CONNECTING THE MAPS
(A lecture delivered to the Vedanta Society of Southern California, Sunday, December 10, 1978)

Let me begin with a quote from Plutarch: "All becoming has two causes, of which the most ancient theologians and poets chose to turn their attention to the stronger only, pronouncing over all things the universal refrain: 'Zeus first, Zeus middle, all things Zeus', while they never approached the necessary or physical causes. Their successors, called Physikoi (the physicists), did the very reverse; they strayed away from the beautiful and divine principle and refer all things to bodies, and impacts, and changes, and combinations." I want to talk about both kinds of causation. Swami Ashokananda once said that Vedanta is like a great department store. There are all sorts of items for sale there, items to suit almost every need. You go; you buy what you need. It is not required that you buy everything in the store. But there are certain things that have been, in my opinion, dishonestly advertised, and I feel that the shelf displays need some touching up, and among those items which have been wrongly represented are the three Gunas and the Five Elements. But first I need to present the problem.

Suppose we just consider the present situation. You see somebody here, an embodied being, moving and talking, and the question is: Of what are these bodies made? Of what is all this made? Well, the chemists will give you a real quick answer. They are made of a very few ingredients. There are only about 92 things out of which this visible world is made, and these bodies are made of only a handful of those 92. Really not an awful lot of things; hydrogen and oxygen and carbon and nitrogen and a few other things in smaller amounts. Now where do they come from? They come from the stars. That is to say, all except hydrogen are derived from hydrogen in the bellies of the stars. Hydrogen falls together by gravity in a star like our sun — well, let's take a larger star, not one like our sun. Let's consider a larger star because the other chemical elements that get scattered around here, out of which these bodies are made, are not made in stars like our sun. Our sun will make helium out of hydrogen, and carbon out of helium, and that's probably as far as it will go. But larger stars make a whole lot of other things, larger chemical nuclei up to the size of iron, and when the centers of those stars are iron, those centers collapse by gravity and the outer portions are blown away by the energy released in the collapse. Out of those things we are made, that is to say, out of those things our bodies are made, and all of those things were made out of hydrogen by what we call transformational causation. The hydrogen goes to helium, the helium goes to carbon, the carbon goes to oxygen then to neon, magnesium, and so forth, and all of this is transformational causation, and we understand it very well. It is governed by the conservation laws; for example, in any transformation, the energy at the end is never more than the energy at the beginning. But the hydrogen does not arise by transformational causation. It cannot arise by transformational causation. Hydrogen is made of energy, and energy cannot arise by the transformation of energy. Hydrogen is made of electrical particles, and those particles do not arise by the transformation of something else. The electrical particles fall together by gravity, and the gravity does not arise by transformational causation. And the electrical particles have inertia, and the inertia does not arise by transformational

causation.

Now this, really, is the big problem in human knowledge. We have understood for a long time how transformational causation goes. We start with certain ingredients and end up with something else.
The sun begins as hydrogen and ends up as carbon. The great question is: How do the original ingredients arise? Now instead of taking the materials out of which all this is made, let's take the energies. It's obvious that I'm moving around, and my lips are moving. All this is done on some kind of energy. And when we look at the kind of energy, we find that it is chemical energy. It comes from eating. There's a story on that. Swami Shantaswarupananda, when he first came to this country, wouldn't eat well. He just ate the teeniest amounts, like Swami Pavitrananda, and I was supposed to feed him you see, and to see that his diet was properly nutritious, but he wouldn't eat it. And so, Swami Ashokananda was upstairs to scold him one day and said, "All energy comes from food. Spiritual energy also comes from food. The more you eat, the more spiritual you are." (Laughter.) Well, this energy by which we move these bodies around is actually canned sunlight. It is chemical energy now. We get it by eating potatoes and wheat grains and corn and various other things and by drinking milk and by eating cows and chickens and various things, but the energy that they have comes from the sun. The energy changes from one form to another without any change in the amount. The plants hold out their hands and catch the sunlight. They pick up carbon dioxide with their hands, and water with their feet, and there are a few minerals thrown in, but that's not where the energy comes from. The energy comes from the sun. So when we eat all those things, we oxidize them back to carbon dioxide and water. When the plants got them they were carbon dioxide, water and sunlight. After we're through with them, they're once again carbon dioxide and water, and we run around on the canned sunlight. So all this that you see moving here is moving on canned sunlight. Even these lights that burn here are burning on canned sunlight. The sun puts water up into the sky, we catch it in the mountains, run it down through those big turbines, and we cause the electrons to flow through these wires. But it's canned sunlight. Now where does the sun get its energy? Now you see, we are tracing it back. We're tracing it back to its source. It's chemical energy here, that's electromagnetic energy. But formerly it was radiational energy coming from the sun. Before that it was kinetic energy in the sun. The energy that the sun radiates away, in the state before it is radiated away, is kinetic energy. But how did the sun get its kinetic energy? How did it get so hot? It got hot by falling together by gravity. Now, once again, this is all transformational causation. We start with certain ingredients and end up with something else, something which looks very different, not by any change in the amount of energy but only by a change in form. From gravitational energy it goes to kinetic energy then to radiation then to electrical and magnetic energy and we move around. All this is transformational causation. The energy changes in form but not in amount, and these other forms of energy come from gravitational energy by this transformation. But the gravitational energy does not arise by transformation. Now there is the problem, you see. All the chemical elements besides hydrogen arise from hydrogen through this kind of causation, and all these other energies arise from gravitational energy by this kind of causation, but neither the hydrogen nor its gravitational energy can arise in that way.

Now these five kinds of energy that I just listed are the Five Great Elements of antiquity and they need to be properly dusted off and re-translated into English.* The present translation, which is probably in all the books on these premises, including the Sanskrit dictionary, has Akasha translated as ether. But the notion of ether left physics in 1905, and it is high time somebody noticed that and redid the translation. Ether will not do. There is no such animal. Now to translate that fine Sanskrit word as ether is, in my opinion, dishonest advertising. And if we are to be honest, in this department store of Vedanta, we should advertise the wares satisfactorily.

Now the notion that there are five great forms of energy is an old, old idea. In the Upanishads we find the statement that "From Brahman arises Akasha. From Akasha arises Vayu. From Vayu arises Tejas. From Tesas arises Ap and from Ap arises Prithivi." These are the Five Great Elements of antiquity, usually translated ether, air, fire, water and earth. You may skip all those translations. The first energy is gravitational energy. It goes to kinetic energy, that goes to radiation and that goes to electricity and magnetism, which were said to be twins. They really are twins. Those people had it straight — very, very straight — and a very long time ago. Now those five energies are said to be perceived by our five senses. Akasha is said to be perceived by the ear. The ear has three kinds of sensations and the oldest one, the saccule, senses our orientation in the gravitational field. Now in all our books, the first element will be translated as sound. But the universe does not arise from sound. Not only that, but sound arises by transformation and not by the first cause or Prakriti. By the first cause (from Brahman) Akasha arises. It is gravitational energy. From that arises an energy, Vayu, which is perceivable by the skin. That is kinetic energy. Temperature is a measure of kinetic energy. From that arises Tejas, 'that which shines'. It doesn't mean fire, it means that which shines. It means radiation, some of which is perceivable by the eyes. From that arises Ap and Prithivi are electricity and magnetism, perceivable by the tongue and the nose. Protons taste sour. The raw ingredients of this universe, that is to say the heavy ones, the protons, the nuclei of the hydrogen atoms, taste sour. Nothing else in this universe tastes sour. So electricity is what we taste with the tongue. The nose perceives molecular configurations, and that's a magnetic problem. That's complicated and I'm not going to go into it, but the magnetic pairing of the electrons is what holds the molecules together; so the structures are really magnetic structures and those structures we perceive by the nose.

