Divisible quantum dynamics and the temporal Tsirelson's bound

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Bell's inequalities give bounds to the correlations of space-like separated measurements of two classical systems. Entangled quantum systems can violate this bound, up to Tsirelson's bound. Beyond that, PR-boxes achieve the maximum algebraic bound. Here, we study the analogous temporal Bell's inequalities of the time-like separated measurement of two systems. We find strong evidence that entanglement-breaking channels define the classical bound of the qubit temporal Bell's inequality, and that divisibility implies the temporal Tsirelson's bound [1]. Furthermore, PR-box-like behaviour occurs if indivisible processes are allowed. This suggests that divisibility of processes in time is similar to principles such as information causality and macroscopic locality that restrict correlations in space.

References

[1] T. Le, F. A. Pollock, T. Paterek, M. Paternostro, and K. Modi, J. Phys. A: Math. Theor. **50**, 055302 (2017)