

PHYS 344 Introduction to Quantum Science

How to sit in 3 chairs at once,
and speed without getting a ticket.

Lecture 01: How to Sit in 3 Chairs
(Particle-Wave Duality and Superposition)

Quantum Mechanics

In the quantum world you can:

- Sit in 3 chairs at once

- Speed without getting a ticket

- Walk through walls

Can I create my own reality?

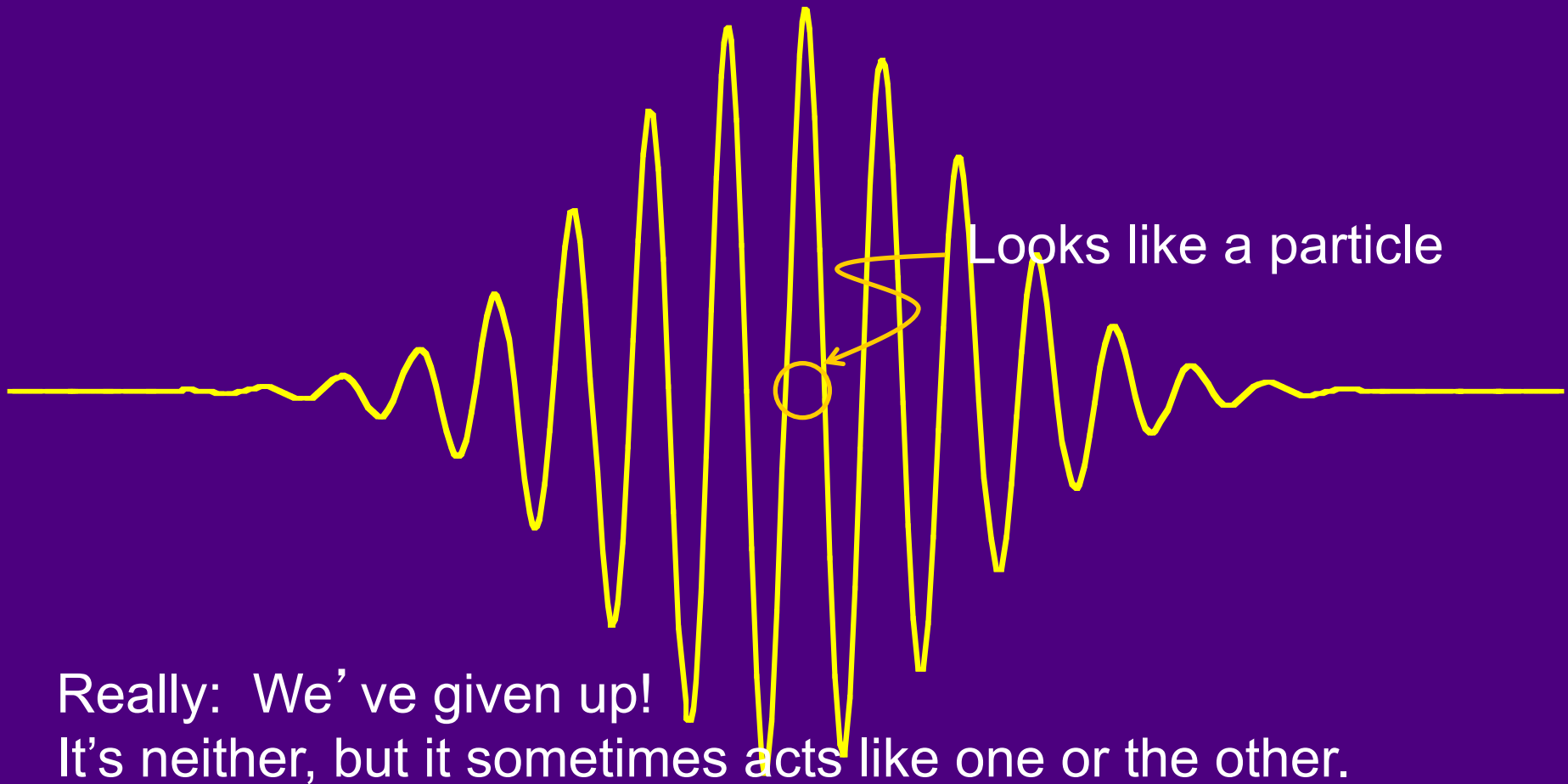
“God does not play dice!” (Einstein’s famous objection)

Quantum Mechanics is about really small things



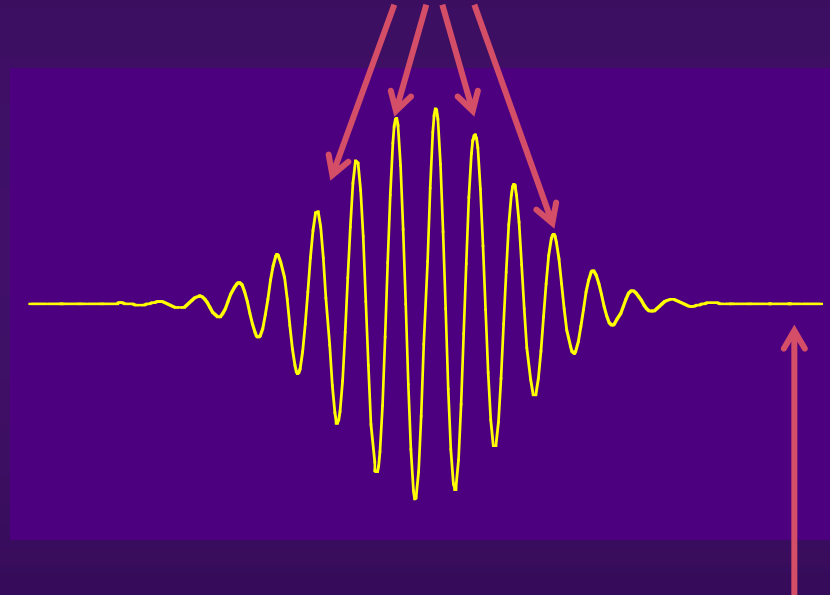
Atoms, protons, electrons...

