

**Essay**

# **Luminiferous Aether & Transcendent Substratum**

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## **Abstract**

We offer a conceptual alternative to the now virtually abandoned notion of a luminiferous aether and propose a 'new physics' embracing the central idea that spacetime itself is regarded as a secondary reality, constructed from something more primitive: twistor space, a transcendent substratum or mesostratum. We also present a critique of mathematics as the sole means for discovery and validation of physical truths.

**Keywords:** Mesostratum, twistor space, aether, new physics, spacetime.

## **Introduction**

In his latest book [1], Roger Penrose contemplates the fashion, faith, and fantasy which have entrapped most theoreticians in their pursuit of truths about ultimate physical and transcendent realities. Penrose reexamines the uncanny enfolding of mathematical truths with the minutest and largest properties and phenomena of the physical world and the remarkable effectiveness of mathematics in describing and predicting those properties and phenomena. However, Penrose implicitly cautions that discovering mathematical truths is not the same as discovering physical truths: ". . . as regards what is really going on in the physical world, there is something profoundly missing. To get a proper solution [for example] to the measurement paradox, we need a change in the physics, not just some clever mathematics, brought in to cover the ontological cracks!"

## **Discussion**

Theoreticians have built ingenious mathematical structures and objects - virtually without empirical content - which are applied to help improve understanding of almost every aspect of the physical world. They have uncovered mathematical truths that echo and illuminate empirical observations and discoveries - certainly contributing to knowledge of the physical world. Based on strict adherence to fashion, faith, and fantasy, as elucidated by Penrose, they have tyrannically insisted that mathematics is the exclusive instrument for the discovery and validation of such knowledge.

Large, powerful, expensive high energy facilities are often demanded by theoreticians who have adopted iron-clad premises based essentially on combinations of fashion, faith, and fantasy. Extreme high energy apparatuses - like CERN's Large Hadron Collider - are designed to duplicate conditions assumed to have prevailed at the onset of a super-hot Big Bang. Alternative hypotheses based on abundant evidence that the Cosmos emerged quiescently from a Bose-Einstein

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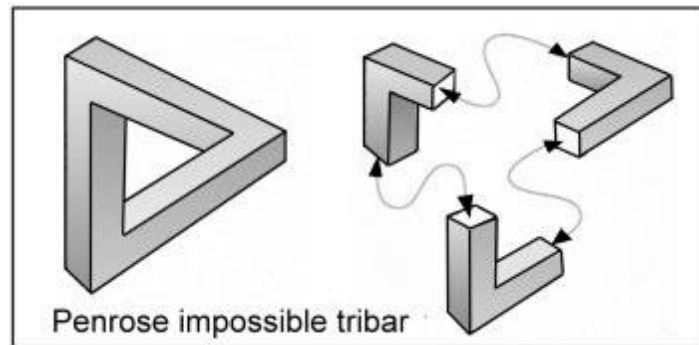
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Condensate substratum are ignored or dismissed [2].

Theoreticians have imbued space with metric attributes and properties. Synthetical spaces ostensibly produce quantum particles, quantum waves, and force fields that interact energetically. Current concepts of spacetime are not restricted to just four dimensions. In an attempt to explain quantum particles and waves, string theory posits ten-dimensional spacetime. M-theory, an elaboration of string theory, posits compactified dimensions which reside unnoticed in Minkowski spacetime. Synthetical sub-spacetime manifolds are considered able to manifest as physical objects. Various vibrational modes of the manifolds are taken as being the origins and constituents of quantum particles, fields and forces that pervade the cosmos.

Penrose bemoans the multitude of compact extra sub-space dimensions of string and M-theory although they may well lead to an ultimate destination and next level of understanding. In his view, that destination resides in twistor space which he studiously sets apart from the domain of Minkowski spacetime. Twistor space is envisioned as a separate domain which coexists with and complements Minkowski spacetime. Twistor space transcends Euclidian space and time wherefrom Minkowski objects - such as light rays and light cones - are mapped onto corresponding twistor objects - such as twistor points and Riemann spheres, receptively.

Twistor space attributes may be best understood and explained with reference to the Penrose impossible tribar. The tribar, an imagined three dimensional object. cannot exist in ordinary Euclidean space, yet, its individual parts can. Penrose notes that locally there is nothing impossible about the tribar concept. The impossibility is non-local, and disappears if one considers a small enough region of the tribar. Penrose devised a cohomological context in which the local parts may be joined, as illustrated by arrows in the figure.

