https://www.youtube.com/watch?v=8CChnwOsg9I

Before the Big Bang 9: A Multiverse from "Nothing"

That sentence doesn't have a question mark at the end, and that's a mistake. ((* - *)) My version: Before the Big Bang The universe was-existed, but it was in a different state than the Big Bang universe. Before Třesk, there is a two-quantity space-time 3 + 3 dimensional, Euclidean flat-non-curved, infinite, without the passage of time, without expansion, without matter, without fields and… and even perhaps without laws-rules.

The big bang is just a **change of state !! a jump extreme change** from the state of 3 + 3 flat-equal dimensions of infinite space-time to the state of "opposite", ie extremely curved dimensions No. Probably this will be "our Universe" as a "locality-singularity" that "floats" in the pre-bang grid 3 + 3 flat dimensions, a locality that manifests itself as a space-time chaotic dense foam (non-isotropic ??), boiling vacuum, http://www.hypothesis-of-universe.com/docs/c/c_415.gif , in which it begins genesis **a)** "unpacking" of curvatures of dimensions and at the same time plus **b)** "packing" of dimensions into bundles-balls, whose geometric configuration of curvatures "in the package" "freezes", will remain "forever" unchanged, and… and these packages will behave and manifest as elementary particles = matter (25 pieces of the Stanrard model). When "unpacking" the foam of dimensions (time and space rotate at each point), the 4 geometric configurations of the curves "unpacked" (expanded into smaller curvatures) will behave as a "physical field". In parallel with this sequence - the genesis of "unpacking and collapsing" the curvatures of dimensions everywhere in this space-time, the second sequence will develop in parallel: a sequence of laws-rules-principles that did not exist before the Bang. (and there were not all the laws we know today after the Bang, and they were gradually recruited). Whether this "our" Universe will "expand" expand "to infinity and forever", I do not want to speculate… and if all dimensions, both time and length, would equalize to the same state as they were before the Bang.

Alex Vilenkin
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Did the universe have a beginning or has it always existed? Is there only one universe or many? In this series, we examine competing models of what happened during or before the Big Bang. In this episode, we interview Alex Vilenkin, who suggested that the universe has a spontaneous origin from "nothing" and no cause! * This was suggested by Jakov Zeldovich and not by Vilenkin * He also showed that our big bang will not be alone, that there are an infinite number of big bangs forming a multiverse. Of course, the idea of a universe was discussed elsewhere. Here, however, we clarify many misunderstandings about this concept with the scientist who invented it. In particular, the suggestion that the universe originated from nothing cannot be confused with the suggestion that the universe originated from

vacuum fluctuations. Below are the topics we are discussing. Please note that we did not release the film until Alex Vilenkin saw the proposal and approved it.

(01)- In this series we explore competing models for what happened at or even before the Big Bang. In many of the models we've explored the universe is seen as having always existed. But one scientist who takes the opposite view is Alex Vilenkin. In 1982, he published a paper **showing how the universe might have spontaneously created itself from nothing**. * He pointed out he meant an abstract vision. What and how he explained, proved, proved, justified, argued the vision, I would be interested* And what he means by ***nothing*** is not the quantum vacuum as some have alleged, but a state where there is not even any space or time. * So: "show" = say, um, that's not such a big deal. Such a statement is the same as declaring Hell and Devil * What's more, this nucleation event wouldn't just lead to one universe being created.* So more devils in Hell .. * Vilenkin was one of the first scientists to argue * the cashier at the newsstand in the subway* can claim * that our universe is merely one of an infinite number of bubble universes.* Maybe it is, but **to claim** (?!?!) That it was created out of nothing and in addition another infinite number of universes "out of nothing" as bubbles in that environment NIC, it wants admiration for courage…* These are some of the most controversial claims in Physics.* Sure, it's a scream for sci-fi* So who better to explore them with, but Alex Vilenkin himself. "Before the Big Bang" "Episode 9" "A Multiverse From Nothing" I had a good Math teacher, who encouraged me to study Mathematics and gave me some challenging problems. So that was very helpful in elementary school. And then in high school, I had a good Physics teacher. I also had a friend who had similar interests, and we decided to study together the General Theory of Relativity. So that was a challenging project and we had to learn a lot of math.* So that's what I miss We had some Calculus at school, but we studied─ You know, Differential Geometry, which was pretty advanced stuff. And we read a book which was Eddington's "Mathematical Theory of Relativity". And at the end of the─ We met every week to discuss what we learned, and at the end of the book there was some discussion of Cosmology with, you know, discussion of the structure of the universe and the beginning of the universe. * The structure today and the structure immediately after the Bang, these are the states side by side "heaven and bagpipes"… And I was amazed that people can learn anything about such matters. So, from then on, I couldn't imagine doing anything else. In 1927, Werner Heisenberg published his classic paper on the Uncertainty Principle, (*) which implies pairs of particles and antiparticles spontaneously appear from the vacuum. According to Quantum Mechanics vacuum is actually a scene of a lot of activity. * Mainly because **s t i l l** at the level of the Planck scales the sizes of length and time intervals are dominated by crooked dimensions, there is chaotic foam not only after the Bang, http://www.hypothesis-of-universe.com/docs/c/c_167.gif but even today, ie anytime, anywhere…; The universe is still expanding from the "vacuum foam" * If you look at small microscopic distance scales, particles pop in and out of existence, and they kind of live on borrowed energy.* The vacuum foam probably "boils" even non-chaotically, so that even particle-antiparticle pairs can break out of it, which in turn "dissolve" into the "foam", thus unpacking their dimensions from which they are built. There is no need to "borrow" energy, because this is reflected in the modeling of the curvatures of the dimensions that collapse into the exact packaging configuration of the electron and positron You can have electron and positron pop out, * in a locality of some "chaotic curvature", two packs with the opposite "spin" are packed, ie with the opposite meaning of packing the dimensions - they are in absolute balance, and therefore their dimensions are unwrapped again in a flash * but then they have to disappear, because energy conservation does not allow particles simply to come into existence. So, they borrow a little energy from the vacuum * borrows no energy from the

