

Quantum Physics

Extended Boole-Bell inequalities applicable to quantum theory

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We address the basic meaning of apparent contradictions of quantum theory and probability frameworks as expressed by Bell's inequalities. We show that these contradictions have their origin in the incomplete considerations of the premisses of the derivation of the inequalities. A careful consideration of past work, including that of Boole and Vorob'ev, has lead us to the formulation of extended Boole-Bell inequalities that are binding for both classical and quantum models. The Einstein-Podolsky-Rosen-Bohm gedanken experiment and a macroscopic quantum coherence experiment proposed by Leggett and Garg are both shown to obey the extended Boole-Bell inequalities. These examples as well as additional discussions also provide reasons for apparent violations of these inequalities.

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