Are Tensors Powerful Enough to Model 4D Dynamics? [1]

Terry Bollinger
2024-01-28.08:57 EST Sun

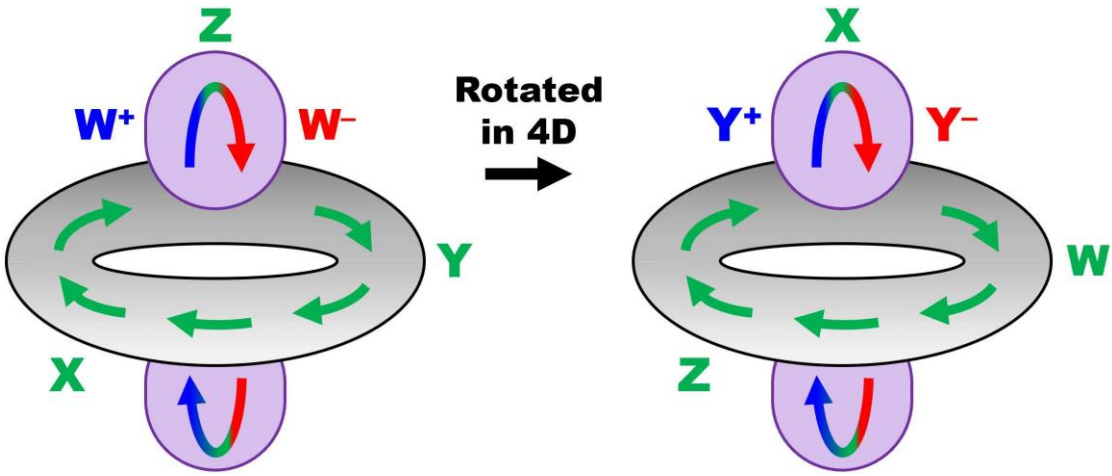

Figure 1. *Two 3D slices of mutually orbiting flows in Euclidean WXYZ 4-space.*

Vectors and tensors are delightfully powerful and lovely mathematical concepts for describing many phenomena in the physical world, but how well do they address 4D dynamics? For example, declaring that "half-spin is fundamental" and thus need not be explained in the math (Pauli) seems a bit of a fudge. Why not assume it's an example of 4D dynamics and then try harder to figure out how that works?

An example: In 4D, you can have two ring-like flows that orbit each other in a fully symmetric fashion (Fig. 1). What is the proper way to use tensors to set up the differential equations for such double flows? Can one model interactions between the two flows?

There may be answers to such questions in the deeper literature. However, considering how inflexible and geometrically opaque the Betti number descriptions of the static versions of even the simplest such configurations are, such as the mutual-loop-orbit example, it's hard to imagine that good dynamic models exist. But for modeling real-world physics with 4D aspects (half-spin again), why should anyone assume 4D is simpler and more static than 3D?

References

[1] Comment on an excellent quick summary of vectors and tensors in a LinkedIn post: https://www.linkedin.com/feed/update/urn:li:activity:7157059805604438016?commentUrn=urn%3Ali%3Acomment%3A%28activity%3A7157059805604438016%2C7157370733650714624%29