# The Galaxy Project: An Introduction

by Benjamin Deniston

*This is an edited transcript of the first of several classes on the Galaxy Project of the LaRouche PAC Basement Team. The video is available on the LaRouche PAC website as the Weekly Report of the New Paradigm for Mankind Program for Wednesday, Oct. 28, 2015.*

I'm glad to be here today in front of a live audience in a new format for our New Paradigm Show on the LaRouche PAC website. This is the beginning of a class series on what we've called the Galaxy Project, or the Galactic Science Driver Program. This is an introductory class; there will probably be five to eight classes, delving into aspects of this Galaxy Project that the LaRouche PAC Basement Team has tackled as a new program.

Given the nature of this event, it might be useful to restate very briefly, re-situate—I'm a part of the LaRouche PAC Science Team, or as Mr. LaRouche has named us, the Basement Team. It's a scientific program, part of a scientific research team, rooted in attempting to revive, re-develop, and carry forward a very specific current of physical science rooted in the Renaissance. You can go back farther, but much of our focussed work has been rooted in the Classical Golden Renaissance in Italy—the development of modern science centered around the work of Nicholas of Cusa and his followers through Johannes Kepler, and on through followers of this specific school of scientific thought, which has been largely lost in the recent century.

What we've taken on here is the prospect of looking at the Galactic System as a next stage in the scientific frontiers for mankind, continuing in this specific tradition of real physical science. It's about the way people approach scientific questions, but it's also about what mankind is. What is mankind's nature and role in the Universe? That was very clearly understood in the Renaissance. There was a very clear, unified concept underlying the development of science, and it's been lost in science today. So when we look at this question of mankind going to the Galaxy as a new level of science, we're also talking about a new level for mankind, a new stage for mankind as a species.

Mr. LaRouche has defined the Galactic level as a frontier project. He has pointed to Johannes Kepler as a critical reference point, as Kepler had demonstrated the validity of this Renaissance conception of man—and carried forward the founding of modern science—in his discovery of the Solar System as a single organized system, accessible uniquely to the mind of man, as Kepler was able to demonstrate.

In that same tradition, today we look to the Galaxy as the next frontier for mankind. We're looking at the prospect of mankind becoming a galactic species. I say that just in honor, or rather in dishonor, of the new Star Wars movie,—most people have seen the advertisements of the latest episode in the Star Wars sci-fi saga that's coming out this winter. This is a good opportunity to emphasize—when we say mankind can become a Galactic species—we're not talking about the pop-science, sci-fi conception of jumping in your spaceship and hopping around to different parts of the Galaxy, and we're a Galactic species when we travel through the Galaxy.

That's not what we're talking about. We're talking about something much more profound in the way mankind, you could say, enters the Galaxy, or becomes a Galactic species. It is not a question of where we physically place people, or place objects. It's a question of where mankind is, in a uniquely human, mentally creative way, with respect to the nature of organization of the Universe. That's what we're talking about.

How is it that mankind can come into being in the Universe from the standpoint of certain higher-order processes, in a way that no animal species ever could, and understand that that really is a sacred process? We're re-defining our understanding of the Universe through revolutionary breakthroughs, some of which we will discuss today; but we're also re-defining our

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*Humankind, the galactic species, observes our own galaxy. The Milky Way, a bright band of stars partly obscured by galactic clouds of gas and dust, is what we can see of the Home Galaxy with the naked eye. Because we reside in the galactic plane, we have an edge-on view. The laser beam is pointing to the galactic center. The many stars distributed across the sky are also in the galactic plane; because they are foreground objects, they appear not to be. This is the Very Large Telescope in northern Chile, operated by the European Southern Observatory.*

existence in the Universe at the same time.

That's going to be the concluding point of the introduction today. The guiding theme throughout this series is that we're not just talking about finding some new law that describes some aspect of the Galaxy; we're talking about how we raise mankind to a fundamentally new level of existence in the Universe from the standpoint of a Galactic Principle, a Galactic level of existence for mankind, as I would put it.

## Climate and Water

You may be familiar with the LaRouche PAC activity with respect to the issue of water and drought if you are following our website. We've discussed the issue of water from the Galactic standpoint. I think it's very useful as an opening example, just to get thinking in the proper framework, the proper conception.

