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

Are we made of math?

Jsme z matematiky ?

92 410 zhlédnutí
31. 7. 2021
Sabine Hosenfelder (+ my opinion in red to the Czech translation)

As you have no doubt noticed, there is a lot of mathematics in physics. But what is the difference between the mathematics we use to describe nature and nature itself? Is there a difference? Or can they be exactly the same, that everything * is math? We'll talk about that today. In the comments to my previous video on complex numbers, I noticed that many people said the numbers were not real. But the numbers are real, of course. 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 body, it is real "as the interactions of mass atoms or chemical or biological compounds ... so that "pain" speaks of the state of reality, numbers do not. !! Here is the reason. You probably think I'm "real." Why? Because the hypothesis that I am a human being standing in front of a green screen and trying to remember that the "h" in a "human" is not silent explains your observation. And does that explain your observation better than any other hypothesis, for example, that I am computer-generated, in which case I would probably look better, or that I am hallucinating, in which case your subconscious speaks German and das macht irgendwie keinen Sinn oder? In physics, we use the same term "reality" that something is real because it is a good explanation for our observations. Our observations of reality may not yet be "real reality," nor is mathematics an observation of reality, and therefore not "real." I'm not trying to tell you that this is the right way to define reality, it's just all I can say for me. how we use this word. We don't really see elementary particles like the Higgs boson with our own eyes. We say they are real because certain mathematical structures we came 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 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 wanted to defend our vanity. Hoggs-boson "I designed" and "that's why" we found it, and I'm convinced that if we "designed" axion, tachyon, etc. "(or Beelzebub), we'd also find it in those "numbers and mathematical abstractions." It doesn't have to be the discovery of Higgs-physical particles. The same with gravitational waves, black holes, or the rotation of particles. These abstractions describe the "observational reality." The spin of a particle, if it is real, then we can "describe it" by numbers = mathematics. But the fact that we can "make math" = a description !!! spinning abounds. And the numbers are just like that. They are a proposed description of reality. Of course, we don't see numbers as objects passing by, O.K. Man is a physical reality. If we want to describe this reality (man) with "numbers", it may be possible, but it's damn complicated. However, it is not possible to make a person out of numbers !!, but as attributes

of objects, such as rotation, which is a property of certain particles, not a thing in itself. Mass is also a "property" of mass particles (25 basic) and of them mass conglomerates such as atoms, molecules, compounds, biological structures. If you see three apples, the number 3 describes what you see, so it is real. No, number three is a description of reality (three apples is the same as 2 billion atoms Again, if it's not the concept of reality you want to use, it's perfectly fine, but then I urge you to come up with another concept 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 is not expanding, but "the curvatures of the dimensions of space-time are expanding," which is based on "the same mathematics, new numbers, new abstractions." Any observation of reality can be "mounted on fictional theories" (see Higgs-boson) and it can be argued that the observations "fit" on the abstract adapted to that mathematics." Interestingly, not all numbers are real. The example I have just given was for integers, but if you look at all numbers with infinity many decimal digits u comma, in fact, we don't need all these digits to describe the observation, Sure. We don't need "just" numbers to describe reality ..,., Because we can't measure anything with infinite accuracy. Measurements are subject to the "laws of mathematics," and are not necessary for reality. In fact, we only need a finite number of digits. We need it, the Universe doesn't need it. All these numbers with infinitely many digits are called real numbers. Which may sound weird, we don't know if the real numbers are, um, real. Numbers are real in abstraction, but they are not necessary “for the existence of reality.” There are laws that do not have to be built only “on the base of numbers,” with the support of numbers But physics is obviously more difficult What we know today, everything in the universe is made up of 25 particles that hold together four fundamental forces: gravity, electromagnetic force, and strong and weak nuclear forces, which can be mathematically **described** by Sabina confirms my view that "numbers" are only a physical **description** of the reality, not the reality itself. Einstein's theory of general relativity and quantum field theory, which are theories that have been extremely successful in explaining what we observe. Explaining reality can be done successfully by anything, and it doesn't have to be just "numbers" and equations. As for science, 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 such questions. That's sad ... the cosmologist should know. Space-time is a mathematical structure, error, big error. Space-time is a structure of artifacts that "carry" reality and are a phenomenon-quantity "Length" and "Time", It is not a mathematical structure, but it can be described as a smooth - but also grainy - network, raster, yarn of dimensions of two quantities "length and time" where those dimensions are not mathematical but physical artifacts that we use in our theories. This mathematical structure is defined by its properties. Properties have dimensions, not “mathematical structure.” Even all properties of everything in the universe come from curvature structures of those dimensions, not mathematics structures. Space-time is a differentiable variator with a Lorentz signature, it has a scale of distance, 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, has curvatures, etc. It is a mathematical thing. The curvature of dimensions does not have to be a "mathematical thing" but the curvature can be described by that mathematics. As I say mathematics, it is here to describe reality, not reality itself) We call it "real" because it correctly describes our observations. We can describe real observations as good and bad as possible. It's a similar story for particles. ?? ← I would (quite) be interested in what Sabina meant.

