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Jeff Tollaksen - Is Time Real?

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plus my comment

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(01)- jeff what does your research say about the nature of time this is a perhaps the biggest question one of the most profound questions the nature of time uh there are many different aspects that one has to consider * So far, no great research on "time" has been done by science…; and there are certainly not many aspects of time that man did not invent himself, so there are not many "observed" aspects in reality. (We don't know at all why time here on Earth has the pace of flow we see-feel; we don't know at all whether the pace of time everywhere in the Universe is "stop-state" the same, although scientists come here claiming that the pace of flow here in our terrestrial system is is the fastest and the flow of time is slowing down everywhere else - Prof. Kulhánek says, we do not know at all whether the pace of time has changed in the historical stages since the Big Bang, when ?, and how? ; and we don't even know if "time" has dimensions and how many? we do not know at all "how time curves" and whether this curvature can go as far as wrapping the "packing" of the time dimension; we don't know at all why time has only one arrow of time, etc. So time research is the least researched artifact in the entire physical arena of the World in real life and on paper.) you know there's the time that we experience * in general, experiences are only "emotional, subjective". as human beings this has a certain quality to it it has a direction to it there's an arrow of time so one might ask what is the nature of that well we don't really know is it related to the expansion of the universe perhaps is it related to the thermodynamic arrow of time the direction of entropy so and so forth these things we really don't know this is much debate * on the contrary: there is still little, insufficient debate going on about it however if you ask about the nature of time at a microscopic level when you're dealing with quantum mechanics uh what our group has discovered in the *microworld* is uh absolutely extraordinary features completely different from the way we experience time on a human * in the *macroworld*, or the macro level, which is somehow in the middle of the size scales in space http://www.hypothesis-of-universe.com/docs/c/c_017.jpg level so one thing uh that particularly aharonna who is it ? had started was he noticed that one of the profound and fundamental differences between classical physics and quantum mechanics is that in quantum mechanics as a matter of principle at its very core the nature of the boundary conditions in the

theory is completely different from the boundary conditions in classical physics * (the nature is different in principle) so in classical physics * - in the macro world we know that if you know the state of the universe at one time every other later time is not independent of that state they're all completely slaved in a sense (they are all completely dependent in a sense) because the theory is deterministic you know the state at one point it determines the state at every other point and i know the laws of physics and we know suppose we know the laws of physics we know the way things interact with each other then there's uh it's really just like big machine it's just a clockwork that there's no there's no freedom after you know the state of the universe at one point however in quantum mechanics in principle we cannot know more than what is the basic description um which is given by the wave function even for a single particle this sort of sense of the likeliness likelihood of different properties of the particle to probability so it ends up being a probability but the actual basic mathematical description is isn't even yet a probability i mean you know the probability you can only define if you have many particles you have a whole ensemble and you do many many experiments on it and so and so forth so uh it it turns out that um uh even if you know everything that can be known about a single particle or for the universe for that matter you cannot predict the future like we could do in classical physics so this allows one to say that the most basic description of a particle of a quantum particle allows you to say that you have two boundary conditions the pass of that particle and its future so if you're asking what is the nature of the properties of the particle during the time between its past and its future it turns out that the past and the future play an equal role on an equal footing and so now when you're asking about the nature of time as you can kind of see this is totally different from what happens in classical physics um and uh the one picture that has been very fruitful in terms of making a number of uh very uh important discoveries uh and several different disciplines of physics has been the notion that when we describe a particle we use the usual standard way of thinking about it in quantum mechanics in which you have a state which evolves forward in time and we use a second state which is specified by a just a standard experiment just like we did in the past when we prepared the particle in some definite state that we knew in the future we do another experiment like that and now we have another wave which is actually going in the opposite era of time and so if you're asking about the nature of the time on a quantum mechanical level you have time going in both directions * at the quantum level there is a foam of curved dimensions, which means that the collapse and expansion of dimensions is chaotic and it means that the "direction" of time "alternates" for a while it can go in one direction and in the opposite direction for a while, inside elements time is packed into a ball, ie "the arrow on the dimension points to the right once to the left for the second time as the ball from the time (of course also length) dimension is packed into a ball… and in a sense the the way the properties of the quantum world show up you have to they uh sort of kiss in the present so to speak and one has to devise all kinds of new ways of observing the quantum world to see how this this shows up so you're claiming that the movement from the past to the present is equal * and in other words I described that above to the movement from the future to the present that's right i mean is that a mathematical formalism that you need or is that something that you really have evidence for well there's there's two answers to this first of all uh it's been proven that this way of expressing the theory is in fact equivalent in terms of the predictions it makes the standard way which is time asymmetric so what this means is that in fact you cannot say for sure at this level whether the old way of looking at it the time asymmetric way is the correct way or this new way of looking at it you can't say which one is the correct way and so at this point it becomes a question of well which approach is more useful which approach