Now you see this is really our problem. We can trace the material of these bodies and the materials of all this stuff that we see with our eyes back to hydrogen. It is perfectly easy; we know all the details now. But we have no way to get the hydrogen, the original material. It cannot arise by transformational causation. And we can trace all these energies back to the energy of gravitation, but we have no origin for the energy of gravitation. We have no origin for the electrical particles which make up the hydrogen, no origin for gravitation and no origin for inertia. Now this problem, the problem of the first cause, was handled a long, long time ago by some physicists in Northern India, probably some 5,000 years ago. Probably somewhere between 2,000 and 3,000 B.C., these things were thought out very carefully in North India - -but not by the Aryans. We think, you see, when we think of India that it has been inhabited by Aryans all along. That's not so. This was done probably by the people who planted rice. Now the rice

people, the people who invented the planting of rice, were in India long before the Aryans came, and there is another batch of people called the Pre-Aryans. They also came before the Aryans. So these old, old people, the Proto-Australoids, probably Rama's people, were there some time around 3,000 B.C. planting rice, and apparently they invented this worship which we do with five ingredients — not the Aryans. It was much older than that, and they apparently discussed these different kinds of energies and noticed that there are five different kinds associated with our five senses of Perception. It is perfectly straight physics, perfectly straight astronomy. There's only one other kind of energy that we know about in this universe and that is nuclear energy, but that's a very different kind of energy; it has to do with the uncertainty principle. Ordinary energies are five, and we do perceive them with our five senses. Not only do we perceive them. Even one-celled organisms perceive them, and the atoms themselves perceive them, that is, the atoms themselves respond to these same five forms of energy. There's no use saying, suppose we had another sense then the universe would appear differently — no, we have the right number now. That's all the energies there are to see. We don' t have to fool around with more dimensions, either. That's not the problem.

The problem is to understand how this hydrogen arises, and it does not arise by transformational causation. Now the notions that are current in the minds of a people when their language becomes codified get embodied in the language, and Sanskrit was codified in India. It comes from that line of languages called the Indo-European languages, related to Greek and Latin and a whole lot of other languages, but Sanskrit was codified in India. The reason we know that is because of the animals that are associated with the early language. When you hear about peacocks and tigers you understand that you are in Bengal. You're not in Greece; they didn't have peacocks. (Laughter.) It's the same as Little Black Sambo. You see, when I was a boy, I thought that Little Black Sambo was an African boy. It wasn't until I was quite grown up that I noticed that he was associated with tigers and melted butter. Now tigers and melted butter are in India and Little Black Sambo is little black Shambhu. Shambhu is a name of Shiva, and it is not an African story at any time. You see I had to be quite grown up to notice this. We take things for granted. Now we know that the Sanskrit language was codified in India and in that language we now have those ideas from the Proto-Australoids who grew rice and did all these worships and studied the Five Elements and all those interesting things. What happened, apparently, was that the Aryans entered India, probably some time around 2,000 B.C., gradually fell deeply in love with what they found there when they came, put it into Sanskrit, and by diligent efforts of memory lasting several thousand years, they have passed it down to us. Some of it has been passed down so long that the meanings have been lost. For example, the entire Indian nation thinks that this universe arises from sound. But that is wrong. They've even designated the sound: it' s Aum.

But the energies of this universe do not arise from sound. Sound arises by transformation. The energies of this universe are first gravitation, then kinetic energy, then radiation, electricity and magnetism. And the important point to notice is this — that the first cause, which we are here to discuss, gives rise to gravitational energy. That is, as the Upanishad says, "From Brahman arises Akasha." All the rest of the arisings are by transformation. But from Brahman to Akasha cannot be by transformation. Now those old

notions were put into Sanskrit and passed down to us largely in the form of the Upanishads. There may be some older texts in the Vedas than the Upanishads, but mostly these things are passed down in the Upanishads. And later on, people had to see if they could systematize the teachings of the Upanishads and that's where these famous six systems of philosophy arose — Sankhya and Yoga, Vaisheshika and Nyaya or Purva Mimamsa and Uttara Mimamsa or Vedanta. All these things arose in an effort to put the teachings of the Upanishads in order. Those hooks are very disorderly. They consist of the blurtings of people who saw things — that's all. "Na tatra suryo bhati na chandra tarakam . . . ." "Not there the Sun shines nor moon nor star, there the lightening does not flash, how could this fire? . . ." — like that. They are just simply sudden statements of somebody seeing something. "Those who know the high Brahman, the Vast, hidden in the bodies of all creatures and alone enveloping everything as the Lord, they become immortal. I know that great Purusha of sunlike lustre beyond the darkness. A man who knows Him truly passes over death, there is no other path to go." It does not sound like a school book. Nobody sat down there and tried to organize this stuff. They simply saw things, experienced things, and let them come out through the mouth, and somebody heard it and memorized it. Somebody heard it and, fortunately for us, memorized it and taught it to their children, and their children, and their children, for several thousand years. Now we have them printed up. They're not in such danger of being lost. But whole hosts of those things got lost. Probably we have saved not more than a few percent of those things that those old Rishis said. We don't even know who they were. We know something about what they saw and what they said.

Now Sankhya is considered to be the first systematization of those Upanishads, of the thoughts that have been passed down in the Upanishads. But the Sankhyans taught entirely transformational causation. They did not have the basic understanding by which they could even understand the language of the Upanishads I don't like to insult people like this, but is a very important point. We are here talking about Gunas, and the whole notion of the Gunas is completely disconnected from transformational causation. It is probably wrong to think that the Sankhyans used the Gunas First. They occur in the Upanishads, and in their proper context, but in Sankhya they think of the Gunas as things and they do chemistry with them — a little bit of this and a little bit of that and we'll make something; and a little bit of this and a little bit more of that and we'll make something else. No! That is not what the Gunas are about. The Gunas are about some entirely different kind of causation. Now the Sankhyans say that Prakriti is the first cause. The word means first cause. It comes from Pra, first, and Kri, to do. And they say that the first cause is made of three Gunas. So far, they're perfectly right. But what is the nature of this first cause? By what kind of causation can you get from Brahman to hydrogen dispersed in space and falling together in its gravitational field? You see, it is really a very hard thing to understand. From a completely formless, completely changeless, infinite, undivided Brahman, you get what we see. Quite a bit divided — divided into atoms. Quite a bit finite — teeny, weeny electrical particles. And quite a bit active — falling together by gravity into galaxies and stars. Now you see, when we say that Brahman is changeless, we say it because we see things in time. And what we mean is that Brahman is not in time. And when we say that Brahman is infinite, we mean that it's not in space. What we see is in space.

Now this business of seeing things in space and time is wrong. We know it

- Dec. 29th – Jan. 3rd Kolkata

Daughter of Thakur

- Lecture on Kapatura Day 1st
  Sri Ramakrishna

- Tapas to escort me

- Jan. 29th 150th Gauri Mata Feb.
  1 week

10:15am – Tapas.

11:05am – Gauri, Boston

now from our physics. Since 1905 we have gradually come to understand, even from our physics, that the notion of seeing things away from us in space and backwards in time is wrong. The universe appears in such a way that we see the whole thing in the past. We cannot see anything when it happens. It is only by seeing events late that we are able to see them away from us. The equation of separation in Einstein's relativity theory puts the separation between the perceiver and the perceived at zero. We see events away from us in space by a trick — we see them backwards in time. And if you're talking about an event of your perception, and the event that that event perceives, then the separation between those two events is zero. Suppose you see a flash of light from a star. We'll call that an event. And your perception of that event we'll call the second event. The separation between those two events is zero. If you can see the event there-then from the event here-now then the separation between those two events is zero, because in that case, always, the distance away is exactly balanced by the time in the past. And, because space and time are opposites, if the distance away is exactly equal to the time in the past, the total separation is zero. If the money you put into the bank is exactly equal to the money which you take out of the bank, then the change in your bank balance is zero. If the number of positive electrical charges which you have in a box is exactly balanced by the number of negative electrical charges which you have in that same box, then the total electrical charge on that box is zero. That's what we mean by opposites, two things that are identical and yet in some sense opposite, so that if you have the same amount of both it's like having none of either. Now space and time are opposites in that sense. They're both dimensions and they both come into the equation of separation. Relativity theory has pointed out in completely unambiguous terms that a distance in space is not a real thing. It's not objective. People disagree on distances in space according to how fast they're going by. And lengths of time are also not objective. There's no such thing as an hour. What you call an hour and what an astronaut flying by in a spaceship at a speed close to the speed of light will call an hour are very different things. What relativity theory pointed out is that it's the combination of space and time which has some semblance of objectivity. If you want to see the universe as objective, that is to say, as independent of the observers, then you must see it in four dimensions — three dimensions of space (right and left, front and back, up and down, perpendicular to each other) and one dimension of time. Now the equations say that space and time are opposites in that very interesting sense; so that between two events, say between here-now and there-then, if the distance between here and there is equal to the time between now and then, then the total separation between the event here-now and the event there-then is zero. It's a very important point because every event that you see, you see as away from you in space and backwards in time, and in every instance the distance is equal to the time so that the total separation, the four-dimensional separation, the objective separation, between the perceiver and the perceived goes to zero. Now if we ask what is behind this, if we ask, from our physics, what is behind what we see, then it says right away that what is behind it is beyond space and beyond time. That is what we mean when we say undivided, infinite and changeless. Undivided means that it couldn't be in space. With space you can see things as divided. Without space you cannot see them as divided. With space you can see things as small. Without space you cannot see them as small. With time you can see things as changing. Without time you cannot see things as changing. Now when we say that the nature of the reality is infinite, we don't mean that it's

bigger than space. (Laughter) We mean that it has nothing to do with space. Space is simply a mistake in our perception. And when we say that the nature of the reality is eternal, we don't mean that it lasts longer than time. What we mean is that the reality is completely devoid of our concepts of space and time. So when we go to describe the reality, Brahman, we find it is totally indescribable, so we grope. From the standpoint of space and time we point the finger. We say if- it's beyond space it's undivided. If it's beyond space it's infinite. And if it's beyond time it's changeless.

