

A paradox in quantum measurement theory?

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Abstract

This paper outlines a 'paradox' in quantum measurement theory, illustrated with two different types of systems. If this paradox cannot be resolved in ordinary quantum mechanics (as I currently think), it is alarming. If it can be resolved, it can be added to a long list of examples that show the internal consistency of quantum mechanics, and in this case I hope the correct analysis will be an interesting example for students. The immediate paradox involves a failure of Lorentz invariance for measurements on certain types of single particle systems. It seems to show that an absolute frame of reference is required to describe wave function collapse. But if the argument is correct, quantum measurement theory is not merely dependant on the frame of collapse - it is inconsistent, and experimental tests would have to be done to verify whether the apparent non-local effects predicted are real.

Keywords: quantum mechanics, quantum measurement, non-local effects

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