(02)- is more interesting does one approach allow you to discover all kinds of new physical phenomena and it's certainly the case with this time symmetric approach that we have made many new discoveries particularly concerning the nature of time where you can distinguish the theories there is a scenario whereby one could say that in fact this time symmetric approach is correct and the old way of thinking about the standard quantum mechanics time asymmetric approach is incorrect and those are situations that we call generalizations of quantum mechanics these are situations where the new perspective the new world view would lead to a new theory which makes predictions which are inconsistent with the old theory and then experimentalists would go out and test to see if those predictions are correct and the implications of this for this time symmetric where the movement from past to future is the equivalent of future to past what are the deep implications for the nature of reality well if one's considering uh generalizations of the theory which can be proven experimentally uh over the standard of understanding the quant time in the quantum realm i'll give you a couple of implications for example one generalization which we created of the theory hasn't been proven yet but it's very natural coming it's very natural to uh to derive it um based on the kind of where we started is um the following question um you know our view of the nature of time uh came out from ancient really ancient times uh **Parmenedes** in particular i believe um which he said the way we should think about the universe is that the universe you know exists with objects unique objects which simply change their state and time but it's the same object from one moment to the next right that's i'm just sort of we've accepted this way of thinking about the universe however around the same time in you know the ancient greeks um there was a very different way of thinking about the nature of time which just you know didn't catch on this is uh from **Heraclitus** and **Eric Clardy's** you know not many of his words survived all this time but one of them goes something like this he said you never bathed twice in the same river and one way of interpreting that is that in fact each moment of time it's not the same universe it's not the same object as it was a second ago or a hundred years ago but literally each moment of time is like a new universe* that is, every second (on our watch) the Universe in the "stop-state" is different, the same Universe has a different configuration is it something completely new it gets reborn again and again * no, it is not born, but its states change by the curvature of dimensions and so one might ask is it possible to reformulate our basic physics in a way that's consistent with that idea * why demolish basic physics? ; suffice it to note that "everything" in the Universe changes-changes, except for those "things" that never change, such as elementary particles or laws and you can prove that it is impossible on a quantum level uh to do it with the standard what a time asymmetric way of thinking about quantum mechanics a one direction a one direction arrow of time the only way you could do it if you want to have such a picture is to use the time symmetric approach where the past plays well the future plays as much a role in the present as as the past and so using that an example of a generalization we were able to reformulate the whole theory in such a way that quite literally it's very beautiful mathematical theory * it doesn't sound right to me, it doesn't fit me right literally every moment is like recreating the universe again and again and again it's a kind of a psychological illusion that we think that the self i was a fraction of a second ago is the same self i am now but it works very well the way it works is we're we have connections across time so to speak you know we have we're entangled with different moments and this entanglement is what actually provides the the continuity in the physics that's just one example to show how the nature of time * (***time is not running out for us, but we run for him***, see HDV interpretation) can be profoundly different in this view and actually profoundly different from a quantum perspective when compared to a classical physics perspective

I have no other remarks. If I did, I would keep repeating myself.

JN, 01.10.2021