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[502] On the inequivalence of the CH and CHSH inequalities due to finite statistics

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Different variants of Bell inequalities, such as CHSH and CH, are known to be equivalent when evaluated on nonsignaling outcome probability distributions. However, in experiments, these probability distributions are estimated using a finite number of samples. Therefore the nonsignaling conditions are only approximately satisfied: the robustness of the violation depends on the chosen inequality variant. We explain that phenomenon and propose a method to optimize the statistical robustness of Bell inequalities. In the process, we describe the finite group composed of relabeling of parties, measurement settings and outcomes, and identify correspondences between the irreducible representations of this group and properties of probability distributions such as normalization, signaling or having uniform marginals.

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