https://www.youtube.com/watch?v=CTpp0EChDbI

Are we made of math?

92 410 see
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Sabine Hosenfelder + my opinion in red to the Czech translation

00:00
(01)- There's a lot of mathematics in physics, as you have undoubtedly noticed. But what's the difference between the math that we use to describe nature and nature itself? Is there any difference? Or could it be that they're just the same thing, that everything *is math? That's what we'll talk about today. I noticed in the comments to my earlier video about complex numbers that many people said oh, numbers are not real. But of course numbers are real. * Numbers are real in mathematics, ie in the human abstractions we use to describe reality. They are not "physically real" in the Universe. Mathematics describes physical reality. Without mathematics, physical reality would also exist. Pain is a state of the human organism, it is real "as an interaction" of mass atoms or chemical or biological compounds ..., so "pain" speaks of the state of reality, numbers do not. !! If we have a mess of numbers chaotically "spit" on paper, they will say nothing about reality or physics. Here's why. You probably think I am "real". Why? Because the hypothesis that I am a human being standing in front of a green screen trying to remember that the "h" in "human" isn't silent explains your observations. And it explains your observations better than any other hypothesis, for example, that I'm computer generated, in which case I'd probably be better looking, or that I'm a hallucination, in which case your sub consciousness speaks German und das macht irgendwie keinen Sinn oder? We use the same notion of "reality" in physics, that something is real because it's a good explanation for our observations.* Our observation of reality does not have to be "real reality" yet, nor is mathematics (the content of mathematics) an observation of reality and therefore not "real". I am not trying to tell you that this is The Right Way to define reality, it's just for all I can tell how we use the word. We can't actually see elementary particles, like the Higgs-boson, with our own eyes. We say they are real because certain mathematical structures that we have come up with describe our observations *What Sabina just said is not good. We humans often behave by "inventing" a theory supported by "fictional numbers-equations" and then (only then) looking for reality…; in the case of the Higgs-boson, we searched for it "furiously" to suppress our "collapsed pride" if it didn't work out. But we could suggest anything "for Higgs" - in numbers and predictions - and we would find Higgs anyway, bychom we would find him in a hot dog. If we want to defend our vanity. The Hoggs-boson "suggested" and "therefore" we found him. I am convinced that if we "designed" axion, tachyon, etc. "(or *Beelzebub*), we would also find it in those" numbers and mathematical abstractions. ". Same thing with gravitational waves, or black holes, or the particle spin. * These abstractions describe the "observed reality." The spin of particles, if it is real, then we can "describe" it by numbers = mathematics. But the fact that we can "make math" = description !!! for spin, there is no guarantee that the particle in reality abounds in spin. And numbers are just like that.* They are a designed character description of reality Of course we don't see numbers as objects walking around, * O.K. Man is a physical reality. If

