Setting Out

In ancient Europe, scouts to foreign lands brought back tales of unicorns. Unicorns were described as being "like a horse", but with horns on their foreheads. Centuries later, when no horse had ever been known to have a horn, it was logical to assume unicorns were simply a hoax or a made-up mythological creature. To this day we still think unicorns are fantasy creatures that exist only in the imagination. But the tales about unicorns, from expeditions into the forests of India and planes of Africa, were in fact true.
But the truth is more ugly. It doesn't fit what we prefer to imagine.

Unicorns do exist. In reality, unicorns are shorter and fatter than in the fairy tales, have ugly gray armored skin and look exactly like a rhinoceros. The only thing those first explorers got wrong was their choice to use the words "like a horse" as part of their description.

We can understand their simple mistake, but the choice of how specifically something is defined can mean all the difference in the universe, when it comes to proving if something has a factual basis. If a test fails that specific initial description in repeatable experiments, it can burn down entire genres of rational analysis along with it.

As we will see, a critical experiment in the latter part of the 19th century would turn out to have so vividly defined a precedent in the paradigm that it made a unicorn out of an entire facet of spacetime and marked "prohibited" an entire qualitative mathematical vantage point. There is "a something" that we acknowledge undeniably throughout scientific phenomena, (as noticeably as a rhinoceros) but have been strictly barred from calling it "a something", since that one defining experiment. The trip we are about to embark on will attempt to rescue this particular dark unicorn from fiction, bring the magic into reality and to show that in fact, it is the key puzzle piece missing in so many modern physics conundrums.

To Be or Not to Be

When theorizing about the potential characteristics of things that do not interact with normal matter, we are theorizing about completely dark things, things that, by definition, "do not exist", by the current model. As we go forward, we will be

exploring in great detail, things that, by technical definition, do not exist. Regardless of how exact the boundaries of something that does not exist is, regardless of how much it can explain the unanswered questions about what DOES exist, it must, for the time being, be restricted to the category of a device for theoretical analysis.

The pioneers of history won their battle, forging the way through the existential jungle and arrived at classical quantum mechanics. They used their last ounces of strength to show us a locked, seemingly impassible door marked with the Greek symbol Psi.

For those of you pragmatic and with enough intestinal fortitude to continue reading, we are about to burn the bridges of classical physics that led us to that barred door, in order to see what substance remains, after the flames subside. You will need the strength to temporarily dismiss any doubts arising from classical conclusion, so that the threads of paradox can be burned away, and the hidden features of the map revealed.

Classical quantum physics stops at the symbol Psi, and has accurately defined that its gradients and time derivative equal the magnitudes of momentum and energy associated with observables. But looking closer at Psi on the current

map, (at that crossroads of the quantum and relativistic highways), somehow the basic building blocks we call momentum and energy, (and even distance and time), get super-tangled in a way that mocks the rationality of either or both interpretations. We will explore those basic building blocks, see what we could have possibly overlooked, and explore what is beyond the quantum door.

The standard model, superimposed onto relativity, currently requires hyperbolically fantastic exotic mathematical descriptions and mind-bending higher dimensional spaces to try to keep our old definitions connected rationally to the empirical, but there is a problem. The closer we get to merging the two models, the more tangled and unfathomable the description becomes. Something is suspiciously wrong with one of the definitions that are common to both.

Reminiscent of Zeno's paradox, every step taken to modify a strained or obsolete model, (to fit new data) presents a new and increasingly complex obstacle to reaching a pure definition. Although it is intriguing to explore the magic of abstract manifold topologies and higher dimensional superstring theories, to incorporate the existence of these observations, we have now come to a non-deterministic, non locally-causal iron wall of non-realism that no amount of higher order splicing can surmount. The path to progress promised by higher mathematical contrivances that only extrapolate classical assumptions presents a kind of never-achievable pursuit that borders on addiction.

