Aa 152 pro english

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What's wrong with physics? | Sabine Hossenfelder

Co se děje s fyzikou ?
73 374 zhlédnutí
10. 6. 2021
(my comment is in red)

00:00
[Music] Hi everybody thanks for coming for this talk i've taken some inspiration from a leonard cohen quote that you've probably heard there is a crack in everything that's how the light gets in and so jumping off from that i want to talk about the cracks in the foundations of physics in the foundations of physics we have theories that are extremely well confirmed by observational evidence but they also have some shortcomings so we have some puzzles that we know really really need an answer and i briefly want to go through what i think are the most pressing problems in the foundations of physics um that's for starters there's dark matter which you've probably heard of so if we look out into the cosmos and we look at stars in our own galaxy or other galaxies or galaxy clusters then we have trouble explaining what we are seeing there if we only use the type of matter that we have experimentally found here on earth so um it doesn't really matter if we are looking at the velocities of galaxies and galaxy clusters or the cosmic microwave background or just the overall galactic filaments the way that they are forming it's just not working out properly in our theories
I have the following views and links against dark matter :
http://www.hypothesis-of-universe.com/docs/aa/aa_017.pdf
http://www.hypothesis-of-universe.com/docs/aa/aa_031.jpg
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and so one of the solutions that physicists have come up with is to say well there has to be a new kind of matter * It's not a solution or a solution, it's just an idea for a solution. The idea is not a reality, and the evidence is lacking that's out there in the cosmos which is called dark matter and though it's not a particularly great name uh it would be better to call it transparent dark matter because it it's not that it absorbs light it does not interact with light at all so that that's a way to reconcile the observations with our theories it's not the only way another way to do that is to postulate that actually gravity works differently than Einstein taught us and that's called modified gravity either way there's there's something in our theories ** One of the "modified suggestions" for the problem of gravity in the galaxy is mine, where I believe that physicists make the mistake of finding the reason "why the arms of galaxies move faster than they should" that they fit into Newton's equation **$F = G. M . m / r^2$** ; for this, "**r**" substitutes the distance between two bodies, while in the galaxy there is already such a large curvature of space-time (from our observatory) that it is necessary to substitute the distance in the arc for that line, not the shortest distance. **that we are missing and uh we need a solution to that um possibly connected to that is the problem * I just offered it to you. When you use it, you will find that no dark matter is missing in the galaxy that we don't know what the quantum properties of space and time are we do have theories for matter that is described by quantum mechanics or more specifically by quantum field theories so we know that particles have quantum properties and they can do weird things like being in two places at the same time and they obey Heisenberg's uncertainty principle we also know as Albert Einstein taught us that matter or more generally all kinds of energy causes space and time to curve so the problem is * So the problem is also, and big, that physicists have not taken my proposal into account and are blind to it. (since 2001, when I put it on the internet for the first time)..(To this day, no one in 20 years has commented on my opinion: to insert a line in an arc in the galaxy into Newton, whether it is right or wrong… , while hundreds of Czech physicists have read it) if you have a piece of metal like a little particle that has quantum properties and is kind of neither really here nor there but actually in two places at the same time then what happens with the curvature of space-time einstein's theory of general relativity can't tell us because * and what is the result when time and space are "quantized"? it doesn't know anything about quantum properties so that's a problem it's just mathematically it's an inconsistency that requires a solution one of the ways to resolve this problem is to quantize space and time and obtain what what's normally called a theory of quantum gravity um which we don't have * This is possible, but what does this have to do with the fact that galaxies are lacking in matter because it says "substituting" into Newton, ie to behave according to Newton? yet um another possibility is that there's something about um quantum theories that we don't understand so that's the other way uh to potentially resolve this problem no one really knows how to do it and then let me name a third problem which is that in in quantum mechanics we don't really know how measurements work so quantum mechanics is a theory for for small things basically * Why not solve the transition from the positions of quantum

