

The lived World and the World of Science

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The question is

“...how to combine the perspective of a particular person inside the world with an objective view of that same world, the person and his viewpoint included.” (Thomas Nagel: The View from Nowhere)

The world of science: basic structure

- Galileo Galilei introduced the distinction between primary and secondary sense qualities
- Primary sense qualities: Mathematical properties ("The Book of Nature is written in the language of mathematics").
- Governed by deterministic mathematical laws

- From the scientific revolution philosophers have – by and large – taken the world of science for granted.
- Renè Descartes is the first, and best, example
- Objectivity: Describing the world independently of man
- "Objectivism" or "scientific fundamentalism"

However, there is a problem

- Descartes saw the problem
- My body is governed by deterministic mathematical laws (in Descartes' terminology, it is a *res extensa*), but my mind is free and rational.
- Therefore he introduced a second kind of thing: a *res cogitans*
- A human being is both a *res extensa* and a *res cogitans*

Descartes' problems

- How can *res cogitans* and *res extensa* interact?
- Is my body an object in the physical world?
- I feel that I *am* my body

One of the first to address this problem was Maurice Merleau-Ponty

- In *The Structure of Behavior* (1942) he challenged reductionist (or mechanistic) biology.
- "A total molecular analysis would dissolve the structure of the functions of the organism into the individual mass of banal physical and chemical reactions. Life is not therefore the sum of these reactions."

In *The Phenomenology of Perception* (1945) Merleau-Ponty addressed the problem of the body

Main points

- My body is not an object in the physical world
- I *am* my lived body

- I have access to the world through my body
- The subject of knowledge is a body subject (opposed to Descartes' *res cogitans* as subject of knowledge)
- I perceive the world not only with my senses, but by acting in the world

- Our primary access to the world is through practical activities
- (This is similar to Martin Heidegger in *Sein und Zeit*).
- Tools are primarily defined through their *use*. They are only secondarily physical objects.

Phenomenology of Perception
chapt. 4: The synthesis of one's own body

The blind man using a stick:

"[T]he stick is no longer an object perceived by the blind man, but an instrument *with* which he perceives. It is a bodily auxiliary, an extension of the bodily synthesis."

The two aspects of the stick may be said to define two different sticks:

- The stick as an instrument
- The stick as an object

Which is real?