All this must be set to one side and replaced with the risk and danger of traveling into the exotic realms of physics in a concerted and determined, almost visceral way and discover directly how things truly exist in spacetime, at the peril of our cozy and safe "discrete-object on a workbench" classical method of modeling spacetime.

The scientific minded person must ask themselves the questions, "Will I survive the transition?", "do I have the adaptability to translate the old objectives and potentials to the new description?". In essence, the choice must be made between possessing a description that provides the wonder of unattainability or possessing a more practical but "inside-out", description that provides real, tangible progress. Our willingness to re-imagine the way we interpret classical physics will be the deciding factor.

The brainstorming expedition in the next few sections will be equipped with safety gear, including tethers to classical rational structure that determine how daring we can be in deviating from classical preconceptions in our interpretation

of the data. All deviations are weighed against how far they stray, and how to get back. We will continue to persist down dangerous paths for only the most promising developments.

Absolute baseline classical safety lines:

1. Energy exists
2. Mass exists
3. Dark energy and dark matter exist beyond what is measurable
4. Mass/energy equivalence exists, potentially including the immeasurable
5. Time and space exist
6. The speed of light is constant but otherwise time and space are relative
7. Dynamics of motion and geometry of some sort are taking place in the intrinsic structures of quantum and relativistic systems, which may be involved in the puzzling behaviors found in spacetime

Second stage safety lines

1. Laws of conservation, (current boundaries)
2. Symmetries
3. Beauty or awkwardness of classical interpretations (by degree)

This list of safety lines is not exhaustive by any means but in general, (as should any pursuit of a reductive fundamental theory), willingness to explore a challenge of an existing description was weighed against any potential holes or dubious foundations. On the opposite side, the model for exploration included heuristic correlations that hold suspicious clues in the following facets of physics:

1. Wave particle duality, quantum erasure
2. Quantum wave behavior and collapse
3. Time and length dilation with speed/gravity
4. The uncertainty principle and odd challenges to the Copenhagen model
5. Orthogonal relationship between electrical and magnetic waves
6. The nature of spinors
7. Spacetime curvature and the fundamental forces
8. Reciprocal facets of geometry in the anatomy of the photon and electron
9. Cosmic inflation and contraction

10. Dark matter and dark energy
11. Bell's Venn diagram, hidden variable paradox
12. Virtual particles and fluid dynamics implications
13. Velocity present in mc^2 (i.e. mass somehow "contains" velocity)

Launch

Matter appears out of nowhere, matter turns into energy, energy turns into matter and matter changes. Spacetime is constantly making and unmaking these measurable forms of matter. All this is happening alongside and within visible energy visible matter, dark energy and dark matter. Our first task is to explore the boundary between what is dark and what is light. What does observable mean?

Spacetime fluidly results in forms of matter and energy from nothing, but we know for a fact that the "nothing" of spacetime is actually full of dark matter and dark energy, as well as transient normal matter production. Spacetime fluidly allows matter to become energy and energy to become matter, according to some manner of configuration that we have some quantitative math for, but don't know the how.

The energy of spacetime in observable things presents itself quantum packets, having a fixed size, on the smallest scale and forming the divisions of energy that constitute all possible structures. The structures formed from this system of Planck units have an underlying presence of randomization, described by the uncertainty principle. To loosely consolidate this handful of observations, spacetime is fluid-like changes to energy/momentum configurations, including dark matter and dark energy with features having a fixed minimum size, with which larger things are built, and the system experiences random variation. Depending on the situation, sometimes spacetime results in normal observable matter and normal energy which arises alongside or within the dark matter and energy.

We are first going to explore the nature of the relationship between existence and nonexistence and increase the resolution regarding what forms that boundary, how our empirical observations as members of the category of normal matter are related to our definitions we use to describe physics and how all of these things are related to the Heisenberg uncertainty principle.

