seminars

Nanoscience and Nanotechnology: small is different
Nanociencia y Nanotecnología: lo pequeño es diferente

Tuesday 21st February 12:00h

c/Faraday, 9
Conference Hall
Imdea Nanociencia
Ciudad Universitaria de Cantoblanco

Does God play dice?

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Quantum mechanics does not deal with individual events and all its predictions are of a statistical nature. For example, if we have radioactive nuclei or molecules in excited states we can, in principle, predict the average rate of decay but not when exactly this given nucleus or molecule passes to its ground state. This situation leads to long-time and very hot debates on “completeness” of quantum mechanics, its applicability or inapplicability for macroscopic objects, existence or nonexistence of underlying classical reality (“hidden parameters”), role of measurement devices and observes, and so on, and so forth.
Discussions involved the greatest physicists of twentieth century and can be briefly summarized as an exchange of mottos:
Albert Einstein: God doesn’t play dice.

Niels Bohr: Einstein, don’t tell God what to do. Recently, we proposed [1-4] a purely phenomenological way to build the quantum theory as the most robust description of reproducible experiments and have shown that this may be done independently on any assumptions on underlying ontology, based purely on logical inference approach and a minimal amount of additional physical postulates, such as applicability of classical physics at the average. Basic experiments of quantum physics, such as Stern - Gerlach or Einstein - Podolsky - Rosen - Bohm experiments can be analyzed within this framework, without any presumptions on wave function and Born rule. In a sense, our approach is a formalization of a well-known quasi-philosophical motto, ``quantum theory describes our knowledge of atomic world rather than the atomic world itself'' which can be now analysed by conventional powerful tools of mathematical physics. Basic equations of quantum mechanics can be derived in this way.

In the context of the question in the title, one can say: We do not know what He is doing and, of course, we do not dare to tell Him what to do but our human way of thinking forces us to describe the reality as if He would play dice.

[1] H. De Raedt, M. I. Katsnelson, and K. Michielsen, Quantum theory as the most robust description of reproducible experiments. ANN PHYS (NY) 347, 45 (2014)
[2] H. De Raedt, M. I. Katsnelson, H. C. Donker, and K. Michielsen, Quantum theory as a description of robust experiments: Derivation of the Pauli equation. ANN PHYS (NY) 359, 166 (2015) [3] H. C. Donker, M. I. Katsnelson, H. De Raedt, and K. Michielsen, Logical inference approach to relativistic quantum mechanics: derivation of the Klein-Gordon equation. ANN PHYS (NY) 372, 74 (2016) [4] H. De Raedt, M.I. Katsnelson, and K. Michielsen, Quantum theory as plausible reasoning applied to data obtained by robust experiments. PHIL TRANS ROYAL SOC A 374, 20150233 (2016)

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