mechanics to gravity by "unpacking the dimensions of čp" ?? … Both the physical field and matter are built of "curved dimensions of 3 + 3D space-time" um in principle it also applies to large things but in in these cases the effects are so small that we can't observe them so for practical purposes it's a theory for small stuff like single particles maybe atoms and the problem is in this theory the measurement process is kind of not properly described it's just there exomatically in the theory um we use something that's called a measurement and then we calculate the probability for getting a particular outcome but the theory does not actually explain what the measurement is so if quantum mechanics was a theory for small particles and your measurement apparatus is made of these small particles and the theory should actually tell you just what a measurement is and how it works but it doesn't um so this is another of the cracks in the foundations of physics uh before i go on i want to tell you a little bit more precisely what i mean by foundations of physics um what i mean with that is a particular area of physics so physics has a lot of different areas that are the areas that i'm not talking about for example there's um solid state physics condensed metaphysics atomic physics nuclear physics optics quantum optics plasma physics and so on and so forth so so that's all parts of physics that i'm not talking about i'm talking about those areas of physics where of QM and OTR we deal with the natural laws that can for all we presently know not be derived from any underlying theory and that's general relativity which i already talked about that's Einstein's theory which tells us that gravity is really an effect of the curvature of space and time and then on the other side we have the theory for the matter in the universe which is quantum mechanics or quantum field theories and the particular properties of the particles and their interactions that are collected in what's called the standard model of particle physics * Here it is necessary to reconsider the theory of mass structure, according to HDV. now what's happening in these areas uh not a lot general relativity is more than 100 years old and the the development of the standard model *It is still just a model "in the chosen sign language". The letters describe reality in proper modeling. Even if the model is correct, we still do not know the essence of reality. Here is my HDV design. The "model" did not address "what the elementary particles are from"; only string theory set itself the task, but did not solve it… was largely completed in the mid 1970s and ever since then the foundations of physics have remained unchanged so we have added some constants to those theories for example you may have heard that 20 years ago it was discovered that the cosmological constant which is a constant of nature is not zero as has had been assumed for a long time but it's actually small and has a positive value um the cosmological constant determines the expansion of the universe so if it's um positive it means that the universe is not only expanding but that this expansions are actually speeding up um so we have added this constant to general relativity um but actually it was already introduced originally by einstein so it's it's definitely not a new thing um in this in the standard model um we have added masses for a particle that's called the neutrino but the theory for this um goes back to the 1950s there also in the 1970s there were several of the particles of the standard model that had not yet been experimentally confirmed um it's taken until um the mid-90s to observe um all the quarks that are in the standard model and the final particle in the standard model uh was experimentally confirmed in 20 and 12 that's the so-called higgs boson * my views on the Higgs boson and the Higgs mechanism are here →

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but also in this case the theory goes actually back to the 1960s so um you know um we we have not made any progress uh on these big problems the cracks * **maybe because you ignored HDV** on the foundations that i was talking about um earlier how have physicists reacted to that well there's a lot of talk about crisis crisis crisis in particular if you look in the media but if you talk to physicists and uh you know i would encourage you to to to do that you know if you run into a physicist ask them they will probably um try to tell you that there's no such thing as a crisis in the foundations of physics and one of the one of the main reason i think why they would say that is that if you're yourself working in a particular area then it certainly looks like there's a lot happening because there are always papers being written their conference (It has been 40 years for my HDV hypothesis before anyone notices it and starts thinking about it. If I knew the math, HDV would have been completed and studied around the world long ago.) is being held you know there are seminars that you go through and you have very engaging uh conversations and so on so so if if it's happening right in front of your nose and it looks like um there's really um a lot progress being made but nothing seems to be coming out of it um the other the other thing that emphasis always tell O.K.me um is that i'm just too impatient you know why all this talk about stagnation these are really tough problems and it just takes some time to figure out how the universe works O.K.and everyone has their own favorite example that they name here for example it took 100 years from the discovery of atomic spectrolines to them ultimately being explained due to quantum mechanics so the discovery was around in the 1820s and then they were explained around the 1920s or it took 30 years from the hypothesis of neutrinos so then being experimentally confirmed and this is all well and fine but what these arguments neglect to take into account is that at this time there were far fewer physicists um trying to actually solve these problems so today we have many more phrases than 200 or 100 years ago and the fair comparison would be to count working hours so i've i've done a little uh numerical exercise uh for you um the number of scientists is exponentially increasing um not only in physics but generally in all disciplines
because no one has read HDV yet
