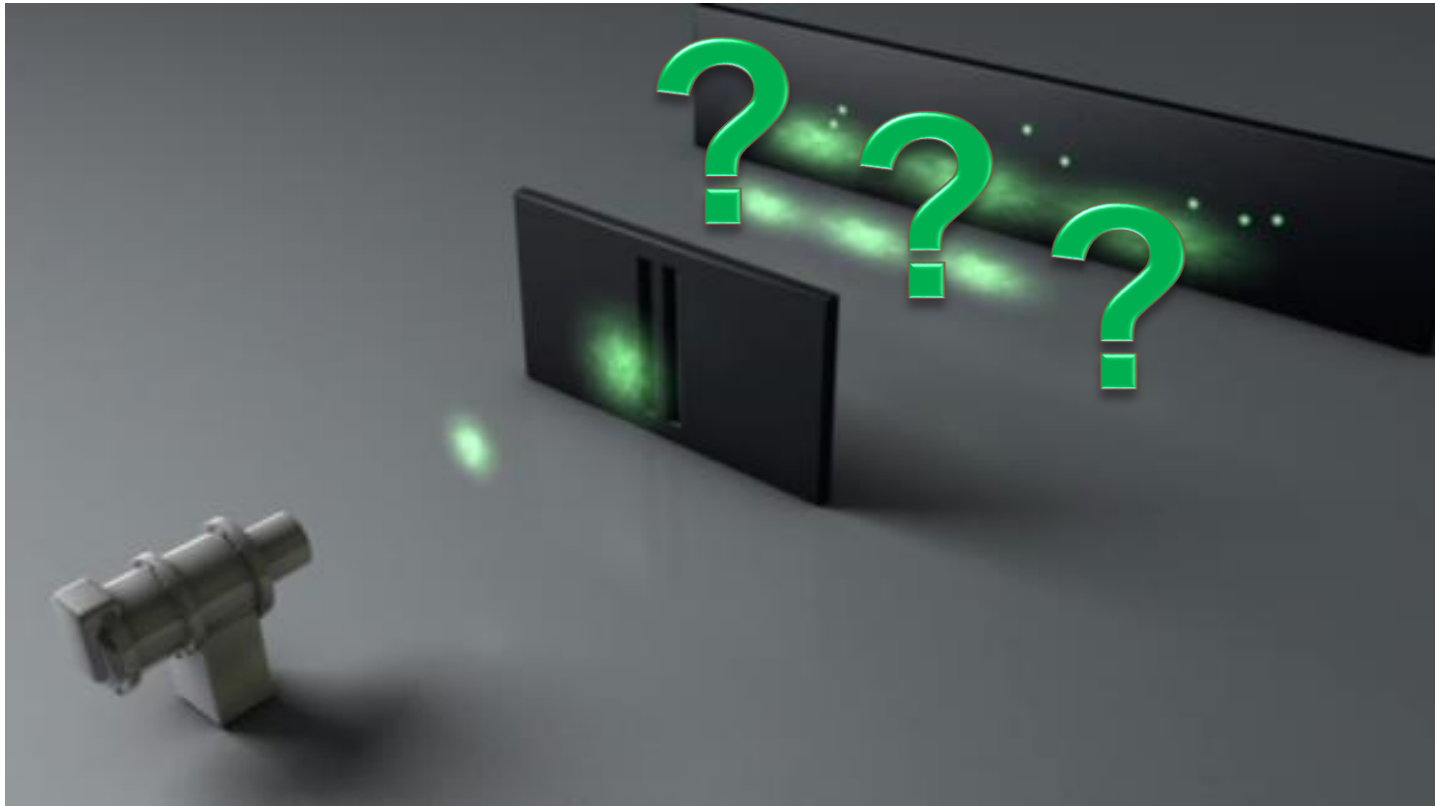
- leave and arrive individually
- arrive at discrete, random locations
- produce an interference pattern



