Comment on "Resolution of the Einstein-Podolsky-Rosen and Bell Paradoxes"

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In a recent letter,[1] Pitowsky has given a model of electron spin in which "Every electron at each given moment has a definite spin in all directions",[2] but which, he claims, does not imply Bell's inequality. The use of nonmeasureable sets in the model prevents the usual proofs of the inequality from going through. I give here a very simple proof of a Bell-type inequality from the quoted statement. The inequality shows that the statement is inconsistent with quantum mechanics.

Consider N pairs of electrons in the singlet state. One member of each pair moves to the left and the other to the right. Let $N(A^+ : C^+)$ be the number of pairs in which the left member has spin up in the A direction and the right member has spin up in the C direction. Let $N(A^+ C^- :)$ be the number in which the left member has spin up in the A direction and spin down in the C direction. According to the quoted statement, these are meaningful quantities. Then

$$\begin{aligned} N(A^+ : C^+) &= N(A^+ C^- :) = N(A^+ B^- C^- :) + N(A^+ B^+ C^- :) \\ &\leq N(A^+ B^- :) + N(B^+ C^- :) = N(A^+ : B^+) + N(B^+ : C^+). \end{aligned}$$

Quantum mechanics predicts that if $N(A^+ : C^+)$ is measured, then

$$N(A^+ : C^+)/N \approx \tfrac{1}{2}\sin^2\tfrac{\theta_{AC}}{2},$$

where θ_{AC} is the angle between A and C. According to the quoted statement $N(A^+ : C^+)$ exists independently of whether it is measured or not and so the approximation holds whether it is measured or not. The above inequality is inconsistent with the approximation for $\theta_{AB} = \theta_{BC} = 60°$ and $\theta_{AC} = 120°$.[3]

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[1] I. Pitowsky, Phys. Rev. Lett. **48**, 1299 (1982).

[2] Note added. The quoted statement is motivated by the strict anticorrelation between measurement results on the two electrons along the same direction, no matter how distant. How could this happen unless the measured values exist as the electrons separate?

[3] Note added. Bell's lesson is intact: Nature provides spacelike separated and random, yet correlated, events.