um actually if you compare physics with other disciplines of science it turns out that physics is one of the slower growing disciplines probably just because it's it's fairly old already and now if you know this factor by which it is increasing you can calculate it back and and ask what's the comparison between the working hours back then to the working hours um today um it just just to give you an idea how much this number has changed if you look at the data from the american physical society and the german physical society then the number of physicists has increased by about a factor 100 in the past 100 years and i'm i'm i don't know i do not know but i'm guessing that is probably pretty much the same in most of the developed world so now you can guess how much working time starting today corresponds to 40 years working time starting 100 years ago okay so um i'll leave you guys um five years eight years three years um it's 14 months if you go by working hours only businesses today should be able to do in 14 months what a century earlier took 40 years so i i dare to say it's it's fair to call it a stagnation (!) we have known of **a)** dark matter and the lacking **b)** quantization of gravity **c)** plus unfinished string theory since about 100 years um this this has been known in in the 1930s okay so that's not 100 years but 90 years but it's a long time and given that the number of physicists is increasing exponentially * I'm still alone and alone for HDV ... and alone. Unbelievable that in 20 years of HDV presentation on the Internet there was no one who would at least try !!! Understand HDV and think about it. um i i think it's it's not a good argument to say that well in the past we had also faces where not a lot has happened and in any case the slowdown per se in and by itself is not what worries me uh what merge what

worries me is not that physicists have trouble solving difficult problems uh because i know how it is you know um but my my worry is that um they have put forward and continue to put forward thousands of hypothesis to solve these cracks on foundations of physics that all turn out to be wrong and yet they do not change their methodology* unfortunately physicists in the Czech basin **in principle !!!! and intentionally !!!** they don't read HDV out of hatred for me and HDV hasn't gotten into the world yet**…; in 20 years I haven't received any professional response: what's wrong with HDV and why it's wrong.** so i i have good reason to think there's something really seriously going wrong and that's what worries me so exactly what is going wrong well the problem is that physicists rely on beauty to try and make progress in the foundations of physics they think that the theories that they have are not pretty enough they have certain shortcomings and the mathematics is not as nice as they would want it to have and then they invent prettier theories and then they are surprised if no evidence is found that supports those theories um this image that i have here shows the root diagram of e8 e8 is a particularly big symmetry group that a lot of people like and then they come to think that certainly this pretty mathematics must have something to do with the foundations of physics they are largely unaware that this is what they are doing because these requirements of beauty have become mathematical standards so physicists are today pretty much taught that it's good if a theory which they develop fulfills certain criteria of beauty for example it has a lot of symmetry it has a lot of unified structures it fulfills the mathematical criterion that's called naturalness and so on and so forth and um too many of them don't reflect on what they are doing um why is this a good criterion to even use um now some philosophers have told me that i i should not call this um ideals of beauty but i should instead call it metaphysical requirements um other people have told me i should just call it um beliefs um you know doesn't really matter what you call it i think all of this is kind of correct uh the reason that i call it um ideals of beauty or appeals to beauty um is that i think historically that's where it came from if you look back into the into the history of physics then originally you had this very strong tie between physicists believing that the laws of nature are beautiful and believing that the laws of nature were made by god and certainly if god made them they have to be beautiful so there was this link there and then over the course of time physicists have stopped talking about god but they still hold on to this idea that certainly the foundations of physics have to be beautiful in a very particular way um so this is what why i call it uh appeals to beauty but it's also correct to just call it metaphysical requirements so i now want to tell you um a little bit in more detail just exactly what what problems this causes uh to go through some um predictions that have been made using these ideals of beauty that did not pan out starting with a particle that's called the axion the standard model contains a number that's the so-called setup parameter that is small physicists think it's ugly um that that's this criterion of naturalness that i was mentioning earlier um there just shouldn't be any small unexplained numbers in the theories um they have therefore tried to make the standard model prettier and this prettier theory predicts a new particle which is the axiom now this axion was proposed in the 1970s and it was pretty much immediately ruled out it just crudely in conflict with uh observations and what happened then and this is this is symptomatic uh for what would happen later over and over again um they did not discard this idea of there being a new particle um based * ha-ha, all ideas are based on ideas, (even fairy tales for children) on this idea that the standard model has to be beautiful in particular way instead what they did was that they made their theory of this new particle more complicated so that it would evade the experimental constraints that had been found to that date so they invented a new particle which was then called the invisible