So far: General quantum state = a quantum superposition of eigenstates

eigenstates (like basis vectors) are special quantum states for which the outcome of some measurement is completely unambiguous.

Two examples:

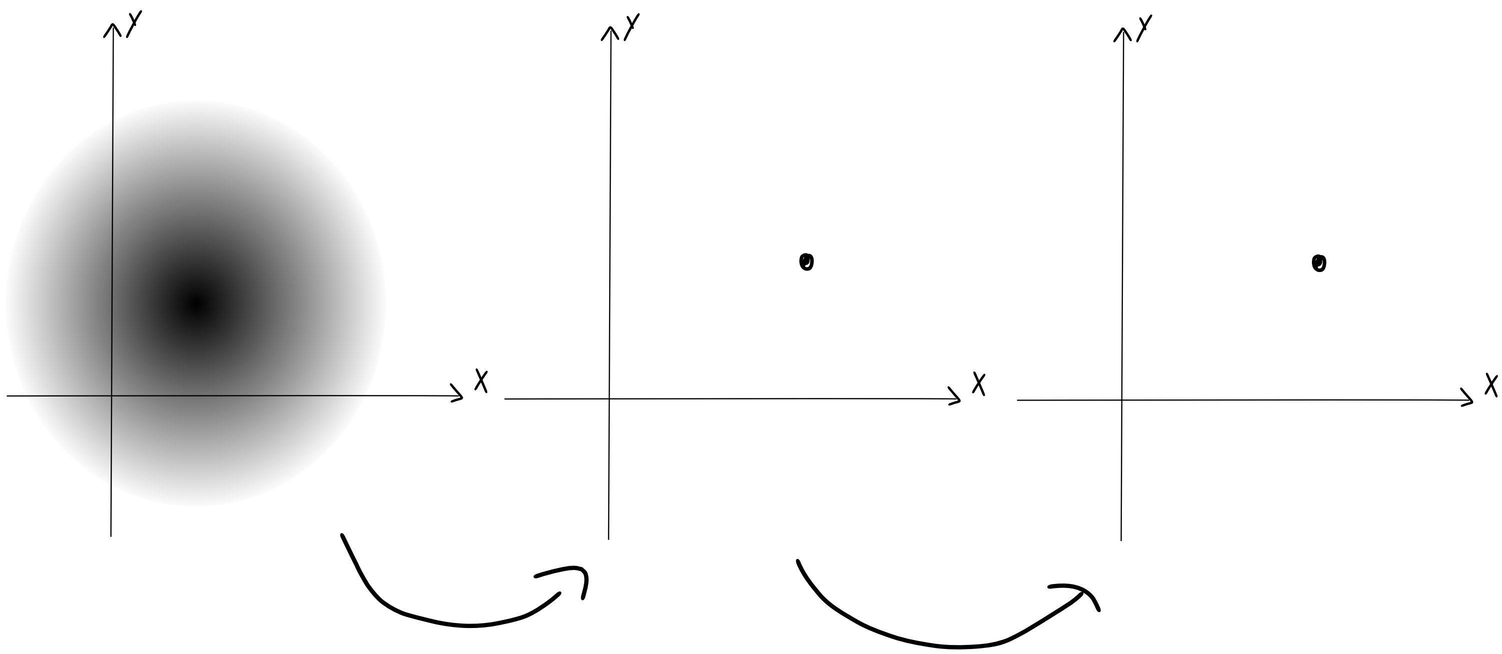
	Polarization states	Position states
measurement	going (or not) through a polarizer oriented vertically	detecting particle at position $\vec{\mathbf{x}}$ (for any $\vec{\mathbf{x}}$)
eigenstates	$\|0\rangle,\ \|90\rangle$	$\|\vec{x}\rangle,\quad x \in \mathbb{R}$ (one eigenstate for every value of $\vec{x}$)
general quantum state	$a_0\|0\rangle + a_{90}\|90\rangle$	$\int d^3x\ \psi(\vec{x})\ \|\vec{x}\rangle$

integral = sum over all possible states

coefficient in quantum superposition = a complex number for every position = WAVEFUNCTION

