

Quantum Physics 105

Holographic Theory

Dutch Physicist Gerard t Hooft and the co-inventor of String Theory, Leonard Susskind proposed the Holographic Principle in 1993. This theory states that all of the fundamental information (physics) in one part of the universe can be equivalent to some information (physics) defined on the boundary of that part of the universe. For instance, all of the information in your PC could be depicted as its shadow cast on the desk. Based on my previous rant, we know that M-Theory tells us we are living in a four dimensional brane floating in a fifth dimensional space-time. That higher dimension could be the real reality of the holographic image we perceive as our own brane existence. So what does that mean? We do not really exist? Are we all Ghosts? Hardly...

The Holographic Theory has gotten a lot of support due to recent discoveries in the field of Black Holes. Maximum entropy or information content, of any region in space is defined by its surface area rather than its volume. The Holographic Bound is how much information can be contained in a specified region of space. Additionally, Black Hole Thermodynamics are allowing physicists to calculate the absolute limits of the holographic bound.

In their paper "The Holographic Bound in Anti-de Sitter Space", Susskind and Edward Witten wrote that the correspondence between string theory in Anti-de Sitter space (In mathematics and physics, n -dimensional anti de Sitter space, sometimes written as AdS_n , is a maximally symmetric Lorentzian manifold with constant negative scalar curvature. It is the Lorentzian analogue of n -dimensional hyperbolic space, just as Minkowski space and de Sitter space are the analogues of Euclidean and elliptical spaces respectively) and super Yang Mills theory (Yang–Mills theory is a gauge theory based on the $SU(N)$ group which proved successful in the formulation of both electroweak unification and quantum chromodynamics (QCD) and all super Yang–Mills theory is Yang-Mills coupled with supersymmetry, i.e. coupled to massless spin-1/2 particles. While it's very much like what is observed in the Standard Model there is one big difference. These fermions transform in the adjoint representation of the gauge group. In other words under the right conditions, this permits an extra symmetry between the gauge bosons and the fermions, called supersymmetry) is an example of the Holographic principle according to which a quantum theory with gravity must be describable by a boundary theory. The problem of course with this is the arguments are incomplete because, while the bulk theory has been related to a boundary theory, the holographic bound saying that the boundary theory has only one bit of information per Planck area has not been justified. Susskind and Witten demonstrated that this bound is the physical interpretation of one of the unusual aspects of the correspondence between Anti-de Sitter space and the boundary conformal field theory, which is that infrared effects in the bulk theory are reflected as ultraviolet effects in the boundary theory. Make sense? I don't quite buy it yet either.

But having said this, let's explore it in more detail. What if, for example, a Black Hole was just the result of a crashing of one the universes servers? The surpassing of

entropy beyond the holographic bound, creating a sheer overload of information in one region of space can exceed the ability to be contained in the surface area.

So Black Holes are caused by too many people logging on?

There is a book out there called *The Holographic Universe*, and in it, its author, Michael Talbot suggests that our world and everything in it are only ghostly images or projections from a level of reality literally beyond space and time.

Ah...the paranormal fog seems to be lifting a bit.

Time will tell if the universe actually is just a tiny reflection of a greater masterpiece. But if it is, then everything is a ghost. The question would then be, where am I really? But don't fret too much on this. The problem that I see with all of this is a common sense one. A wave is a 3 dimensional + time construct. Therefore, sound is a three dimensional + Time construct, as is any other wave for. If the world is really just a 2 dimensional reality, then someone better generate a whole lot of math that makes predictable models, and would allow me to continue being a sound engineer and make a living. But in all fairness, I want to present all the theories here that I can. Just because I don't buy into it doesn't make it any more wrong or righter than the rest of the Quantum interpretations circling around out there.

Information theory

What if the universe is just a very large mega-computer? Remember the Hitchhikers Guide to the Galaxy? Grab your towel and DO NOT PANIC! This theory, developed about 40 years ago to maximize the amount of information that can be transmitted over information pathways, proposes that physical reality is simply pure information. In this view, reality is not the quantum, but the "bit". I would propose that we have John A. Wheeler to blame for Information Theory. The term "IT" came from Wheeler, from the term "Bit", which correlates with his belief that everything physical is made up fundamentally from bits, binary yes or no, or 0-1 indications. In other words, IT states that everything has its foundation in an immaterial source of Bit Soup, or data, and the posing of yes-no conditions result in a response to suggest that the universe is participatory. In 1998, Wheeler compared the universe to a computer, and based on yes-no logic, it was not unreasonable to imagine that information sits at the core of physics just as it resides in the core of a computer. I will look at my computer in a much different way now.

My first question is, who is sitting at the keyboard?

My second question is, what is the universe computing, and are we a part of the output? MIT professor Seth Lloyd proposes that the universe is computing itself. And it has been computing itself since it came into being!

He claims that the first patterns were simplistic, beginning with particles and the basic laws of physics. But as time (which by the way doesn't exist in a 2 dimensional world, Lloyd) passed, the computations became more and more complex, such as intricate and complex patterns of stars and galaxies.

We all know of course that the answer is 42.

He further justifies his theory by offering it as the answer to how complex systems such as living creatures can arise from fundamentally simple physical laws. He further argues

that the need for divine intervention or GOD is not required for IT. This of course appeals to the purely scientific crowd eager to remove any resemblance of Intelligent Design from the final theory of everything. But again I ask, if the universe is a computer, then who sits at the keyboard, clicks the mouse, and watches the video game unfold before his or her eyes?

Just like the movie, *The Matrix*, Information Theory places Humanity in the middle of a system that is controlled by the supercomputer, programmed from seeds of complexity based on laws of quantum and particle physics. But wait...I thought they said that the computer calculated those laws first? How can something that was created first, calculate the laws it is based upon? As I have said, I don't buy into IT being IT. I do concede that Information Theory has a place in the TOE (Theory Of Everything), but only a contributing one.

I am reminded of something Einstein once said. The more I understand about the universe, the more I see the hand of God, or something like that. But what if God were a supercomputer, or at least, some nerdy geek playing on his PC in his mama's basement?

Before you burn me at the stake, let me just say that if the universe really is one big computer, processing reality as a whole, it does offer an explanation for the evolution of systems. Each time it processes, it has access to more information from which to build upon, so the outcome is continually evolving, always expanding. But it doesn't explain how a wave can propagate through a medium, or replace the Fourier Transform. My favorite retort is, it seems that modern man appeared somewhat out of nowhere as a separate species from Neanderthals. Explanation?

I prefer to believe in the hand of GOD.

The scary thing is, while the IT theory fits in rather well with all of the other quantum theories, but I refuse to believe I am a hologram. On the other hand, a hologram may be exactly what a ghost is, but more on that later.

There is a positive spin to this type of theoretical thinking. It has spawned the development of super computers, and is contributing to the creation of the Quantum Computer, complete with high levels of artificial intelligence. That will open a totally new can of worms.

I am gradually working up toward the payoff with all of this, which is *Zero Point Energy*, and wormholes, but before we cross the threshold from "normal" into "paranormal", we need to spend a little time exploring dimensions.