axion and people are still looking for * When a couple of physicists do "something" that "should" = could be, then hundreds of physicists have been blindly looking for and searching for decades a .and science is wasting time. - - How little would be enough to understand HDV and the science would be one floor of knowledge higher. (small step for JN and big leap for physics) it um the problem is um well it's invisible so these particles were specifically designed to be hard to detect um and what you see in this image is an example of one of these experiments that's that's looking * and looking ... and looking ... and looking for these particles uh there are like one or two dozen of them none of them have seen any any accents it's also uh very interesting sociologically if you talk to the young people today they don't they don't call it the invisible axion they just only call it the axion if you read it in the popular news popular science news um coverage of axions they usually forget to mention that actually the original axiom was already ruled out in the 1970s okay so another example of failed predictions and you've probably heard of those are the ideas that the symmetries in the standard model should be unified to one large symmet group * and what about the idea that "equations" exist only on paper in mathematics, that equations do not exist in the real-universe, or is the Universe governed by the law of "alternating symmetries with asymmetries" ?? otherwise there could be no genesis of "everything" in the universe… so what you see in this graphics these are the particles of the standard model they kind of you know there's some structure * certainly, even within the quark and lepton - there are structures: the spatio-temporal dimensions themselves, the packed dimensions to it but it's not as structures as it could be and a lot of us think that's that's ugly um these particles can be grouped according to three different symmetries um but these these different symmetries they kind of sit a little bit awkwardly next to each other and you can you can make this much more beautiful by postulating that actually the three different symmetry groups should be unified to one big one * Sabina here means symmetry between particles, ie between their properties and behavior…, but topological-geometric symmetries can be in - inside the particle, they are also used "inside the particle", ie the use of curvature of dimensions to make the shape of the particle so i i should have said earlier butforgot that um these three different symmetries correspond to three different interactions (!!) that wehave in a standard model so that's the electromagnetic interaction and the strong and the weak nuclear force * external symmetries (internal topological symmetries are or are not guided by "curvature" of dimensions) so that there are three forces in a standard model and they belong to three symmetry group so if you combine them it basically means there's um actually only one big force um but to us it appears as if there are three different ones and that's certainly an appealing idea i totally agree on that the trouble is it does work particularly good um [Music] these ideas generally have the consequence that protons become unstable now um protons are one of the constituent particles of atomic nuclei there are lots of them around us and physicists have looked for proton decay starting in the in the 1980s so far they have not seen a single proton decay what you can do with that data is you can set bounds on the lifetime of the proton we have to know that if we we now know that if the proton is actually unstable it is very very very long lived and this puts constraints on these theories uh some have actually been ruled out uh but um physicists have not discarded those theories instead they have made them more complicated and so there's still people looking eg HDV uh to find evidence for um those ideas um another kind of failed predictions um the standard model contains another number that's the mass of the higgs boson * which is small i should be more precise here and say it's actually the mass of the higgs boson divided by another mass which is called the planck mass * attention !! "Looking for the Higs boson" is not the same as "looking for the Planck mass" of the Higgs boson; Planck's mass is only an "interval" or the smallest possible "quantum of mass" (not mass) similar to Planck's length and Planck's time are only "shortest intervals" so you get a number that doesn't have units this number comes out to be about 10 to the minus 15. um that's very small and it's supposedly ugly now what physicists did and you've heard this a few times now so you can probably see what's coming they have tried to make the theory prettier to get rid of this small number one way to do this is to introduce new particles * aha, or Sabina, if we have something that is uncomfortable that we want to get rid of, then we introduce "something else" aha…, and we have taken care of um so that's the so-called supersymmetric partner particles * physics always and still tends to do (on paper and theoretical abstraction) only and only symmetry… why can't asymmetries be in reality? and at the same time symmetry is a trace amount in the universe, asymmetry rules um to each of the known particles in the standard model there's a partner particle um that's supposed to cure this ugliness in the standard model these particles were supposed to appear at the large hadron collider * why force "destroy" ugliness ?, that is, destroy asymmetry by blowing billions of money into the chimney and raping thousands of physicists to one **biased idea ..