Particles are Waves?



The Wave Tells All

The particle is somewhere in here



But not here

Shape of the wave: Energy, Velocity, etc.

Quantum means quantized

Answers come in whole numbers

Example: Coke cans in your refrigerator are quantized.



Waves can be quantized too -- like a violin string or jumprope



Measurements Part I: How to Sit in Three Chairs at Once

What's in a state?

State = whatever the particle is doing.

“In the tree” state



What's in a state?

State = whatever the particle is doing.

“In the tree” state

Wave wiggles in the tree



What's in a state?

State = whatever the particle is doing.

“On the couch” state

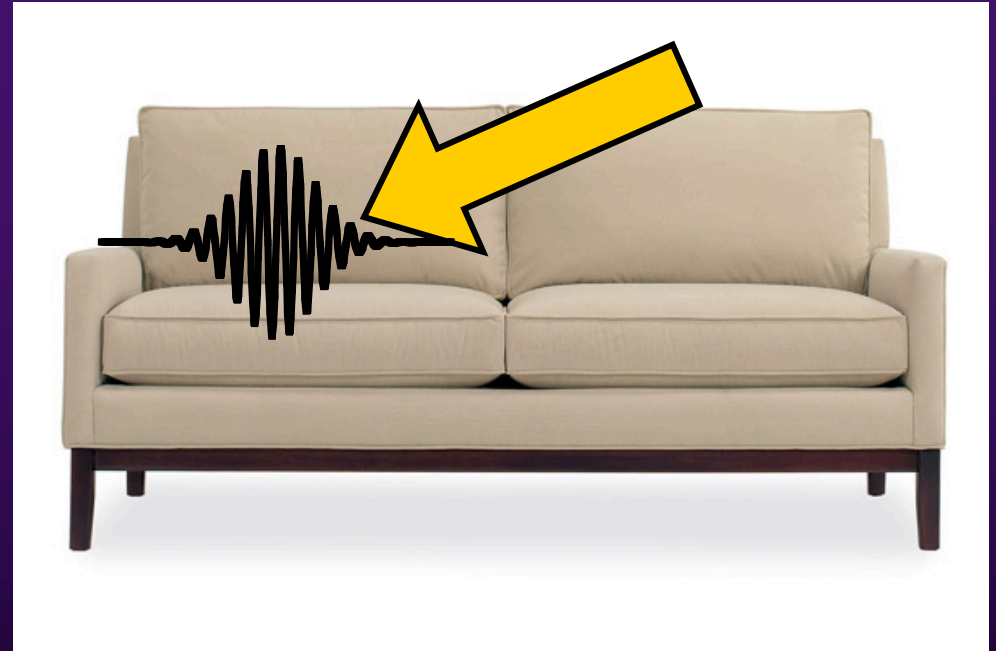


What's in a state?

State = whatever the particle is doing.

“On the couch” state

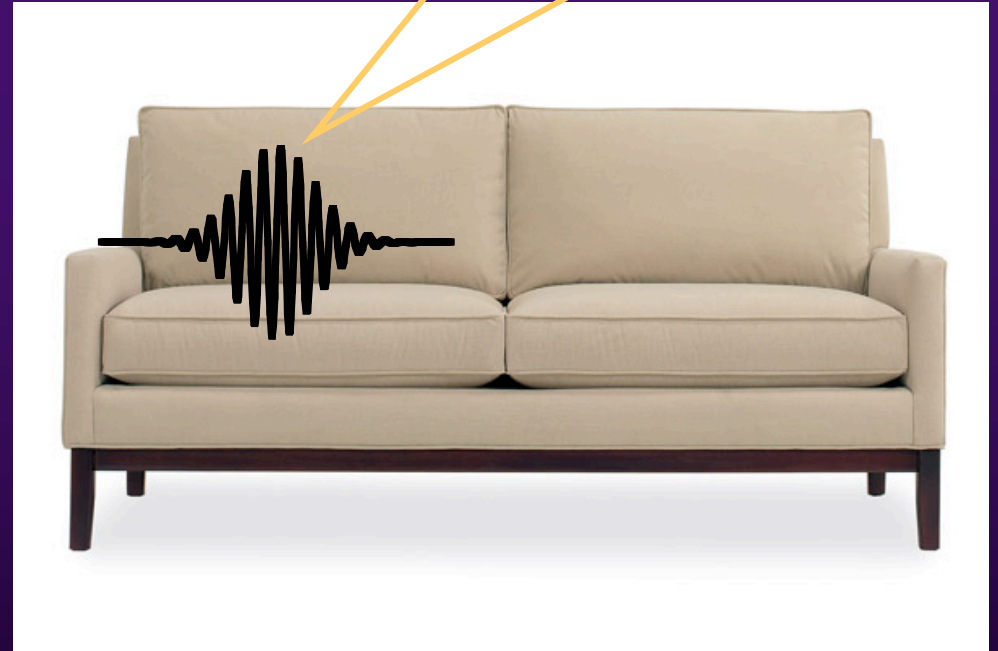
Wave wiggles on the couch



Measurements

Ask the particle questions

Where are you?



Waves can be in two places at once

There's still only one particle!

30% "In the tree" state and 70% "On the couch" state
(No more movie theater dilemmas!)

