Fermions as 4D Vectors (The Pond Analogy)

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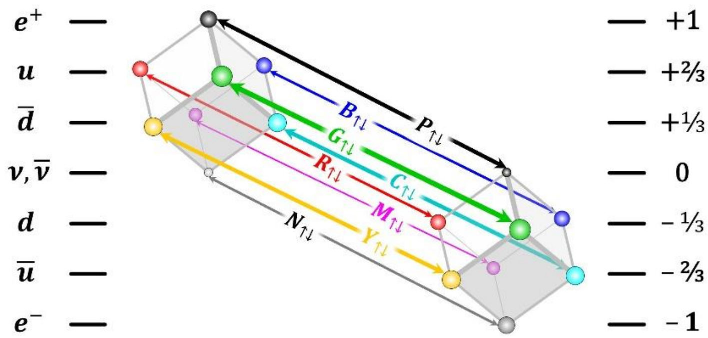
[Email Excerpt]

>... "Are the [particle-like] points in 3D simply a projection of the 4D vectors? Or is it not quite as simple as that?"

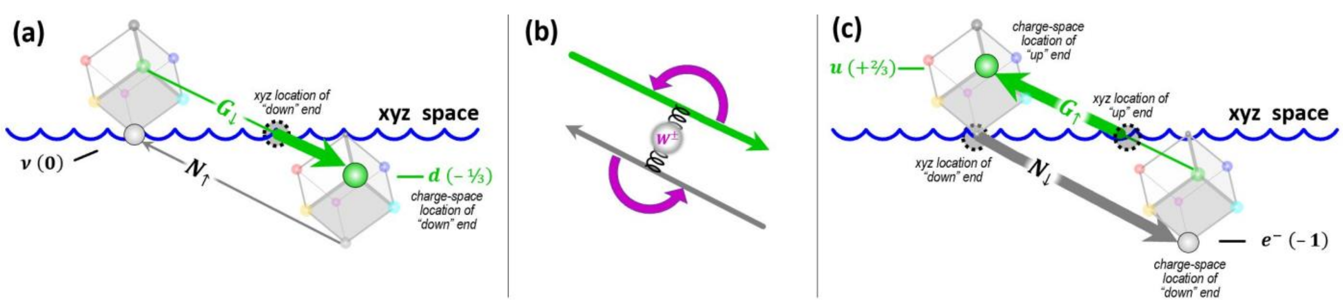


Imagine sitting in a boat on a pond. The pond surface has a sign that says "xyz space," but the water is so murky that you cannot see below that surface. [Note: Figures 2(a) and 2(c) "borrow" the vertical axis to show charge displacement in Glashow space also.]

Hollow tubes float on the xyz surface. Each tube holds a free-rolling marble that causes one end to sink out of sight. Each tube thus looks more like a point to any xyz observer.

Each tube has an arrow drawn along its length. Since the murky water hides these arrows, each tube end has the label "up" or "down." These labels let an observer know which way the arrow points, even when most of the tube is hidden.

To you, floating in your xyz surface boat, each tube looks like a point, though an oddly sticky one if you try to move it. Due to a trick in tube-end geometry, the more light you shine on a tube end, the smaller and more point-like it appears. The point-like intersection of the vector with xyz space creates the illusion that the mostly-hidden tube is a point.



In your pocket, you discover a weird little wind-up fidget spinner, labeled W, with two oppositely spinning disks. It takes much energy to wind it up, but once you succeed, you find you can insert it between any closely adjacent pair of up and down tubes. Flips are rare since the tubes don't get that close very often. Releasing the W _rotates_ the up and down tubes in opposite directions, using them as torque leverage against each other.

The result is that both tubes flip directions. Their internal marbles resettle and restabilize in new positions, and the directions of their arrows reverse. At the visible xyz surface, the "up" tube becomes a "down" tube, and the "down" tube becomes an "up" tube.

If all of the tubed were identical, this kind of paired flipping would not make much difference. However, it turns out there are eight varieties of tubes, and only four are common: R, G, B, and N. The tubes and their endpoints can have very different properties on the xyz surface.

For example, N ("negative") tubes stay firmly in place when their arrows point down but fly away at maximum speed when flipped up. The N-down version is more commonly known as an electron, and the N-up version is known as an electron neutrino, a very ghostly particle that moves exceptionally close to the speed of light. The very name of this particle reflects its intimate relationship to the electron since they are the same particle in different orientations in a dimension beyond xyz.

This seemingly new and exotic fourth dimension is, in fact, neither new nor exotic. It is the same electric displacement axis James Clerk Maxwell first proposed in the mid-1800s. The new and exotic part is that Maxwell's electric displacement is composed of three orthogonal charge dimensions. That's a different story.

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