** (?) (Hitler also had a tight idea and raped 90 million Germans into this single "tight" idea) and they did not and this is not the only prediction that physicists have made based on this idea * that is, the idea of destroying asymmetry by "supersymmetry" that um the standard model has to be pretty um they have also had this idea that we should see gravitons at the LHC or tiny black holes extra dimensions and so on and so forth none of that was seen the only new particle that was seen at the LHC is the higgs boson * but even the higgs-boson physicists did not see !! ; was not seen, only "jets = shards" were "seen" after collisions of "visible particles" and they were evaluated (according to ideas-hypotheses) that they are "witnesses = evidence" about the higgs-boson which was predicted already in the 1960s and the interesting thing about the higgs boson is that it was not predicted based on an argument from beauty so definitely it was not there to make the standard model uh more beautiful indeed a lot of people thought that it was ugly when it was first um introduced but the higgs boson has to be there because otherwise the standard model just doesn't work * Why shouldn't the Standard model work without a higgs-boson ??? I haven't really found it anywhere yet, I haven't read it, and as for the higgs-mechanism, it's just an unproven idea…., It's just as unproven as my vision in HDV that mass in space will occur by curvature of dimensions is born-mass or physical field is produced and mass is a "property" of matter,… every "curvature of space-time dimensions" is "mass-forming" - small curvatures are fields, "wrapped" curvatures are elementary particles of matter only 25. that's a very important point that i will come back to in a bit okay so another fade prediction these are the searches for dark matter you've probably heard of them um there's hypothetical ! a particular type of dark matter particle that's called weakly interacting massive particle um this has been sought forth since the mid 1980s uh so far none of them have been seen and each time an experiment comes back empty-handed handed um theorists assume that the interaction probability of those particles is just smaller um than what they were possible than what they were able to test so you have to build a larger detector * Billions more money because of the chyme?, Because of the observationally undiscovered and theoretically unproven particle of dark matter ?? This is a roughness unheard of against HDV… why not build a detector on "strings" for string theories ??? Thousands of physicists can do it for 50 years for billions of money… Nobody gave me a penny on HDV and this has been going on for decades what you see in this image is um one of these dark matter detectors is called xenon 1t the 1t ? stands for 1000 then it's an upgrade from the xenon 100 that's an upgrade from the xenon 10 which is an upgrade from the original xenon so each time there's an upgrade and the sensitivity to the supposed dark matter particles becomes better but they still haven't found it so why did anyone believe that there has to be such a particle well it's a numerical coincidence that * uh it goes under the name the whimp miracle miracle if you postulate that such a particle exists and it has masses that are about in the energy range that the LHC tests and it interacts with a particular strength that's about the strength of the weak interaction um then um it it is produced in the early universe in the right amount to explain our observations * The observations are correct, but they are incorrectly evaluated…; why not test the "theory" ??, eg the Hubble law of expansion may not be linear, but there is a more logical reason for "unpacking" space-time from Bang uh for dark matter so it's not a particularly strong argument at least what i think um but uh it was enough to convince a lot of physicists that it's a good idea to build all these experiments uh some of them are still running they still haven't found anything um and so another failed prediction this is the last one um general relativity has this cosmological concept which i mentioned earlier as a free parameter that's a constant of nature that just has to be determined by measurement and that's exactly what was done 20 years ago but there are a lot of physicists think that the value of this concept is not pretty because it's very small it's not zero but it's very small and so what they do is that they invent prettier theories do they invent new theories for "beauty"? that supposedly explain this value of the cosmos constant but really the only thing they do is that they make a very simple theory more complicated and none of the predictions from these theories has ever found any experimental confirmation so why do physicists believe in beauty um ultimately i have to say i don't know it's a big mystery to me but um here's what i'm what i'm guessing um i think they they just don't think about what they're doing uh largely they're doing it because um they've been taught that that's what you're supposed to do um there's also you know the in the popular science literature as well as in the more professional literature there's a lot of talk about how important it is for your theory to be beautiful and so on and so forth and when asked many of them will actually claim that um that's reasonable to do because Dirac and Einstein were successful because they were guided by beauty the problem is that this is just wrong you know it's it's a false reading talked a lot about beauty it was very important to them personally but after they had their big successes with uh general relativity and the drock equation they tried to use their sense of beauty to constructmore theories and it didn't work for neither of them it worked and neither did it work for any other people who've been going on about beauty so even for the smartest of the smart it it didn't work to rely on beauty and even and even if it was right um that there were successful you also have to look at the people who were guided by beauty but who actually not successful if you look at the history of physics then factors that arguments from beauty have worked