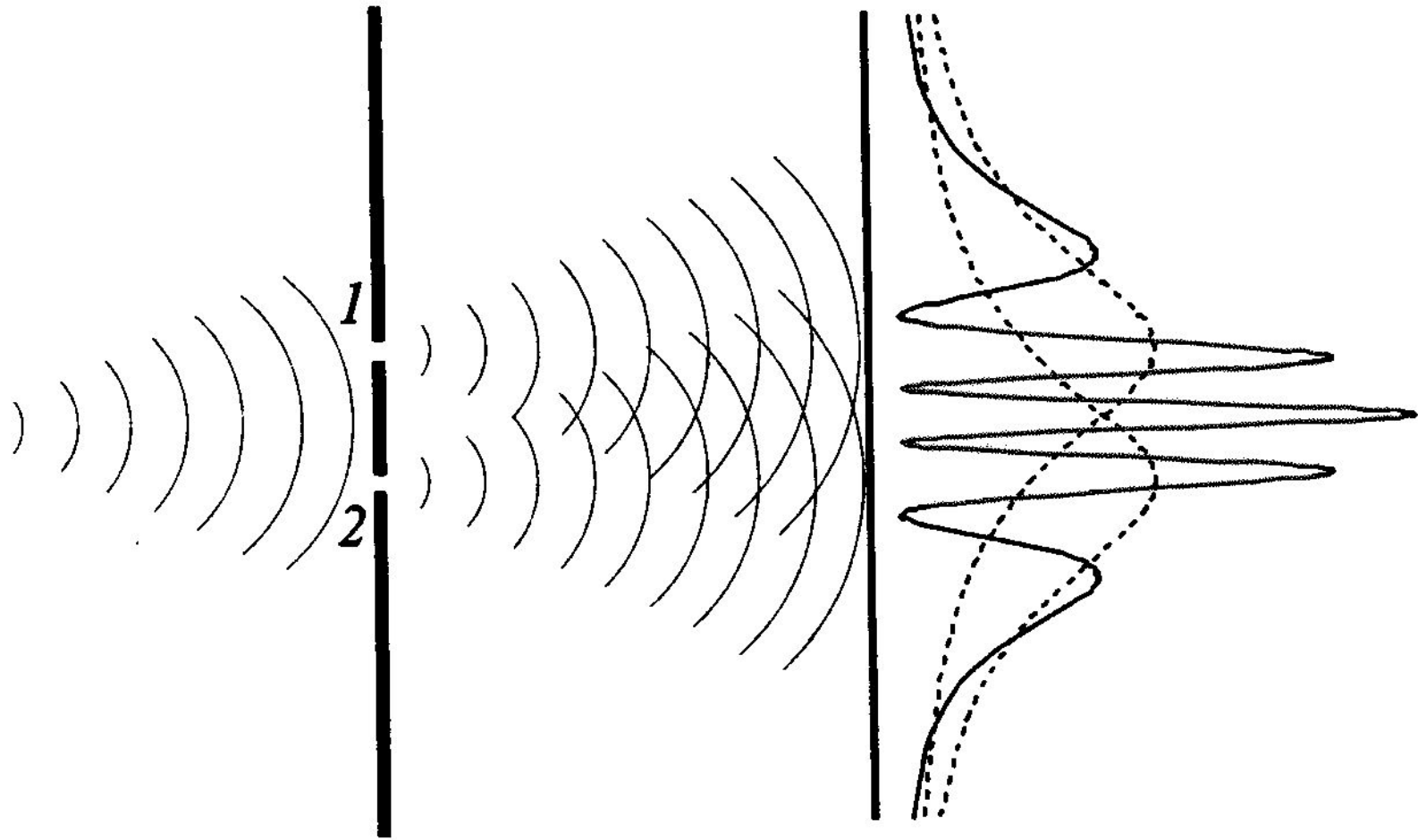
Niels Bohr: Virkningskvantet og naturbeskrivelsen ("The quantum of action and the description of nature", 1929)

- The example of the stick used by a man to find his way around a dark room.
