Welcome Namaste

DEV SANSKRITI
VISHWAVIDYALAYA

Expansions of Quantum theory towards Consciousness

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Lecture 1

Basic Principles and logical Foundation of Quantum-Theory

Gotthard Günther (1900 – 1984)

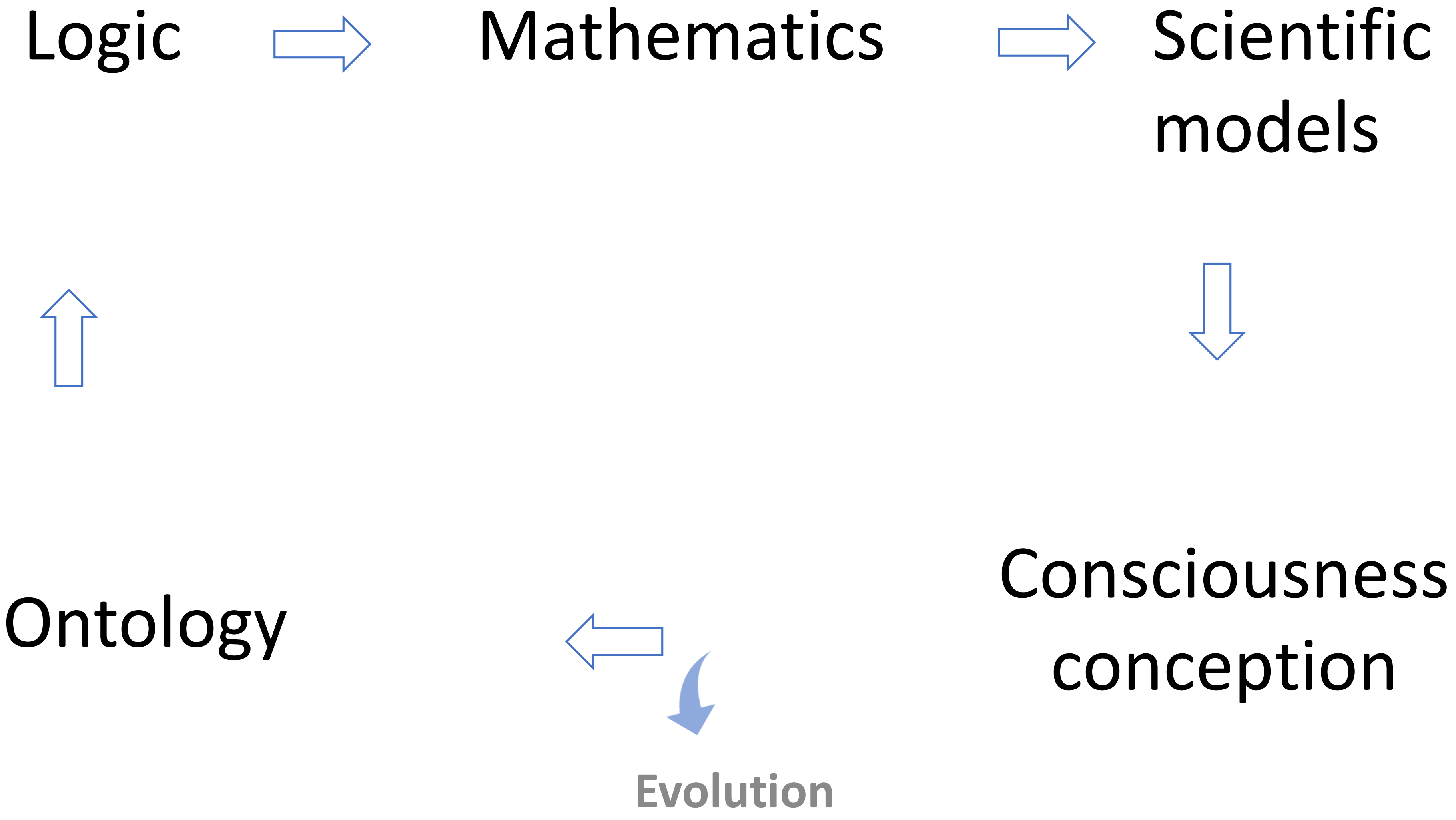
“The basic question, on which everything else depends, is no longer the classical question of the essence of being, from which all being emerges, but the question about the negativity that has never been overcome by any being. That's the philosophical question of the future ...”

