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The CHSH Inequality of Quaternion Series Quantum Mechanics
DOUGLAS SWEETSER, CTO quaternions.com — It is accepted that experiments have proven Bell's inequality for complex-valued quantum mechanics showing the non-local nature of quantum mechanics. A quaternion has complex numbers as a subgroup. Any and all results in math or physics done with complex numbers can also be redone using quaternions of the form (a, b, 0, 0). A quaternion series is n (possibly infinite) quaternions which is a semi-group with inverses. An inner product can be defined for a quaternion series which has the properties required of a Hilbert space. A Jupyter notebook has been written that does the CHSH proof using quaternions of the form (a, b, 0, 0) along standard lines. The demand that the final two terms be zero is then relaxed. This requires a change in a normalization factor. The quaternion 3-vector must point in precisely the same direction in space for this to work. The fixed 3-vector is consistent with the level of precision experimentalist use to point their data collectors. This is the same as saying physicists have chosen to point in the spatial direction (1, 0, 0) since the birth of quantum mechanics. Instead of a complex number being a necessary abstraction, quaternion could be physical events in space-time. This shift in math will not be seen at the lab bench.

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