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Modeling violation of the Leggett-Garg inequality

The Leggett-Garg inequality is a widely used test of the "quantumness" of a system, and involves correlations between measurements realized at different times. According to its widespread interpretation, a violation of the Legget-Garg inequality disproofs macroscopic realism and non-invasiveness. Nevertheless, recent results point out that macroscopic realism is a model dependent notion and that one should always be able to attribute to invasiveness a violation of a Legget-Garg inequality. This opens some natural questions: how to provide such an attribution in a systematic way? How can apparent macroscopic realism violation be recast into a dimensional independent invasiveness model? The present work answers these questions by introducing an operational model where the effects of invasiveness are controllable through a parameter associated to what is called the measurability of the physical system. Such a parameter leads to different generalized measurements that can be associated to the dimensionality of a system, to measurement errors or to back action.

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