vibration of the dimensions of the vacuum, but the curvature - packing the dimensions into a ball * and then they have to disappear pretty promptly. More than a decade before Vilenkin's paper, **Edward Tryon** proposed that the universe might be a vacuum fluctuation. Ed Tryon had what seemed to be a weird idea that─ The whole universe could appear in that way, as a vacuum fluctuation. http://www.hypothesis-of-universe.com/docs/c/c_166.jpg Well, when the studied scientist said it, it's commendable… when an untrained layman says HDV, it's whistling and shouting curses at crazy phantasmagors… You can picture it like you have an empty space which you can, kind of, picture like a sheet of paper. And then you can imagine a bulge forming on the sheet of paper, and taking the form of [a] balloon, and then eventually pinching off.* http://www.hypothesis-of-universe.com/docs/c/c_221.jpg You can imagine anything, any idea, vision, idea… e.g. HDV. However, it is necessary to meaningfully follow the vision from contemporary knowledge of physics and argue the reasons - those visions could easily slip into phantasmagoria * And this would be a new closed universe. So, the problem is that the universe is a lot more massive than electron and positron. So, you would imagine that such as─ But you need the universe to exist for billions of years. But Tryon realized that there is no problem, because the energy of a closed universe is equal to zero, actually. Because gravitational energy is negative and energy of matter is positive. And in the case of a closed universe─ That is, the universe which closes on itself, * After a big bang, our universe is just a "final location" "swimming" in the endless flat 3 + 3 dimensional environment, or is the "location" large almost (!) as an endless space-time before the bang (?), the location that "absorbed" all Endless dimensions and twisted them into dense foam ..., all, that is, such considerations can be imagined under the next unlimited vision angle that "unit intervals" cannot be determined. *Almost endless* dimension (interval on it) is as big as *almost zero* dimension. space closes on itself like the surface of a ball. For a closed universe it's a mathematical fact that the total energy exactly adds up to zero. O.K. The gravitational energy compensates exactly the positive motion energy of matter. And so there was no problem. No conservation law forbids creating a closed universe from the vacuum.* On the one hand, **a)** the law of maintaining is the illusion of mathematicians, because in real-space is this law just "stop-status" in the dynamics of changes - changes every second everywhere! ; and for **b)** no law conservation does not apply "in time" and "in position", "stop-status", immediately changes "in place and in time" to the law of violating the law conservation in the **locality**. Inside the universe applies "alternating symmetry with asymmetries" and thus alternating the law conservation with its violation. Equations are just mathematical, in the universe rule "chaos inequalities", equations are rare and only on paper. * And Tryon told me actually how it happened that he came up with this idea. He was sitting in a seminar, and I'm not sure that the topic of the seminar was related to this, but he said that it came to him like a flash of light, that he kind of had this sudden realization. O.K. And when the speaker stopped to collect his thoughts, he just blurted out, maybe the universe is a quantum fluctuation.* O.K. It depends on scale and "nesting into" * Everybody laughed because they thought there was a funny joke, but he was serious.Tryon's proposal is that the universe **came** from the vacuum fluctuation.* O.K. However, our universe - the state after the bang started "chaotically blazing foam" bogus dimensions of the space-time 3 + 3 that were smooth before the bang, straight, and **comes** from the state before the bang from a flat 3 + 3 state without unpacking the time and without unpacking the lengths, They don't even expand, they are straight, endless. But one can still ask where did the vacuum come from?* That's what I say ...; and in HDV In 1982, Vilenkin decided to address this issue in the context of inflationary cosmology, which implies a stupendous, exponential growth spurt in the early universe.For more information on inflation, watch Episode #4 of this series.1982 was the year when the theory of inflation was, kind of, more or less completed. Alan Guth originated this idea. He likes to say that inflationary expansion can produce a big universe from almost nothing.* Guth's inflation is an erroneous

idea ✦ http://www.hypothesis-of-universe.com/docs/c/c_239.jpg ; http://www.hypothesis-of-universe.com/docs/c/c_232.jpg All you need is a tiny piece of some high energy vacuum,* However, the high-energy vacuum must be extremely crumpled timage, foam dimension, the crumpled paper **can be expanded (!),** But flat flat paper is not possible, as it did a.guth, cannot if you do not use a magic wand that will be the length of time to timing new and new new and new Points to handed out bounded lines which can then expand and produce a huge universe.You still need this initial piece, and─ So, the picture to me seems incomplete.

(02)- Where did that thing come from? So, that bothered me, and I kept thinking about what was the possible beginning of inflation. * One of my opponents defended inflation as follows : http://www.hypothesis-of-universe.com/docs/c/c_233.jpg What could trigger─ produce this initial thing? The trick to understanding the Vilenkin's proposal design is to think about something that is impossible in Classical Physics, but it is smooth permitted in Quantum Physics. Quantum Physics "brings observers into the" foam ", crumpled 3 + 3 dimensions. The foam is mathematically linear. http://www.hypothesis-of-universe.com/docs/aa/aa_195.pdf → I understand that on small size scales, spacetime is "quantized" because space-time manifests itself like foam, (which are clusters of alternating curvatures of dimensions) or crumpled space-time, or "topological curvatures of longitudinal dimensions". Therefore, in such a "foam", a "locality" with "low curvature" may be in the way and the particle passes through (because the potential barrier is less than the energy of the particle) or a "locality-barrier" with "high curvature" and the particle does not pass. which is "demonstrated" by the probability that 99% of localities with a higher barrier and 1% with a lower barrier through which the particle passes are found in the foam - this is quantum tunneling = that 1% of localities where curvature is less than "curvature" particle energy.* It's a process that is essential for the Sun to shine: Quantum tunneling.* I wrote about quantum tunneling here: http://www.hypothesis-of-universe.com/docs/aa/aa_194.pdf If you imagine, for example, that you want to get a can of Coke out of [a] vending machine, you have to throw in a coin and then the Coke comes out.It cannot come out otherwise because there is a wall.There is a energy barrier that prevents it from coming through.But according to quantum theory, there is a small probability for the can of Coke actually to spontaneously materialize outside of the veinding machine.* However, then there is also a small probability that two horns will grow on God's head… Of course, if you wait there for this to happen, you'll have to wait much longer than the age of the universe.* at the end is the end of the existence of the Universe But there is a small probability. Such quantum tunneling events happen routinely on microscopic scales. For example, they are responsible for most radioactive decays, where a nucleus is forbidden classically to break up because there is an energy barrier, * They are "localities-arrays" of certain curvatures of dimensions that are higher than the curvatures of "localities" that want to "break through" the barrier.

Simply and still to the point of exhaustion: everything that physics produces can be "filtered" by HDV's view of the curvatures of dimensions čp… .**the whole physics, the whole Universe is only about curvatures of dimensions**, but quantum mechanically it happens through quantum tunneling. See[ing] how what I call tunneling from nothing is possible, * imagine you, you finally imagine that a smoothly continuous entity can't, you can't quantize, but you can quantize "foam"… because it's a state of curvature dimensions, which appear to the Observer as, as…as grainy, as alternation of zeros and ones, as alternation of densities and dilutions, as alternation of "nothing" and "something", as a flow of electrons in a copper wire, where there is a "gap" and " electron ".. and a gap and an electron, etc. let us imagine we have a closed universe which has two ingredients : It has a high-energy vacuum, of the kind that you need to drive inflation. Inflation, I should say, is a rapid accelerated expansion of the universe, * unfolding curvatures of length and not only length but also that time