That much description of Brahman we can get from physics — that what is behind this universe of physics is changeless, infinite and undivided. Now we see it as divided — very finely divided into atoms, and nobody ever understood why. And we see it squeezed down to these minute electrical particles and nobody ever understood why. Einstein said, "We cannot understand, theoretically, why matter should appear as discrete electrical particles." And we see this thing as changing, and, once again, no one ever understood why. By no one, here, I mean no modern physicist has ever understood why what we see should be divided into atoms, made of discrete electrical particles, moving, falling together by gravity, and yet resisting every change in its state of motion. You see how crazy it is. It wants to fall together by gravity, it wants to fly apart by electricity, and it wants to remain totally stationary. (Laughter.) Well, you laugh, but you're no different. We do exactly the same thing. We want to be totally in love, totally free, and totally alone. (Laughter.) We fall in love; we get married. Then we find that our freedom is gone, and we want out. And once again we're lonely. And we want in, and we get out, and all the time we say, "Leave me alone!" The universe is made out of frustration. There is nothing accidental about it. It is made out of frustration because we see the universe by a mistake. We see it as in space and time by a trick — by a mistake. Now those old people, either the Mohenjo-Daro people or, more likely, the earlier Proto-Australoids, probably had this figured out. We don't know how long ago it was figured out that this whole thing is seen by a mistake. The kind of causation by which we see this thing is a causation by mistake — what we call apparitional causation — the kind of thing that you do when you mistake a rope for a snake. Nothing happens to the rope. But when you mistake a rope for a snake, three things are necessary. First, you fail to see rope rightly. This is the veiling power of Tamas. Secondly, you see the rope as something else. Now this else is the projecting power of Rajas. And then, thirdly, you saw the rope in the first place, otherwise you could not have mistaken it for a snake. You didn't mistake some other thing for the snake. You mistook the rope for the snake, because you saw the rope. This is the revealing power of Sattva. The mistake is not made at midnight and it is not made at noon. In the Sanskrit books it is specified that it is done in the twilight, as probably you are all aware. Why? Because you do have to see the rope, but you mustn't see it rightly. Now the veiling power of Tamas, the projecting power of Rajas, and the revealing power of Sattva — that is where the notion of the Gunas arises, in connection with the first cause, Prakriti, or Maya. The Vedantins say that Maya is made of three Gunas. The Sankhyans say that Prakriti, the first cause, is made of three Gunas. But the notion of the three Gunas arises here, and not in transformational causation. Sankhya took the whole thing the wrong way. They went all the way down through their entire cosmology building everything out of the Gunas. Nothing is built out of a Guna. Nowadays you find in most of the Sanskrit literature that Rajas is activity. No. There is no mention in the Sanskrit dictionary of any activity in

relation to Rajas. It is an impurity, the notion of an impurity, like smog. If you're talking about the sky, smog is there, that is Rajas. If you're talking about a field and it's all grown with grass that's fine but if you plow it and make it all dusty that has to do with Rajas. If you have nice, clear water that's fine, but if you put something in it, that's Rajas. It's an impurity. - It's seeing something else. I even hear such extravagant notions as matter is Tamas, energy is Rajas and consciousness is Sattva. Erase! Erase! No such animal. Matter is made out of energy. Matter is energy. We learned that from relativity theory. There are not two different things called matter and energy. It is just, once again, a mistake in our perception. So there's no use trying to use the Gunas for things like that. The Gunas arise in apparitional causation. When you mistake one thing for another, you fail to see the thing rightly because of the veiling power of Tamas. You jump to a wrong conclusion because of the projecting power of Rajas. But first of all you did see the thing, by the revealing power of Sattva. For instance, if you mistake a rope for a snake, you do see the length and diameter of the rope, but you see it as the length and diameter of a snake. Now the curious thing is this, that if you mistake the changeless, the infinite, the undivided for the changing, the finite and the divided, you had to see the changeless, the infinite, the undivided first, last and always. Because really there is nothing else to see. And the changeless, the infinite, the undivided has to show up in our hydrogen, just as the length and diameter of the rope must show up in the snake. If you see the reality as divided into atoms, the atoms will all come back together like a stretched rubber band, by gravity. Gravity is the undividedness seen in the divided. Electricity is the infinitude seen in the finite. Inertia is the changelessness seen in the changing. The more squeezed down into tiny electrical particles you see it, the more electrical energy those particles will have. The more spaced out those particles appear, the more gravitational energy those particles will have. And, finally, the faster you see the particles moving, the more inertia they will appear to have. Now this is what the universe consists of. We see it as divided into atoms but falling together by gravity. The undividedness has been seen. We see this as made of minute particles and yet every one of them is electrical; it wants to become infinite. As Swami Vivekananda said, "The whole universe is not big enough for even one particle." Everything tends toward infinite dispersion. Everything tends toward infinite condensation, and everything tends to resist every change in its state of motion. Now everything in the universe runs toward the changeless, toward the infinite, toward the undivided. There are no other goals. There is no mechanical universe driven from behind. No. The whole thing is driven from the front. Hydrogen is driven toward all other hydrogen in the universe because the reality is undivided. The electrical particles are driven toward infinite expansion because the reality is infinite. And all matter is driven toward resisting every change in its state of motion because the reality is changeless. Now hydrogen atoms are very direct. If you let them go, they'll fall straight toward the closest blob of matter — no fooling around. (Not that anything comes of it. Nothing reaches the goal through transformational causation.) But unlike the hydrogen, we are indirect. We have egos which are genetically invented and genetically misprogrammed to run in roundabout ways. We run after the undivided, the infinite and the changeless, not by directly falling to the ground and such things, but instead we run at the dictates of the genes to undertake transformational actions --actions by transformational causation — to do the bidding of the genes. That is, we do actions which give rise to viable offspring. We are

programmed that way. The whole notion that this is a building, that these are lamps — these are genetic notions. Our ego itself is genetic and the programming of the ego is genetic. We are identified with a piece of matter called the body, and the whole thing goes on from there. But you see, it is not possible to get anything out of it. It's made out of frustration, and you can never get anything out of it. If we had gotten into this dilemma by transformational causation, we could get out by transformational causation. If we had gotten into this by walking too slowly, we could get out by walking a little faster. We didn't get in by walking. If we'd gotten into this by talking naughty things, we could get out by sweet talk. We didn't get into this by talking. We didn't get into this by any action whatsoever. All actions are transformational in nature and they arise only within the domain of the apparition.