Carl Friedrich von Weizsäcker

German physicist and philosopher (1912 - 2007) who made important theoretical discoveries regarding energy production in stars from nuclear fusion processes.

Later in his career, he worked on the conceptual definition of quantum physics with particular focus on the Copenhagen interpretation.

Philosophical Circle Walk



Classical period (~1000 BC → 1896)

Two values:
1. Being and
2. thinking the being

⇨ Real numbers / quantiative

⇨ Classical Newtonian Physics: Describing absolute, objective, irreflexive systems

⇩

Consciousness ⇔ nothing = negation of being

Consciousness is an epiphenomenon

⇦ Being/ thinking ideally repeats being, otherwise mistake/false

⇧

Distributed Subjectivity

C.F. v. Weizsäcker

(History of Nature)

"Man seeks to penetrate the factual truth of nature, but in its ultimate, incomprehensible background he unexpectedly sees himself as in a mirror."

Quantum Physics (1896→ today)

Two-valued logic insufficient ⇒ $\mathbb{C}_2$ Two different Negations -1 and i ⇒ Quantum Physics Physical description is knowlege about reality

⇓

Consciouss observer
Reality depends on knowledge about reality
Distributed subjectivity

⇐

Physical being and subjective experience mixed

⇑ Two-valued logic insufficient

Transclassical period (today →...)

4-valued logics ⇒

$\mathbb{C}_2 \cdot \mathbb{C}_2$
Qualitative mathematics ⇒

Quantum Physics
Analytical Psychology
QNB

⇓

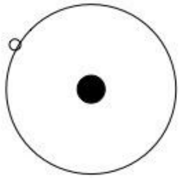
Implicite Selfconsciousness is transcendental;
Explicit Selfconsciousness is double reflexive.

⇐

Orthogonal complementarity of reflexive object/subject reflexion

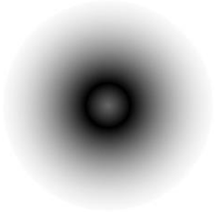
⇑

Classical- vs. Quantum-Physics



Classical Physics

- Observation object can be small
- One physical reality
- commutativity
- locality
- causality
- Non contradictions allowed



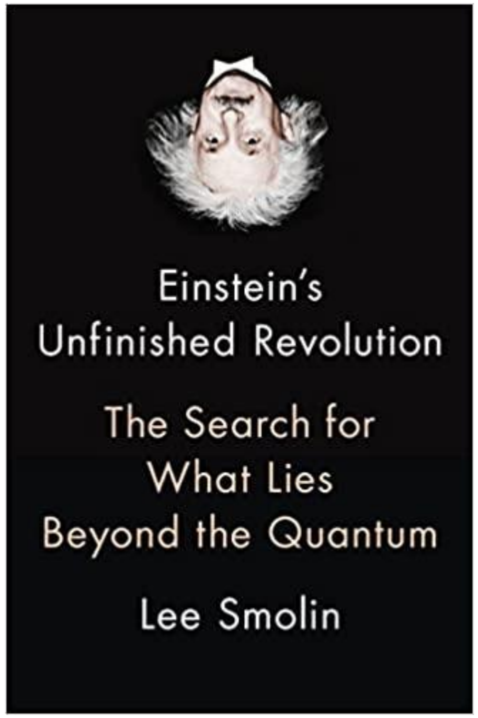
Quantum Physics

- Any observation affects the object
- Cut between the observer and the observed
- Unity of a quantum object
- Non-commutativity
- Non-locality
- A-causality
- Bohr: Complementarity