"expands" (*says Kulhánek: the pace of time is fastest here in our system, everywhere else - in the whole of the universe - it seems, and we know from STR that the pace is slower there - that dilates time everywhere, because the bodies are in motion "v" → "c". does not run, says Kulhánek, and time runs only "around" galaxies*)). which is driven by this unusual stuff which is called high energy vacuum. or sometimes false vacuum. And a remarkable thing about this vacuum is that it has a repulsive gravity.* Well, well ... "repulsion" is essentially a manifestation of "unpacking" that "boiling" vacuum… So, when the universe is filled with this stuff ─ [The] repulsive nature of gravity * ??? gravity has only one nature… but the vacuum has the opposite nature, but when the vacuum expands to "geometric parabolic curves" - gravity, and continues to expand, then this unfolding of parabolic curves "has a repulsive nature", ie not "gravity itself" but it expanding large-scale curvatures causes the universe to expand with acceleration.* This is a logarithmic view of the ´Observer´ on the size of the intervals in the geometry of the unfolding shape. This http://www.hypothesis-of-universe.com/docs/c/c_357.jpg can be a picture of the reader's imagination. Also, the other ingredient is just ordinary matter. So we have this universe with these two ingredients. Now let us imagine varying the radius of this universe. If we make the radius small the density of matter will grow, * if a constant amount of matter is "born" after the Bang, eg 10^{53} kg, and if the new matter does not change during the aging of the Universe. Does anyone know? The increment of matter "over time" can be a "descending exponential"… but we know that the energy density of the vacuum is constant, which means that with increasing x^3 energy is born somewhere, in a boiling vacuum… because the principle of mass formation is "curvature" of dimensions. In the vacuum on the Planck scales, the spacetime still "shrinks = packs into an even more boiling vacuum, which means the" emergence "of new energy into the density of the universe to be constant and then the attractive gravity of matter will dominate, and the universe will collapse. If you increase the radius, the matter will be diluted, and the repulsive gravity of the vacuum will dominate, and the universe will inflate, expand with acceleration. Okay. Now, I wanted to start with a very small universe. So, suppose I have a very small universe─ Classically, it would collapse,.Because of gravity. However, there is an energy barrier between that and the large size of the universe that would make it inflate. But what I realized is that instead of collapsing, the universe can do something more interesting: It could tunnel to a larger radius. So, it would be a quantum tunneling process. So the universe will turn out to a larger radius and will start expanding. And then I asked myself, how small this initial universe can be. So, I looked at─ Mathematically, I discovered that when I take the size of the initial universe to zero, the mathematical description of the whole thing simplifies greatly, and what I had was a mathematical description of a universe tunneling from a point, to a finite radius, and starting to inflate.* Expand. http://www.hypothesis-of-universe.com/docs/c/c_240.jpg unpacking is not "central"! , where luminous filaments are "packed space-time" into matter and gaps - empty spaces between galaxies are each otherwise "unwrapped locality" of dimensions… because even "emptiness" carries the bushes of gravity p etc. It's just that unpacking the Universe isn't just like http://www.hypothesis-of-universe.com/docs/c/c_241.jpg "a tuned space spiral from one point." So, a point is no space at all. So, basically this is no space, it's no matter, and the universe in this picture is created spontaneously from basically "nothing". I write "nothing" in quotation marks because it's not a philosophical nothing, because─ We assume that the laws of Quantum Mechanics are there. Somehow "there".* probably (according to physicists) somewhere above the universe, below the universe, next to the universe, in nothingness .. There is no space or time, and the universe tunnels from this timeless, spaceless state into existence.* This is the basic idea of today's cosmology, ie an idea that is about 50 years old. And that's exactly the idea I want to replace with a new one : HDV ((*-*)) As it appears the universe has a very small size. It's filled with this high-energy vacuum, (which is n-curved space-time, ie foam of dimensions)

and it starts to inflate very rapidly.* Universe or space-time? The mathematical picture that I had gives the probability for the universe to appear in different sizes and also filled with different kinds of high-energy vacuum,and what I found was that the highest probability is for the largest energy vacuum, and the smallest initial size. So, the universe appears extremely tiny. But then the high energy of the vacuum, and its repulsive gravity, caused the universe to expand very fast. http://www.hypothesis-of-universe.com/docs/c/c_239.jpg So, it doesn't stay small, it becomes huge in [a] very tiny amount of time.* But it was never examined whether it expanded unevenly over time; in any case, I think that the passage of time is not uniform throughout the age of the universe, the passage of time changes in that 3 + 3 network structure. And, of course, the pace of time changes in the spirit of STR and in the gravitational fields. All this is not discussed for the global "expansion of space-time". So, how does for Vilenkin's tunneling-from-nothing model differ from Tryon's vacuum fluctuation model? mathematically It's different from Tryon's model in two regards: First, Tryon had the disadvantage that he didn't know about inflation. So, he wouldn't explain why─ I mean, if the universe appears as a quantum fluctuation * at the level of the Planck scales… because there is a space-time "foamy", n-dimensional then a small quantum fluctuation is much more probable than a large one. He assumed the pre-existing empty space, pre-existing vacuum, and it wasn't clear where that came from.* HDV ((* - *)) describes this in its version So, the main difference is, in the picture of tunneling from nothing, there is no space before that and no time. When we say 'nothing' in this context, tunneling from nothing, we don't mean quantum vacuum. I understand

(03)- It's actually what Tryon meant. And here we have a state without space, completely.* Of course - the pre-big-bang being was there, only in a different state: totally flat without the flow of time and without matter. So there is no vacuum.* In HDV there is a pre-big-bang state of spacetime, like infinite 3 + 3 D, flat, no matter, no fields, no passage of time, no expansion… and no laws There are─ The laws of physics I assumed to be there,* No non-existent laws in pre-big-bang do not exist, perhaps… perhaps except for one, two. I think one of them is the "law of alternating symmetries with asymmetries" and that's a great mystery. **Where they come from and what determines which laws they should be?** * Laws are also ´ born-recruited ´ after the Big Bang on the basis of configurations of packaged packages of dimensions, ie quarks, leptons, bosons, which by their "position" in the field of curved dimensions generate "laws, providers, prindips" reciprocity and properties not only each particle (charge, spin, mass) but also other behavior of elements in space-time and conglomerates of elements (atoms, molecules, compounds) in fields, etc., etc. Simply: immediately after the Bang there was no chemical law on how sulfuric acid will behave towards marble. Most cosmologists accept that in order to understand the origin of the universe we need to combine the General Theory of Relativity with Quantum Mechanics into a theory of Quantum Gravity.* We must ?? Why do we have to? Can't they coexist side by side? But there is no agreement in the field about how to do this.* As I have written elsewhere: http://www.hypothesis-of-universe.com/docs/g/g_039.pdf gravity is nonlinear and quantum mechanics is linear, so straightening a parabola into a straight line by splitting it into infinitesimal lines and I put them back together and I have a straight line - this is a fraud on the principle. All Quantum Gravity theories are now still at a pretty rudimentary level of development.* What is it ? So, you can use what is called 'semi-classical gravity', which is the approximation where things are almost classical,* aha… that's the line composed of cut parabolas, or scams but, for example, things like quantum tunneling can still be described. And in that regime all these different theories are pretty much more or less the same. almost Vilenkin = Tryon; Einstein = Newton, well ? The difference has come really at the true