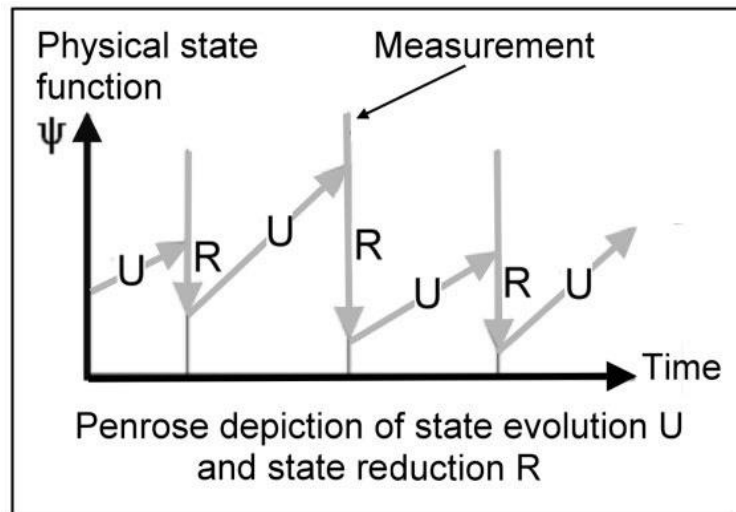


Penrose resolves the impossibility issue with twistor theory in which the basic idea is to regard conventional Minkowski spacetime as being subsidiary to twistor space: “Being a fully complex space, [twistor space] provides the potential to exploit complex-number magic in ways that do not readily present themselves in the standard spacetime framework. Accordingly, rather than using descriptions in terms of real spacetime coordinates, one uses the complex twistor variables. . . . twistor functions are not really to be viewed as 'functions' in the ordinary sense, but as what are called elements of holomorphic sheaf cohomology.”

Penrose explains that although the notion of sheaf cohomology is sophisticated mathematically, it is

inherently simple. He suggests that the easiest way to picture this notion is to think of the way in which a conceptual manifold can be constructed with a number of coordinate regions or patches. Each 'patch' may be defined such that there is a transition function or 'overlap' between pairs of patches. The transition function provides the glue that unites the patches to construct the manifold and analogously provides the means to join the three 'local' parts of the Penrose tribar.

Twistor space provides the cohomological foundation for realization and study of strings and other types mathematical 'continuum' objects that are impossible to realize solely in particulate space-time reality. Consider the emission of a quantum 'particle' from a physical device, the detection of the 'identical' particle by another device and the curious and seemingly inexplicable mode of transit from source to detector. The process alternates between two completely different states: transit (involving state evolution  $U$  which is continuous and deterministic) followed by detection and measurement (involving an abrupt state reduction  $R$  which is discontinuous and probabilistic) as depicted by Penrose:



Since the state function  $\psi$ , describing state evolution  $U$  is continuous, it is a valid descriptor only of the in-transit process conceptually occurring in twistor space (the mesostratum) [3]. The instant the electron or photon is detected and measured, the wave function is said to have 'collapsed'. This simply means that  $\psi$  does not anticipate reduction  $R$  as a particle 'jumps' from twistor space to Minkowski spacetime.

Einstein stressed that special relativity took away the last mechanical property of the aether: immobility. However, he asserted that special relativity does not necessarily rule out the aether, because the latter can be used to give physical reality to notions of acceleration and rotation. This concept was fully elaborated within general relativity, in which physical properties (which are partially determined by matter) are attributed to space, but where no substance or state of motion can be attributed to Einstein's aether.

Penrose's twistor space which corresponds to the transcendent mesostratum substratum [3] conceptually overcomes the problem of attributing substance to aether. Twistor space is not a substance but a venue or domain where 'continuum things' such as light waves, electromagnetic

waves and fields transpire and evolve as U before reduction R, i.e., detection/measurement in the physical world.

## Conclusion

After an incisive critique of current theoretical physics [1], Roger Penrose offers a ‘new physics’ embracing the central idea “. . . that space-time itself is regarded as a secondary notion, constructed from something more primitive, with quantum aspects to it, referred to a twistor space.” Penrose has in effect revived the notion of ‘luminiferous aether’ which in the late 19th century, was the postulated medium for the propagation of light. The negative outcome of the Michelson-Morley experiment suggested that the aether as a substance was non-existent. Instead of characterizing it as a substance, Penrose’s twistor space aether is a substratum, which corresponds the transcendent mesostratum [3] a hyperspace domain, wherein state evolution U prevails exclusively, for example as Schrödinger wave functions and other wave propagation modalities.

## References

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3. Exploration of Mesostratum Physics, Vary, A., *Prespacetime Journal*, Volume 7, Issue 11, 2016..