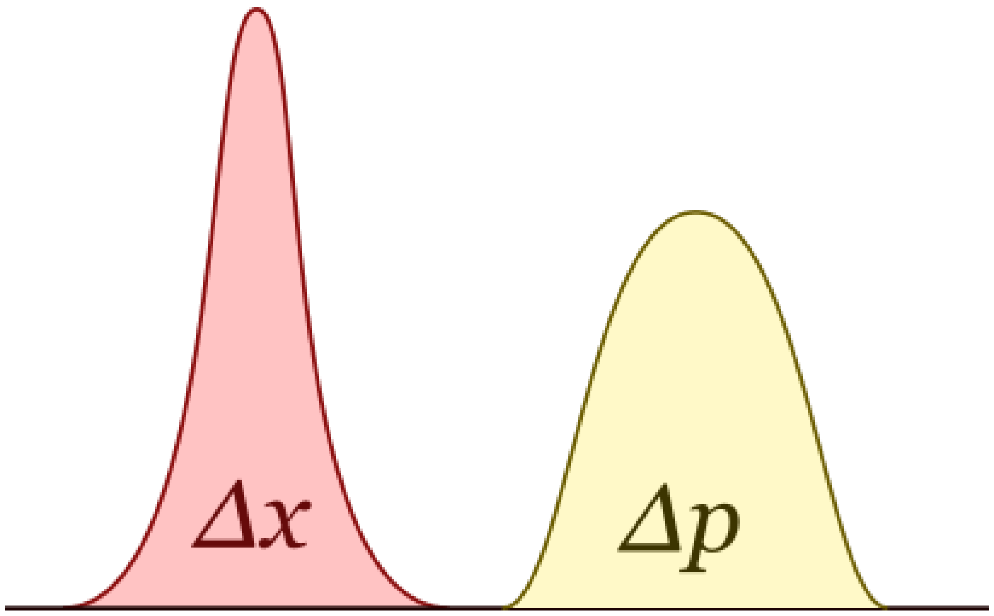
Seven Rules of Quantum Theory

Lee Smolin

Einstein's Unfinished Revolution: The Search for What Lies Beyond the Quantum



1 Heisenberg's uncertainty principle



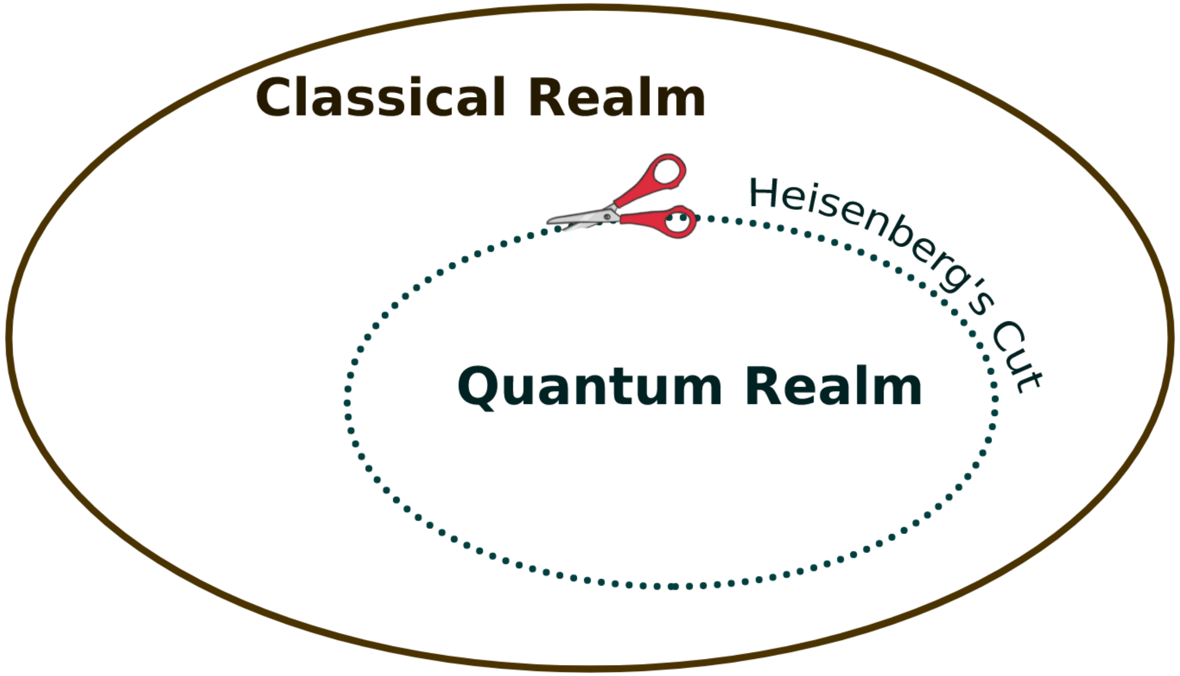
Position Probability Distribution

Momentum Probability Distribution

$$\Delta\chi\Delta\rho \geq \frac{\hbar}{2}$$

We can only know **half** of what we would need to know if we wanted to fully control or predict the future.