we want to describe this reality (man) with "numbers", it may be possible, but it is uncomfortable, complicated. (Similarly, it is inconvenient to write the interactions of nuclear physics in a two-character system as HDV does. http://www.hypothesis-of-universe.com/docs/eb/eb_002.pdf. Therefore, the "old" notation technique will be more useful even if it turns out to be true. on the side of two-character real estate). But you can't make a man out of numbers !! but as attributes of objects, like the spin that is a property of certain particles, not a thing in and by itself. * Mass is also a "property" of mass particles (25 basic particles) and from them "mass conglomerates" such as atoms, molecules, compounds, biological structures. Each assembly of simple "components" has its own original feature If you see three apples, three describes what you see, therefore it's real.* No, the number three, ie the three, does not describe the "object of reality" (three apples is the same as 2 billion apple atoms.) Again, if that is not a notion of reality you want to use, that's totally okay, but then I challenge you to come up with a different notion that is consistent and agrees with how most people actually use the word.* And that's what it's about. I will take reality and "describe it" by some abstraction, for example, I will take Hubble's observation and describe it "as an expansion of the universe" and I will claim that my abstraction is true. No, Hubble was wrong, the universe does not expand, but "the curvatures of the dimensions of space-time expand," which is based on "new mathematics", new numbers, new abstractions based on the same observation.) and to claim that these observations "fit" on abstract mathematics adapted to this. Interestingly enough, not all numbers are real. The example I just gave was for integers. But if you look at all numbers with infinitely many digits after the decimal point we don't actually need all those digits to describe observations, * Sure. We do not need "only" numbers popisu to describe reality ((Above all : mathematics is "number times number"; physics is "number times physical quantity, object of reality")) , because we cannot measure anything with infinite accuracy. In reality we only ever need a finite number of digits. * We need ; The universe doesn't need it. Now, all these numbers with infinitely many digits are called the real numbers. Which means, odd as it may sound, we don't know whether the real numbers are, erm, real.* The numbers are real, necessary for the chosen abstract notation technique, but they are not necessary "for the existence of that reality." There are laws that don't have to be built just "on the base of numbers," with the support of numbers; maybe they don't contain laws or numbers, they don't need them But of course physics is more difficult than just number. For all we currently know, everything in the universe is made of 25 particles, held together by four fundamental forces: gravity, the electromagnetic force, and the strong and weak nuclear force. Those particles and their forces can be mathematically described * Sabina confirms my opinion that "numbers" are only a physical description of the reality, numbers that are more complex in themselves are not the reality itself. by Einstein's Theory of General Relativity and Quantum Field Theory, theories which have been remarkably successful in explaining what we observe.* Explanation-description of reality can be successfully done by anything meaningful, and it does not have to be just "numbers - mathematics" and equations, as my opponents have argued for 2 years in discussions, that the universe cannot be described using HDV, for example. For what the science is concerned, I'd say that's it. But people often ask me things like "what is space-time?" "what is a particle?" And I don't know what to do with questions like this. * That's sad ... the cosmologist should know. My HDV primarily !!!! addresses these two issues, they are crucial and crucial Space-time is a mathematical structure * Error, big error, absolute error. Spacetime is a "physical artifact," not a "mathematical artifact." Physical artifact which is "presented" by 3 + 3 dimensions in the geometric form of two phenomena = quantities "Length" and "Time". These are also the "building blocks" of matter, as well as physical fields, ie basically forces and other physical derived quantities. Spacetime is not a mathematical structure, but it can be described as a smooth (but also grainy) network, raster, yarn, 3 + 3 dimensions of two

quantities "length and time", where those dimensions are not mathematical but physical artifacts. that we use in our theories.* In theories we use the physical quantities, especially "length" (three dimensions as space-on) and "time" (as "time-on" also with three dimensions) This mathematical structure is defined by its properties.* Properties have dimensions, not a "mathematical structure". Even all the properties of everything in the universe come from the curvature structures of those dimensions, not from the structures of mathematics. Space-time is a differentiable manifold with Lorentzian signature, it has a distance measure, **space-time "has no" scale, but we humans can choose intervals on dimensions. Perhaps it can be said that the Universe itself "quantizes" dimensions into units of intervals, both time and length, and puts them into mutual relations. it has curvature, and so on. It's a math thing.** * The curvature of dimensions does not have to be a "mathematical thing", but the curvature can be described by mathematics, using mathematics. As I say, mathematics is here to describe reality, not reality itself We call it "real" because it correctly describes our observations. * We can describe real observations with everything possible and therefore well and badly It's a similar story for the particles.* ?? ← I would (quite) be interested in what Sabina meant by that.

