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

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" but which, he claims, does not imply Bell's inequality. A non-Kolmogorov probability theory in the model prevents the usual proofs of Bell's 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.

Let N pairs of electrons, each with total spin zero, emerge in opposite directions from an interaction. 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 of pairs 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

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

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 $\theta_{AC} = 120°$.

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

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