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Geometric Decompositions of Bell Polytopes with Practical Applications PETER BIERHORST, National Institute of Standard and Technology, Boulder, CO — In the well-studied (2,2,2) Bell experiment consisting of two parties, two measurement settings per party, and two possible outcomes per setting, it is known that if the experiment obeys no-signaling constraints, then the set of admissible experimental probability distributions is fully characterized as the convex hull of 24 distributions: 8 Popescu-Rohrlich (PR) boxes and 16 local deterministic distributions. Here, we refine this result to show that in the (2,2,2) case, any nonlocal nonsignaling distribution can always be uniquely expressed as a convex combination of exactly one PR box and (up to) eight local deterministic distributions. In this representation each PR box will always occur only with a fixed set of eight local deterministic distributions with which it is affiliated. This decomposition has multiple applications: we demonstrate an analytical proof that the minimum detection efficiency for which nonlocality can be observed is 2/3 even for theories constrained only by the no-signaling principle, and we develop new algorithms that speed the calculation of important statistical functions of Bell test data. Finally, we enumerate the vertices of the no-signaling polytope for the (2, n, 2) "chained Bell" scenario and find that similar decomposition results are possible in this general case. Here, our results allow us to prove the optimality of a bound, derived in (Barrett et al., PRL, 2006) on the proportion of local theories in a local/nonlocal mixture that can be inferred from the experimental violation of a chained Bell inequality.

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