Review of: "The Standard Model Symmetry and Qubit Entanglement"

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Potential competing interests: No potential competing interests to declare.

The aim of this work is to include symmetries of the Standard Model of particle physics and beyond into "quantum first" proposals for quantum gravity, specially those based on the conjectures relating gravity to entanglement. For this purpose the author study homomorphism of the space of parameters describing 1, 2 and 3 qubits with 3+1 and higher Euclidean or Lorentzian spacetimes. This approach is inspired by classical Kaluza-Klein models for unifying gravity with electromagnetism and its more modern incarnations as string and matrix (M-) theories, and by works in quantum information that relate the dimension of space(time) to directionality of quantum communication.

In the positive side, this manuscript includes a concise review of above mentioned ideas. However, in what concerns the main subject of the manuscript, that is providing a consistent physical picture of what we perceive as spacetime, its dimension, and its content - the elementary particles - this work simply presents mathematical similarities and analogies - homomorphisms. For instance, homomorphism of Bloch sphere presenting a qubit and unitarity constraint with 3D Euclidean space; homomorphism between parameters characterizing state of 2 and 3 qubits with (5+1)D and (9+1)D spaces, respectively. But the manuscript does not discuss very different physical interpretation of parameters/variables characterizing state of qubits, namely their interpretation as probability, and classical concept of geometry of the spacetime. Moreover, I don't see why the comparison is stopped at 3 qubits, unless it is because the corresponding spacetime has the same dimension as the prediction of superstring theories ! In addition, despite the discussion about quantum first models and holography principle - area law - in the introduction section, the work presented here does not related its results and conclusions to these models and conjectures. In particular, it is not clear how the geometric properties of one or a few qubits matter for infinite number of qubits and their entanglement graphs depicted in figures in the manuscript.

In conclusion, this work describe mathematical relations between state space of small quantum systems and geometry. But, it does not clarify or demonstrate anything concrete about Standard Model of particle physics or quantum gravity.