2 Heisenberg´s Cut



Any system to which quantum theory applies must be a subsystem of a larger system.

3 Rule 1: Schrödinger Equation

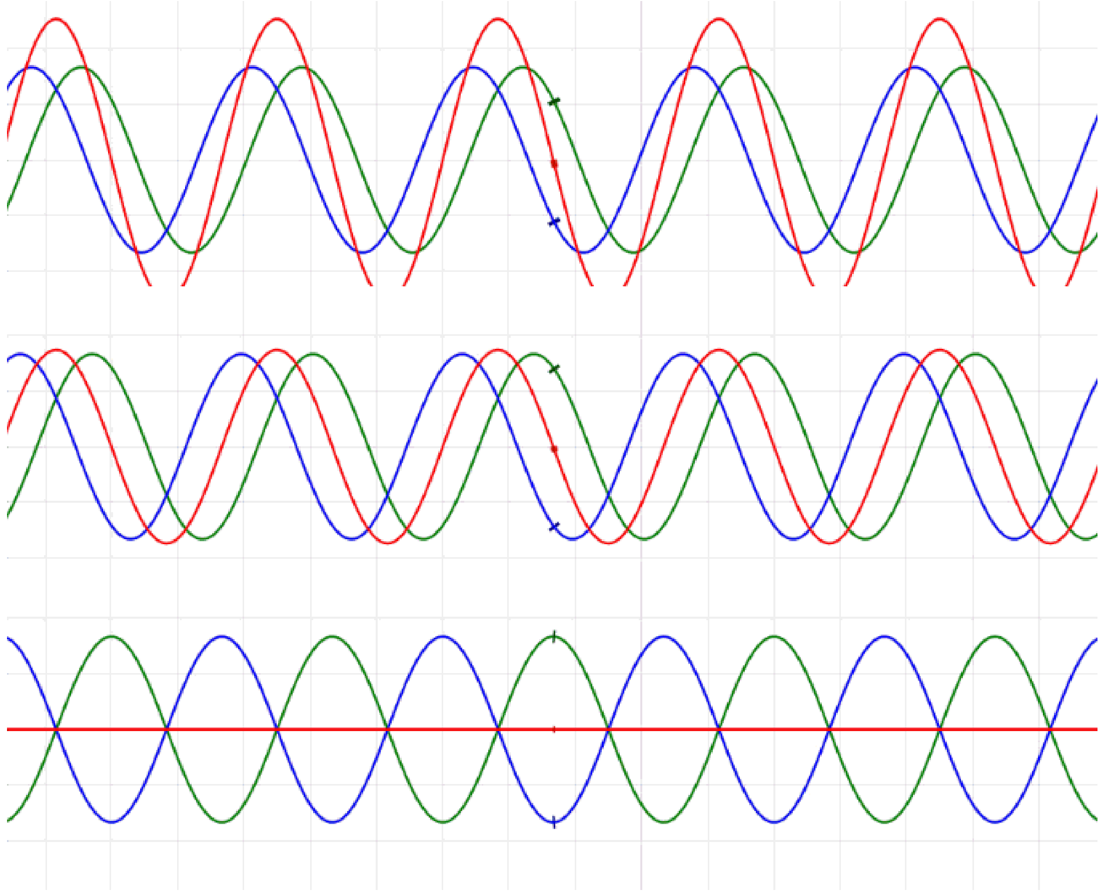
$$\hat{H}|\psi\rangle = E|\psi\rangle$$

Hamiltonian Operator
(Energy Operator)

Energy Eigenvalue

Given the quantum state of an isolated system at a particular time, there is a law that can predict the exact quantum state of that system at any other time.