As is well known in Schrodinger's thought experiment, the nature of spacetime has proven without doubt that the act of making an observation, (taking a measurement) has a way of pulling particles out of the realm of what may or may not exist and into the realm of what does exist. This fact seems metaphysical somehow but is the quantum equivalent of the test given to primates and other intelligent species, to learn about the boundaries of their self-awareness.

In the test, animals with high intelligence are marked with a spot of paint on their foreheads and placed in front of a mirror, to see if their self recognition is acute enough to, (in essence), use rudimentary rules of science to deduce that they are seeing their own image reflected, instead of another animal. The subject animals observe their reflections and end up doing basic tests on the geometry of the mirror, (looking behind it, touching it, smelling it etc).

The crucial act of intelligence is that they take note that the patterns of motion in the mirror are identical to their own. Their ability to isolate what part of their existential experience they themselves are responsible for is the golden factor that sets them apart as being of higher intelligence.

To do this they have to be smart enough to put to one side the things their instinct wants to see and be resolved to what they are truly seeing. More primitive species do not see past their desire to fight an enemy, meet a friend or call up whichever misleading classical instinct they would reactively look for. They detect data normally associated with something familiar, like another gorilla then systematically test for the other data normally associated with that familiar thing and draw the conclusion that they must be seeing themselves.

It is very important to point out that their accurate conclusion is not based whatsoever on finding positive empirical evidence of "themselves". What could they ever see in the mirror that could identify a substance called "themselves"? They have never seen themselves. The reflection fails all tests of being something "not-self" and so must be "self". They are left with no other logical possibility than to conclude that this mysterious thing must be part of what they are.

In quantum physics, and in any observation, we are necessarily, to some degree, looking into a mirror. We approach our models for what we observe, based on looking for our instinctive structure of classification. It always takes deliberate effort to recognize the self in the interpretation and put our instinctive format to one side and take into consideration that what we are seeing may fall outside of our definitions or even outside define-ability. As we stand in front of our

“particles”, looking at them from all angles, but there is always something that doesn’t smell right about their behavior, (things that seem to defy rationality), and we can notice that they have traits that mirror how we function and exist. But we can begin to lay the groundwork for exploring beyond our definition of existence, rationally.

The higher primate realizes there must be something else that has properties that exist beyond the boundaries of the defined instinctive objects seen in the mirror. In the case of the painted gorilla, its own existence is observed conclusively, having properties and indeed a location beyond the defined physical parameters it would otherwise classically know to be another gorilla.

Far from being metaphysical, this circumstance is entirely to do with the concrete mechanisms of what it means to take a measurement. It was inevitable that using measurement to explore our universe would come to the impasse where we must describe the very substance that our tools-to-describe are made of.

This problem is codified exactly in the formula for the Heisenburg uncertainty principle and without a doubt proves that there is a defined limit to what we can measure. Like early explorers that knew their ships could not challenge the open oceans, when you are sure that there is a physical limit to your personal ability to explore, there is very strong possibility that there is more to explore.

If the tools that are required to detect a substance (i.e. fundamental particles) are also made of that substance, it is quite likely that only things of a certain forms are detectable by that tool. Analysis of the structure of the tool itself would require a different empirical method, (like was required of our distant cousin in the mirror).

So how do you explore something when you don’t have the mechanism to measure it directly? The standard method is to measure it indirectly to the extent that you learn its properties well enough to devise a way to directly measure it. The same goes for finding a way to forge a river and how to find an invisible man in the rain. Systematic deduction, a process by which the effects that an undefinable thing has on the definable things, must serve as the factual data that we can logically reduce to a necessarily undeniable picture in the abstract. Defining the undefinable, until that knowledge, as a bridge, leads to new tools for defining and a new era of discovery.

In this exploration we will trace the pattern of all of ways the immeasurable affects what is measurable, in those shaded areas of unexplained physics. We will pay no attention to the fact that what we are exploring lives on the other side of an unfathomable boundary called non-existence, (a place we might note where everything not-yet measured has always existed, before it was measured and defined). We must start with where we are now and the current picture of things, before we tear it apart and begin investigating.