Now this kind of causation that we're talking about now, this apparitional causation, is called, in Sanskrit, Vivarta. That means you mistook one thing for another. Nothing happened to it. Nothing has happened. You're still perfectly good. Nothing has happened. The other kind of causation which we've been talking about, transformational causation, is called, in Sanskrit, Parinama. Now the Sankhyans were Parinama-vadins; they believed in transformational causation. The Advaita Vedantins are Vivarta-vadins. They believe that the first cause is apparitional. After that, you can do whatever you like. (Laughter.) But the first cause is apparitional. Nothing has happened. Nothing whatsoever. That's why Advaita Vedanta has this notion of Anatavada, complete non-birth. No birth has happened. Nothing has happened. Now you see the problem. Since we are genetically programmed, the problem is to countercheat the genes. The genes have us programmed to run after the undivided in a way which will never beat fruit. It bears offspring, but it will never get you to the undivided. The genes have us programmed to run toward these three goals through transformational causation, and the whole thing is just as frustrating as trying to pick yourself up by your bootstraps. You'll never get it done, you see. The whole universe is like that. We are programmed to run in wrong directions. You see even the hydrogen can't get it, and it's not even misprogrammed. But through space and time it is not possible, by transformational causation, to reach that which is beyond space and time. So our problem is to countercheat the genes. Essentially there are two ways. Either re-direct the genes or tell them to go to blazes. Just don't cooperate. Just tell them to go to, and simply discriminate between the real and the transient. You remember the Vedantins say that there are four things that you have to have if you're going to succeed. "Nityanitya vastu viveka", discrimination between the real and the transient. "Ihamutra phalabhogaviraga," renunciation of the enjoyment of the fruits of action. Then there are the six treasures and, finally, Mumukshutvam, or the yearning for liberation. "Ihamutra phalabhogaviraga," renunciation of the fruits of action. You see what that means? Don't get caught in transformational causation! Fruits of action means you did something by transformational causation and you want something back. You wait for the mailman. (Laughter.) You wrote a letter and now you wait for the mailman. Don't wait for the mailman! If you don't expect anything, you're out. It's nice and simple. We sit around here waiting for mailmen. Okay? That's what the game is. You do something and wait for the fruits. So, "Ihamutra phalabhogaviraga" means, don't wait for any fruits. That's what keeps you here. Expectation keeps you here. Nothing else keeps you here. We've got the wool pulled over our own eyes and we hang onto it

tightly. Someone would have to cut off our hands to get the wool off our eyes, we hang onto it so tightly. So there are four things. First, discrimination between the real and the unreal. We got into it by an indiscrimination, we get out by discrimination, not by action. Second, we have to give up the notion that we're going to get out by action. You seer we have mistaken the rope for the snake and become snake fanciers. First is to discriminate between the rose and the snake. Second is to cease being snake fanciers. Then the next problem is the mind. It's going to be done by the mind. It's not going to be done by somebody else, like your hands or your feet. So you have to have the mind in good shape. Therefore, the third is these "six treasures." You've got to be able to control you senses and keep them under control, you've got to be able to put up with heat and cold and the faults of others — all these things — and you have to have Shraddha, this tremendous enthusiasm that you're going to get the job done. It's translated as faith, but faith is not a very good translation of Shraddha. It means a tremendous spiritual enthusiasm that you're going to get the job done now. Fourth, and finally, you have to have Mumukshutvam. That is to say, yearning for liberation.

Now if you look carefully, you'll find that these four things are your four Yogas. Jnana Yoga is the discrimination between the real and the unreal. Karma Yoga is doing your actions in such a way that you don't wait for the mailman. Raja Yoga is control of the mind -- that's your instrument, that's the boat in which you're going to cross the sea; keep it caulked. And Mumukshutvam, yearning for the reality, that's Bhakti Yoga. You see, it doesn't matter how you look at this, they're always saying the same thing. Whether they speak of these four things that you have to do as part of Jnana Yoga, or whether they speak of the four Yogas, you see that all the four Yogas are there. It doesn't matter, you see, what way you look at it, we got into this by an indiscrimination; we'll get out by discrimination. Now in Bhakti Yoga what we do is to countercheat the genes. If you like to pick flowers, you don't pick them for corsages. You offer them in the worship. If you like to cook, you offer it in the worship. All of the things that you do, you offer in the worship. You see, that is countercheating the genes. Worship, rightly done, is simply a countercheating device for channelling your actions toward discrimination. The actions which you do in the worship couldn't possibly bear fruit. The genes have us persuaded to run after things through transformational causation. Your trick is to countercheat back and do those same actions that are dictated by the genes in such a way that they do not get the genetic job done but contribute, instead, toward your discrimination. Well, what else is there more to say? If we had gotten into this by transformation, we could get out by transformation. We got in by apparition, we'll get out by undoing the apparition. But this notion of the Gunas, you see, arises there. It would never have arisen in transformational causation. So if, by any chance, you think, or sometimes read, that the Sankhyans invented the notion of the Gunas — no. They not only did not invent the notion of the Gunas — they never had a handle on it. It's the Advaita Vedantins that have it. Now I myself am very fond of cartography. I myself feel that if I'll told how I got into this, I'll know what to do about it. I like to know how I got where I am. Once there was a lady in a store, and she asked the clerk if he could please help her out. And he said, "Certainly, Madam, how did you get in?" (Laughter.) If you tell me how you got in, I'll tell you how to get out. But we have to understand, you see, that through transformational causation we didn't get in, we don't get out. Now not only

is there no action by which you could get out, but there's also no action by which you could get in. One place in the Upanishad, it says, about a man of realization, "Such thoughts certainly do not distress him, why I did not do the right, why I did what is sinful." In another place it says, "If the killer thinks that he is killing, or the killed that he is killed, neither of them knows. That neither kills nor it is killed." The reality behind this is completely beyond space and time. Our whole notion of seeing a universe within space and time is simply a mistake.

Dehabhisane galite vijnate paramatmani Yatra, yatra manoyati, tatra, tatra sanadhayah

"When body-consciousness has melted away, and the Supreme Self has been realised, Where, where the mind is sent, there, there it gets Samadhi."

****Akasha, usually translated as ether, is the gravitational energy of matter dispersed in space. The word also means space. The gravitational energy is in the space of the dispersion. Our orientation in the gravitational field is perceived, through the saccule in the ear.***

Vayu, usually translated as air, is kinetic energy. dispersed in space, falls together by energy is converted to kinetic energy. as temperature, through the skin.

Tejas, usually translated as fire, is that which shines. The excess kinetic energy (heat energy) of a condensing star is lost to the surrounding space as the energy of its radiation. It is radiation which is perceived through the eye. Ap and Prithivi, usually translated as water and earth, are electricity and magnetism.

The presiding deities of Ap and Prithivi were said to be twins. Electricity and magnetism go together. You cannot have one without the other. Electricity and magnetism are perceived through the tongue and the nose. Protons taste sour, and the molecular configurations perceived through the nose are magnetic.

CORIOLIS

What we usually think of as opposites are two things that are identical in some way but opposite in another, like up and down. They are identical in that they are measured along the gravitational gradient, but opposite in that they are measured in different directions along that gradient. Now if we see the Universe as made of protons and electrons and falling together by gravity, and if we see gravity and electricity as opposites, then the question is: In what way are gravity and electricity identical, and in what way are they opposite?

They are identical in that both operate on what we call the inverse square law. If the particles are twice as far apart, both the gravitational and the electrical field fall off to one quarter. But they are opposite in that their fields are directed in opposite directions. Gravity is "condensational", in that it pulls protons toward each other. And electricity is "dispersional", in that it pushes protons apart. Also, gravity and electricity are identical in that the gravitational rest energy of the protons, due to their dispersion in the gravitational field, is the same thing as their electrical rest energy, due to their condensation in the electrical field.

But, since Einstein has already shown the identity of *acceleration* and gravity, perhaps we should see a merry-go-round as having a two dimensional, dispersional, gravitational field with a Coriolis effect. If, then, we consider electricity as a *three* dimensional, dispersional, gravitational field, it would appear that magnetism may be the Coriolis effect of electricity. Like the Coriolis effect of the merry-go-round, the magnetic field is perpendicular to the direction of motion and proportional to the speed.

These ideas occurred to me in the Vedanta monastery nearly half a century ago, and Michael Fell, charmed by the ideas, was sure that they had been used before. So he promised to look them up when he got to Cal Tech, but he later reported no sign of it.

I write these things up now because I see a connection between the notion that electricity might be a manifestation of gravity and the ideas of those old physicists in India a few thousand years ago. They saw energy as the underlying existence *seen* in time and space. The underlying existence, being *not* in time or space, was seen as neither changing, finite nor divided. And since *that* is what we see in time and space, the changeless, the infinite and the undivided must show through in our physics.

So far, so good, the changeless shows through in time as inertia or mass, and the infinite and the undivided show through in space as electricity *and* gravity. And that gives us the physics which we have, the physics of gravity, electricity and inertia. But what always bothered me is that we have only one

energy of position in time, and *two* energies of position in space. Now if electricity can be considered a manifestation of gravity, then that duality disappears.