A particle is a vector in Hilbert space, oh god, horror - a particle is a physical reality and if it is DESCRIBED by humans. Then the "description" of a particle may be a vector in Hilbert's "space", which again is not physical space but human abstraction on paper, which transforms under certain non-reducible representations of groups of gauges. That's the best answer to the question of what a particle is (I know a better answer.) Again, we call these particles "real" because they correctly describe what we observe. So when physicists say that space-time is real or the Higgs boson is real, it means 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 by numbers. However, many people do not seem to be satisfied. ☺ Now it may be partly because they are looking for a simple answer but none just exists. (!) But I think there is another reason, and that is that they intuitively think (who? Those seekers?) That in space-time and matter must be something more, something that distinguishes mathematics from physics. Certainly. There must be more **in physical reality** than there *is on mathematical reality* on paper - which is not and only a description of reality. Something that makes mathematics real, or, as Stephen Hawking put it, "breathes in the fire of equations." . But these mathematical structures in our theories already describe all our observations. That is, following the evidence, you don't need anything else. This is not true. The evidence is changing because theories change every century… people find better and better theories. It is therefore possible that reality is in fact mathematics, for me a fundamental disagreement…that there is no difference 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 be changed by always using "different" mathematics - we change mathematics, not reality This idea does not contradict any observation. ☺ The origins of this idea go back to Plato, which is why it is often called Platonism, even though Plato thought that ideal mathematical forms are somehow beyond human knowledge. The idea recently received a modern formulation from 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, say, grandiose. ☺ Not only does he claim that reality is in fact mathematics, but that all mathematics 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 spatiotemporal dimensions and this happens. All together with the sequence of new and new laws theories that describe our observations, but everything ☺ ☺ The exponential functions, Mandelbrot sets, number 18, are all real (← on paper.). In physical reality, only changes in the curvatures of the dimensions of quantities according to the laws skutečné are real, and these do not have to be "mathematical". like you and me. If you trust Tegmark. But should you trust Tegmark? As we have seen before, the rationale 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 This means that we have no reason to talk about the reality of mathematics, which does not describe what we observe, therefore, the mathematical universe hypothesis is not scientific. This is generally the case for all types of multiverses. Physicists who believe this claim that unobservable universes are real because they are in their mathematics. (Agree.) But just because you have math for something doesn't mean it's real. (Agree.) You can only assume that it is real, but it is not necessary to describe what we observe, and therefore unscientific. (Agree.) Let me make it clear that this does not mean that it is wrong. It is not wrong to say that an exponential function exists, or there are an infinite number of other universes that we do not see. It is only a statement that is based on faith and is not substantiated. (O.K.)
Which is wrong to say that science says so. (O.K.) What about the question of whether we are from mathematics? You cannot falsify this hypothesis. Suppose you have an observation that

you can't describe with math, it can always be because you just haven't found the right math. (O.K.) The idea that we are created from mathematics is also not bad, but it is unscientific. You can believe it if you want. There is no evidence for or against. Perhaps the proof would be found. I'm not made of "mathematics" - but for masters of physical theorists, the strings are "out of nowhere" - they just forgot to prove it. In conclusion, I don't make these videos to convince you to share for my opinion. I just want to introduce you to some topics that I think stimulate you to think about and that's what I'm talking about when I'm creating HDVs and give you a starting point, hoping to give you something interesting to think about. which is not the case in the Czech Basin, there the new hypothesis of HDV provokes insanity, insult and hatred and persecution This video was sponsored by Brilliant, a website and application that offers a wide range of science and math courses. The math we learn in school is really only a small part of all the known mathematics, and if you want to get an idea of what else exists in the world of mathematics, Brilliant is a great starting point. Their courses are interactive, so you will be asked questions along the way that will allow you to test your understanding. For example, if you enjoyed this video, you can check out their Mathematical Fundamentals course, which includes a combination of logic, number theory, and algebra. To promote this channel and learn more about diamond, go to brilliant dot org slash sabine and sign up for free. The first 200 subscribers to use this link will receive 20 percent of their annual subscription. Thanks for watching, I'll see you next week. (Thank you.)

Out of desperation (that my candle is already burning) and that I don't have money for a consultant and translator, I translate my texts into English myself using google

JN, 04.08.2021