quantum gravitational level, where the nature of space-time actually may change like in String Theory, which says that space may have more dimensions,* yes, time can have more dimensions .., together then when they are packaged they produce matter or maybe even the space and time themselves are kind of semi-classical concepts, and on a more microscopic level we have some different structures,* structures = intertwined crooked dimensions of three lengths intertwined with three dimensions of time - boiling vacuum so that space and time emerge when you go to sufficiently large scale[s].* Here's attention: the flow of time in one arrow dominates on large scales, but on small scales, in that foam, the flow of time is "omnidirectional"…; dotto inside packaged packages that present elements of matter And the same is true of Loop Quantum Gravity.* O.K. , loop gravity occurs, for example, when two black holes approach, rotating at an angle to each other, and then a "more complicated distortion of space-time" occurs in the environment of two black holes, but it is not a 3 + 3 state "packed" into a ball… If the universe began from such a quantum nucleation event, then what would be the cause? * The principle of dimensional curvature is the answer to that mystery Many quantum mechanical processes do not require a cause. For example, if you have a radioactive atom, you know that it will decay. But you cannot tell when. So, there is a─ Half-life time, for example, that you can tell that in a year the probability for this atom to decay is 50%. Then the year has passed, it didn't decay. The probability for it to decay the next year is still 50%. Eventually, it will decay. But if you ask why did it decay at that particular moment? There is no reason. There is no cause.* Or we don't know her yet. So, quantum mechanical processes like these are uncaused, and the spontaneous creation of the universe is of the same nature.* This is still your "first" vision. The "second" vision has not yet been explored, my HDV: a step change in the curvatures of dimensions 3 + 3 Euclidean flat before Třesk into extremely curved curvatures - plasma, foam of dimensions, boiling vacuum, after Třesk - our Universe It doesn't require any cause.* ? I can't judge that. Nevertheless, I think that your vision "first": the origin of the Universe Out of Nothing, ie the origin of space and time and matter with "finite mass" is a vision less beautiful than the vision "second" when flat 3 + 3D space-time is infinite in čas, and in which the “cut-bang” (without cause) becomes the “final locality” (singularity?) of extremely curved dimensions and this “foamy locality”, the foamy plasma environment of chaotically curved dimensions, becomes the developmental incubator of changes , ie the production of packages = elementary readers by packing dimensions into balls, which are the building blocks of other products - atoms, molecules, compounds, chemistry, biology and DNA…, everyone knows.

It is only a small ESSENTIAL difference between the “first” vision : the origin of everything from Nothing and the “second” vision of matter and fields in the space-time foam environment, from the dimensions of two basic quantities, where each configuration of the used curvature of each dimension from 3 + 3 adds "properties" and "laws" to configurations. I believe that when there are people who understand HDV that they will perfect that vision of HDV into a rough, beautiful, meaningful description, this description of mine is simple, rough. While many physicists accept that a breakdown of causality occurs at the quantum level, there are different interpretations of Quantum Mechanics. So, how does this impact on the nature of causality in Quantum Cosmology? The only interpretation of Quantum Mechanics that appears to make sense in Cosmology is the Everett's interpretation or many-worlds interpretation.* **This interpretation also squeaks** Because the other─ For example, the so-called Copenhagen interpretation─ This interpretation requires that there is an observer outside of the universe with some measuring bla-bla device, measuring the universe. In the case of the universe, we don't have such an observer. So, the universe is a self-contained system, and I think many-worlds interpretation is required here. In the Copenhagen interpretation things are a-causal simply because it's kind of built in the nature of [the] interpretation. You have a wavefunction describing your atom, and then the wavefunction

collapses → on the paper "in math" *the function* collapses, but what collapses in the real-universe? and how? in the course of measurement, resulting in some of the outcome probabilistically. And there is no cause how you choose these things— the outcomes.In the case of many-worlds, there is no these collapses of wave function, and the wave function evolves deterministically.* You have replaced one defect with another So, in a sense, this is a deterministic interpretation of Quantum Mechanics. However, this wave function describes an ensemble of universes, * (set, that's how much? Half infinity?) and in different members of the ensemble, in different universes, you get all possible outcomes of your measurement. Simply, you don't know which universe you are in. So, which universe you end up in is also an a-causal kind of process. [Phil] I've heard some people claim that's when— Could the pilot wave theory, or De Broglie-Bohm, that that is causal.Do you have any comment on that? Well, I— I thought that this pilot theory ? is a beautiful idea. I looked at it in my youth, very which was very long time ago, and I didn't really follow it afterwards. It was— To my understanding, it is not really a well developed theory. It applies to kind of simple settings, a particle moves in some potential, but applying it to Quantum Field Theory, or to Quantum Gravity, I don't think it is at that stage yet. If something could come from nothing, then why doesn't this happen all the time? * Maybe it's happening. Even in "today's" boiling vacuum, elementary new particles are formed (?) Pairs of particles certainly, but I don't know if so particles, maybe Why don't tigers just appear in our living room? In Quantum Mechanics many things are possible that are not possible in Classical Physics. And, indeed you can have— In principle, you can have very strange things happening. Like objects coming out of thin air. However, there are some rules. And these rules are conservation laws. So, energy conservation is always enforced. So, for example, you cannot have a tiger appear out of— In the vacuum because [the] tiger has a mass, some energy. But if you have a lump of matter, in principle it can turn into [a] tiger.

(04)- And Quantum Mechanics will not tell you that this is absolutely impossible, but if you try to calculate the probability of this happening, it will be pretty low. On the other hand, in [the] micro world, when you collide particles like they do at the Large Hadron Collider, you collide two particles and they turn into all sorts of things. They turn into other particles, or you can collide two protons and they turn into a cascade of a huge number of other particles.* Most often they are "jets", which I consider "shards", not real particles of matter in SM So, on the microscopic scale such processes do occur, and— If you think of the quantum creation of the universe, it is a tiny microscopic universe that has to pop out out of nothing.* Ugh, you don't have to… If you calculate the probability of this happening— I should say that, conceptually, interpreting this probability is a little difficult. But still, if you do the calculation you find that it is far more probable than having a tiger materialized in front of you. Once the small universe nucleates, it is thought to undergo inflation.* It is created, yes, for sure, but from the dimensions of the quantities **Length** and **Time** by the style of packaging… etc. see HDV But as Vilenkin pointed out in the early 1980s, this was a mind-blowing implication for the large-scale structure of reality. It all has to do with how inflation ends. It happens through bubble nucleation.* What are "bubbles" made of and what is "nucleation"? I think that the bubbles will be from the dimensions of space-time and nucleation is the wave-wrapping of those dimensions into balls… http://www.hypothesis-of-universe.com/docs/c/c_421.gif ; http://www.hypothesis-of-universe.com/docs/c/c_388.gif ; http://www.hypothesis-of-universe.com/docs/c/c_283.jpg So, it is like boiling of water. A tiny bubble of our vacuum, like the one we live in pops out in this expanding,* and what emerges from the "alien" vacuum? inflating universe, and it starts to grow.* what is "growth"? When I say "the crooked-coiled dimension, it expands and thus stretches and thus" increases the length "(interval), then it makes sense, but for you it" grows "from what? And this bubble nucleation