# Predict: What is the electron doing?

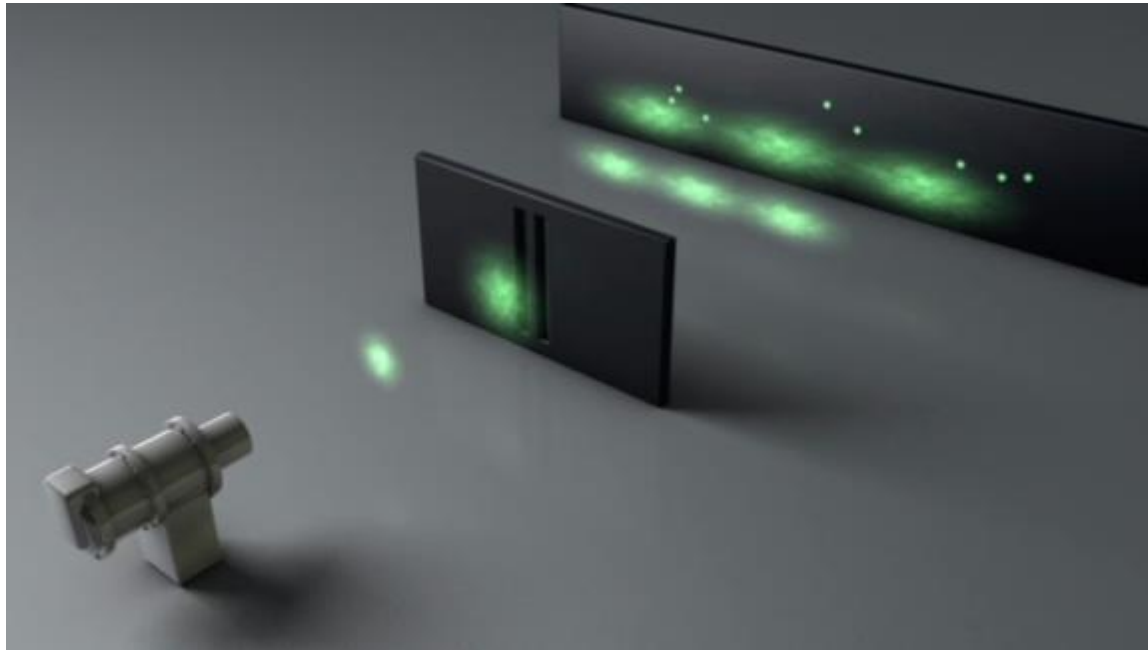


# What is your interpretation?

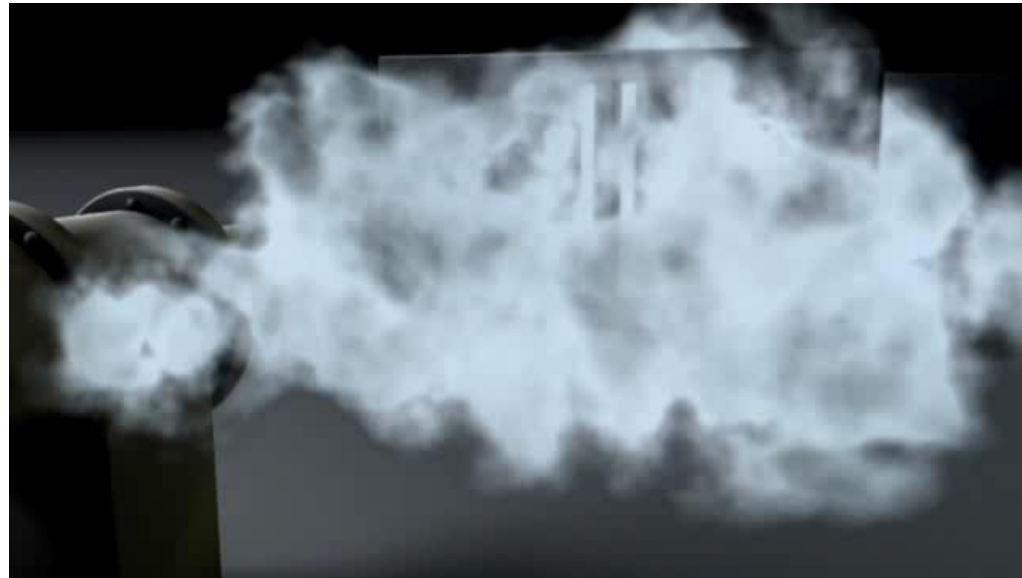




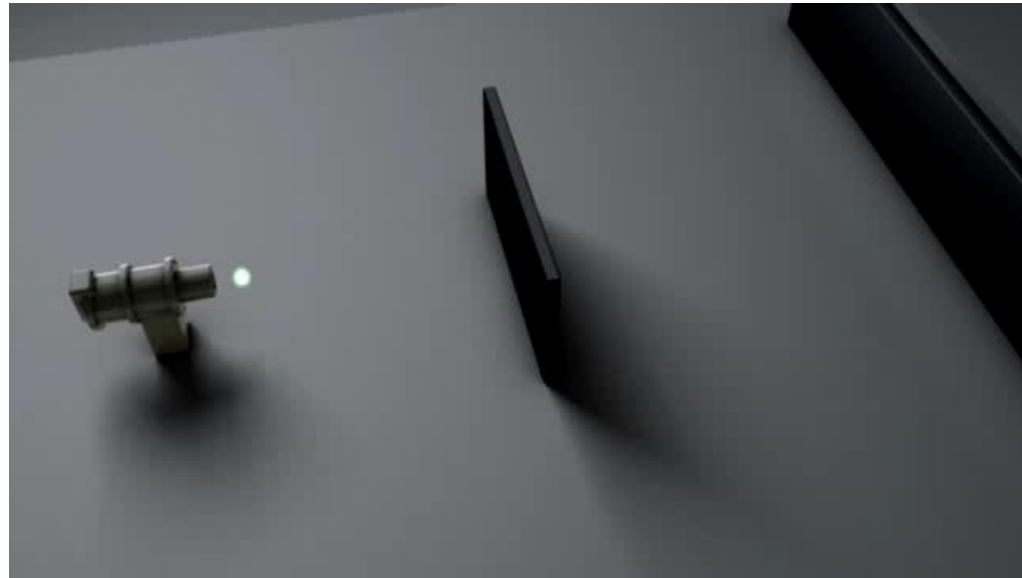
