

Sequential transformation contextuality

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Talk proposal for JIQ 2017

Abstract We introduce a notion of contextuality for transformations performed in sequential contexts. It is distinct from both Bell-Kochen-Specker contextuality, which relates to measurements, and Spekkens' notions of preparation and transformation contextuality. We consider a transformation-based model for quantum computation known to have important applications for secure delegated quantum computing and show that strong, or maximal, sequential transformation contextuality is necessary for deterministic computation non-linear functions in this model. More generally, sequential transformation contextuality is shown to be necessary to obtain an advantage over classical implementations for the task of probabilistically computing non-linear functions in this model, and the degree of contextuality is quantifiably related to the degree of advantage obtained.