Waves of Probability

Is "probable" an actual substance that exists in nature? If one wanted to go looking for a quantity of "probable", where might it be found in its natural habitat? Probable and probability come from the Latin root *probābilis*, meaning provability or credibility of something. The very operative words here are "of something". Adjectives necessarily must have a noun to describe. Is it rational to discuss behaviors of things and also to say that there is nothing there that is doing the behaving?

It is a special kind of paradox to say that math is describing an adjective with no substance. It is a red flag. In an unfortunate spiral of irony, modern physics is operating under the explanation that quantum wavefunctions are mathematical descriptions of sheer "provability", itself. Capturing wild adjectives running free without their corresponding nouns is a dangerous business.

One can speak of the probability of seeing a shooting star, or a probability of getting stopped at a red light. Probabilities are definitely handy anytime there are too many variables to predict exactly, when the variables are too difficult to measure, or when the variables are unknown. But using a probabilistic description is only useful when the predictions you need to make will get by with a "close-enough" output.

The devil is in the details, so they say, and the seemingly "statistically irrelevant" aspects of an organic system that we think will suffice with probability to define it often actually do have a longer-term relevancy in whatever is trying to be controlled. Simply put, there is always something smaller and it is probably important. Probability can be used as leverage until the detail or the bigger picture can be learned, about a system, but the universe has never once yet presented limits to the scale of its features, (not even the quanta).

The human desire to understand is very strong and without access to the data for what is going on intrinsically in spacetime, highly intelligent and functional work-arounds have been developed to stand-in for an understanding of quantum behaviors and by association, an understanding of the nature of our reality. But we still do not, in fact "understand" quantum mechanics. Those accurate mathematical predictions, without an in-a-nutshell style understanding, has had the side effect of forcing irrationality into the accepted dogma of our description of reality, even if, (ironically) it only serves as a security blanket.

This poison is already seeping into the belief systems and outlooks of the younger generation of would-be scientists. A man concluding that he is observing an irrational system, simply because he cannot understand it, is like the man who thinks the room stinks when the smell is from his own mustache.

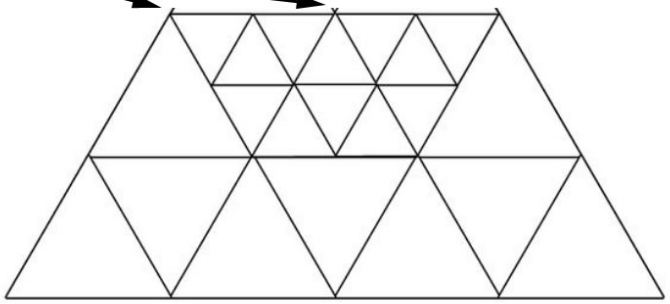
Einstein was always opposed to the idea of reducing the universe to probability. He did not want to, in-effect post a sign reading, "dead-end, non-deterministic" on the boundary to the quantum world. His objection is fitting, since he was part of the generation of scientists who had the lunacy to try to "look inside of light" to find out "what it was made of". Einstein's notions of determinism and hidden variables should not be taken lightly and are to be disregarded at our own peril.

The word hidden does not only mean that "if it is not under the bed or buried on a desert island", it does not exist, but more profoundly, "hidden" in this sense refers to something having properties we do not yet know to look for. The place where we look for things of this variety is located deep within the foundation of scientific curiosity. Scientific discovery is and always will be the search for the rational and comprehensible in the previously unknowable and chaotic.

Science is about new maps. At its root it, it means searching beyond current knowledge and so beyond our capacity to logically calculate. Logic is a tool limited to comparisons of options that are already known. Logic can never know how the definitions of what is known can themselves change when new discoveries are made.

