# Can quantum theory be underpinned by a non-local hidden variable theory?

Bryan Dalton

*Centre for Quantum Technology Theory, Swinburne University of Technology, John St, Melbourne 3122, Australia*

The description by a Bell-type non-local hidden variable theory of bipartite quantum states with two observables per sub-system is considered. Bell inequalities [1] of the Collins-Gisin -Liden-Massar-Popescu type [2] which involve combinations of the probabilities of related outcomes for measurements for the four pairs of sub-system observables are derived. It is shown that the corresponding quantum theory expressions violate the Bell inequalities in the case of the maximally entangled state of the bipartitite system. This shows that quantum theory can not be underpinned by a Bell-type non-local hidden variable theory. So as a Bell-type local hidden variable theory has already been shown to conflict with quantum theory, it follows that quantum theory can not be understood in terms of any Bell-type hidden variable theory.

[1] J Bell, Physics, 1, 195 (1964)

[2] D Collins, N Gisin, N Linden, S Massar and S Popescu, Phys. Rev. Letts. 88, 040404 (2002)