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Titel: Superluminal local operations in quantum field theory: A ping-pong ball test

Abstract:

It is known that in quantum field theory, localized operations, e.g. given by unitary operators in local observable algebras, may lead to non-causal, or superluminal, state changes within their localization region. In this article, it is shown that both in quantum field theory as well as in classical relativistic field theory, there are localized operations which correspond to “instantaneous” spatial rotations (leaving the localization region invariant) leading to superluminal effects within the localization region. This shows that “impossible measurement scenarios” which have been investigated in the literature, and which rely on the presence of localized operations that feature superluminal effects within their localization region, do not only occur in quantum field theory, but also in classical field theory. (Joint work with Albert Much, arXiv:2308.16673)