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Any Ontological Model of the Single Qubit Stabilizer Formalism must be Contextual[1] PIERS LILLYSTONE, JOEL J. WALLMAN, Institute for Quantum Computing, University of Waterloo — Quantum computers allow us to easily solve some problems classical computers find hard. Non-classical improvements in computational power should be due to some non-classical property of quantum theory. Contextuality, a more general notion of non-locality, is a necessary, but not sufficient, resource for quantum speed-up. Proofs of contextuality can be constructed for the classically simulable stabilizer formalism. Previous proofs of stabilizer contextuality are known for 2 or more qubits, for example the Mermin-Peres magic square. In the work presented we extend these results and prove that any ontological model of the single qubit stabilizer theory must be contextual, as defined by R. Spekkens, and give a relation between our result and the Mermin-Peres square. By demonstrating that contextuality is present in the qubit stabilizer formalism we provide further insight into the contextuality present in quantum theory. Understanding the contextuality of classical sub-theories will allow us to better identify the physical properties of quantum theory required for computational speed up.

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