Abstract

Many features of quantum theory such as Bell nonlocality and steering have been shown to have no classical counterpart. While both nonlocality and steering are defined in exper imental setups that assume space-like separation, the no-signalling constraints imposed by relativity are not enough to single out either classical or quantum correlations. In this work, we use the generalized probabilistic theory (GPT) framework, which contains classical and quantum theories as particular cases, as well as more general ones, to investigate the relationship between the no-signalling constraints and the aforementioned phenomena. We define a GPT and use it to show that there exists GPTs that can model so-called post-quantum assem blages as common-cause processes. We further use that GPT to investigate the information processing consequences of post-quantum steering. Next, we prove that non-signalling chan nels in locally tomographic theories (a class that includes classical and quantum theories) are affine combinations of product channels. Finally, we use this parametrization of the non-signalling channels to show that given any causal locally tomographic GPT, there exists a second GPT that can realize all non-signalling channels of the first theory as common-cause processes.