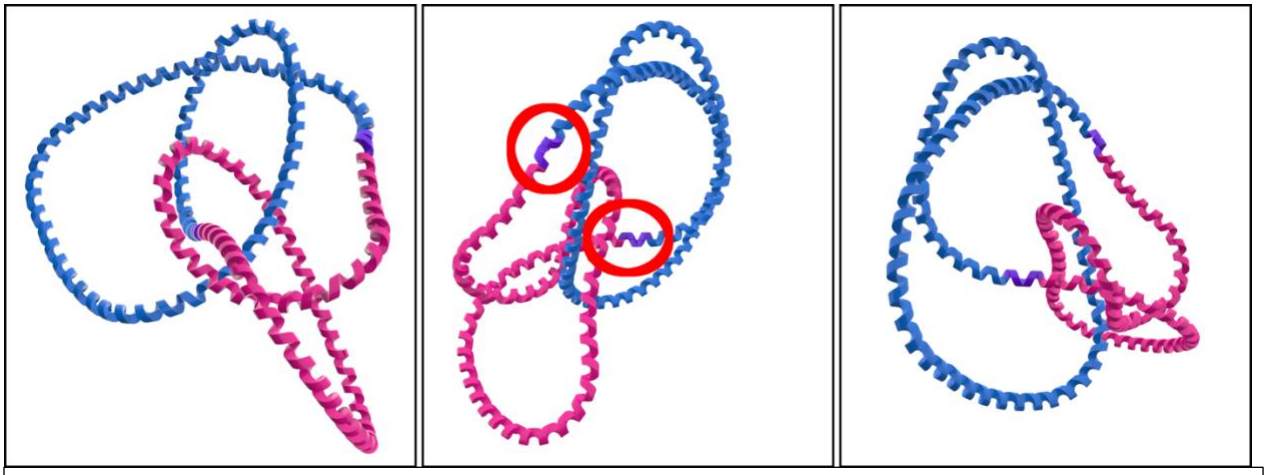
A Spacetime Model that Makes the Wave Function Real:

Identifying a Mechanism to Bridge the Gap from the Wave Function to Ontic Structure to Objective Reality



3-D rendering of a knotted scroll wave filament; opposite chirality of wave propagation along the filament is shown by pink/blue regions; chirality perversions, where direction of propagation reverses itself, circled in the 2nd frame

- It is generally accepted that entropy is the causal power behind the arrow of time.
- A particle only experiences time if it has intrinsic mass.
- Fermions are the particles that have mass, and thus the particles that experience time.
- Solutions to field equations typically represent fermions as spinors.
- A more accurate, local solution to field equations represents fermions as a type of oscillation called a 3-dimensional scroll wave.
- The type of scroll wave that accurately represents a fermion propagates from a 1-dimensional phase singularity (the filament) in the structure of a topological knot, with chirality perversions where wave front propagation reverses itself.
- In topology, any knot is confined to 3 spatial dimensions.

⇒ Given that:

1. All matter is fundamentally composed of fermions.
2. Any fermion is synonymous with an oscillation that propagates from a phase singularity.
3. The phase singularity that exists as part of an oscillation that generates a fermion particle has the structure of a topological knot.
4. Knot theory is specific to 3 dimensions.

We should conclude that all matter in the universe can only exist in 3 dimensions. In any n-dimensional bulk, the dynamic vacuum energy of free space will necessarily create knotted phase singularities that can only exist in 3 spatial dimensions. These phase singularities will generate fermions, and these particles will in essence be embedded in a 3-brane within any n-dimensional bulk.

- Considering only the mathematical principles that can be generalized to any physical system, if a system is in a state where a knotted, twisted scroll wave exists, there are many, many more possible states that the system could evolve to where an oscillation does not exist than states where a continuous, knotted, twisted scroll wave does exist.
- Even though the fermion is a *fundamental* particle, it is still an excitation is propagating from a knotted, twisted filament.
- The oscillation that generates a fermion can be viewed as a system evolving from one state to another.

- Just like any other closed system, the entropy of a unique state of the system at any moment can be quantified. As the system evolves, the entropy of the past states of the system can be quantified and summed over time.

⇒ Given that:

1. The field oscillation that generates a particle can be viewed as a physical system with a quantified value of entropy.
2. For a particle to exist, the oscillation generating the particle must propagate from a knotted, twisted filament.
3. The system evolves exclusively to states where a knotted, twisted filament exists to facilitate the oscillation.
4. Considering all possible states that the system might evolve to, there is a low probability that the system will be in a state where a knotted, twisted filament exists.

We should conclude that the evolution of that system from one state where the particle exists to another state where the particle continues to exist can be seen as the system evolving to states of lower entropy.

- For any physical system to exist, the component particles of that system must exist.
- Any physical system that can be observed to exist in the universe must include fermions as components of that system.
- As fermions exist over time, they can be viewed as fundamental systems evolving to states of decreasing entropy.

- As any macroscopic system evolves to states of higher entropy, obeying the 2nd law of thermodynamics and establishing the arrow of time, the fundamental components of that system are evolving to states of lower entropy.

⇒ Rather than holding the view that entropy increases in any closed system, we can adopt the view that as any physical system evolves macroscopically to a state of increased entropy, the fundamental components of the system evolve to states of low entropy. When accounting for the decreased entropy of the fundamental components of any macroscopic, physical system, we should conclude that entropy can rightly be seen as a conserved value.

The implications of these conjectures are profound. Extraordinary claims require extraordinary evidence. The emerging field of 3-dimensional scroll waves is a complicated and extraordinary area of mathematics. Within the mathematical description of these oscillations is a conceptual understanding of matter that serves as the required extraordinary evidence.