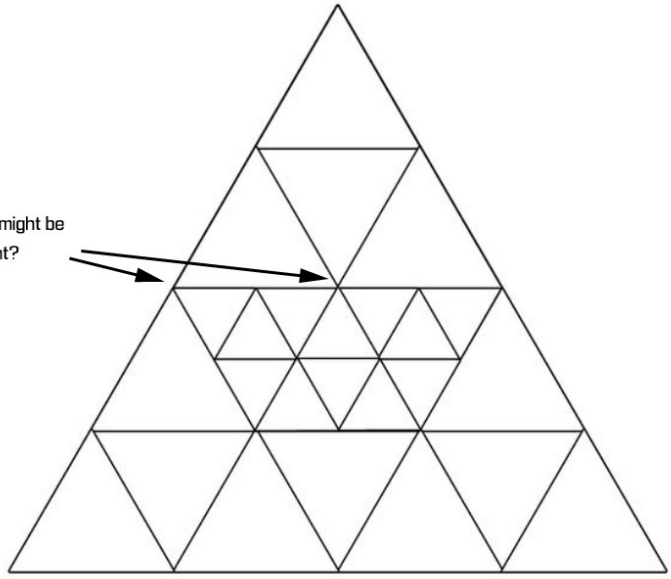
How many triangles do you count?

How many clues that there might be hidden tringles do you count?

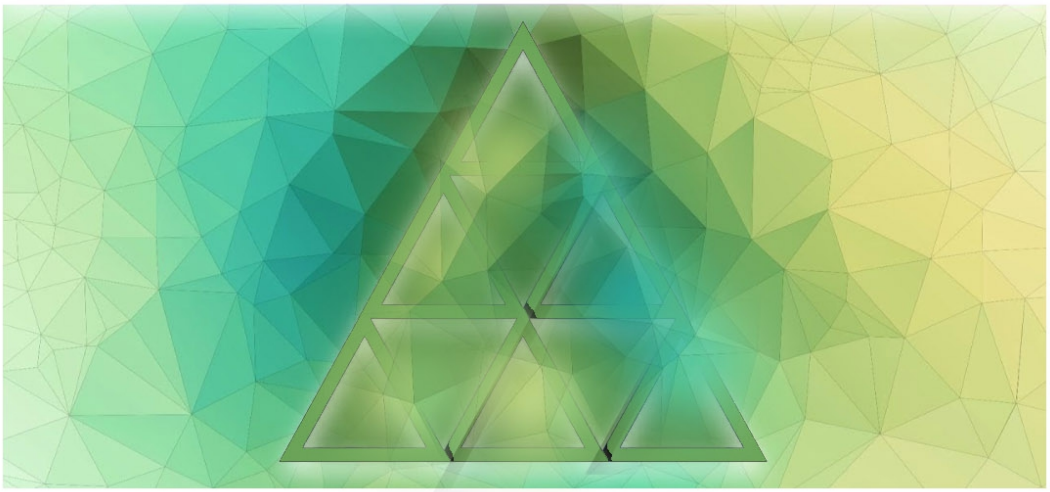


How many triangles do you count?

How many clues that there might be hidden tringles do you count?



What defines the difference in the two categories of tringle here?

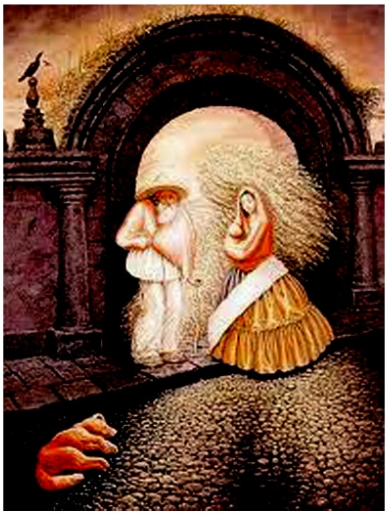


From the ground, the earth very definitely and undoubtedly appears to be flat, it took hundreds of years to convince early scientists that it was a sphere. The wind, to all sensible people very definitely appears to have zero material substance. It seems ridiculous to suggest that tiny invisible life forms go inside us and make us sneeze, and it took many many years to convince doctors of this, even faced with obvious proof. The stars and moon and sun all certainly do appear very credibly to be revolving around earth, and energy stored inside invisible atoms are things that only sorcerers speak of.

