

Abstract Submitted  
for the APR20 Meeting of  
The American Physical Society

Sorting Category: G05. (T)

**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.

☒ Prefer Oral Session  
☐ Prefer Poster Session

Douglas Sweetser  
sweetser@alum.mit.edu  
CTO quaternions.com

Date submitted: 10 Jan 2020

Electronic form version 1.4