is also a random quantum process. It happens at different points randomly, and so— You will have, after a while, this inflating (unpaking) space sprinkled with these different bubbles. The bubbles that formed earlier big, the bubbles that are just forming are tiny. And as I said the bubbles grow, * they only melt so that the curvature of the dimension expands-unpakings but they very rarely collide, because the space between them is expanding even faster.* Space expands-unpakings and bubbles (with a different curvature of dimensions) "float" in it http://www.hypothesis-of-universe.com/docs/c/c_244.jpg ; http://www.hypothesis-of-universe.com/docs/c/c_241.jpg .. this is an imperfect visualization of "unpacking" and "centers in the Universe are not just one but millions of such centers, so the area of galactic clusters and half-empty spaces between them unfolds differently." http://www.hypothesis-of-universe.com/docs/c/c_240.jpg the different curvatures of the curved dimensions fit together We cannot really travel to other bubbles because the boundaries of the bubbles are expanding so fast. They expand at the speed approaching the speed of light. So, no matter how fast we travel we will not reach the boundaries. So, for all practical purposes, we live in a self-contained bubble universe. And an unlimited number of such bubble universes will be formed in the course of inflation So, that is why it is called "eternal inflation". Inflation never ends in the entire universe.* and it did not end in another part? It ended in our part of the universe, and this is what we call our Big Bang,* and in another part weren't the big bangs? when this energy of the vacuum went to ignite a fireball of particles, and that's— That was our local Big Bang in our bubble.* And what exists between the bubbles? is Beelzebub ruling there? But countless Big Bangs happened before it in other bubbles * and what about "bangs - splinters" in those bubbles? and will happen after it. Many textbooks claim that inflation happens after the Big Bang. But when we spoke to Alan Guth, the father of inflation, in Episode #4 of this series, he claimed that it might be better to think of inflation version A happening before the Big Bang.* How about thinking about version B, ie HDV? !! * In the early interpretation, Big Bang was kind of a singularity, where if you take the simplest cosmological models and continue them back in time you find a point where the energy density and temperature become infinite.* O.K. But there is no matter in the infinitely crooked chaotic foam of dimensions! Matter is born by the process of packing dimensions into "prescribed" configurations from the "prescribed" number of dimensions for each basic elementary particle http://www.hypothesis-of-universe.com/index.php?nav=ea (what is the " prescription "I don't know yet) It's simply the point where the mathematics of the theory breaks down. You cannot go any further and so, that's where you stop. But— The meaning I use the term Big Bang in is the beginning of the standard, hot cosmological evolution. So, when the universe has a very high temperature, very high density, is rapidly expanding— That's the Big Bang. Before that, according to present views, we have inflation. Now Big Bang, the term, is sometimes applied to [the] initial singularity, if you want to consider one. But, in fact, I think [a] singularity is not a useful thing to have in a physical theory, because you want your mathematics to work, you don't want it to break down."What happened before the Big Bang?": inflation.* ? inflation, but what? what inflated? and where was it? in what? "What happened before inflation?" * An unanswerable question for physicists and their visions. For HDV, it's absolutely essential and realistic: 3 + 3d flat space-time, infinite, no matter, no fields, no flow of time, no expansion of space. Then in this middle big-bang. No matter what you say you can keep asking what happened before that.* Yes, these are bad questions, because the flow-time before the big bang did not exist, but there was a majestic 3 + 3d space-time with two quantities (which have three plus three dimensions) So, creation from nothing kind of seems to be the only thing that stops this infinite regress. Not no When I had the idea that inflation is eternal I went to see Alan Guth and tell him about this. And he actually fell asleep. I should say that now he is a great enthusiast of eternal inflation. When I got to know Alan better, I discovered— Well, first of all, I discovered that he's a pretty sleepy fellow. He comes to

seminars regularly, and he regularly falls asleep a few minutes after the seminar begins in most cases. Sometimes actually [he] stays awake, but these are exceptions. But then, no matter what, in the end Alan wakes up and asks [the] most penetrating questions about─ About what was said in the seminar. If I knew his supernatural abilities, I would continue telling him about my idea, but I quickly retired. Many have claimed that as other bubble universes cannot be directly observed, the multiverse is not science. In Episode #4 we talked about the possibility of detecting signatures, bubble collisions in the Cosmic Microwave Background, But the Vilenkin and his collaborators have recently worked on a new proposal for testing the multiverse.

(05)- multiverse picture, there is not just one type of bubbles. String Theory, for example, predicts an enormous number of possible types of vacua, and all these vac─ With this vacuum comes a corresponding type of bubble which can be filled with that vacuum.* The basis of the vacuum is a network of 3 + 3 dimensions called space-time… and only "then" the vacuum is formed, eg into "foam of curved dimensions", in which packed geons, cocoons… or pairs of particles can "form-disappear", simply the vacuum is "full curvature dimensions "and dimensional curvature is the PRINCIPLE of realization = constructions of matter in the style of" packing "into, which" take on "properties ..etc. as HDV says And in the course of eternal inflation all these vacuum states will be populated to have bubbles within bubbles, within bubbles. When inflation was going on in our region of space, bubbles of different vacua popped out and expanded. * We just each tell each other a different fairy tale… ***"me about the goat, you about the car"*** When we worked on this idea we thought, 'What is going to happen to these bubbles when inflation ends?' The answer is that instead of expanding they will start contracting and they will collapse. * When the universe and all its curved dimensions expand (by which I mean spaces-volumes between galaxies, and spaces in the cosmic web, and spaces in galaxies and spaces trapped in matter = 3 + 3 dimensions packed), so that all curvature of all dimensions therefore, "matter will melt", the Universe will be in the state that prevailed before the Bang of this universe, the flow of time will stop - it will be unpacked, expansion will stop - the dimensions will be Euclidean-equal - laws, rules, principles will disappear, etc. The multiverse is changing just and, thanks to the "curvature" of dimensions, this is a basic act They will form black holes. And we've calculated the mass distribution of these black holes. So, there are there is a very uniquely defined distribution of masses.* At the large scale, the weight distribution is homogeneous, because the distribution of curvatures is also homogeneous… http://www.hypothesis-of-universe.com/docs/c/c_362.jpg The picture presents a luminous mass, yet this "network of points" could easily serve as a visualization of inhomogeneous curvatures of spatiotemporal dimensions ... that is, as if I asked a graphic designer to draw networks of more and less vibrant fields and volumes of spatiotemporal dimensions And, for one thing, these black holes are interesting because they may explain, say, the origin of supermassive black holes that we observe in galactic centers. But also if we really detect black holes with this predicted mass distribution, that would be evidence for the multiverse, that we indeed had this period where bubbles were nucleating. So, these are basically failed bubbles, these big black holes. So, these are direct tests. If we are lucky enough, we will be able to observe these things. But also there are indirect tests possible. The idea is that if you have indeed these bubbles with variety of physical properties,* the mass elements have properties, but what are the properties of space-time? than the only one : "CROSSING THE DIMENSIONS" some people noted that this will explain fine-tuning, observed fine-tuning of the constants of nature.* Constants are an interesting topic. Among other things, the "size" of the constant certainly depends on the human choice of units (and which quantities have units?… That?). http://www.hypothesis-of-universe.com/docs/c/c_052.jpg It will be more mysterious to find out "why the elementary

