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Could Einstein have been right after all?

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One of the most surprising aspects of quantum theory is that it tells us that we live in a nonlocal universe in which random correlations seem to appear instantaneously between arbitrarily distant locations. This idea was completely abhorrent to Einstein, who dismissed it as "spooky action at a distance", yet the 2022 Nobel Prize in Physics was awarded for experimental demonstrations half a century ago of this phenomenon. It is even said that so-called loophole-free experiments confirmed nonlocality beyond any reasonable doubt. But have they really? I shall argue that no experiment whose purpose is to confirm the predictions of quantum theory can possibly be used as an argument in favour of nonlocality because any theory of physics that does not allow instantaneous signalling to occur and has reversible dynamics (such as unitary quantum theory) can be explained in a purely local and realistic universe. What if Einstein was right after all?… Once again!

This talk is based on the original doctoral work of Paul Raymond-Robichaud while under my supervision, which was published in the journal Entropy and is available open access at https://www.mdpi.com/1099-4300/21/1/87. More advanced material can be found at https://doi.org/10.1098/rspa.2000.0585, https://doi.org/10.1098/rspa.2020.0897 and https://doi.org/10.48550/arXiv.1710.01380.

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