



Contribution ID: 427

Type: **Talk**

[552] Bell nonlocality with a single shot

Friday, 3 September 2021 11:30 (15 minutes)

In order to reject the local hidden variables hypothesis, the usefulness of a Bell inequality can be quantified by how small a p-value it will give for a physical experiment. Here we show that to obtain a small expected p-value it is sufficient to have a large gap between the local and Tsirelson bounds of the Bell inequality, when it is formulated as a nonlocal game. We develop an algorithm for transforming an arbitrary Bell inequality into an equivalent nonlocal game with the largest possible gap. We also present explicit examples of Bell inequalities with gap arbitrarily close to one, and show that this makes it possible to reject local hidden variables in a single shot, without needing to collect statistics.

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Session Classification: Quantum Information and Quantum Computing

Track Classification: Quantum Information and Quantum Computing