Ask A Genius 27 - Informational Cosmology 3

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December 5, 2016

Scott: One thing comes to mind. The separation in magnitudes between the quantum and the relativistic. Persistent structures such as electrons being locked into orbit around nuclei, protons and neutrons. Those are informationally something. Higher-up, you can get larger persistent structures.

Rick: That's another deal. Where macro world stuff has particular claim on existence, you can't have whatever you want. What you have are things that can exist sitting on a foundation of quantum randomness, the only things that can successfully exist on a macro level are things that can exist in a way that are consistent with quantum laws by taking advantage of the statistics of large numbers.

Where if you can't count on a single atom behaving in a particular way 100% of the time because it is a quantum thing, because it is incompletely defined, and that incomplete definition that allows for a range of possible outcomes, the only way that something can exist at a macro level is by being part of a system that has so many quantum parts to it that quantum uncertainty is statistically dampened to near zero.

So, the same way Hamiltonians and cause-and-effect can exist in a persistent world, a time-based world, because they embody persistent principles, so do macro objects; they can exist in a macro

sense across large spans of time, and definitely in space because they have worked from a quantum foundation.

They have existence in a way that defies quantum uncertainty. The basic principles of existence and non-existence. The things that get to exist are those that are consistent with those principles, which we have some idea of – but not a complete idea of.

Scott: In the macro world, there is fraying of the information that is locked down too. I mean, disorganization happens. Things break down.

Rick: Hawking had the inkling of a theory about 30 years ago. There is the theory of knots. Knots are a weird thing theoretically. The existence of a knot is not quite a thing in itself. It is a thing defined by logical constraints in the structure of a thing that wraps around itself in three dimensions.

Hawking - knot theory was popular a couple decades ago, postulated some theory based on knots in space ad the weave in space, which, I believe, is the interactions among particles seen as woven timelines of these particles. I think it is a legitimate point of view.

That you have particles that are woven together by history of interaction, which is entanglement – almost literally, or literally. If you have enough entanglement among particles, it creates a durable weave of causality and persistence that generates a durable, persistent world, but is still woven and still, as you say, can unravel at the edges.

Where most things are fairly well-defined because of their history of interaction and most macro interactions and because of their continuing interactions, but you can pull at the weave experimentally; you can isolate and magnify uncertainties to make situations and objects arbitrarily large. You can pull causality away from them to create islands of uncertainty if you want to do an experiments with uncertainty.

Also, you can create islands of super-certainty. There's a natural level in our world given the scale of our world of pin-downedness, of definiteness, but you can mess with that. You can manipulate that according to the laws or principles of quantum mechanics. There is always a potential unravelling.

When you talk about entropy, you have these examples that there is always a non-zero chance that you'll suffocate because due to random motion all of the air molecules will be not where you are. They'll always be in the opposite corner, but the odds of that are so low that it has never happened.

Scott: Terence Tao has worked on formulations to see if water can spontaneously blow up.

Rick: It probably can, but by can you're stipulating. A lot of things can happen, but that depends on a definition of can including everything that a non-zero probability. Once you limit can to anything that has enough of a probability that it can happen within a reasonable universe, then

not everything can happen. The math on the air molecules or the math on water exploding is low enough that it can't happen or won't happen within the lifespan of the universe.

Scott: So, can is spatially and temporally variant. It depends on the number on time and the number on space. How much space? How much time?

Rick: They diamonds aren't really forever.

(Laugh)

Rick: They really have a lifespan. Because they are tightly packed, there's a lot of binding energy. That carbon molecules tend to pop off the surface at a certain rate. It is like tempered glass – Pa-ting! Pa-ting! Pa-ting! The rate at which carbon molecules pop off is such that even after 4 billion years. You've still got a diamond. It hasn't evaporated, but if you had a trillion years then it would largely evaporate.

Scott: That would amount to a medium world object with fraying at the edges. Same with DNA. Macro objects would be galactic clusters shedding off stars, planets, galaxies, and so on.

Rick: The universe itself is subject to fraying from two points of view. From the universe as we experience it, being in it, there are various catastrophes that could happen with low probability as

far as we know, which is collapse in heat death. It is the loss of all information in the universe. We get obliterated along with all of the information in the universe.

Then there's the framework where the universe is an information structure within the armature world. Based in some kind of hardware somewhere, that fraying, that loss of the universe, is a low probability possibility across any framework from which you view the universe – as hardware, as a self-consistent mass of information, and as the place in which we exist.

It is not guaranteed to continue to have existence. As long as you characterize guarantee the way you characterize can, you can't guarantee anything that has a non-zero chance of happening. I mean, you can guarantee the existence of the universe for the next 2 minutes because the probability of the universe winking out in the next two minutes is infinitesimally, almost, small.

It is the same issue with can as with guarantee.

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