Comment on Peter Woit's blog („Not Even Wrong") on „Multiverse Mania"

(http://www.math.columbia.edu/~woit/wordpress/?p=4447&cpage=1#comment-104367)

February 22, 2012 at 11:03 am

Peter, I share your reservations regarding the many-worlds-hype (as far as it is a hype), but you have to differentiate:

Max Tegmark's level 1 appears trivial to me, since any possible state must exist within any given approximation at a sufficient distance in a presumed infinite universe. However, proposed numbers for distances are usually quite unrealistic if they are based on mere chance fluctuations (such as "Boltzmann brains") and do not consider an evolutionary universe of given age. (I have never seen realistic estimates for the rate of evolution of specific life forms per volume, for example, but I don't actually care for such trivial doppelgangers at huge distances.)

If you give up homogeneity (as you do in inhomogeneous inflationary models, usually presented at his level 2), you may speculate about all kinds of "landscapes" and ages, including bubble universes and all that, but any estimates must depend on your specific speculation – so here is the true hype.

The original many worlds concept (Everett) is given by his level 3. They do not exist somewhere in space and time, but somewhere else in what we classically call configuration space.* In contrast to all other levels, these many worlds are NOT science fiction, since they are solely based on the empirically well founded Schrödinger equation. (I would instead regard collapse theories or hidden variables, when used to avoid Everett's conclusion, as science fiction.) Unfortunately, David Deutsch introduced considerable confusion, when he turned Everett's proposal into science fiction by considering time travel between different "worlds" (in conflict with Schrödinger and decoherence, for example), or when he regarded quantum computers as calculating in parallel worlds. This parallelism would be no more than the superposition principle. If quasi-classical "worlds" are defined to split according to

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* Note added: Every Everett „world" will in general represent a whole multiverse in the sense of level 1 and 2 – possibly including its own spacetime, even though measurement-type processes would affect the local density matrices only in their causal future.

decoherence, quantum computers have to remain in one and the same world in order to be able to produce results that may be used in our world.

Tegmark's level 4, finally, seems to be based on a confusion between the concepts of physical existence (to be based on observations and experience) and mathematical existence (which means no more than consistency of an otherwise arbitrary definition – usually within a given axiomatic system). This level does not seem to be relevant for physics at all (except that inconsistent formal concepts cannot be consistently used in physics either).

PW's answer:

Thanks for the clear outline of the various "multiverses", which seems quite sensible to me.

One of the more annoying aspects of multiverse mania is the tendency to throw some very different things all together. In particular, there's

1. The "multiple worlds" of decohered quantum phenomena, which are an interesting and very real topic we know a lot about theoretically and experimentally.

2. The cosmological "multiverse" of causally separated parts of what used to be called the universe. These may exist, but require a serious theory, since we have no direct experimental evidence. These are the ones that get exploited by string theorists, giving them whatever properties (different values for anything string theory should be able to explain but can't) they find convenient.

3. Different laws of physics. Once we understand what the fundamental consistent mathematical structure is behind the laws of physics, we may very well find out that it contains pieces disconnected from ours (with different values of some constant, different numbers of dimensions, different gauge groups, etc.). Then if one wants to think of these pieces as "existing", I suppose one can. But we're a long way away from this…