Quantum Physics 103

The discovery of one theory that binds it all together is still fleeting. It has inspired great scientific adventures concerning parallel universes, 11 or more dimensions, holograms, membranes and strings. Almost sounds like the stuff I use to keep in my pockets as a child. Hell I STILL keep stuff like this in my pockets. Let's go over some of the predominant theories making the rounds today in scientific circles.

M-Theory

M-Theory is thought by many to hold the best potential to be the Great and Powerful GUT (Grand Unification Theory). The brain child of Edward Witten, he gave it the name in 1995 while at a conference at USC. According to Witten, the M could stand for "magic", "mystery" or "membrane", depending on your taste. Well I have my own word for it. Mayhem!
One of the keys to M-Theory is the acceptance of an infinite number of parallel universes that exist adjacent to our own. Also, there is this reference to the "brane". Simply put, the visible, four-dimensional universe is restricted to a brane inside a higher-dimensional space, called the "bulk". The additional dimensions are compact, in which case the observed universe contains the extra dimensions, and then no reference to the bulk is appropriate in this context. In the bulk model, other branes may be moving through this bulk. Interactions with the bulk, and possibly with other branes, can influence our brane and thus introduce effects not seen in more standard cosmological models. I don't know about you, but my "brane" is killing me!
The other "brane" next to the one we reside in, is thought to be the one that banged into us to form the Big Bang, giving us everything from life, Barbi, donuts and American Idol, is theoretically a hidden universe embedded in higher dimensional space. This theory is exciting many theoretical physicists because it brings together five similar but conflicting theories involving superstrings which I believe is the most fundamental form of matter in the universe, parallel or otherwise. But to me, a Brane is just a fanciful term for a universe. But the concepts of M-theory weigh heavily in my own development of my megaverse theory. The names have been changed to protect the guilty!

String Theory

String Theory has been around a long time. Let's review the history of String Theory. It really all started with 1921 the Kaluza-Klein Theory in 1921, in which Electromagnetism can be derived from gravity in a unified theory if there are four space dimensions instead of three, and the fourth is curled into a tiny circle. What makes this discovery fairly powerful is Kaluza and Klein made this discovery independently of each other. So this set the stage for what would unfold almost fifty years later.
Fast forward to 1970 and String Theory is born. Three particle theorists independently realize that the dual theories developed in 1968 to describe the particle spectrum also describe the quantum mechanics of oscillating strings. Then in 1971, Supersymmetry is invented in two contexts at once: in ordinary particle field theory and as a consequence of introducing fermions into string theory. And while it holds the promise of resolving

many problems in particle theory, there is a snag; the theory requires equal numbers of fermions and bosons, so it cannot be an exact symmetry of Nature. Doom on you!
But then something cool happens. In 1974 the concept of Gravitons hits the streets. String theory using closed strings fails to describe Hadronic Physics because the spin 2 excitation has zero mass. Oops, that makes it an ideal candidate for the missing theory of quantum gravity!! DOH! This remarkable discovery marks the advent of string theory as a proposed unified theory of all four observed forces in Nature.
And this brought us Supergravity in 1976. Simply adding Supersymmetry to gravity creates … drum roll please…..Supergravity! This made string theory more viable,
By addressing the issue that gravity can't be separated from the spectrum of excitations. Seems like now we are well on our way!
Low and behold, in 1980 Supersymmetry was added to string theory to create an excitation spectrum that has equal numbers of fermions and bosons, showing that string theory can be made totally supersymmetric. The resulting objects are called superstrings. Then the Big Year arrived, 1984.
This was THE year for string theory! Deadly anomalies that threatened to make the theory senseless were discovered to cancel each other when the underlying symmetries in the theory belong two special groups. And *viola!* String Theory is accepted by the mainstream physics community as an actual candidate theory to unite quantum mechanics, particle physics and gravity. Then from 1991 until about 1995 we enetered into the Duality Revolution period. This tied in with Black Hole research and higher dimensions that explored how different versions of string theory are related via duality transformations. String theory becomes the focus of a very deep and abstract analysis.
In 1996, by pairing Einstein relativity and Hawking radiation, Black Hole Entropy became an accepted reality finally achieving a microscopic origin for black hole thermodynamics, String theory becomes the enlightening mechanism for the understanding of Black Hole Quantum Mechanics. A quantum Excedrin is born.
For the lay out there, strings are mathematical representations of elementary particles and their interactions. But they are far more than that. Physically, they are one-dimensional constructs that appear to be open bits of line or closed
loops that vibrate in varying modes, at various frequencies, depending on configuration and length. It is believed that these objects at the sub-atomic level represent the fundamental particle. However, it is now believed that there are in fact “cosmic strings” that may be light years in length, and may be remnants of the Big Bang.