- The two aspects of the stick are *complementary*. One aspect excludes the other.
- (However, the stick as an instrument is primary, and as a physical object secondary.)

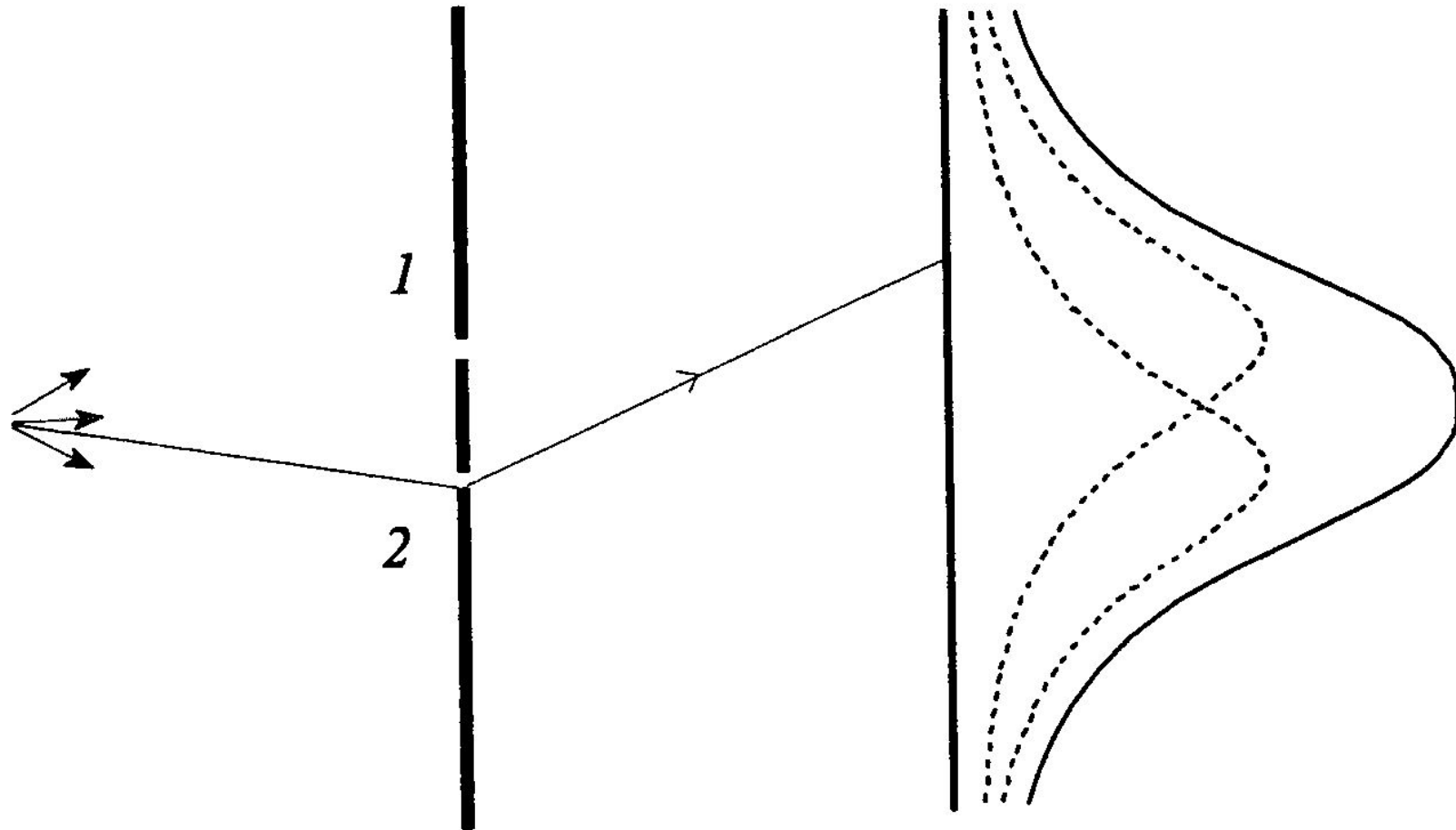
Alternative to reductionism: Bohr's idea of complementarity

