Hierarchy of Quantum Fields, Scalar Field Neutrinos, Neutrino Dark Matter, Spacetime as a Product of Rotating Quantum Fields in a Higher Dimensional Bulk, The Nature of the Temporal Dimension

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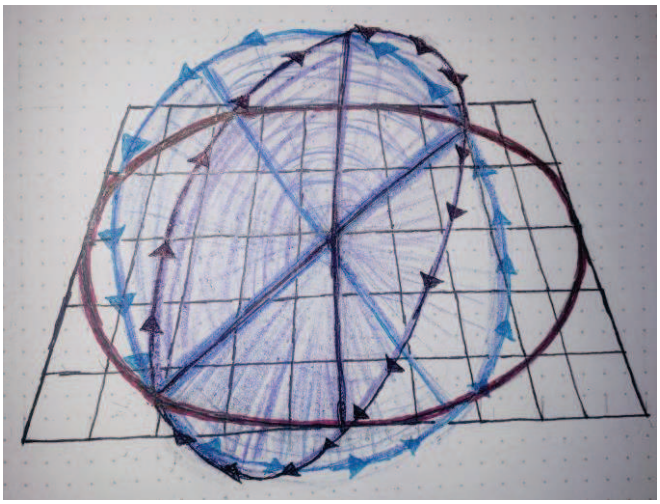
Abstract

We postulate that quantum fields are more fundamental than spacetime. There is a hierarchy of fields, with the scalar, Higgs field being the most fundamental and the vector and spinor fields being a result of the 2-dimensional scalar field, being synonymous with a 2-brane, rotating through some higher dimensional bulk. As this field rotates the path integral of all possible paths of rotation through the higher dimensions can be summed into a projection into a brane which incorporates 1 extra dimension. The incorporation of another dimension creates a 3-brane that houses some vector fields. This brane, being coupled to the 2-brane, continues to rotate and the continued rotation produces a 4-brane to house all of the spinor fields. With 2 complete rotations the spinor fields will yield some paths in which a point of the scalar field would have 2 complete rotations bound up in its path back to its starting point on the scalar field, which would be the paths of spinor field particles. There would also be some paths which some points on the scalar field could complete 2 full rotations and instead of having those rotations bound up in the path, the particular paths would essentially unwind the part of the field along those paths. The would-be spinor fields would become a scalar field. The would-be spinor particles would become scalar values. We postulate that these would-be spin ½ particles might be right-handed neutrinos. Applying this possibility to recent work by Latham Boyle, Neil Turok, Kieran Finn and others, we explore the possibility that these paths might be the source of Dark Matter.

1. Branes and the Bulk

If the fields are thought of as branes of some dimension that is associated with the particular kind of fields of that dimension, within some n-dimensional bulk, then scalar field would be a 2-brane within the bulk. We are postulating that vector and spinor fields are projections of a rotated scalar field. These fields become material by incorporating additional dimensions from the bulk which are not present in the 2-brane that contains the scalar field. This provides a mechanism by which the ideas and equations that provide evidence for the Holographic Principal are manifested in the universe.

As the 2-brane is rotating through any number of dimensions in the bulk the sum of all paths and all rotations that any point on the scalar field takes through any number of dimensions, in completing either a single full rotation or any odd numbered sum of rotations, and returning back to its original orientation can be summed up by a collection of paths that would be the path integral of all paths of all points that would be a closed, minimal surface manifold, projected into the direction of the complex plane relative to the scalar field.

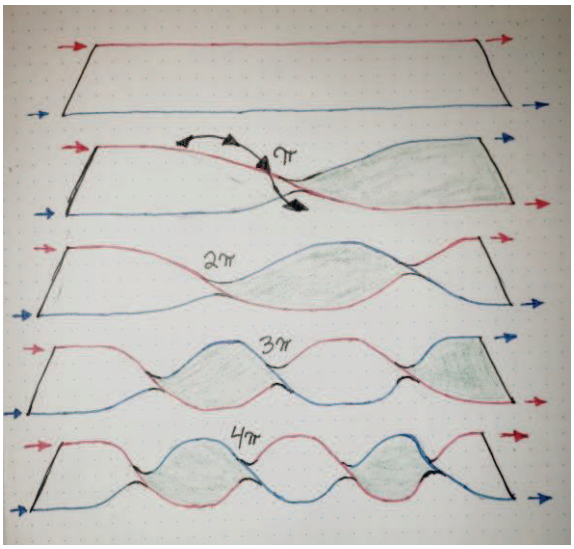


Considering the principle of least action, we are able to treat all these paths as paths beginning and ending on the scalar field with 1 single rotation through the complex plane. The projected

minimal surface plane would require the inclusion of an additional dimension from the bulk. This new 3-brane will be the home to the vector fields associated with photons and gluons. These vector fields produce spin 1 particles, which can be in some particular orientation, and after a single, complete rotation (or any odd number of rotations) would be back to their original orientation. This is consistent with some point on the scalar field completing a single rotation, and that path of a single rotation being the path of a spin 1 particle.