particle is built by a" Somewhat "approved template, ie a non-random configuration of the packaging of dimensions" unelected "and unelected given curvatures. I have no idea Because obviously we can live only in those bubbles which are suitable for life. But you can turn this around and make it a testable prediction. You can say, okay, if you have a theory of this multiverse, Can we try to predict what kind of bubble we are most likely to inhabit? In particular, what values the constants of nature, like [the] gravitational constant, or electron charge, or whatever other parameters [it] will have. This prediction was actually successful for one constant, which is the cosmological constant of the vacuum energy density, or it is sometimes called dark energy.* O.K. Vacuum energy in HDV theory can be nothing more than a "dense foam of curved dimensions"… curvature of dimensions is the main reason for the realization of matter (and fields as well) There was a great problem related to this parameter, which is that particle physics models naturally predict a huge value for this cosmological constant. And that would cause the universe to inflate at tremendous rate, which we obviously don't observe. So, the the problem was why the vacuum energy is so small. If you calculate the vacuum energy, this large value comes from quantum fluctuations due to different fields. Like, for example, photons contribute positively to vacuum energy and electrons being fermions contribute negatively. So, in principle, you can imagine that different contributions will cancel out, but that would require cancellation up to 120 decimal points.* !?!? I personally do not believe in the accelerated expansion of the Universe. I am a conservative and I believe in "parabolic gradually slower and slower unpacking", ie at $\Lambda = 0$ https://astronuklfyzika.cz/Gravit5-3-TemnaEnergie.gif So, that would be a tremendous fine tuning. However, if you have a huge multiverse with a very large number of different vacuum types, in most of the bubbles you will have [a] cosmological constant very large, and there will be no observers there. But in some very, kind of rare bubbles, just by chance, you will have a small value. And that's where the observers will be. Now, you can try to figure out what value we are likely to observe. Steven Weinberg was the first to find the bounds. He found the bounds if the─ He figured that if the cosmological constant is bigger than some certain value, then the repulsive force due to it is too large to allow galaxies to form. So that obviously will not be a populated type of universe. But the next step was to figure out─ Okay, this is where we don't live, right? So, this is not really a useful prediction. But you can try to calculate where we are most likely to live. And that's in those bubbles where the cosmological constant does not start dominating before galaxies are formed. So it allows galaxies to form. And then you have a large number of galaxies. After that, [the] cosmological constant can dominate without damage. And that predicts a value, or a range of values rather, which at the time when the prediction was made people paid little attention to it, because anthropic arguments were in disrepute─ Disresp─ Disrepute, I think. ─Yeah. And, then─ [A] value in the predicted range was actually observed. It came as a shock to most physicists when the antropically predicted value of the cosmological constant was actually observed. And this changed many minds. So, no other possible explanations for the observed value of the cosmological constant have been found. So, this may be our first indication that there is indeed a huge multiverse out there. If the amount of dark energy in the universe is delicately fine-tuned for life, the multiverse can explain why. We have to live in a part of the multiverse that permits life. http://www.hypothesis-of-universe.com/docs/g/g_041.pdf

(06)- But a recent study has suggested that dark energy could be many times larger than the observed value, without threatening life Furthermore, they claim that this puts pressure on the multiverse as an explanation. I think they somewhat exaggerated the─ That─ So, the initial prediction when you calculate the probability distribution. That calculation was actually a pretty rude. The─ Basically the probability of finding a certain value of [the] cosmological

constant was identified with the fraction of matter that clusters in galaxies. So, if you have a cosmological constant large enough to make, say, most of the matter to avoid clustering in galaxies, and only a few galaxies are formed, then the probability of such a universe is low. And if most matter is in galaxies, then the probability is high. When you calculate the probability distribution using this you find that it is pretty broad. And the observed value is on a low side of the distribution but within the 95% range. So, what they did─ They did a more realistic calculation using [a] numerical simulation of the universe, and they found that it is somewhat broader than─ But, in my view, not dramatically broader than analytic calculations did. But the main point is not that, that I want to make. The main point is that this model is, as I said, it is rather primitive. For example, it doesn't consider differences between galaxies. So, if the cosmological constant is large, for example, then it starts dominating early. And this means that galaxies also must form early.Any galaxies that you form will form earlier than galaxies in our version of the universe. Earlier means density is higher. So those galaxies will be denser. And stars will run into one another more often, and what's more important, supernovae will explode closer to us, right? Because the density of stars will be higher. In the last few months there appeared a paper where─ I don't remember the names, there were four Japanese authors─ They did a simulation but now including this effect of supernovae. And with some realistic assumptions about how close you can afford to have a supernova to you without causing a great extinction. And they found that as a result the probability distribution changes in such a way that we happen to be just in the middle of the distribution. So, I think there is no big problem there. While eternal inflation may be possible to probe experimentally, is there any prospect for evidence of tunneling from nothing? The mathematics of this proposal gives you a probability distribution for initial states. So you can say what kind of state the universe is most likely to appear. Inside it will be very small, filled with this high-energy vacuum. What kind of fluctuations it will have, and so forth. The problem is that after that, you have this eternal inflation with bubbles, and so forth. So, the universe forgets its initial state. So, you have tunneling from one bubble to another. So, it's kind of a process where the initial state is completely erased. And that's why it's very hard to test. So far nobody [has] really figured out how it can be tested. The universe could be closed, like a sphere, or negatively curved, like a saddle, or have no curvature, like a flat plane.* https://astronuklfyzika.cz/Gravit5-3-TemnaEnergie.gif; https://astronuklfyzika.cz/Gravit5-3-TemnaEnergie.gif ; https://upload.wikimedia.org/wikipedia/commons/thumb/d/dc/Friedmann_universes.svg/440px-Friedmann_universes.svg.png One thing tunneling from nothing does suggest is the shape of the universe. The universe in this picture has to be closed. Because an open universe is infinite, and the probability for an infinite fluctuation is exact exactly zero. [Phil] We observe the universe to be flat. Is that right? Geometrically, yes. It's flat with a very high accuracy.* From a global point of view, in a "stop-time" overview >> today << it is also almost flat, (geometrically Euclidean) up to a distance of about 400,000 years, http://www.hypothesis-of-universe.com/docs/c/c_239.jpg , as the picture shows http://www.hypothesis-of-universe.com/docs/c/c_029.jpg from a distance is flat, but in localities everywhere in the universe elected, galaxies, clusters of galaxies or networks, these localities are variously non-flat, ie curved - the curvatures of 3 + 3 dimensions float in the whole range: from extreme curvatures through geometric curves such as parabola = gravity to those almost linear curvatures. [Phil] So, how do you make that? 'Cause, isn't a closed universe curved? Sure. The universe is closed, and when it appears is like a three-dimensional sphere of extremely small radius. But then it inflates, and Inflation makes it huge.* Stop-states of the Universe in stop-time So, we see only [a] small portion of this universe and it appears flat to us.* O.K. On the observability horizon, which is 13.8 billion years away from our system, space-time is rotated, distance = line from our system to the visibility horizon is rotated, it is curved just

