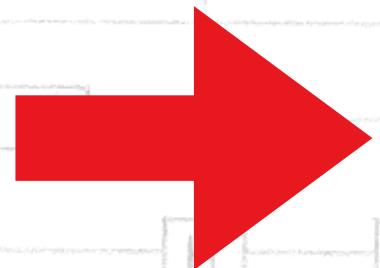


What Is The Qubit State?

Don't even think of comparing
the qubit with a classical bit!



The Qubit is **NOT** like a classical bit

The qubit doesn't store information in the classical sense.



Stop comparing it with one!



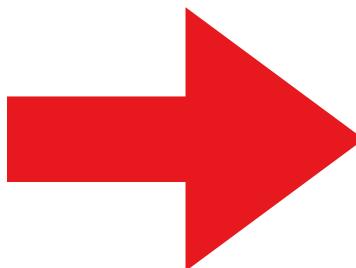
Not a spinning coin



Not a cat that's dead and alive

Schrödinger used the cat analogy to show how absurd the idea of being in multiple states at once is.

It is **not** 0 and 1 at the same time



But? What Is It Then?



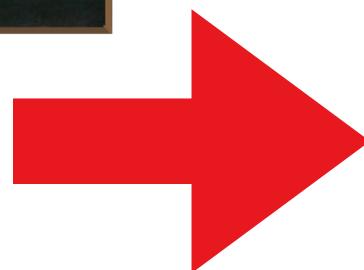
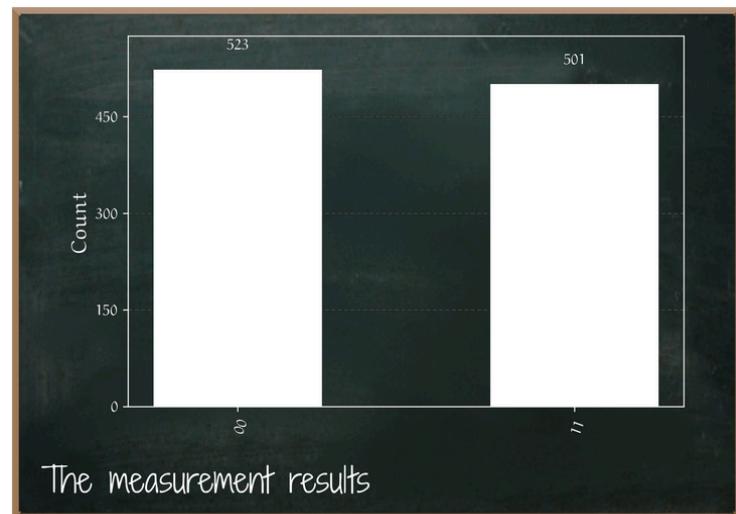
Thanks Prof!

A qubit is a quantum system described by a 2-dimensional Hilbert space $\mathcal{H} \cong \mathbb{C}^2$.

A qubit behaves like a slot machine with a single lane and two possible outcomes



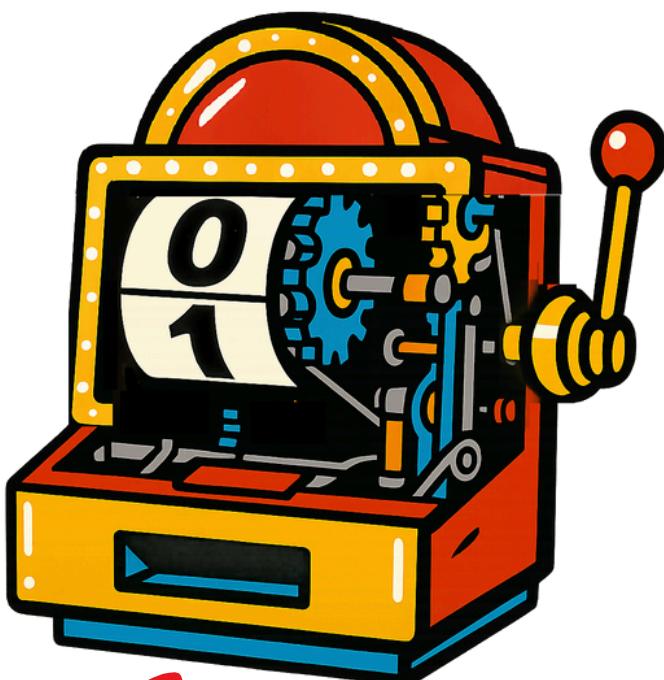
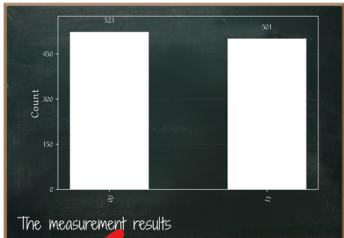
Play often and you'll get a Bernoulli distribution



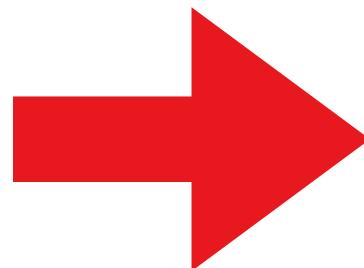
The Quantum State is the Inner Workings Of The Qubit

The slot machine is not in two states at the same time, either!