Before String Theory came along, all we had to work with was the Standard Model of particle physics, which was made up of a large group of equations that identified the 12 basic particles that make up life, the universe and everything. Also included were the protocols for how they behaved with each other. And even though the majority of physicists hailed the Standard Model as the most successful theory in history (and some still do), there were significant issues with it. First of all, and the most obvious is it didn’t include Gravity in its inner workings. Troubling as well was the need to add additional particles to fill in the blanks concerning some high energy reactions new technology began revealing to us, and there was of course no provision for explaining where the particles came from. String Theory cleared up a few of the problems, but still others remain.

It is widely believed by many physicists that Strings and Superstrings offer the next best hope for the unification of relativity and quantum mechanics. As I mentioned above, strings represent the most fundamental of all particles. It doesn't get any smaller than this. However, I hear the boys a Princeton are talking about the theoretical possibility of substrings, so before I even finish explaining it, it may already be obsolete. Such is the nature of Quantumville. Just when you think you have a grasp on reality…a particle comes along and pulls the rug out from underneath you…
But to move along (or I will never finish this segment), strings have an infinite number of vibrational patterns, or resonances (frequency again...hmmm) which are related to different masses and charges, as well as *creating* them. This frequency is measured in amplitude and wavelength. And it propagates, or travels through spacetime as a 4 dimensional construct, or 3 dimensions plus time. And there is a correlation. The greater the amplitude (level) and wavelength (lower the frequency), the greater the energy and mass. Consequently, amplitude is related to energy, and wavelength is related to mass. This compliments my own "Fundamental Frequency Theory and reinforces its relevance in relationship to paranormal activity. Lower frequencies will result in physical manifestations (mass), while higher frequencies result in non-visible phenomena. Amplitude is directly related to the intensity, or power of the effects. But I stray a bit in the effort to pat my back…
Let me paint a very simplistic picture of string theory. Think of a guitar. Play a chord on it. Each string is vibrating at a different frequency, creating a different note, and interacting with the resonance of the body of the guitar.

Welcome to string theory!

Recently, there has been a revelation that there are strings that have more than one dimension, and some operate in higher dimensions than our four spacetime ones. These have been called "branes" as in "membranes", with a one-brane being a single dimension string, a two-brane being a two dimensional string, etc.
String theory started out as a possible explanation for the observable relationship between mass and the spin of specific particles. However, a new theory, Quantum Chromodynamics caused string theory to migrate on to the realm of the graviton. While gravitons have to yet been proven to exist, theoretical physicists have long suspected that they do. String theory is the only theory so far that incorporates their unique particle properties. This brings us to the five theories of strings (six if you count Bosonic String Theory) and their complicated conflicts with one another. But just to end with a migraine, there are a lot of different string interpretations floating around out there. For example, my friend Richard David Ruquist (Google him sometime fr some interesting reading) is developing an interpretation containing no less than 26 dimensions! Acording to Richard, String Theory can support

1. The usual 4D spacetime
2. A Calabi-Yau Manifold 3D subspace of 10^-30 cm discrete units
3. Plus any number of time dimensions

He offers up Vafa's 12d Superstring which can have either 1 or 2 time dimensions. His 26d theory has 16 time dimensions! Pass the Percocet…