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## Cosmological implications of quantum entanglement in the multiverse

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We explore the cosmological implications of quantum entanglement between two causally disconnected universes in the multiverse. We first consider two causally separated de Sitter spaces with a state which is initially entangled. We derive the reduced density matrix of our universe and compute the spectrum of vacuum fluctuations. We then consider the same system with an initially non-entangled state. We find that scale dependent modulations may enter the spectrum for the case of initially non-entangled state due to quantum interference. This gives rise to the possibility that the existence of causally disconnected universes may be experimentally tested by analyzing correlators in detail.

### Summary

Inflationary cosmology and the string landscape suggest that our universe may not be the only universe but part of a vast complex of universes that we call the multiverse. Until recently, however, this multiverse idea has been criticized as a philosophical proposal that cannot be tested. However, there may be quantum entanglement between two causally separated universes in the multiverse, and it may produce detectable signatures. I'm going to discuss that quantum entanglement would be able to provide some evidence for the existence of the multiverse.

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