-> clicker question
-> clicker question

measurement of position



measurement of position

subsequent measurement of position gives the same result (if performed soon enough that the wavefunction had no time to evolve in time)

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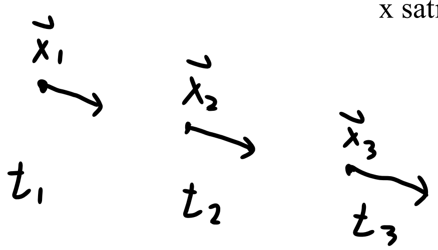
General (delocalized) wavefunction COLLAPSES (changes to) to a position eigenstate when position is measured.
Before the measurement, the particle did not have a well defined position.
After the measurement, the particle does have a well defined position.
Measurement **changes** the state of the particle!
There is no way to measure anything without disturbing it in quantum mechanics.

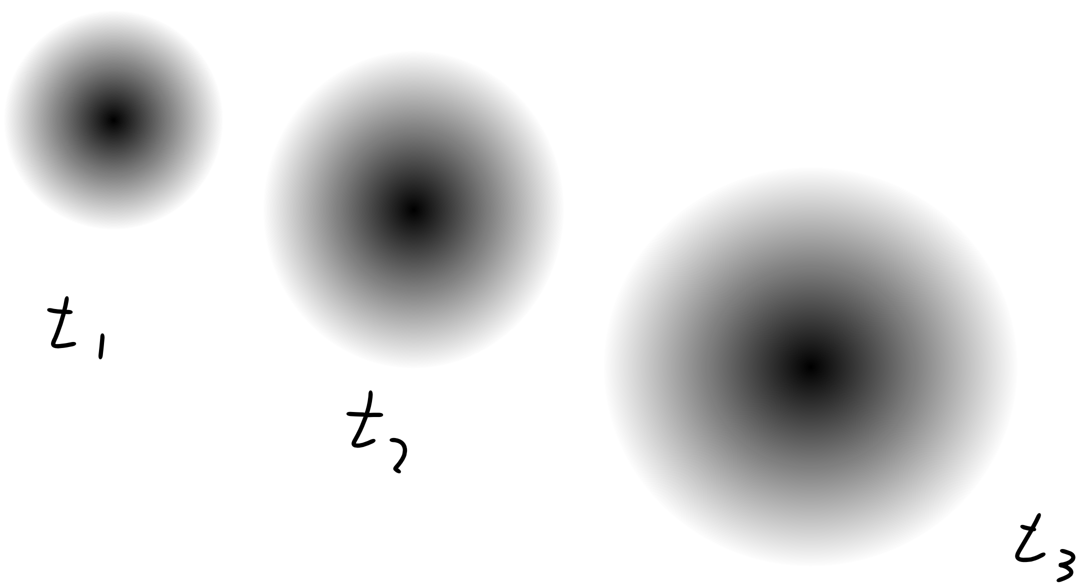
But, what is the wavefunction?
A: It's a complete description of the state of the particle.

To describe a particle in classical mechanics, we specify positions and velocities. These can change with time.

$\vec{x}$ satisfies Newton's equation: $m \frac{d^2\vec{x}}{dt^2} = \vec{F}$



To describe a particle in QM, we specify the wavefunction. The wavefunction changes with time, too!
(Schrodinger equation tells you how, we will get to this.)



In QM, the wavefunction replaces positions and velocities in the description of a particle's evolution.
Given a wavefunction, we can predict the probabilities of detecting the particle at different positions, or of measuring it to have a particular velocity.

Looking ahead: Schrodinger equation:

$$i \frac{d}{dt} \psi(x,t) = -\frac{\hbar}{2m} \frac{\partial^2}{\partial x^2} \psi(x,t) + V(x)\psi(x,t)$$