- Originally developed to solve the particle/wave dualism in quantum mechanics
- Later developed to cover other areas, in particular as an alternative to reductionism

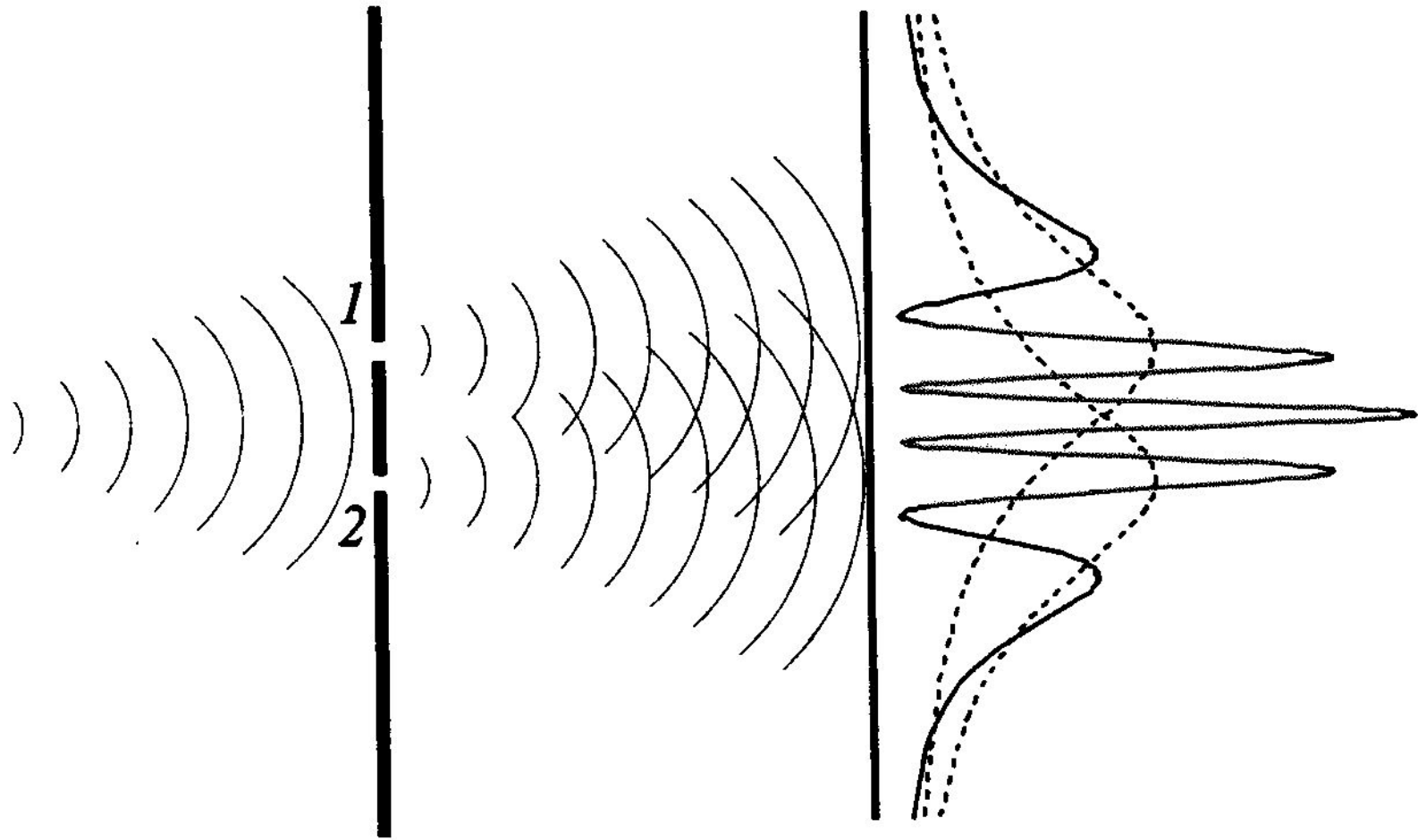
The double slit experiment: waves



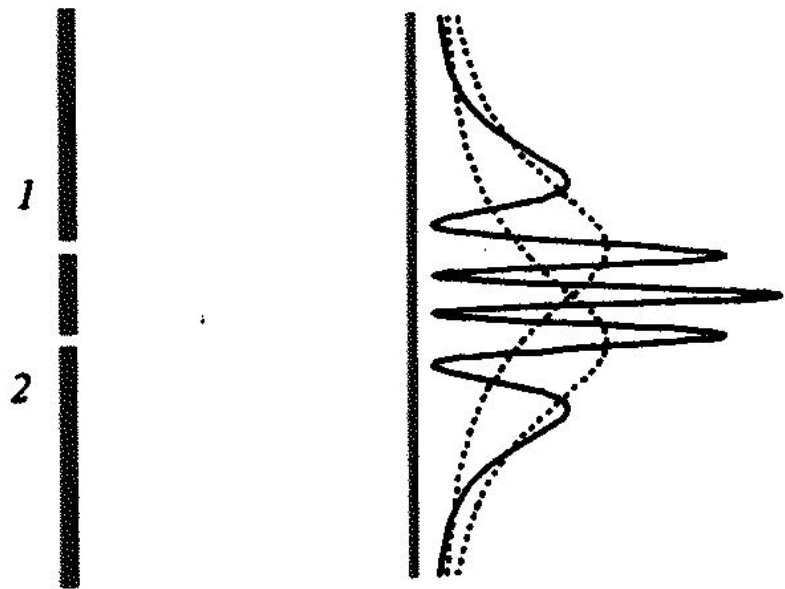
The double slit experiment: particles



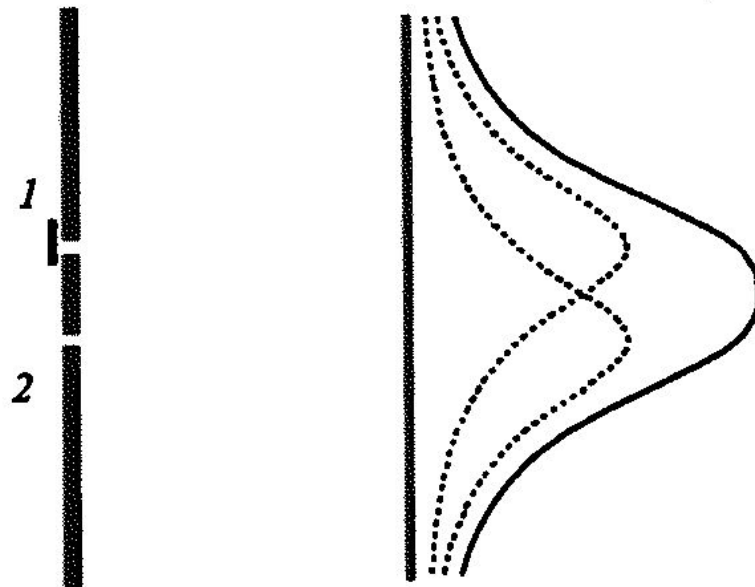
The double slit experiment with electrons: both particles and waves?