We are left, then, with the duality of space and time which showed up in Einstein's 1905 geometry as a pair of opposites, but on what?

John L. Dobson July 16, 2002
4135 Judah Street, San Francisco CA 94122 (415) 665-4054

Cosmological Fossils

In the four-dimensional geometry of Einstein's Special Theory of Relativity, space and time come in as a pair of opposites, and that immediately suggests that world which we see may be "apparitional" rather than "actual". That seeing the Universe in space and time may be like mistaking a rope for a snake. "Actual" would mean that the Universe arises by action, by a process of physics. But there is no process of physics by which we can get a Universe of energy at the end without having a Universe of energy at the beginning. That is, the Universe cannot be "actual" without completely violating our Conservation Laws. And the Conservation Laws forbid the existence of perpetual motion machines, and that includes "actual" universes.

In Einstein's geometry, although the square of the space separation between two events comes into the Pythagoras equation with a plus sign, the square of the time separation between two events comes in with a minus sign. So that, if the two are equal, the total separation will be zero.[1] In that sense space and time are opposites, like positive and negative electrical charges. And that puts the total separation between the emission and absorption events for a single photon at zero.

Now Einstein, like most of the rest of us, could not accept that zero because it would put the separation between the Perceiver and the Perceived also at zero, and that would call into question the very objectivity of the Universe which Relativity Theory had been invented to save.[2] But all we know of photons is their emission and absorption events. They are never seen "from the side". And objectivity cannot be supported by Quantum Mechanics. There is no talk of a Universe independent of the Observer, just as there is no talk of an apparitional snake that is independent of its Observer. Both the apparitional snake and the Universe are "participatory". Also, from Bell's Theorem and the work of Clauser and Freedman in 1972 we know that either objectivity fails or local causation fails, and in either case our current notions of space and time are suspect.[3]

It may seem outlandish to suggest that the separation between the Perceiver and the Perceived might really be zero, and that seeing the Universe in space and time might be like mistaking a rope for a snake. But is it any more outlandish than Inflationary cosmologies or the Anthropic Principle? Anyhow, it is only the consequences of this suggestion to our physics that are of interest here. Does it explain anything which needed to be explained and does it predict any measurements which have not yet been made? That is the real question. If we posit an "existence" not seen in space and time, then in what way would the characteristics of such an "existence" show up in our physics?

If we are willing to accept negative statements, the characteristics of such an "existence" can immediately be stated. Since change can be seen ***only in***

time, that which is not in time must be Changeless. Since smallness and dividedness can be seen ***only in space***, that which is not in space must be Infinite and Undivided. (If we mistake a rope for a snake, the rope must be different from the snake. Otherwise no mistake has been made.) That might explain why what we see as matter is made up minute particles, widely dispersed through space, and continually changing. But why should the minute particles be electrical? Why should the dispersed particles fall together by gravity? And why should the particles resist every change in their state of motion? In short, why should matter show gravity, electricity, and inertia? It could be because we cannot take the one for the other without first seeing the one. (We cannot mistake a rope for a snake without first seeing the rope. Otherwise we could just as easily mistake it for a Chevy. It is the length and diameter of the "real" rope which we see as the length and diameter of the "apparitional" snake.

If this straightforward interpretation of Einstein's equations is permissible, and if the consequent suggestion is correct – that the separation between the Perceiver and the Perceived is "really" zero, and that seeing the Universe in space and time is like mistaking a rope for a snake, then the first cause of our physics must be "apparitional."

For the first time we can see an explanation for why matter shows gravity, electricity, and inertia. They are simply the characteristics of what, through apparition, we see as this Universe. They are like the fossils of those characteristics seen in our physics. If the Undivided is seen as dispersed through space, then the Undivided will show in that space as gravity, just as the length of the rope will show as the length of the snake. If the Infinite is seen as minute particles, then the Infinite will show in those particles as electricity, just as the diameter of the rope will show in the snake. And if the Changeless is seen as changing in time, then the Changeless will show in that time as inertia, just as the color of the rope will show as the color of the snake.

This suggestion would explain why the Universe is so energetic. Energy is apparitional. It arises by the first cause of our physics. The Universe is wound up to 9×10^{23} ergs/kilogram against its tendency toward undividedness, which we see as gravity; against its tendency toward infinitude, which we see as electrical charge; and against the Uncertainty Principle because we can know where things are in space and time. These are like the two sides and the edge of the same coin. They are all related to seeing things in space and time. Only if our uncertainty in their space-time positions went to infinity could their momenta and their energies go to zero. Energy is apparitional. Only its changes are "actual". They arise through transformations of the energy from one form to another without any change in the amount.

We also see in this suggestion an explanation for the Conservation laws. In order that the observable Universe should represent zero change in the Changeless, it must appear as pairs of opposites, time against space, gravity

against electricity, plus against minus, momentum to the right against momentum to the left, and spin up against spin down.

If this suggestion is correct, then several predictions can be made regarding physics and cosmology.

First, the Universe cannot have arisen "through random fluctuations in nothingness", as has been recently suggested, or the physics of the Universe would be different. The particles would not be electrical. It must instead have arisen from the Infinite, but not as an event in time. Since time is part of the Universe, the Universe cannot have arisen as an event in time.

Secondly, the cosmological expansion rate cannot exceed escape velocity. Otherwise there would be a dispersional energy unbalanced by its opposite. A dispersional energy unbalanced by the condensational energy of gravity would represent a "real" change in the Changeless.

Thirdly, the protons should not decay. If hydrogen is the primordial apparition, then neither the electrons nor the protons should decay. If they arise by "apparition" they should all be alike, like dollars in the bank, and without history.

Fourthly, this interpretation of the Pythagorean Theorem for one dimension of space, and time, seems to predict an ultimate failure for field theories, including the Grand Unified theories. If the separation between the emission and absorption events for photons, gravitons, and neutrinos is really zero then the question is not how the energy gets from one event to the other, but by what mechanism do we see that zero separation spread out in space and time?

There are two other considerations which might be worth mentioning. The first concerns Heisenberg's Uncertainty Principle and Pauli's Verbot. If the Universe consists of a gravitational plurality seen against an electromagnetic duality, then there should be some mechanism for preventing the demise of the one in the presence of the other – lest the dancer disappear and leave her pirouette behind. As I see it, the Uncertainty Principle prevents the demise of the electromagnetic duality between the electron and the proton in the presence of the gravitational dissimilarity between the proton and the positron. And the Exclusion Principle prevents the demise of the plurality for particles with an extra half of the spin duality. If this is true, it suggests that gravitational interactions may not show quantum effects.

The second consideration concerns the conditions near the border of the observable Universe. Although the "existence" underlying the Universe must be Infinite, the Universe itself must be finite, even though the border may be unreachable. Such a border is implied by the cosmological redshift. But this

redshift also implies a low energy and therefore, low mass for the particles seen near the border. This low mass, through the Uncertainty Principle, should allow the particles seen near the border to tunnel back in. If the mass of a particle near the border is seen to approach zero both its momentum and our uncertainty in that momentum will be seen to approach zero. As a result our uncertainty in its position must approach infinity. This might account for the hydrogen needed in the Steady State model to balance the cosmological expansion. If so, it might also include an admixture of helium.

This low mass also implies a 3°K background radiation even for the Steady State cosmology, since radiation moving through the low mass particles near the border will be so often picked up and reradiated that it will become thermalized to 3°K.[4] The amount of radiation thus predicted is much less than that predicted by the Big Bang model, and it is much closer to the actual measured amount.[5]

We are all genetically programmed, along with the seagulls and the dogs, to see the Universe through a classical, Newtonian bias, and to see it as "actual." All I am suggesting is that we lay that bias to rest, take Einstein's equations a little more seriously, and take a long, hard look at these cosmological fossils and the evidence that the first cause of our physics might be "apparitional."

John L. Dobson
December 26th 1985

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[1] Albert Einstein, ***The Meaning of Relativity***, Princeton University Press, 5th Ed. 1956, pp. 37-38.
[2] ***Ibid.***, pp. 37-38
[3] Stuart Freedman and John Clauser, ***"Experimental Test of Local Hidden Variable Theories"***, Physical Review Letters, 28, 1972, 938ff.
[4] Sir Fred Hoyle, ***"The Origins of the Universe - A lecture"***, 1975.
[5] Sir Fred Hoyle, ***The Intelligent Universe***, Holt, Rinehart and Winston, 1983, p. 181.

