A Model for Entanglement

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Abstract

Perhaps the most puzzling aspect of entanglement[1] is that a measurement of a local member of a pair of entangled particles causes an instantaneous reaction in the distant particle. This model makes use of stochastic time[2] which posits that time isn't a smooth blanket over space-time. This says that a distant observer observes each particle of the pair at a different proper time. The initially close together pair in their proper frame of reference only to a distant observer only appears to spread. In this model there is no action at a distance.

Introduction

positing granular stochastic space-time[3], one naively might assume that while the space component of space-time is indeed stochastic, the time component covers the manifold like a continuous blanket. Allowing however that the time component is also stochastic allows a model for entanglement.

The Model

Consider observing at a distance two entangled particles moving away from each other. If the observer moves to the reference frame of one of the particles at a particular time, the other particle will be at its own time. If we backtrack that particle to be at the same time as the first particle, we argue that the two particles will be at the same point in space-time. There will then, be no action at a distance. And that is good as entanglement-action-at-a-distance defies logic.

This model at the Planck scale of time and space implies that there is a continuous fluctuation that violates special relativity. But averaged over space and time relativity is preserved in the model.

References

[1] C. Kam, Z. Wu, 'What is Entanglement', arXiv:2403.13669

[2] C. Frederick, 'Stochastic Space-time and Quantum Theory', Phys-Rev D 13, 1976

[3] C. Frederick, 'Granular Space-time', arXiv:1601.0717v14