badly you don't have to dig very deep to find ideas in the history oorbits of the planets are determined by polyhedra that are stuck inside each other um well it turned out to be wrong um also for a long time people held on to this idea are just the prettiest kind of emotion that you can think of there was a peculiar history in in the foundations of physics around the turn of the 90s to the 20th century in which a group of physicists became convinced that atoms are really not in the invisible ether so here's an image of such or not it certainly has a certain aesthetic appeal i won't deny that it turns out to be wrong though um and then um there was this idea that the universe is eternally unchanging that people try to hold on to uh for for a long time so the universe has always been this way and will always be this way it's kind of comforting i guess uh but it also turns out to be wrong and then there were uh quite a variety of um prominent physicists who in their late years after they had made their big success um try to use their sense of beauty to come up with um ideas of unified theories and it just worked terribly badly yes repulsive so relying on beauty is bad science and we can learn this from history and seeing that examples of where standards of beauty have changed in the history of science and i think this is a very good argument to see why it's a bad idea to use ideas of beauty to construct theories it's really putting the carriage before the horse it is describing nature that makes the it should not be the starting point and i think that this obsession with beauty is really the reason why we are seeing um the stagnation in the foundations of physics um physics is a very mature discipline and the simple things have been done so it takes increasingly more time and more need to test new theories HDV and this means we must choose make a wrong choice if um we come forward with an unpromising theory then what happens is that we get negative experimental results * eg evaluation of star motions in galaxy arms when physics uses Newton's law **$F = G. M.m / r^2$** for non-curved "**r**" ; In the galaxy, it is already necessary to insert a "curved line" in the arc this means the theory is just uh being ruled out and that's also a result but it's not a very useful result um if you want to develop a new theory um so the result is that we have a lack of data lack of data in the sense that we have no positive evidence for a new phenomenon for which we could construct a theory so we get stuck with the unpromising theory um and the cycle just repeats and we have basically been in this cycle for the past 40 years * (My HDV has been on paper for 40 years and it has been presented on the internet for 20 years.) so um this then brings me to my recommendation uh what what i think physicists could do better !!! * they could also do better by ignoring HDV uh i think we should learn from history progress in physics has either been driven by experiments so historically um there's been a lot of experiment driven um breakthroughs um where we had data that was in need of a theory but progress can also be theory driven where you have a prediction that is done being tested and confirmed by experiment and if experiments become harder to do then this theory driven progress becomes more and more important so we really have to pay attention to how to do it and um if you look at the cases where theory-driven breakthroughs have happened uh it was the resolution of inconsistencies in the theories that were then being used in the foundations of physics that worked so i have some examples for this here electromagnetic waves are necessary to make electromagnetism internally consistent so there were a prediction that was then experimentally confirmed Einstein's theory of special relativity resolved an inconsistency between electrodynamics and galilean invariants of space and time general relativity then further resolves an inconsistency between special relativity and newtonian gravity um anti-particles that was derock's great breakthrough it was based on a resolution of the inconsistency between special relativity and the first formulations of quantum mechanics and after some further work this eventually led to the development of quantum field theories which are the theories that we still use in the standard model today and also the Higgs as i already said is necessary for consistency of the standard model without the Higgs the standard model will eventually predict uh probabilities larger than one so that that's just mathematical nonsense and so um there are as i and i started with this in the very beginning there are real problems and foundations of physics that are not um you know next lack of beauty um i already mentioned these in the beginning um dark matter the lacking theory of quantum gravity the quantum measurement problem there are also certain aspects of dark energy that are actually problems of inconsistency so i think physicists should focus on trying to solve these problems um so this brings me to my summary using criteria of beauty to assess theories is bad scientific methodology there is no reason it should work it has not worked in the past and it does not currently work physicists should instead focus on resolving inconsistencies because that's how the fight gets in if you like this and if you want to know more about the problems in the foundation of physics i encourage you to check out my book lost in math * that is, without mathematics which was recently published as paperbook for more debates talks and interviews subscribe today to the institute of art and ideas at iai tv.. So, Mrs. Sabine, what's going on with physics? Yes, it is stagnating because it is stuck on several issues that it wants to solve with "**violence**" through the LHC, and is not interested in new ideas such as HDV.

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