# Interpretations: Collapse



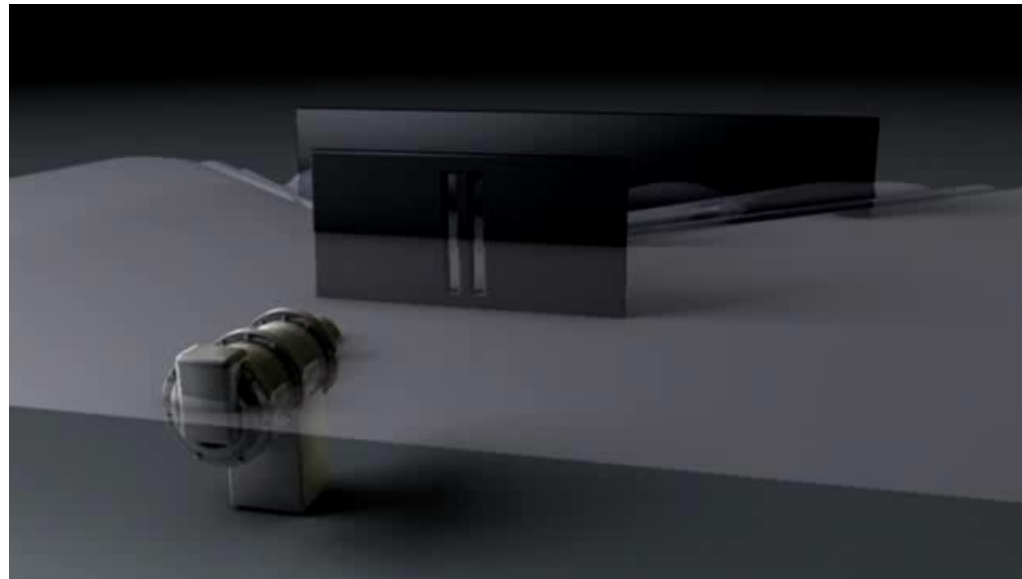
# Interpretations: Copenhagen



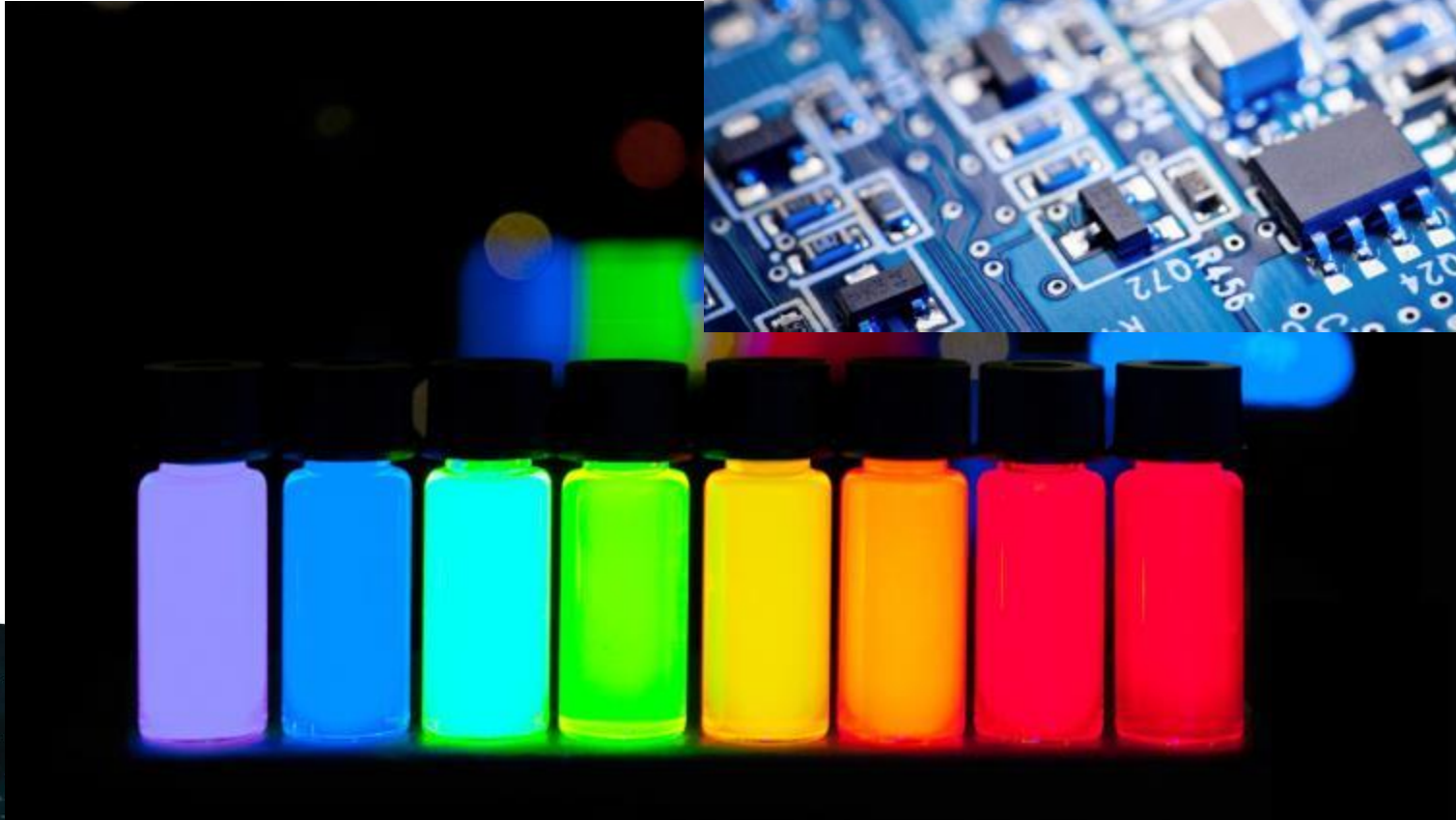
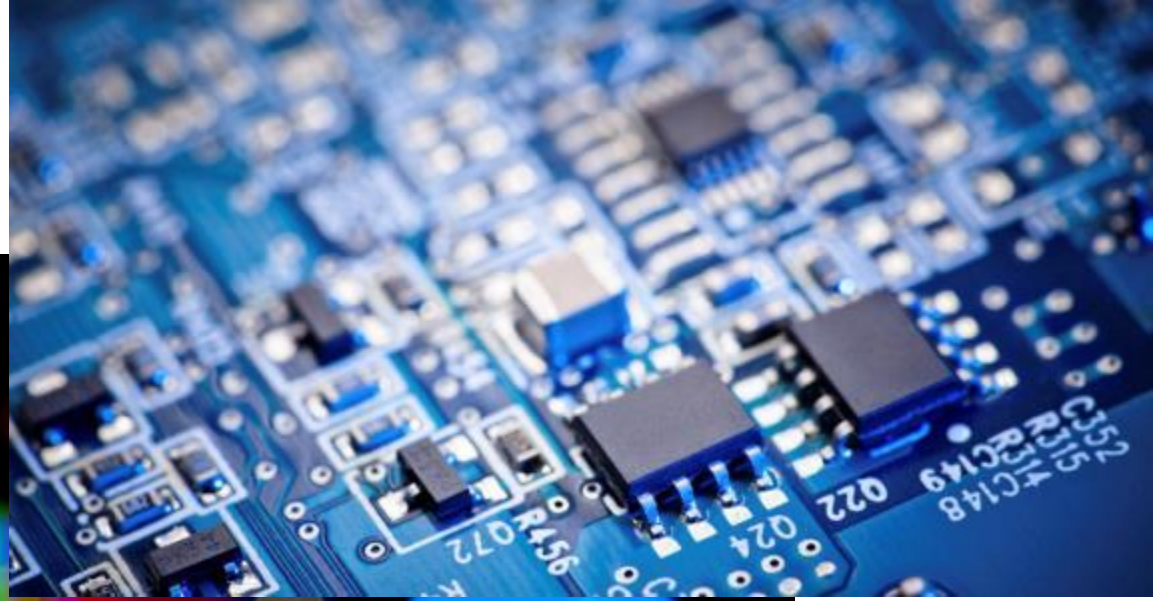
# Interpretations: Many Worlds



# Interpretations: Pilot Wave



# Quantum Used in Technology



# Thank You!!

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