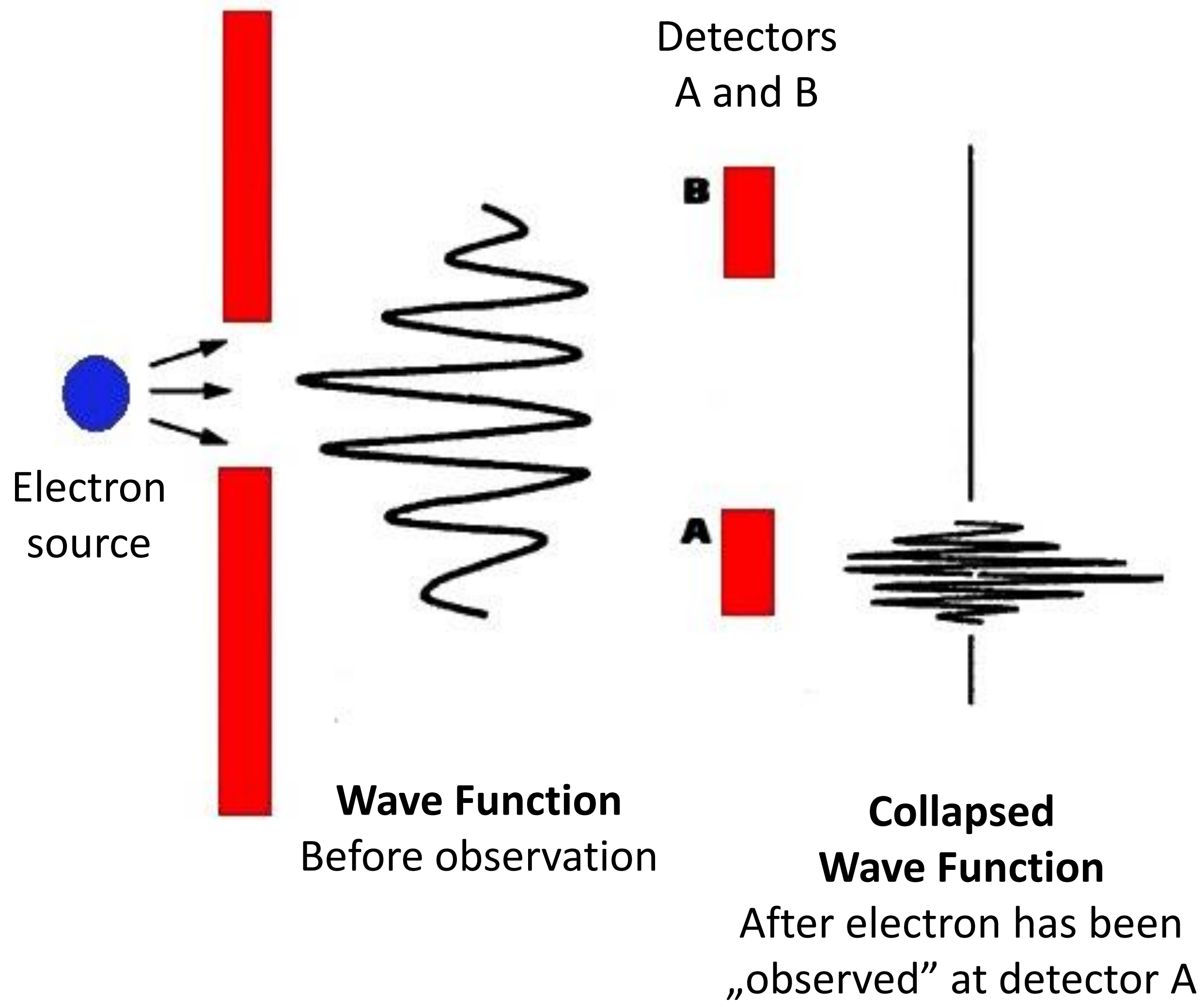
4 Superposition Principle



Wave superposition, where green and blue are the traversing waves and red is their net sum.