Creation *Ex Nihilo* or from Wheeler's "Pregeometry"?

Must we assume that in the absence of particles and fields, and in the absence of space and time, there would be "nothing"? Or can we, without so rash an assumption, find clues to the nature of what John A. Wheeler and C. M. Patton refer to as "pregeometry?" ["...something deeper than geometry, that underlies both geometry and particles." And which they suggest, "must provide the Universe with a way to come into being.")

The other night at the telescopes, when we had them out on the sidewalk for public use, a young man approached me wishing to talk cosmology, and finding me not very enthusiastic that the observational evidence strongly supports the Big Bang, he demanded to know how I solved the problem of 'creation *ex nihilo*' for the Steady State (as if there was no such problem for the Big Bang).

I asked him why he took the creation to be *ex nihilo* (out of nothing). I suggested that he might be jumping the gun, that it might be an unwarranted assumption. I reminded him that in the absence of time we would have the absence of change, but not necessarily *nothing*, and that in the absence of space we would have the absence of dividedness and smallness. "And the absence of largeness," he added. "Yes," I said, "but not necessarily *nothing*. (Size, whether large or small, would be finite, and in the absence of the finite we also have the possibility of the Infinite).

I said that to get the Universe out of the Changeless, the Infinite, and the Undivided was a very different problem from getting it out of nothing. He didn't seem to see that. He seemed to take the Infinite as equivalent to *nothing*. Then I reminded him that *ex nihilo* was an expression of the Roman Catholic philosophers but that even they didn't get the Universe out of *nothing*. God was there. At that point the young man accusingly asked me if I believed in God. I replied that that was not our problem. Our problem was whether the Universe comes out of the Changeless, the Infinite, and the Undivided or *ex nihilo*. And I also reminded him that we were not concerned with beliefs but with evidence.

The real question, as I see it, is not whether we live in a Big Bang or Steady State Universe, but whether the Universe arises ex nihilo or from John Wheeler's "pregeometry." In a 1975 article titled, "*Is Physics Legislated by Cosmology?*", J.A. Wheeler and C. M. Patton use the term "pregeometry" to refer to "...something deeper than geometry, that underlies both geometry and particles." And they suggest that "For ultimately revealing this structure no perspective seems more promising than the view that it must provide the Universe with a way to come into being."

Could the Changeless, the Infinite, the Undivided be taken as clues to the nature of that "pregeometry?"

We came to this terminology only by asking what couldn't exist in the absence of space and time, that is, in the absence of the geometry. The terminology is entirely negative; it makes no supposition as to what might exist, only what might not exist in the absence of the geometry. But if the Changeless, the Infinite, the Undivided can be taken as clues to the nature of our "pregeometry", the question is: could such a "pregeometry" provide the Universe with a way to come into being?

Most modern cosmologists, whether proponents of the Big Bang or Steady State models, seem to assume that in the absence of particles and fields, and in the absence of space and time, there would be *nothing*. But that rash assumption leaves us without a "pregeometry" which could "provide the Universe with a way to come into being." We are back to creation *ex nihilo*.

Our problem now is to show how such a "pregeometry", characterized by changelessness, infinitude, and undividedness, could provide the Universe with a way to come into being. The problem arises because the Changeless cannot be changed; nor can the Infinite be made small; nor the undivided be divided. So the problem is how to get from one to the other.

The only way that I see to get from the Changeless to the changing without ever changing the Changeless is by mistaking the one for the other. But if that really is the solution to this problem then our physics will necessarily be "participatory" and associated with uncertainty, just as when one mistakes a rope for a snake. In such a scenario the snake is "participatory" and associated with uncertainty. Its existence is not independent of the observer and one cannot find out what kind of a snake it is.

If we have mistaken our "pregeometry", which is not in space and time, for the measurements of our physics which are in space and time, then the measurements of our physics must also be "participatory", and similarly associated with uncertainty.

Arguing from illustration, I think we can show a plausible way that such a "pregeometry" could provide the Universe with a way to come into being, and also provide a basis for the physics which we see. Just as when a rope is mistaken for a snake, the existence of the snake is *nothing but* the existence of the rope seen as something *else*, the existence of the Universe might be *nothing but* the existence of the "pregeometry" seen in space and time as something *else* (as changing, finite, and divided). Regardless, just as the basic characteristics of the rope *must show up* in the snake for which it is mistaken, just so in the Universe the characteristics of the "pregeometry" must show up in our physics.

My suggestion is that the changelessness shows up as inertia, the infinitude as the electrical charge, and the undividedness as gravity.

The Universe as we see it consists of an enormous amount of energy, yet no process know to our physics gives rise to any such energy. But if we have come from this suggested "pregeometry" by such a process of apparition then the existence of the energy falls out quite naturally. If the undividedness *must show up* in the appearance of division the result will be the gravitation wind up that we see. If the infinitude *must show up* in the appearance of the small, the result will be the electrical wind up that we see. If the changelessness *must show up* in the apparently changing, the result will be the resistance to change or inertia that we see. I see no other explanation for the existence of the energy that we see.

If there is anything to this suggestion (and it's certainly counter-intuitive), then it would seem to me that in order to avoid representing any "real" change in the Changeless the Universe must arise as pairs of opposites so that the total linear momentum, the total angular momentum and the total charge of the observable Universe should be zero. If it could be shown that there is an overall residual momentum or electrical charge, I should deem this suggestion to have failed. And if, as this suggestion seems to imply, hydrogen is the "primordial apparition", then neither the proton nor the electron should decay. For if it arises by apparition how could it decay by transformation within that apparition? If it can be shown that the proton does indeed decay then I should deem this suggestion to have failed.

John L. Dobson
January 1989

Creation *Ex Nihilo* or from Wheeler's 'Pregeometry'?

John L. Dobson © January 1989
Sidewalk Astronomers
1801 Golden Gate Ave., San Francisco CA 94115 [415] 567-2063

Must we assume that in the absence of particles and fields, and in the absence of space and time, there would be nothing? Or can we, without so rash an assumption, find clues to the nature of what Wheeler and Patton refer to as 'pregeometry'? ("...something deeper than geometry, that underlies both goemetry and particles." And which they suggest "...must provide the Universe with a way to come into being.")

The other night at the telescopes, when we had them out on the sidewalk for public use, a young man approached me wishing to talk cosmology, and finding me not very enthusiastic that the observational evidence strongly supports the Big Bang, he demanded to know how I solved the problem of 'creation *ex nihilo*' for the Steady State (as if there were no such problem for the Big Bang). I asked why he took the creation to be *ex nihilo* (out of nothing). I suggested that he might be jumping the gun, that it might be an unwarranted assumption. I reminded him that in the absence of time we would have the absence of change, but not necessarily nothing, and that in the absence of space we would have the absence of dividedness and the absence of smallness. "And the absence of largeness," he added. "Yes," I said, "but not necessarily nothing." (Size, whether large or small, would be finite, and in the absence of the finite we have the possibility of the infinite.) I said that to get the Universe out of the changeless, the infinite, the undivided was a very different problem from getting it out of nothing. He didn't seem to see that. He seemed to take the infinite as equivalent to nothing. Then I reminded him that *ex nihilo* was an expression of the Roman Catholic philosophers but that even they didn't get the Universe out of nothing. God was there. At that point the young man accusingly asked me if I believed in God. I replied that that was not our problem. Our problem was whether the Universe comes out of the changeless, the infinite, the undivided or *ex nihilo* . And I reminded him that we were not concerned with beliefs but with evidence.

The real question, as I see it, is not whether we live in a Big Bang or Steady State Universe, but whether the Universe arises *ex nihilo* or from Wheeler's 'pregeometry'. In a 1975 article entitled *Is Physics Legislated by Cosmogony?* J. A.Wheeler and C. M. Patton use the term pregeometry to refer to "...something deeper than geometry, that underlies both geometry and particles." And they suggest that "For ultimately revealing this structure no perspective seems more pro nising than the view that it must provide the Universe with a way to come into being."