according to STR… because STR is by its nature a rotation of systems, ie the Observer and system Object. The photon that leaves the quasar lying directly on the horizon will no longer reach us because it flies "radially" from us, and from the quasar a short distance from the horizon it flies towards us "in an arc" because the global space-time is already rotated at the horizon The tunneling from nothing proposal requires that the laws of physics exist platonically independent of the universe.* But laws cannot exist "independently" of the Universe, of the existence or non-existence of the Universe. It is absirdita. The sequence of laws is born during the aging of the Universe One reaction has been that this cannot be. As laws are just descriptions of how objects behave and have no causal powers. People who say that was a mere descriptions─ I don't know where they get this knowledge. It seems to me that the laws may well have some platonic existence.* No. Laws also have their genesis, ie the "tree of succession" of the emergence of new and new laws. After the Big Bang, "all" contemporary laws did not exist. In biology, we have a lot of rules and laws that weren't in that hot plasma after the Bang [Phil] Do you have any thoughts on why the laws are what they are? http://www.hypothesis-of-universe.com/docs/g/g_041.pdf ; http://www.hypothesis-of-universe.com/docs/eng/eng_009.pdf Any ideas about that or it's just a given? I wish I had, but it's certainly the question that suggests itself.
And the only attempt to address it, which I know, was made by Max Tegmark, who suggested [an] even bigger multiverse * Is this an "attempt"? and even one? the best ? how to prove that the laws (physics, chemistry, biology) are platonic chosen all at once? …?. ,☺ He said that, okay, maybe all possible mathematical structures are somehow realized. I think this idea has some problems, like, for example, there are many more complicated mathematical structures than simple ones. The laws we observe have certain simplicity to them. Einstein said beauty.

(07)- So, this seems to be a different selection criterion from just a random pick in the huge set of mathematical structures. But the bottom line is that we have no idea where the laws of physics come from.* I repeat: laws are born, arise, recruited into a parallel sequence along with the formation of elementary particles and their interactions into more complex structures, which is the "interweaving" of packages of curved 3 + 3 dimensions in the welcome of space-time. A frequent problem that has been raised in the context of a multiverse is that of a "Boltzmann brain". If universes can spontaneously appear, why not just a brain?* ,☺ I will point out my work here again http://www.hypothesis-of-universe.com/docs/eng/eng_009.pdf when I regret with sad amazement that there was not a single person in the world who would read it and offer it to perfect this vision And if such brains dominated the multiverse, then why aren't we one of them? In the multiverse you have these bubbles nucleating,* "Multiverses"; "Bubbles" are, in my opinion, a useless fantasy which are populated by observers like us, and you can also have these freak observers that fluctuate out a vacuum, or isolated disembodied brains, * I like that more than you say, they like the fairy tale Devil and Spinner as people suggest, which have the same perceptions as we have. Once you have a specific model ,☺of the multiverse, * and the model Hell with devils is not enough ?? you can figure out which are more probable. Like, you can compare their numbers, and if your model predicts ,☺ * sometimes "model" predicts a devil with three corners… that predominantly the observers are Boltzmann brains, that the model is, I would say, ruled out by observations. Maybe not ruled out by observations, but I think this model is unsatisfactory. ! But there is a criterion which you can figure out, and there are quite a few multiverse models which do satisfy the criterion─ That ordinary observers dominate over Boltzmann brains. So, I don't think it is an insurmountable problem. It is just a condition that needs to be satisfied. In one of our previous episodes, we discussed the No Boundary Proposal of Hartle and Hawking. How do these proposals differ from one another? The the two proposals are similar in spirit, but

mathematically, they are rather different.And the predicted initial conditions for the universe are also rather different. In the tunneling proposal the prediction is that the universe appears filled with the very high-energy vacuum * O.K. Every crooked state of three plus three dimensions is already a state of matter and therefore energy… The distortion of dimensions is the essence of the appearance of matter… and no one in the bag is surprised that "the foam of those dimensions" reigns and behaves like a plasma in a chaotic state and it has initially a very small size. Because these things are related: The high-energy vacuum corresponds to small size of the universe.* This is the case after the Bang… but it is still the case in the development of space-time into expanding more complex forms of space-time with matter (fields, stars, galaxies,) the energy (low-energy) vacuum does not disappear, there is 13.8 billion years throughout history, there is all around each of us (on the Planck scales) The Hartle-Hawking proposal, on the contrary, says that the universe should appear filled with very low energy vacuum and have a very large size. The larger the initial size the more probable it is. I find this rather counterintuitive, but on the other hand, things do not have to be intuitive with quantum gravity. While inflation is the mainstream view of cosmologists, it does have its critics. And one of the most prominent of these is Neil Turok. He and his colleagues recently took aim at the Vilenkin's tunnelling from nothing proposal. They claimed that this thing doesn't work and, basically, if you look at other particles, other than just gravity and this field that is responsible for inflation, there are huge instabilities. That somehow these particles are created they are formed * they are formed by packing space-time dimensions by packing space-time dimensions in huge numbers, and─ So the model predicts various disasters which we don't observe happening. And they claimed that this applies both to my proposal of tunneling from nothing and to the ideas of Hartle and Hawking, which were in a similar vein. So, there was now a stimulus to reexamine these ideas, and I actually wrote a paper with Masaki Yamada, here at Tufts, where we show that these things don't really happen. But this required a better understanding of mathematics of the model, and─ So, we felt that we made some progress. In 2003 **Arvind Borde, Alan Guth and Alex Vilenkin** published a theorem, often known as the BGV theorem, which implies inflation must have a beginning.* Inflation of "what" (?) (Matter? Money, love?) Must have a beginning ??? "What" explodes with inflation? It is the inflation of the quantity "LENGTH" and the quantity "TIME" (which each have 3 dimensions). These can inflant and the material elements are only secondary in 3 + 3D But does that mean that the universe as a whole had a beginning?* O.K. "Our" Universe had the beginning of the beginning of the genesis of changes in that Bang (the beginning of the flow of time, the beginning of space expansion, the formation of matter, etc.) and the logic of your sentence implies that there is still a "foreign" Universe and… our "Universe The theorem proves that inflation must have a beginning, right? The universe as a whole─ It doesn't─ The theorem doesn't say that. It says that the expansion of the universe must have a beginning, right? But it opens the door somewhat for alternatives. One alternative that would circumvent the BGV theorem is a universe that contracted before it expanded. While many cosmologists we've interviewed find this a plausible option, Alex Vilenkin takes the opposite view. Strictly speaking the theorem allows the universe, which is contracting from infinite size, for example, * which is the interpretation of "ours" about when from an infinitely large 3 + 3 dimensional universe before Bang (flat without matter, without fields without flow of time, without curvatures of dimensions) was born by step shrinkage = extreme curvature of all dimensions into PoClamp foam of boiling dimensions = plasmas as finite size and then bounces and re-expands. It─ This excludes the model of eternal inflation to the past. The question that the theorem answers clearly is that inflation maybe eternal to the future, but cannot be eternal to the past. There may be problems with contracting universes, because basically contracting universes are highly unstable. If you have, for example─ You know, the galaxy is formed by gravitational instability. You have a small over density and

attracts matter and it grows. In flat space it grows faster than an expanding universe.* It could even be the case that the abrupt expansion of the plasma could occur in parallel with the "abrupt" dynamics of dimension packing, which carries smaller volumes with a denser environment. Both take place s i m u l t a n e o u s l y : expansion of space-time and collapse of space-time (into quarks, leptons, bosons ...; further into atoms, molecules and compounds) When the universe expands, it slows down all these instabilities. But in contracting universes, it grows catastrophically. So, if you have some inhomogeneities in this contracting universe, they would grow out of hand. For example, if you have bubble[s] forming, all these bubbles instead of being driven away from one another they would be driven towards one another.