The list of scientific discoveries that completely shattered common conclusion goes on and on and continues to this day. Maybe its all just a conspiracy and declaring that matter has angular momentum but does not rotate, (even going so far as to say there is no motion) or saying that quantum phenomena are fundamentally probabilistic is all just purely a motivational tactic used to anger theorists into action.

Pop quiz, who can tell me what is painted in the background of the the famous Italian painting, the the Mona Lisa? Who was paying attention to the background of this statement enough to notice that the word “the” was repeated twice unnecesarily in the last sentence?

The human mind is highly skilled at processing and combining things that are found in the foreground. The mechanisms of our minds use “foreground” as the tool of our intelligence. Background is not as simple.



But when the foreground and background start playing games by sharing the same space, you have to be on your toes. You have to know the sandcastle for the beach.

Where should we go looking for the key that would unlock the conundrum of quantum mechanics? The easy answer, as always, is the fact that one or more premise we are using to look at the maps is flawed in some way. Our current topographical maps say that this cliff-line is too steep to cross, and that this river is too fast to cross but maybe there is a place where the cliff and the river merge and are neither river nor cliff but are also simultaneously both river and cliff?

From the early 20th century until now, we answered the question "waves of what?" with the answer, "probability" as a way of saying that we have a mathematical description but do not have a visual or geometric description of how a material, tactile sense that can be attributed to why the math works out the way it does. "Understanding" is that property of modeling a complex system in terms that the physical/tactile/instinctive senses are already familiar with. Metaphors and analogies are a great help with this process. Metaphors allow us to find common shapes in two different concepts. In a way, the action of analogy and metaphor are the process of isolating the underlying building blocks of our reality, and of our physics.

If we allow ourselves the freedom to consider that the physics taking place in the intrinsic mechanics of the quantum particles may be a little different and more fundamental than we might extrapolate from classical quantum physics, and that maybe the classical laws emerge out of those more fundamental rules, we have the most basic lead we can begin to follow. Ultimately probability is a word we will need to use, but it is imperative that we understand the what and the how

operating behind the “when”.

Velocity and Volume

With dark energy and dark matter on one side of the boundary of measure-ability and matter and energy on the other, how much of the behavior of what we CAN measure might be the result of something we CAN’T measure? Do the particles in the standard model that we have already discovered have parts that exist in the realm of immeasure-ability? Immeasurable Dark energy and Dark matter constitute the vast majority of what we know exists. How much of the unexplained behaviors of matter and energy are due to dark matter and dark energy? Do the properties of matter and energy overlap in the places where the mechanics are dark to us?

Here is a thought experiment. Imagine we were only able to detect the existence of water by using a buoyant test-float that sent a signal when waves were detected. Would we consider the waves described by the signal to be the limit of the nature of water, if we had no way of knowing about non-waving water? Would water cease to exist when there were not waves on it?

If all matter and energy particles are waves of something, that “something” would necessarily have to be something other than known matter particles or energy particles and since those particle-waves are the only interactions we have ever had, in order to document the laws of physics, any theoretical “something” that might be more fundamental, would possibly not conform to the laws of physics in the same way matter and energy particles do. This could be true in the same way that water molecules themselves do not have any detectable “tides” or “white caps”, or “undertows”.

Any wave-based test to disprove the existence of “non-waving water”, (as a wave medium) would therefore be quite suspect. To what degree are wave properties responsible for the laws of physics and to what degree might there be underlying laws more fundamental? We will look at the classical momentum-based tests for wave medium, then we will look at momentum itself and its relationship with wave phenomenon.

End of Section 1