

Causal order and simulation in the measurement-based model

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We discuss the emergence of causal order in the measurement-based model, and various links to simulation. On the one hand for standard measurement-based quantum computation (MBQC) the depth of causal order can be directly linked to how difficult the computation is to simulate classically. On the other hand subclasses of MBQC which do not require causal order, such as IQP, can be shown to be difficult to simulate classically (and are related to boson sampling). A version of IQP with quantum outputs effectively samples from unitaries in a way not efficiently possible in standard ‘classical’ sampling approaches. We speculate on the implications for simulation of thermalisation for example.

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