

Contribution Title: SIGNATURES OF NONCLASSICALITY IN MIXED-STATE QUANTUM COMPUTATION

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We investigate signatures of non-classicality in quantum states, in particular, those involved in the DQC1 model of mixed-state quantum computation [Phys. Rev. Lett. 81, 5672 (1998)]. To do so, we consider two known non-classicality criteria. The first quantifies disturbance of a quantum state under locally noneffective unitary operations (LNU), which are local unitaries acting invariantly on a subsystem. The second quantifies measurement induced disturbance (MID) in the eigenbasis of the reduced density matrices. We study the role of both figures of non-classicality in the exponential speedup of the DQC1 model and compare them vis-a-vis the interpretation provided in terms of quantum discord. In particular, we prove that a non-zero quantum discord implies a non-zero shift under LNUs. We also use the MID measure to study the locking of classical correlations [Phys. Rev. Lett. 92, 067902 (2004)] using two mutually unbiased bases (MUB). We find the MID measure to exactly correspond to the number of locked bits of correlation. For three or more MUBs, it predicts the possibility of superior locking effects.