Non-contextuality, finite precision measurement and the Kochen-Specker theorem. (English summary)

81P05 (81P15)

The Kochen-Specker (KS) theorem [S. Kochen and E. P. Specker, J. Math. Mech. 17 (1967), 59–87; MR0219280 (36 #2363)] states that it is impossible to simulate the predictions of quantum mechanics using noncontextual hidden-variable (HV) models, meaning that, in any HV model simulating QM, the result revealed by a measurement of a proposition (represented in QM by a one-dimensional projector) must depend on which other compatible propositions make up the complete measurement (represented in QM by a set of orthogonal one-dimensional projectors). The present paper is the last of a series of papers on a controversy originally raised by D. A. Meyer [Phys. Rev. Lett. 83 (1999), no. 19, 3751–3754; MR1728095 (2000j:81029)]. Meyer’s thesis was that the physical interest of the KS theorem is “nullified” once the fact that measurements are necessarily of finite precision is taken into account. While it has been proven that any HV theory of the type proposed by Meyer leads to experimentally testable predictions that are in contradiction with those of QM [A. Cabello, Phys. Rev. A (3) 65 (2002), no. 5, part A, 052101, 4 pp.; MR1910233 (2003f:81018)], the controversy persists for another model proposed by R. K. Clifton and A. Kent (CK) [R. Soc. Lond. Proc. Ser. A Math. Phys. Eng. Sci. 456 (2000), no. 2001, 2101–2114; MR1794718 (2001g:81020)]. It has been argued that the possibility of such a model is completely unrelated to the notion of precision [A. Cabello, op. cit.]. One of the aims of this paper is to respond to some criticisms about Meyer’s and CK’s papers and elaborate in a little more detail how the CK model can reproduce the predictions of QM to arbitrary precision.

Reviewed by Adán Cabello

© Copyright American Mathematical Society 2005