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Noncontextuality Inequalities

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The Bell-Kochen-Specker theorem demonstrates that the predictions of quantum theory are inconsistent with a noncontextual hidden variable model. Significantly, the notion of noncontextuality to which it appeals is only well-defined for models of quantum theory as opposed to models of an arbitrary physical theory and then only for projective measurements and deterministic models thereof. By contrast, the notion of local causality introduced by Bell is not so restricted in its scope. In this talk, I present an operational definition of noncontextuality that recovers the traditional notion as a special case and allows one to define "noncontextuality inequalities" for experimental statistics. I will demonstrate that a particular two-party information-processing task, "parity-oblivious multiplexing," is powered by contextuality in the sense that there is an inequality that bounds its performance in noncontextual models, and I will report on an experimental violation of this inequality in good agreement with the quantum predictions. Joint work with Daniel Buzacott, Tony Keehn, Ben Toner and Geoff Pryde.