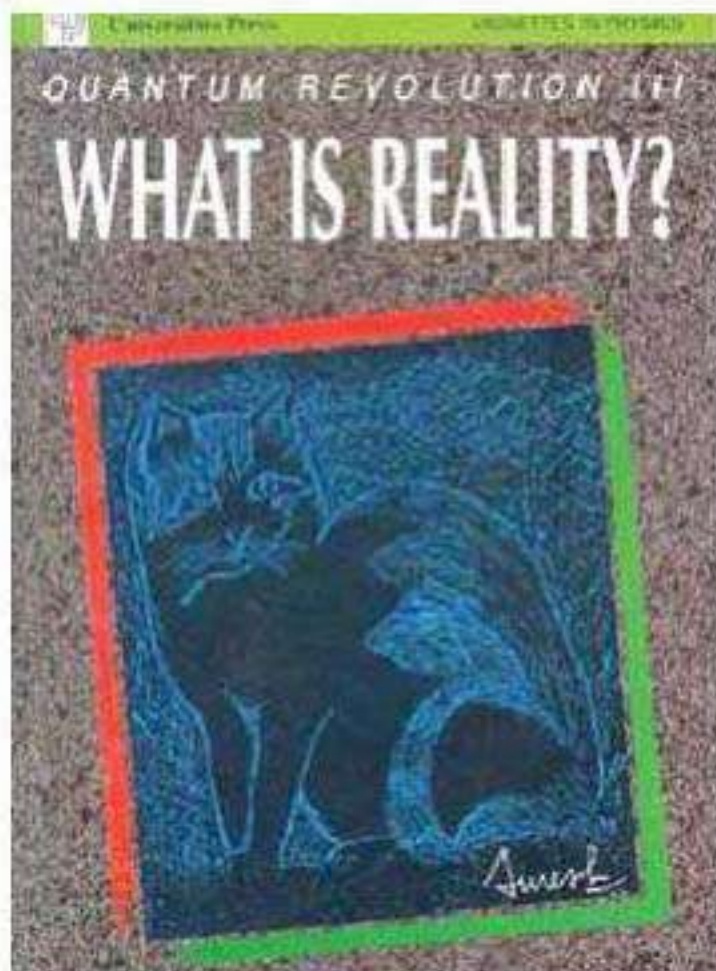


Does our observation shape reality?

Indian philosophy and quantum physics both challenge the notion of objective reality, suggesting that what we perceive may be dependent on observation, consciousness, or deeper underlying principles



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Indian philosophical schools, such as Vedanta and Sankhya, propose that the world is not real, but rather an illusion (Maya) or a dream created by the Self (Purusha or Atman). There was a concept of dual realities postulated by Adi Shankaracharya as Paramarthika Satya (spiritual truth) and Loukika Satya (worldly truth), and Loukika Satya is a myth. Modern physics, especially quantum mechanics, offers various interpretations of the universe's reality. Renowned physicist Padma Shri Dr. G. Venkataraman wrote about the quantum revolution in his book 'What is Reality?'

Sub-atomic particles such as electrons, protons, and neutrons etc., are seen as a collection of vibrations in quantum fields. There are two types of fields, namely, matter fields with matter particles and force fields with force particles. The Higgs field is unlike other fields, still filled by a ghost-like field, even if space were to be emptied wholly. The fundamental particles acquire mass only in contact with the Higgs field. The Nobel Prize in Physics was awarded for this discovery in 2013.

The quantum mystery started with the double slit experiment, in which

particles sent through two slits behave like waves, creating an interference pattern. But when an observation is made to find out which slots the particle passed through, the wave function collapses, and it behaves like a particle going from one of the slots only. Particles sometimes behave like waves and sometimes as particles, and observation destroys the wave function, and it behaves like a particle.

Quantum physicist Niels Bohr says that a quantum system intrinsically has only potentialities, and before an actual measurement, a particle has no definite momentum nor any definite position. It has only the possibility or potentiality of having a momentum or position. Heisenberg also concurs and remarks that atoms or elementary particles are not real; they form a world of potentialities or possibilities, rather than one of things or facts. Physicist David Bohm states that reality happens when we look, and what happens de-

pends upon how we look. The concept of probable realities is explained by Schrödinger in his thought experiment, known as Schrödinger's cat paradox.

Acclaimed physicist Richard Feynman gives an alternative interpretation of the path integral formulation of the double slit experiment, where each path of a particle is equally likely, and the sum over all possible trajectories will explain the collapse of the wave function on observation.

Eminent mathematician Roger Penrose elaborated in his magnum opus 'The Emperor's New Mind' that if we take the wave function as representing the 'reality' of the state of the particle, then we must accept that the particle 'is' indeed in two places at once! On this view, the particle has actually passed through both slits at once. Recall the standard objection to the view that the particle passes through both slits at once: if we perform a measurement at the slits in order to determine which slit it passed through, we always find that the entire particle is at one or the other of the slits. But this arises because we are performing a position measurement on the particle, so the wave function now merely provides a probability distribution for the particle's position in accordance with the square model procedure, and we indeed find it at just one place or another. But, there are also various types of measurements that one could perform at the slits, other than position measurements." Heisenberg's uncertainty principle states that it is not possible to measure both the position and momentum (speed)

of a particle accurately at the same time. It says that the more accurately the position of a particle is measured, the less accurately the momentum can be determined, and vice versa.

The Einstein-Podolsky-Rosen (EPR) thought experiment shows that if pairs of photons are emitted in opposite directions by a quantum source, then measuring one entangled particle instantaneously determines the state of its distant partner, however distant the other particle may be from the first. Some inferred bizarre interpretations, saying that the twin particles 'communicate' with each other even though they are infinitely separated. This type of communication is not possible because it violates the cosmological speed limit of nature, which states that nothing travels faster than light. Penrose concludes that "quantum mechanics is simply wrong when applied to macroscopic bodies...I believe that the resolution of the puzzle of quantum theory must lie in our finding an improved theory."

Niels Bohr and Bohm gave a strong anthropocentric interpretation of quantum mechanics and incorporated the concept of a conscious observer. It is a scientific fact that the universe started from the Big Bang at approximately 13.8 billion years ago, and conscious life forms evolved on a tiny part of the universe, hardly 50 million years ago. Hence, there must be universal validity of the objective reality of the universe, irrespective of observations of conscious beings. Albert Einstein quipped, "Do you really believe that the moon exists only when I look at it?"