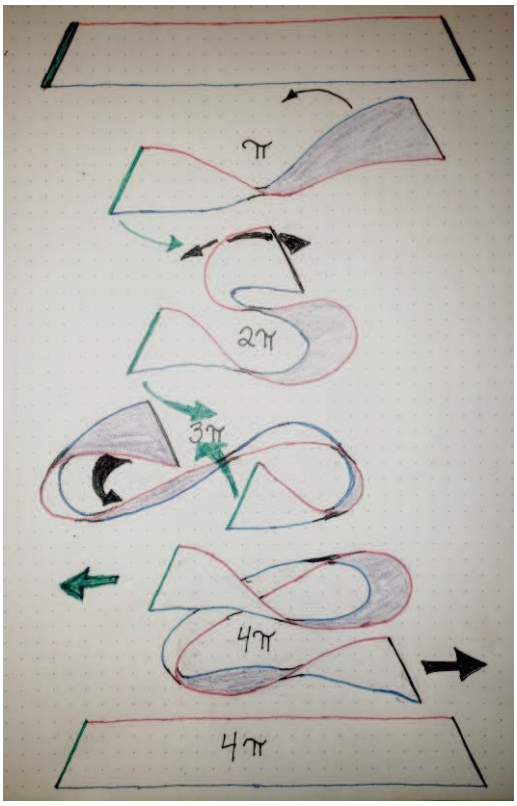
The 3-brane houses the fields corresponding to particles that do not experience time. This is consistent with a brane that has not incorporated an additional dimension that could be the temporal dimension. The spatial dimensions will be shown to be more fundamental than the temporal dimension.

As these branes, now coupled together, continue to rotate in some higher number of dimensions, we consider what happens as the scalar field returns to its original orientation after completing a 2^{nd} full rotation. This 2^{nd} rotation will require that any new paths that could not be included in the path integral of the 3-brane must incorporate an additional dimension for the paths to rotate in. This will yield a 4-brane which will house a new set of fields that will each be associated with some particular particle. Two full rotations will yield some paths which will be associated with spin ½ particles. These particles require 2 full rotations before they are oriented in their original manner. Again, this is consistent with paths that complete 2 full rotations before returning to their origin on the scalar field. These paths can be thought of as having 2 twists bound up in them.



However, there will be other paths that will reorientate the point on the scalar field without having the brane bound up in that path. This idea is easily conveyed with the visualization known as “Dirac’s belt.” There will be some paths that will reorient themselves in the original manner while also untwisting the brane along that path.

Right-handed neutrinos are theorized particles that are thought to be a yet undiscovered piece of the standard model. These particles should be spin ½ fermions. We are proposing that the paths in which some point on the scalar field would complete 2 full rotations and untwist the brane along that path, so that it returns to the scalar field in the same orientation and just as unwound as the scalar field, are the paths that are associated with right-handed neutrinos.



2. Dark Matter

In recent works by scientists at the Perimeter Institue, a strong case has been made for right-handed neutrinos as dark matter candidates. Piggy-backing off of their impressive work, we are proposing that the paths that would yield these undiscovered particles instead become flat as they rotate and unwind themselves, and that rather than producing these spin ½ particles, these paths yield a scalar quantity. Right-handed neutrinos are undiscovered because they do not resemble any other neutrino. The field that would produce these particles becomes a scalar field.

The familiar formula to determine the force of gravity between to massive bodies is $F = G\left(\frac{M_1+M_2}{d^2}\right)$. Note that this is an inverse square law. The force of gravity decreases in proportion to the square of the distance between the bodies. This is because the massive bodies under consideration exist in a 3+1 dimensional spacetime. Gravity is a force that dissipates in all

directions from the center of any massive body. In 3 dimensions this takes the form of a sphere. The surface of that sphere, with the gravitational center in the center of that sphere, would be a plane on which the force of gravity is the same at any point on the sphere. The formula to find the surface area of that sphere is $4\pi r^2$. If what would be the center of a massive body existing in 3 spatial dimensions is reduced to a scalar quantity that exists on a 2-dimensional plane parallel to the scalar Higgs field which is responsible for the intrinsic mass of particles, then the force of gravity between quantities on these scalar fields would not be an inverse square law. Gravity would diminish from the center of mass of a scalar quantity equally in all directions on a 2-dimensional plane. The formula to find the circumference of a circle that would describe a line of equal gravitational force from the center of any scalar quantity is $2\pi r$. This means that the denominator in the formula to find the force of gravity acting between any 2 massive bodies would not be the distance times itself, it would just be the distance. The effect of gravity in 2 dimensions would be much greater than it is in 3 dimensions, particularly as the distance between bodies increases. If right-handed neutrinos are the particles of dark matter, and the field associated with those particles is a 2-dimensional scalar field, that could explain why the gravitational effects of dark matter in the universe are 5x what they are for matter, despite there not being an apparent abundance of dark matter particles to the tune of 5x the sum of all the matter found in the universe.

3. Other Possibilities to Consider

Other spin 1 particles do experience time. One plausible solution is that these particles, the W and Z bosons, which are short lived and are the force carriers of the weak force, are each produced as 1 of the 2 rotations that along the path that would be associated with a right-handed neutrino. It's also possible that some paths that unwind themselves as they complete 2 rotations

are associated with right-handed neutrinos, and there are other paths that have some other particular attributes or directionality inherent to them which yield W and Z bosons, each being associated with 1 of the 2 rotations that occur along that path. There might also be some set of paths that exist in the 3-brane which would be unique to photons and gluons in the absence of a 4-brane. However, in consideration of the 4-brane it might be that the path integral for these paths might not be equivalently reduced to the same set of paths, as some paths that return to the point on the scalar field from which the path originates, after completing a single rotation, could continue their path for another rotation and end their path, once again at the origin on the scalar field, but this time having unwound the brane along that path.

2. The Nature of Time

The 4-brane includes a 4^{th} dimension from the bulk, but some of the paths in that dimension become unavailable. According to least action, if a path from some point on the scalar field were to rotate twice, through 4 dimensions, and return to its origin in its original orientation and without the brane bound up along the path, the shortest path would be to remain at the origin. One possibility is that the paths associated with that particular direction of travel through the 4-brane might have some common attribute that would associate travel along those paths with navigating the 4^{th} dimension back towards the origin. It might be that travel along those paths, if it were available, would be what would allow a body in the 4-brane to navigate the 4^{th} dimension backwards in time.

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