Most modern cosmologists, whether proponents of the Big Bang or Steady State models, seem to assume that in the absence of particles and fields, and in the absence of space and time, there would be nothing. But if we go with so rash an assumption we are left without a pregeometry which could 'provide the Universe with a way to come into being'. We are back to creation *ex nihilo* . If, on the other hand, we take a more cautious approach and assume only that in the absence of time there might be the changeless

and that in the absence of space there might be the infinite, the undivided, then we are left with the possibility of a pregeometry to provide the Universe with a way to come into being.

We came to this terminology only by asking what could not exist in the absence of space and time, that is, in the absence of the geometry. And the terminology is entirely negative; it makes no supposition as to what might exist, only what might not exist in the absence of the geometry. But if changelessness, infinitude and undividedness may be taken as clues to the nature of our pregeometry, then the question is: How could such a pregeometry provide the Universe with a way to come into being?

The problem arises because the changeless cannot be changed nor the infinite be made small nor the undivided be divided. So the problem is how to get from the one to the other. And the only way that I can see to get from the changeless to the changing without changing the changeless is by mistaking the one for the other. But if that is the solution to this problem, then our physics must be participatory and associated with uncertainty, just as when one mistakes a rope for a snake the snake is participatory and associated with uncertainty. Its existence is not independent of the observer and one cannot find out what kind of snake it is. If we have mistaken our pregeometry, which is not in space and time, for the measurements of our physics, which are in space in time, then the measurements of our physics must be participatory and associated with uncertainty.

Arguing from illustration, I think we can show a plausible way that such a pregeometry could provide the Universe with a way to come into being, and also provide a basis for the physics which we see. Just as when a rope is mistaken for a snake, the existence of the snake is nothing but the existence of the rope seen as somthing *else*, just so here the existence of the Universe might be nothing but the existence of the pregeometry seen in space and time as something *else* (as changing, finite, and divided). But just as the characteristics of the rope must show up in the snake for which it is mistaken, just so here the characteristics of our pregeometry should show up in our physics. My suggestion is that the changelessness shows up as inertia, the infinitude as the electrical charge, and the undividedness as gravity.

The Universe as we see it consists of an enormous amount of energy, yet no process known to our physics gives rise to any such energy. But if we have come from this suggested pregeometry by such a process of apparition, then the existence of the energy falls out quite naturally. If the undividedness must show up in the appearance of division, the result will be the gravitational wind up. And if the infinitude must show up in the appearance of the small, the result will be the electrical wind up. I see no other explanation for the existence of the energy which we see.

If there is anything to this suggestion (and it's certainly counter intuitive), then it would seem to me that in order to avoid representing any change in the changeless the Universe must arise as pairs of opposites so that the total linear momentum, the total angular momentum and the total charge of the observable Universe should be zero. If it could be shown that there is an overall residual momentum or electrical charge, I should deem this suggestion to have failed. And if, as this suggestion seems to imply, hydrogen is the primordial apparition, then neither the proton nor the electron should decay. If it arises by apparition, how could it decay by transformation within that apparition? If it can be shown that the proton does indeed decay, then I should deem this suggestion to have failed.

DIRT

In general there are two types of soil, or dirt, on this planet, what we may call mountain soils and meadow soils. Although this is an over simplification, it will serve as a basis for discussion.

What happens in the mountains is that the rain water washing through the rotting organic matter at the surface of the ground picks up carbon dioxide and forms carbonic acid which tends to dissolve the calcium carbonate as it washes through the underlying rocks. This dissolved calcium, as calcium bicarbonate, goes down into the ground water to lower elevations.

During the summer months this ground water, laden with calcium bicarbonate, evaporates at the surface of the meadows and re-precipitates the calcium as calcium carbonate, tending to make the surface dirt more alkaline.

Rhododendrons, Azaleas, Camellias and many other plants apparently prefer what we may call upland forest soils where the fertility of the surface dirt depends largely on the ability of the acids to release the minerals of which the dirt is made. Most of our orchards, including apples, pears, cherries etc. from the rose family, and most of our vegetables, beans and grains like what we may call valley or meadow soils where the fertility depends largely on the ability of the calcium carbonate to hold the necessary minerals in the surface dirt where they are available to the plant's roots.

Plants have a limited ability to select what they need from their available resources by putting out more roots in the areas where they find what they want.

The fertility of garden soils may sometimes be gauged by dripping hydrochloric acid on a sample. If the acid fizzes, the dirt has enough calcium carbonate to hold the necessary nutrients.

The fertility of garden soils may be greatly improved by digging in organic matter, leaves, manure and whatnot, and allowing it to rot, then treating it with hydrated lime, fertilizer and whatever minerals may be needed.

The hydrated lime will be caught as calcium carbonate by the carbon dioxide from the rotting organic matter. Then the phosphates of the fertilizer will be caught by the calcium carbonate. Since calcium ammonium phosphate is insoluble in water, even some of the nitrogen may be caught.

If, after digging-in the organic matter, the soil is allowed to dry before sprinkling-in a 'light snowfall' of hydrated lime, the calcium will be caught. And if, after liming, the soil is allowed to dry, before watering-in the fertilizer, the

phosphate will be caught and be available to hold most of the needed minerals where the plants can get at them.

Some of the rules you learn in chemistry are that all nitrates are soluble, and that most sodium, potassium, and ammonium salts are soluble. But there are a few exceptions. Potassium calcium sulfate is only sparingly soluble, so you can even precipitate potassium if you have some sulfates in your fertilizer. Also, magnesium ammonium phosphate is only sparingly soluble, and calcium ammonium phosphate is insoluble, so you can precipitate nitrogen as ammonium salts, and let the nitrifying bacteria oxidize the nitrogen to nitrate for the plants.

One of the advantages of letting the soil dry before sprinkling it with lime and watering it in is that it allows the earthworms to go down out of harms way.

If you don't happen to live on a delta, where the mineral base of your dirt is silt, brought down by the river from various sources, and if you don't happen to live in south China, where the mineral base of your dirt is thirty feet deep, brought down by dust storms from the Gobi Desert, you may want to up grade the mineral base of your garden. Powdered granite from the aspirator at the tombstone cutter's shop, which splashes in the bucket like water, is probably as good as you can get. Failing that, you might try fine granite sand from the quarry. Or you might add some dolomite number ten, or some oyster shell meal.

(In the nineteen sixties, when I was grinding telescope mirrors against a cast iron tool, with granite sand for my abrasive, I poured the wet slurry around the plants at night, and by morning I could see that they loved it.)

There are quite a number of minerals that are used in small quantities by plants, magnesium, iron, manganese, copper, zinc, boron, and even molybdenum. Salts of these minerals, dissolved in extremely dilute sulfuric acid, may be sprinkled into the surface dirt occasionally to up grade the mineral base of poorer soils.

John Dobson July 4, 2002
4135 Judah Street, San Francisco CA 94122
(415) 665-4054

DON'T YOU SEE?

Neil's Bohr, one of the fathers of Quantum Mechanics, said long ago, "those who are not shocked when they first come across Quantum Theory cannot possibly have understood it." We could say a similar thing about Special Relativity, because Einstein has taken the matter out of physics and reduced the separation between the Perceiver and the Perceived to zero.

Richard Feynman once pointed out the every statement in Quantum Mechanics is really a restatement of Heisenberg's Uncertainty Principle. His principle simply says that the product of our uncertainty in where something is and our uncertainly in its momentum cannot fall to zero; and that likewise, the product of our uncertainty in when something happens and our uncertainty in the energy of the happening cannot fall to zero.

Einstein's famous equation ($E=mc^2$) simply says that there is no such thing as matter, and that what we *thought* was matter is just potential energy. It shows that one gram of energy is enough to vaporize a town. The c^2 is just how many ergs are equal to a gram. It is actually about 900,000,000,000,000,000,000 ergs to a gram.

But Einstein's geometry is even more exciting. It puts space and time in as a pair of opposites such that if a light beam can get from one event to another, the space-time separation between the events is zero. That rules out photons and gravitons.

What all this tells us is that the world which we see is a "mistake-world", a make believe world made of energy – and that energy is the "wind-up" against the mistake. Gravity is the "wind-up" against dispersion; the electrical repulsions of like charges is the "wind-up" against smallness; and inertia is the "wind-up" against change.

Now if, as these equations suggest, the world which we see in space and time is a mistake, then necessarily it will be smitten by uncertainty and frustration.