(02)- A particle is a vector in a Hilbert space * oh god, horrrror… particle is a physical reality = in the Universe and not on paper in "HHH space", and if it is DESCRIBED by humans, then that "description" of a particle may be a vector in "" Hilbert "" space " ", Which again is not a physical space, but a human construction-abstraction on paper, .. that transforms under certain irreducible representations of the gauge groups. That's the best answer ? we have to the question what a particle is.* I know a better answer. Again we call those particles "real" because they correctly describe what we observe. So when physicists say that space-time is real or the Higgs-boson is real, they mean that a certain mathematical structure correctly describes observations.* In this sense, yes, space-time is real, but not by the fact that we humans describe it correctly / incorrectly in mathematics and with the help of numbers. But many people seem to find this unsatisfactory. ☺ Now that may partly be because they're looking for a simple answer and there just isn't one. !! But I think there's another reason, it's that they intuitively think * (who thinks?, ..the seekers?) there must be something more to space-time and matter, something that distinguishes the math from the physics.* Definitely yes. Surely there must be more in physical reality than there is in mathematical reality on paper - which is just a description of reality. Something that makes the math real or, as Stephen Hawking put it "Breathes fire into the equations". But those mathematical structures in our theories already describe all our observations. This means just going by the evidence, you don't need anything more.* It is not true. The evidence is changing because theories change every century… people find better and better theories. It's therefore possible that reality actually is math, * fundamental disagreement with me… that there is no distinction between them. * In my opinion, there is a fundamental difference between them: physical reality cannot be changed, but the description of this reality by mathematics can always be changed by using "different and different" mathematics - we change mathematics, not reality. This idea is not in conflict with any observation. ☺ ☺ The origin of this idea goes all the way back to Plato, which is why it's often called Platonism, though Plato thought that the ideal mathematical forms are somehow beyond human recognition. The idea has more recently been given a modern formulation by Max Tegmark who called it the Mathematical Universe Hypothesis. * There can be as many mathematical (!) Universes as Tegmark can think of Tegmark's hypothesis is actually more, shall we say, grandiose. * ☺ ((HDV is also grandiose)) He doesn't just claim that actually reality is math but that all math is real.* Before the birth of man, mathematics did not exist and yet there was a physical reality (in the form of changes in the curvature of space-time dimensions and thus everything happens

together with the sequence of new and new laws, which also "comes" from changes in curvatures of space-time dimensions). Not just the math that we use in the theories that describe our observations, but all of it. The exponential function, Mandelbrot sets, the number 18, they're all real * ☺ The real on the paper… in the binoculars you will not find-you will not see. (In physical reality, only changes in the curvatures of dimensions of quantities according to the laws skutečné are real, and these do not have to be "mathematical") as you and I. If you believe Tegmark. But should you believe Tegmark? Well, as we have seen earlier, the justification we have for calling some mathematical structures real is that they **describe** what we observe.* Mathematical "structures" are real "on paper" in the sense that we use them to describe reality…, **but it is not necessary** to use only mathematics to describe them. This means we have no rationale for talking about the reality of mathematics that does not describe what we observe, therefore the mathematical universe hypothesis isn't scientific. This is generally the case for all types of the multiverse. The physicists who believe in this argue that unobservable universes are real because they are in their math. I agree But just because you have math for something doesn't mean it's real. I agree You can just assume it's real, but this is unnecessary to describe what we observe and therefore unscientific. I agree Let me be clear that this doesn't mean it's wrong. It isn't wrong to say the exponential function exists, or there are infinitely many other universes that we can't see. It's just that this is a belief-based statement, not supported by evidence. O.K.What's wrong is to claim that science says so. O.K.Then what about the question whether we are made of math? Well, you can't falsify this hypothesis. Suppose you had an observation that you can't describe by math, it could always be that you just haven't found the right math. O.K. So the idea that we're made of math is also not wrong but unscientific. You can believe it if you want. * Maybe proof would be found. I am not "made of mathematics"!…; however, for the masters of physical theorists, the strings are "out of nowhere" - they just forgot to prove it..There's no evidence for or against it. I want to finish by saying I am not doing these videos to convince you to share my opinion. I just want to introduce you to some topics that I think are thought-stimulating, and give you a starting point, in the hope it will give you something interesting to think about.* (.. which is not the case in the Czech Basin, there the new hypothesis of HDV causes madness, insult and hatred and persecution) This video was sponsored by Brilliant, which is a website and app that offers a large variety of courses on science and mathematics. The math that we learn at school is really just a tiny part of all the known mathematics, and if you want to get an idea what else there is in the world of mathematics, Brilliant is a great starting point. Their courses are interactive so you'll be challenged with questions along the way which allows you to check your understanding. If you liked this video you may for example want to check out their Mathematical Fundamentals course, which covers a mix of logic, number theory, and algebra. To support this channel and learn more about brilliant go to brilliant dot org slash sabine and sign up for free. The first 200 subscribers using this link will get 20 percent off the annual premium subscription. Thanks for watching, see you next week.
Thank you. I welcome (finally) the message, the response from Sabina herself
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