

comp.theory: Re: THIS STATEMENT HAS NO PROOF IN ANY SYSTEM = true or false?

## Re: THIS STATEMENT HAS NO PROOF IN ANY SYSTEM = true or false?

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*From:* Keith Ramsay (*kramsay\_at\_aol.com*)

*Date:* 02/03/05

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examachine@gmail.com wrote:

| Mitch Harris wrote:

| > That is probably so. The emotional reaction I do know I had was with

| > your statement "there can be no such thing as continuum in the physical world", which sounded just too (baselessly) authoritarian to

| > pass up comment.

|

| I do not mean to be authoritative. That would be a Torkelism.

Well, he doesn't generally sling around this kind of loose claim the way you're doing. If you don't want to sound like you're presenting yourself as an authority, stop using such phrases as "just doesn't exist", "it \_cannot\_ exist", "there is no such thing" without giving some solid reason to believe that they're accurate. I think you're just being very glib.

| I think the evidence for a discrete world far outweighs the evidence for a continuous world, which is basically non-existent.

On the contrary, there's essentially no evidence that the world is discrete. Really, there's not much that could reasonably be called evidence in either direction.

If the world were discrete, one could hope to observe the fact by examining it at a small enough scale. In principle, then, one should be able to model it at that level. But none of our best actually working models of the world is entirely discrete.

The approach to quantum gravity known as "spin networks" comes close, but still the state of a system is a superposition of states, where the weights can vary continuously. John Baez has pointed out that it's also consistent to have both a model such as the spin network

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model and a model in which the states are treated as having continuous space. The model is discrete in some respects and continuous in others.

There are problems that naturally arise for lots of ways that you could attempt to produce a discrete model of nature. Ones that treat space as a lattice, for example, tend to predict the existence of "preferred" directions in space, or a preferred state of rest, which we don't see. Getting a discrete model to be relativistically invariant is a bit of a challenge.

| If the world were continuous, then there might be a way to store a real  
| number as a physical property. However, all storage devices have to  
| rely on fundamental properties in the atomic world which are \_all\_  
| discrete, e.g. quantum physics.

Not unless you assume what you're setting out to prove. If we record something on an analog device, there usually is no reason to think that the value being stored is one of a discrete set of possibilities. People read about how the energy levels of a bound system are discrete and get the idea that according to quantum mechanics all quantities are discrete, but it's not so.

A lot of the arguments that are put forth in favor of nature being discrete are really only arguments in favor of nature being modelled by a separable space. In topology a space is separable if it has a countable dense subset. By giving enough discrete information one can (apparently) describe a physical situation to any desired degree of accuracy. But if so that merely means that the state is a point in some separable space, not that there is some ultimate level of precision on which there are discrete steps from one state of the system to the next.

| There is also something called Heisenberg's uncertainty principle.  
Why  
| would I believe that something exists beneath the Planck scale, while  
| our physics tells us that you cannot physically subdivide the Planck  
| scale.

Where does it say that? The Planck length is simply a length small enough that to model physics on that scale, quantum gravity effects have to be taken into consideration.

| There is no such thing, as far as I can tell, as to measure time  
| or space in fractions of the Planck scale. I would of course be  
| interested to know if there is a work that shows the Planck scale is  
| bogus!

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It's not so much that it's bogus, as that you're interpreting what it means in a simplistic way. The state of a small piece of space may well be in a superposition, where the location or identity of points is indeterminate in some way. It doesn't follow that the way to think of them is as a finite or even as a countable collection.

| The problem with that kind of a belief is its similarity to theological  
| "reasoning". There is something called "God" that is fundamentally  
| unobservable, but some people believe in its existence. Substitute  
| God  
| with continuum. (That is I object also on metaphilosophical grounds)

I don't think the analogy is a good one. The only obvious common feature of the two ideas is that you don't like them. You're treating belief that something (like space) is continuous as if it were the positive belief in some exotic entity.

But it's the idea that space is discrete that's the positive claim, not yet observed or verified. If space is discrete, we presumably will eventually have a theory that identifies the individual bits of it and can tell us how large a gap there is, experiments that exhibit the effects of there being such granularity, and so on. This has not happened yet. No, physics does not currently treat space as being made up of little points sprinkled around at around a Planck length apart; it just doesn't.

One common point of view of atheists is that the existence of God is something that similarly might be experience (if only it were actually true), but that so long as they have no such experience, they will opt for the assumption that there is none. Belief in the continuity of space is often of the same form: show us a length scale on which space is made up of discrete points and we'll agree it is, but until then we won't assume that there is such a scale.

Of course it's actually worse than that, because it might be that on some scale nature works to a \*close approximation\* like a discrete model, but on even closer inspection the discrete model also turns out to be inaccurate. So it's not at all clear to me that there can be a final and convincing answer to the question. (Actually, the same issue has been pointed out in relation to theology; it's a little hard to see how one would be entirely sure that any experience one had had was actually of God.)

Continuous models are not necessarily any more complicated than discrete ones, so Occam's razor and the like don't

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guide us away from tentatively assuming space is continuous either.

| The only "evidence" for a continuous world is classical and  
| relativistic physics cast in the language of geometry which makes  
| use  
| of real-valued numbers, that is they are no evidence. (How can a  
| "theoretical assumption" be an evidence?) If we take particle physics  
| seriously, which we should, we cannot say that they are equal ways of  
| describing the world.

| Here, something interesting you might ask: but the wave function is  
| continuous right? Right. Does the wave function exist? I don't think  
| so. It is merely another theoretical instrument.

It's fine to be circumspect about how well your models correspond to reality, but you can't be arbitrarily selective about it. For the time being, the best models we have (simplest and covering the most phenomena) have some kind of continuous element to them. Maybe you think you can see beyond the veil presented by our models of nature, and see that nature itself is one way or the other, but I don't see how. Meanwhile, the best guide we have to how nature is is given by those theories.

I don't consider the continuous nature of theories of physics to be very strong evidence that nature is actually continuous, but I think it's strong enough to refute the glib assertions you've been making here, that a continuum in nature just can't exist.

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In some sense I would say all of this is fairly irrelevant to the meaningfulness of the continuum hypothesis. One way that physics supports the meaningfulness of mathematics is by deducing physical consequences with the use of certain mathematical facts. You would be on much more solid ground if you claimed merely that the continuum hypothesis will not be needed to deduce observable consequences of any physical theory. I think that's probably true.

On one axis, there's a gulf between Platonism and several other philosophies of mathematics. Appealing to physics here might sway some people toward thinking that some mathematical question is or is not directly meaningful, but the Platonist has already bitten the bullet in deciding that the meaningfulness of a question doesn't depend upon there being any way even in principle for us to answer it, either by proof, calculation, or experiment.

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