Stars convert gravitational energy into radiation and this drives the cosmological expansion – because the radiation loses its energy to redshifting in the expansion.

The redshifting drives the cosmic microwave background radiation – because radiation gets thermalized to 3^0K by going through the field of low mass particles near the observational border.

Due to Heisenberg's Uncertainty Principle the redshifting also drives the recycling of the hydrogen and the negative entropy from the border – because as the uncertainty in the momentum goes down [due to the mass going down], the uncertainty in where the particles are [must] go up.

Don't you see? If the Universe is a "mistake-world", smitten by uncertainty and frustration, it can go on like this indefinitely. Heisenberg's Uncertainty Principle frustrates the collapse of the electrical duality of the electron and the proton in the hydrogen atom. Pauli's Exclusion Principle frustrates the collapse of the gravitational plurality. And the recycling at the border frustrates the collapse of the negative entropy.

And the Universe sails on.

John L. Dobson
18th of April, 2007

DYING STARS VIEWED FROM DEATH VALLEY

Out through the Furnace Creek Wash we're leaving Death Valley through falling snow. Four years ago we brought the 24-incher ["*Delphinium*"] into Death Valley, for the first time, through a blizzard in the Tehachapis. We barely got through, leaving 7,000 motorists stranded in the passes. We had the advantage of weight. The telescope weighs nearly 600 pounds. On that first trip it endured five nights of rain and wind. That was its first year and its first long trip. By now it's been through several blizzards and some fifteen nights in the rain. *Delphinium* was meant for fairer skies but she spends most of her useful life in the mountains and has to take what she gets. By now she has hauled nearly twenty thousand miles and served many thousands of people in the mountains and the deserts, as far south as San Diego, as far east as Arizona.

We arrived in Death Valley three nights before Christmas and left on New Year's morning. That gave us nine days and nine nights to entertain the public with our telescopes on the sidewalks and lawns of the Visitor Center at Furnace Creek. Thousands of people came to look. Early in the evenings they saw Venus and Jupiter and sometimes the moon.

When the turbulence was low the larger telescopes were often on Saturn or the moon or occasionally on Mars, and on one night on Sirius B, the white dwarf companion of the Dog Star, with a density of thirty tons per pint. It has been pulled together in its own gravitational field till there is no longer any room for the electrons to choose energy states around the atomic nuclei. They must now choose energy states through the star as a whole and further collapse is forbidden by Heisenberg's Uncertainty Principle. Any further decrease in the uncertainly of an electron's position by the further collapse of the star must be made at the expense of increasing the uncertainly of its momentum. This is the terminal ailment of small stars like our sun, making it possible for them finally to cool off without further gravitational collapse.

When the darkness and transparency of the sky were good the larger telescopes were often on the Great Nebula in Orion or on the Crab or on NGC 2024 or occasionally on the Horsehead. Early in the evening they were sometimes on the Dumbbell or the Ring or on the globular cluster M-15 [in Pegasus]. Later in the night they were more likely to be on M-81 or 82 or even on M-31.

Hundreds of people saw the dark lanes of the spiral arms of M-31 through *The Little One* [a 17-incher]. Even in the proximity of the five-day moon it was easy to see. Through the 24-incher the spiral arms of M-81 were easy. M-81 is nearly four times as far away as M-31, which can easily be seen with the bare eyes from Death Valley. It [M-31] is only two million light years away and is the

most distant collection of suns still visible with the bare eyes. The number of suns in M-31 is equal to the number of grains of sixty-grit carborundum in twenty tons. It is the largest member of our local group of galaxies.

We showed the people M-15 so that they could compare an old, densely populated globular star cluster with the young, sparsely populated clusters in the spiral arms, such as the Double Cluster, or the Pleiades, or the Great Nebula in Orion. In the Great Nebula the stars are even now forming from the beautiful, bright cloud of gas which contrasts so strikingly with the associated dust clouds. It is in our own wrap of spiral arm and from our own neighborhood it is undoubtedly the brightest, most beautiful and most colorful sight beyond our solar system. Through either of the larger telescopes it is a spectacular sight. Through either telescope it runs far out of the eyepiece field, more so through the 24. We pull the telescopes too far out to the west and let the cloud drift through the eyepiece field while the people watch. On a good night one can see a great deal of detail in the bright, blue-green nebulosity around the six stars in the Trapezium and the bright nebulosity is studded with faint stars. From the time the Great Nebula was reasonably high above the south eastern horizon until most of the visitors had left, one or another of the larger telescopes could usually be pointed to it.

This was the most publicized tour we ever took and one of the most successful from the standpoint of the number of viewers and the number of objects viewed, even from the standpoint of the number and size of the telescopes. So many people saw things through so many large telescopes that it elicited a great deal of comment. Many wanted to know where to find us again and several people said that looking through the telescopes had been the highlight of their trip.

The Sidewalk Astronomers are Astronomical Entertainers to Her Majesty the People-at-Large. What we need are millions of Sidewalk Astronomers scattered all over the world. If we had several dozen hard-core Astronomical Entertainers in every large city we might be able to get done what we're trying to do. At least half the population of the world should have the opportunity to see the rest of the Universe through large telescopes from beyond the jurisdiction of the city lights and smog. Those who have telescopes should be encouraged to entertain...

There is a special beauty in the astronomical knowledge picked up by those who manage telescopes on behalf of the people-at-large. Everyone should see. Everyone should understand. What we do for ourselves is a waste. What we do for others is beauty. Those who help others to see will see. Those who help others to understand, they indeed will understand.

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Only nine hundred and twenty years ago there was no such thing as the Crab Nebula visible in our skies. Only nine hundred and twenty years ago, as seen from our solar system, that star was invisible to us, but by then the center of that star consisted of one huge iron ball from which no further speck of nuclear energy could be extracted to further the delay of its gravitational collapse. It is a rather curious thing that the most powerful explosion in the Universe appears to be a large iron ball from which the last speck of nuclear energy has already been extracted. We have chemical explosives like TNT, electrical explosives in the form of these huge balls of iron which, in the long course of stellar evolution, form in the centers of stars more massive than our sun. Over the long course of stellar evolution the energy released by nuclear fusions in these massive stars simply delays their inevitable gravitational collapse till it can delay no longer. When the last speck of nuclear energy has been called up and spent and the center of such a star has thus been reduced to iron. Then it is absolutely powerless against its own gravitational field. It has now become a gravitational explosive. There is no way to prevent its collapse to a neutron star, and when it goes the gravitational energy released to other forms when the iron falls to neutrons lights up the interstellar night with the light of a hundred million suns.

From the dust of such exploding stars all of us are born. Most of the materials of which our bodies are made, including the iron, were scattered through the galaxy from the outer regions of these collapsing stars by these brilliant, gravitational explosions during the 5 or 10 billion years before our sun was born.

The spinning iron ball whose gravitational collapse powered the explosion which produced the Crab Nebula spins now as a neutron star at the center of the cloud, visible only on a good night and with a fairly large telescope at a distance of some 6,000 light years. Thirty times a second it spins and thirty times a second it sends us a flash of light. Thirty times a second it spins but its gravitational field is so strong that it does not fly apart. Its gravitational field is so strong that a spoonful of ice cream splashing on its surface would release enough energy to vaporize a town. It has been so pulled together in its own gravitational field that there is no longer any room for the electrons to choose energy states through the star as a whole. Now the electrons sit right on the protons. The certainty in the position of the electron is now bought at the expense of the increased uncertainly in its momentum.

The energy of the electron, and with it the uncertainly in its momentum, is pumped up, in that final collapse, by the gravitational field which pulls the star together to almost unbelievable densities and leaves it spinning so hard that for several thousand years the energy of its spin lights up the interstellar night. This is the terminal ailment of stars a little larger than our sun.

We are grateful to all those who make this trip possible, and to those who contributed to its success. We are grateful to those who made the telescopes, and to those who hauled them, to those who operated them and to those who contributed to the Transportation Fund. We are also grateful to the rangers whose cooperation made it possible for us to show so many things to so many people, and we are grateful to the gardener for allowing us to set the telescopes on the lawn.

Although on this trip we were able to entertain several thousand people with many fine views, billions of eyes are waiting.

Dying Stars Viewed From Death Valley

By John Dobson
Published 2004-10-22 13:08:56
From 1973
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