- “When one wants to clarify the meaning of the words “the position of an object”, for example an electron (relative to a given frame of reference”, one has to specify certain experiments with which one can measure the “position of the electron”: if this is not the case, the words have no meaning.” (Werner Heisenberg: “The Physical Content of Quantum Kinematics and Dynamics”, 1927)



a)



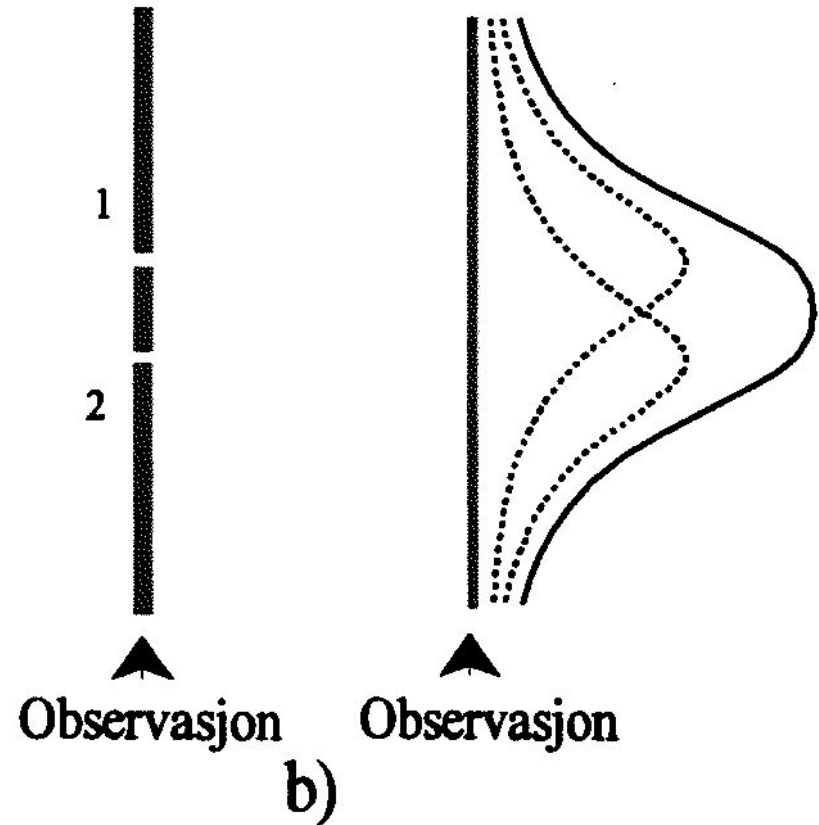
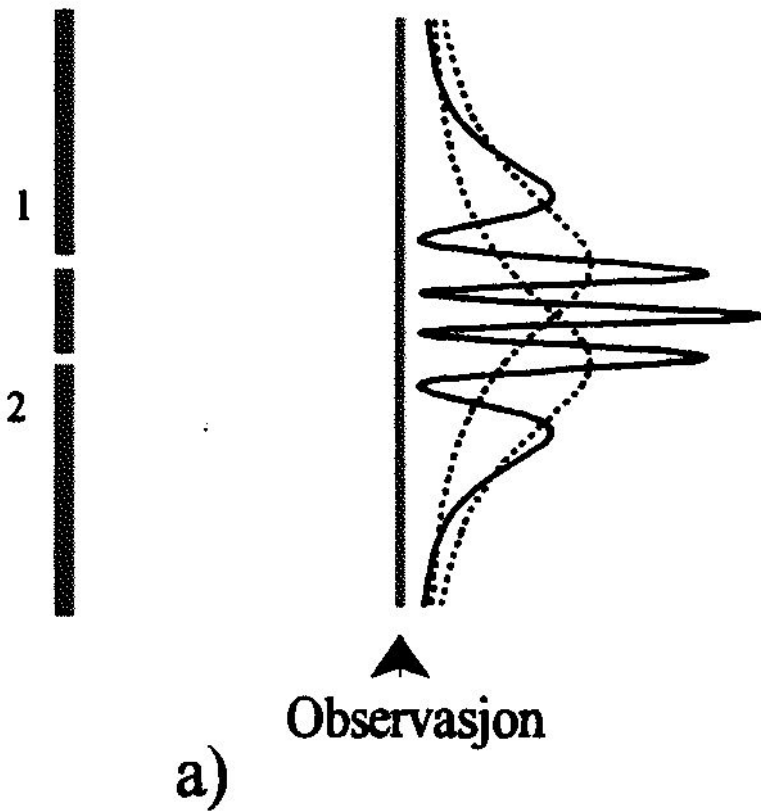
b)