(08)- So, the whole thing will [be] filled up with bubbles and inflation will end. But strictly speaking, it is allowed. One of the great mysteries of Cosmology is why did the Big Bang have such a low entropy condition?* http://www.hypothesis-of-universe.com/docs/c/c_088.jpg Vacuum foam of chaotically boiling dimensions will probably be the most ordered state of matter, ie with the lowest entropy (?) Entropy is an extensive quantity, it's proportional to the volume. And the very small universe will necessarily have a very low entropy. But also it is filled with vacuum, and that is also the lowest entropy that you can have, is the vacuum. While Alex Vilenkin's picture of multiple Big Bangs is a radical one many of his critics propose a cyclic model instead, which also has many Big Bangs. It seems there are very few, if any cosmologists, proposing the standard picture of a single Big Bang. * That's not enough… If you call standard what is called the Standard Big Bang Cosmology, which was the hot Big Bang. You start with a very hot, dense universe which begins at [the] singularity. So that picture I don't think anybody believes. * When I started with HDV, ie with the vision that "our" universe began with a leap event of the change of the previous state (before the big-bang) to the state following the extremely curved dimensions of space-time after the bang, scientists still believed in that singularity. In eternal inflation, there is thought to be an infinite number of infinitely large bubble universes. But some have said that infinity cannot exist in the real world. These bubble universes that form in the course of eternal inflation─ These bubble universes, kind of, if you look at them from outside,* it's a fairy tale they're spherical bubbles which expand. So, at any given time they are finite, but they grow indefinitely to arbitrary large size. But then if you look at them from the inside, if you're an inhabitant of these universes, the geometry of them is very interesting. Because in the interior these bubbles are infinite spaces of negative curvature. So─ How an infinite space can fit into finite space? * You can see that she thought! Scientists is on a completely different direction of creation. It can be seen that although some read HDV, this idea did not "affect" them at all .. it did not lead to new thinking This is because the finite, inflating total universe grows exponentially, becomes exponentially large, and kind of infinity of space and time mix together in an interesting way. So, it's hard to explain in words. But my point is that these bubble universes are infinite from inside, and this is a mathematical fact. You could say, ok, maybe this─ The entire space of the bubble is not in existence at any finite moment. But I don't think that you can really, meaningfully make claims * it is a fairy tale like that, simply because in these inflating universes different points in the space-time are not causally related. So, whether or not the universe is infinite at this moment of time─ You have to define what you call time,* yes, I defined exactly, see HDV and there is no unique definition, because, you know, you cannot synchronize clocks in [an] eternal inflating universe.* Time is not a clock… Time is a phenomenon-quantity which "has = presents" also in three dimensions as the quantity Length with three dimensions, we call it space (in time we could call "time") And only "after this time dimension" when moves the body, the material, so the body "on the time dimension" cuts the intervals with so the sequence of these intervals is

our knowledge of time, the perception of our passage of time. So time does not pass by itself, time does not pass to us, but we-objects flow "after him" Georg Cantor developed a theory of infinite sets, and he defined sets of different level of infinities, so you can have like one infinity bigger than another infinity. Mathematicians, at least some of them─ Some well-known ones, deal with infinities without fear. Until a way to experimentally test the tunneling from nothing proposal is found we may never know if it's right or wrong. But the fact there are still papers being published about it, more than 30 years after it was proposed, shows this idea has much stayed in power.* We have loved the fairy tale "Devil and Spinner" for 30 years, so it survived because it's a beautiful fairy tale, isn't it? So where do we go from here? With the tunneling from nothing, I think now we seem to have entered a very stimulating period stirred by these papers by **Turok and Lehners**.* https://www.aei.mpg.de/43381/homepage-of-jean-luc-lehners I see "how much" one has to write on the web so that someone in the world knows about it and knows the name… I work with My collaborators here, and Hartlel and his collaborators also Kinda were spirits to activity, So, at least there were some issues [with] the mathematical formulation of these proposals which required clarification. And I think we are working on that now. I like the results that we get. We think that we clarified a great deal about how [the] mathematics of the proposal works.* I'm sad when I can't build math for HDV. One day, willing people will build it. Interestingly from history, mathematics was written by geniuses and then physicists "used it for free, ie it was prepared for their visions, and other times physicists did not have mathematics for their visions, so they had to invent it for visions." It would be good to have progress in Quantum Gravity.* Why do you want to "quantize" gravity? really tell me the reason That, you know─ That would provide another stimulus for the field.* Why is the field once smooth and once quantized? **"What"** do you quantize in the field? Even the field is a space-time that is smooth - a little crooked from the perspective of the global Observer, and it is a grainy (boiling) field from the perspective of the Observer in the microworld. As for Early Universe Cosmology, there are many things that one should be looking for, including dark matter, and─ There are some anomalies seen in the Cosmic Microwave Background which kind of call for for an explanation. They may be just flukes but they look suspiciously, kind of, persistent So it will be good to explain those. And maybe I could add one of my other favorite subjects, which is cosmic strings. It's, you know, the─ Progress in Early Universe Cosmology is closely related to progress in Elementary Particle Physics at high energies. We are coming to a point where building bigger and bigger accelerators becomes problematic. Because already we have an accelerator, which is 30 kilometers in size. How much bigger can you get? So, it would be good to find some other ways to investigate high-energy physics. One of the ideas is that in the early universe, of course, at early times tremendous energies were reached, tremendous temperatures, and the idea is that as the universe cools down from this extremely high temperature, it can go through a series of phase transitions, and as a result of these phase transitions, it defects, like cosmic strings or monopoles.* folk story

(09)- Other main walls can form. And cosmic strings appear to be the most interesting of these defects. They are kind of lines of concentrated energy, and they can produce a variety of observational effects.* And the devils are a kind of goats painted red * Observers are well aware of the possibility of the existence of cosmic strings Observers are well aware of the possibility of cosmic strings existing,* but to this day they are not aware of the POSSIBILITY OF EXISTENCE of curvature, ie packing the dimensions of two quantities For example, they can produce gravitational waves and some electromagnetic phenomena. So, if cosmic strings are discovered we are going to learn a great deal about high-energy physics that we cannot learn─ At energies that we cannot even hope to get an accelerators. As astronomers look out

into the cosmos, One can only hope that new phenomenon like cosmic strings, or primordial gravitational waves might be discovered. If they are they may be the keys that could unlock the mystery of our cosmic origin. English subtitles by: SpanishSubs

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