Any two quantum states can be superposed together to define a third quantum state. This is done by combining the waves corresponding to the two states. This corresponds to a physical process that forgets the properties that distinguish the two from each other.

5 Observation



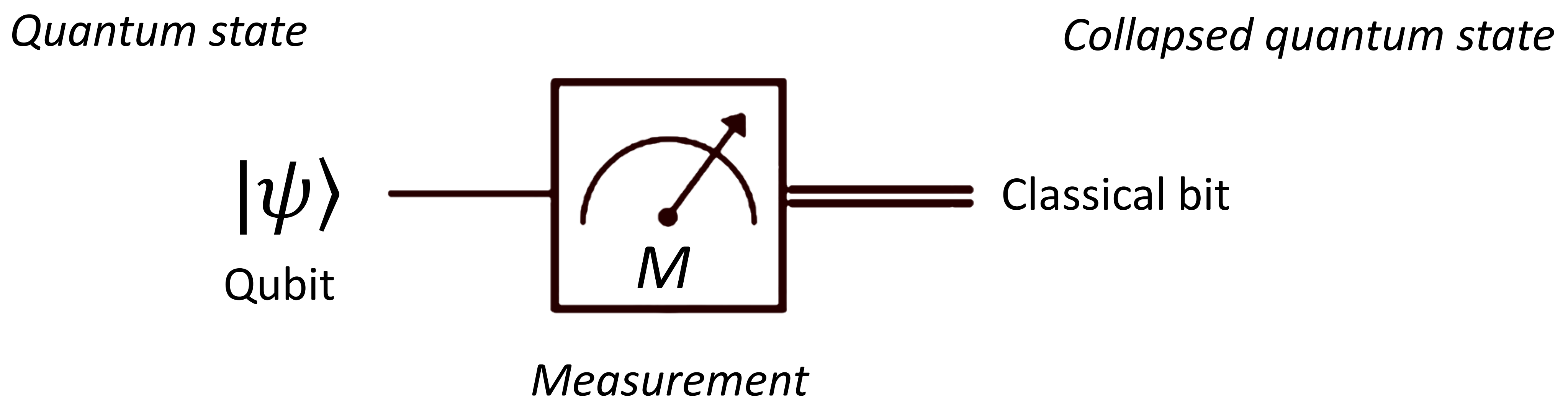
Measurements are special because they introduce probabilities into quantum theory.

6 Born´s Rule

$$p(a_1) = |\langle a_1|\psi_S(t)\rangle|^2$$

The probability of finding the particle at a certain location in space is proportional to the square of the height of the corresponding wave at this point in space.

7 Rule 2: Reduction of the Wave-function



The result of a measurement can only be predicted probabilistically. But afterwards, the measurement changes the quantum state of the measured system by putting it into the state that corresponds to the measurement result. This is called the collapse of the wave function.

Open Questions on Measurement

1. Does the wave function collapse instantaneously, or does it take a certain amount of time?
2. Does the collapse take place as soon as the system interacts with the detector? Or only later, when the recording is made? Or only when it is perceived by a conscious mind?
3. Is the collapse a physical change, which means that the quantum state is real? Or is it merely a change in our knowledge of the system, which means that the quantum state is only a representation of that knowledge?
4. How does a system know that a certain interaction with a detector has taken place, so that it should then and only then follow rule 2?
5. What happens if we combine the original system and the detector into a larger system? Does rule 1 then apply to the whole system?

John Archibald Wheeler

As useful as it is in the circumstances of everyday life to say that the world "outside" exists independently of us, this view can no longer be maintained.

Non-commutativity

Momentum & Position

$$\vec{x} \cdot \vec{p} - \vec{p} \cdot \vec{x} = \mathrm{i}\hbar$$

Heisenberg´s uncertainty principle

$$\Delta\chi\Delta\rho \geq \frac{\hbar}{2}$$

Quantum Unity & Entanglement

Entangled System A+B

$$|\psi\rangle_A \; |\phi\rangle_B = \left(\sum_i a_i |i\rangle_A\right) \left(\sum_j b_j |j\rangle_B\right) =$$

$$\sum_{i,j} c_{ij} |i\rangle_A \; |j\rangle_B$$

ER=EPR