Finite Precision Measurement Nullifies Euclid's Postulates

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Abstract

Following Meyer's argument [Phys. Rev. Lett. **83**, 3751 (1999)] the set of all directions in space is replaced by the dense subset of rational directions. The result conflicts with Euclidean geometry.

Meyer's claim [1] that "finite precision measurement nullifies the Kochen-Specker theorem" (that is, makes it irrelevant to physics) and some of its generalizations [2] have caused considerable controversy that lasts until today [3]. Meyer's proposal was to replace the set of all directions in space by the dense subset of rational directions, arguing that a finite precision measurement cannot decide whether or not a number is rational.

Let us apply the same argument to ordinary geometry and consider only points with rational coordinates. Then the line $x = y$ and the unit circle $x^2 + y^2 = 1$ are both dense but they do not intersect, in contradiction to Euclid's postulates [4].

This work was supported by the Gerard Swope Fund.

References

[1] D. Meyer, Phys. Rev. Lett. **83**, 3751 (1999).

[2] A. Kent, Phys. Rev. Lett. **83**, 3755 (1999); R. Clifton and A. Kent, Proc. Roy. Soc. London A **456**, 2101 (2000).

[3] Numerous references can be found in two recent and mutually contradictory contributions to the electronic archive: D. M. Appleby, quant-ph/0308114; J. Barrett and A. Kent, quant-ph/0309017.

[4] *The Thirteen Books of Euclid's Elements*, translated by T. L. Heath, reprinted by Dover, New York (1956). See for example definition 17 in the first book.