It has two possible outcomes: 0 and 1

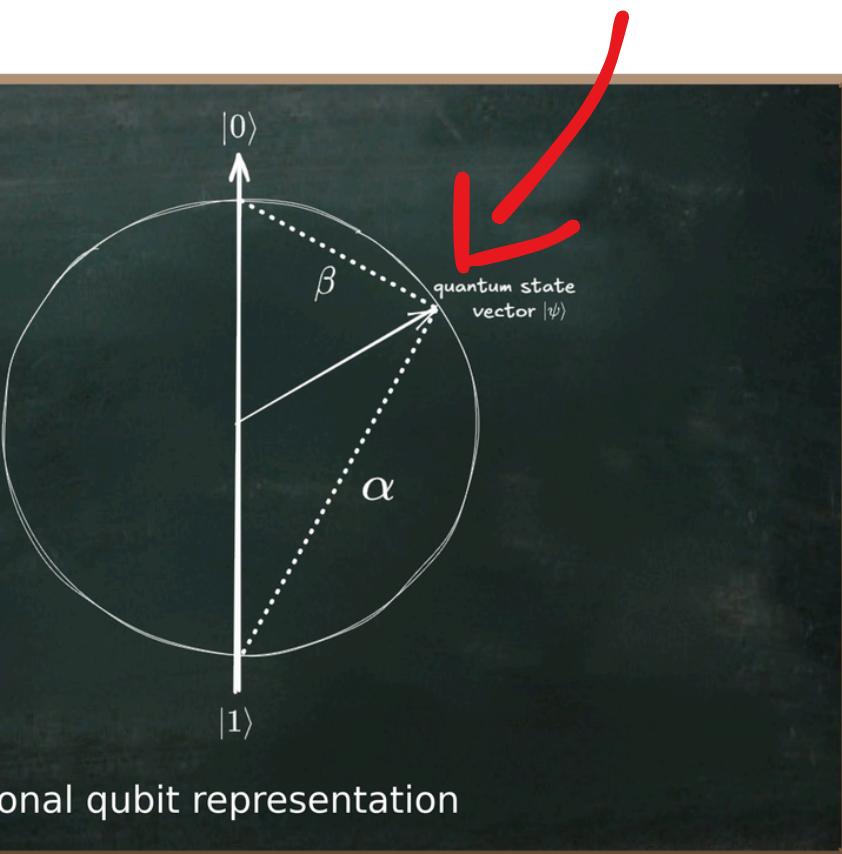


The probabilities of either outcome depend on the inner workings!



The Inner Workings of the Qubit

Not a number, but a direction!



Quantum State

$$|\psi\rangle = \alpha|0\rangle + \beta|1\rangle$$

Direction determines the length of the amplitudes

Normalization

$$|\alpha|^2 + |\beta|^2 = 1$$

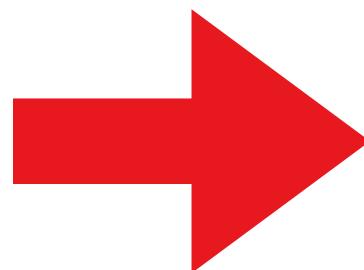
Normalization ensures probabilities to add up to 1

Only when measured:

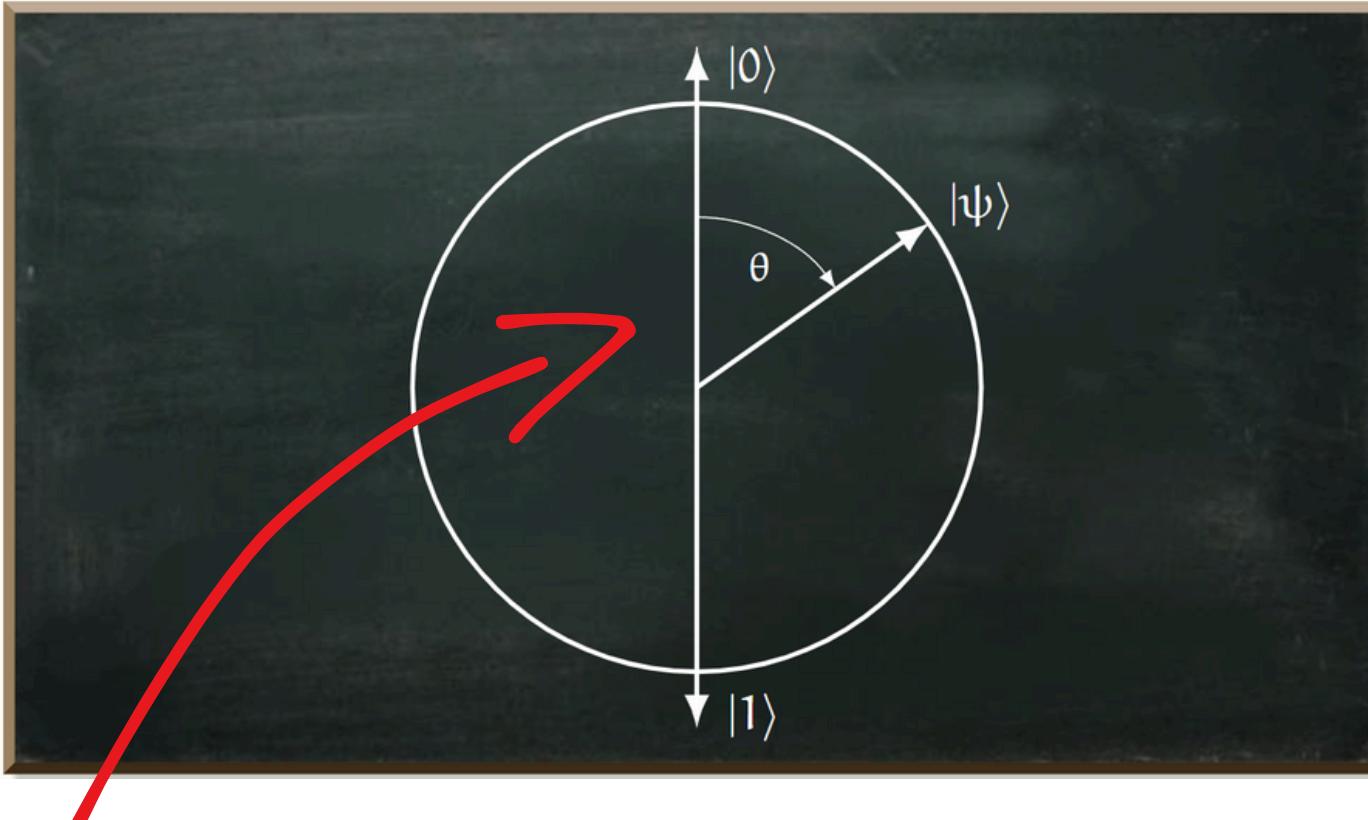
$$|\psi\rangle = X \begin{array}{l} \xrightarrow{\hspace{1cm}} 0 \\ \xrightarrow{\hspace{1cm}} 1 \end{array}$$

$P(X = 0) = |\alpha|^2$

$P(X = 1) = |\beta|^2$

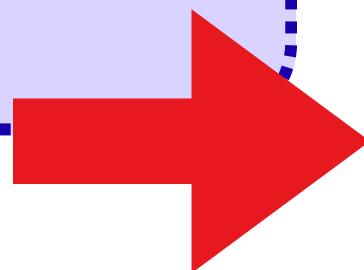


How To Work With The Quantum State Vector



Rotate the quantum state vector

- Rotation keeps the vector normalized
- Rotation only changes the direction and therefore
 - the amplitudes
 - the probabilities

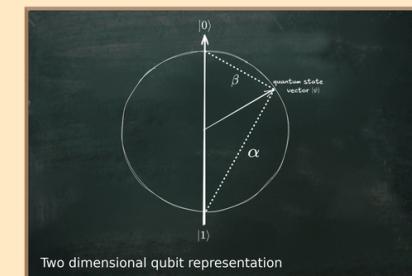


No Mystical Dual States

The qubit is a geometrical system to design and control randomness!

Quantum State Vector

The quantum state vector encodes the amplitudes that determine the probabilities



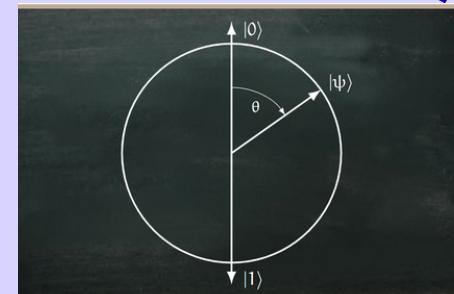
Measurement

Measurement converts those probabilities into definite results: a distribution

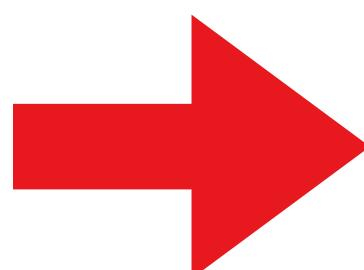


Quantum Operators

Quantum operators only rotate the quantum state vector, preserving normalization and changing amplitudes



Quantum Computing is all about steering an arrow in a probability space until its outcomes reflect the pattern that solves your problem.





Learn how to bring the qubit
into a favorable state



<https://www.quantum-machine-learning.com>



<https://www.quantum-machine-learning.com>

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