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Testing Clauser-Horne-Shimony-Holt inequalities using observables with arbitrary spectrum ANDREAS KETTERER, Laboratoire Matériaux et Phénomènes Quantiques, Sorbonne Paris Cité, Université Paris Diderot, CNRS UMR 7162, 75013 Paris, France, ARNE KELLER, Université Paris-Sud 11, Institut de Sciences Moléculaires d'Orsay (CNRS), Bâtiment 350–Campus d'Orsay, 91405 Orsay Cedex, France, THOMAS COUDREAU, PÉROLA MILMAN, Laboratoire Matériaux et Phénomènes Quantiques, Sorbonne Paris Cité, Université Paris Diderot, CNRS UMR 7162, 75013 Paris, France — The Clauser-Horne-Shimony and Holt inequality applies when measurements with binary outcomes are performed on physical systems under the assumption of local realism. Testing such inequalities in the quantum realm involves either measurements of two–valued quantum observables or pre-defining a context dependent binning procedure. Here we establish the conditions to test the Clauser-Horne-Shimony and Holt inequality using any quantum observable. Our result applies to observables with an arbitrary spectrum and no prior knowledge of their Hilbert space's dimension is required. Finally, we demonstrate the proposed general measurement strategy, that can be seen as positive operator valued measurements performed on the system, using the formalism of modular variables applied to the transverse degrees of freedom of photon pairs.

Andreas Ketterer
Laboratoire Matériaux et Phénomènes Quantiques, Sorbonne Paris Cité,
Université Paris Diderot, CNRS UMR 7162, 75013 Paris, France

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