The paradox

- When we don't know which slit the electron passes through, then it behaves like a wave
- When we know which slit the electron passes through, then it behaves like a particle

"Indeed, the finite interaction between object and measuring agencies...entails the necessity of a final renunciation of the classical ideal...and a radical revision of our attitude towards the problem of physical reality". (Bohr, Discussion with Einstein...)

Crucial point: The observer cannot be abstracted away



Question: Are electrons particles or waves?

Bohr's answer: This question cannot be asked in quantum mechanics. We should rather ask the question: Do electrons behave like particles or waves? In answering that question we should specify under what experimental conditions they behave as particles or waves.

Einstein: Is the moon there when nobody looks?

Einstein, Podolsky and Rosen on "physical reality"

"If, without in any way disturbing a system, we can predict with certainty (i.e. with probability equal to unity) the value of a physical quantity, then there exists an element of physical reality corresponding to this physical quantity (criterion of physical reality)."
(Einstein, Podolski, Rosen: Can quantum-mechanical description of physical reality be considered complete? (1935))

God in the Quad

There was a young man who said "God
Must find it exceedingly odd
To think that the tree
Should continue to be
When there's no one about in the quad."

Reply:

"Dear Sir: Your astonishment's odd;
I am always about in the quad.
And that's why the tree
Will continue to be
Since observed by, Yours faithfully, God."

Bohr on “physical reality”

- “But even at this stage there is essentially the question of *an influence on the very conditions which define the possible types of predictions regarding the future behavior of the system.* Since these conditions constitute an inherent element of the description of any phenomenon to which the term “physical reality” can be properly attached, we see that the argumentation of the mentioned authors does not justify their conclusion that quantum-mechanical description is essentially incomplete.”

Basic idea:

- The “observer” cannot be eliminated
- There is no “God's Eye View” (or no view from nowhere)
- Some perspectives are mutually exclusive
- The everyday world perspective is prior to a theoretical perspective

"In physics we learn [...] time and again that our task is not to penetrate into the essence of things, the meaning of which we don't know anyway, but rather to develop concepts which allow us to talk in a productive way about phenomena in nature."

Bohr in a letter to the Danish author H.P.E.
Hansen (1935)

Can be illustrated by Merleau-Ponty's example of the cube from *The Phenomenology of Perception*:

A cube can be seen from different perspectives.
What is the real cube?

Seen from nowhere?

No, it is the cube seen from all perspectives.

"However, the lesson with respect to the role which the tools of observation play in defining the elementary *physical* concepts gives a clue to logical application of notions like purposeness foreign to physics, but lending themselves so readily to the description of organic phenomena. Indeed, on this background it is evident that the attitudes termed mechanistic and finalistic do not present contradictory views on biological problems, but rather stress the mutually exclusive character of observational conditions equally indispensable in our search for an ever richer description of life."

Bohr: "Atomic Physics and Human Knowledge"
(1957)

In every experiment on living organisms, there must remain an uncertainty as regards the physical conditions to which they are subjected, and the idea suggests itself that the minimal freedom we must allow the organism in this respect is just large enough to permit it, so to say, to hide its ultimate secrets from us. Bohr: Light and Life (1933)

"It is suggestive that the simple concepts of physical science to an even higher degree lose their immediate applicability the more we approach the features of living organisms related to the characteristics of our mind."

Bohr: "Unity of Knowledge" (1954)