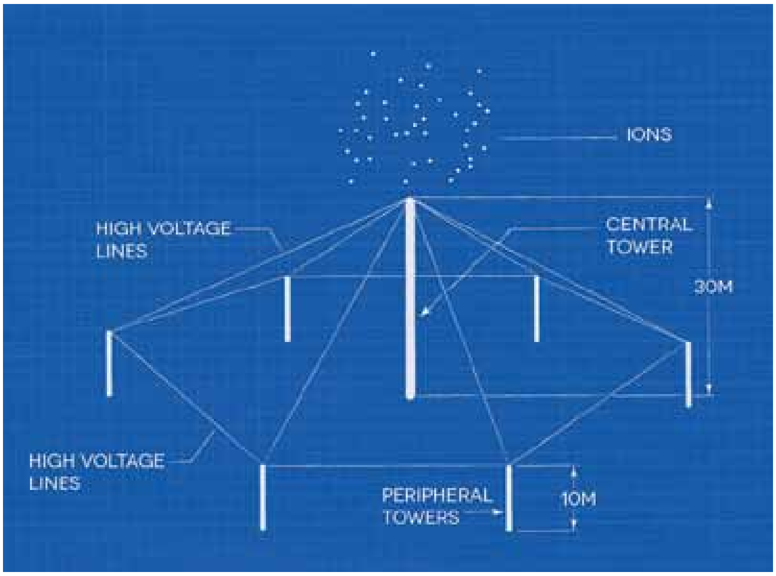
There's much talk of a water crisis going on in California, the West Coast of the United States, and other parts of the world. There's a lot of discussion about the lack of sufficient water to sustain human activity. As we've shown in some of our work, it's a pretty ridiculous claim. There's plenty of water out there, but there are Malthusian fools like California Governor Jerry Brown, who just don't want the water supply, because they don't want population growth. They don't want the level of population they have.

Aside from that genocidal ideology, there's a real lack of understanding of what mankind could be doing to develop the resources we need. With water supply in particular, there are a lot of options. There's desalination, and there are ways to redirect water from one place to another. Those are options.

But as we've discussed and presented on the LaRouche PAC website, there is also another avenue that actually takes us to a higher perspective, which is understanding how our Solar System is actually a subsumed component of our larger Galactic System, and that the water cycle, as we currently depend upon it, the water cycle as it exists on the Earth, is heavily influenced and controlled by effects from our Galaxy; specifically, the atmospheric flows of water vapor throughout the world, how water vapor behaves in the atmosphere, and the conditions that cause it to fall as rain, are largely influenced and controlled by radiation effects from our Galaxy, by what is called cosmic radiation.

We've been learning in recent decades that cosmic ray flux is actually a critical factor in determining how water behaves, and also how climate behaves. We'll get into some of this a bit later; this is a new insight into how radiation effects—energetic effects, not coming from our Earth, our Sun, or our Solar System, but coming from the subsuming environment of our Galaxy—play an active, day-to-day role in affecting something as simple and seemingly Earth-centered as water, your local water supply.

What does that mean for mankind? It means that we have a potential to control these processes and influence the water cycle in a completely new way. I would direct people to the work we have already done on this, on technologies being developed, and technologies that have been demonstrated and are in use, that can be used to manage atmospheric water flows, by tapping into the




Sergey Pulinets

*Tapping the Galaxy for water: This is a schematic of the concept behind the project undertaken by Russian scientist Sergey Pulinets in northern Mexico, where ionization towers were used to stimulate rain in arid regions.*

same types of processes that we get from our Galactic System that affect atmospheric water vapor.

So, that is one example of the type of thing we're talking about, as we gain a greater understanding of the fact that mankind doesn't just live on some isolated planet by ourselves, not even in an isolated Solar System, but that the activity on our planet, in our Solar System, is intimately connected to, and related to, these larger-scale Galactic processes, the larger-scale Galactic System, which contains us. And water is an example. When we develop these higher insights, as mankind, that gives us a greater capability to act, a greater capability to increase our potential as a species on this planet.

That's an example of the integral connection between mankind's scientific understanding of the Universe and mankind's ability to change the nature of his existence, even on Earth, but from the standpoint of these higher-order principles, these higher-order processes, which we can discover and then act upon. It's just one example of some of the work that's actually led to this Galaxy Project, this science-driver program.

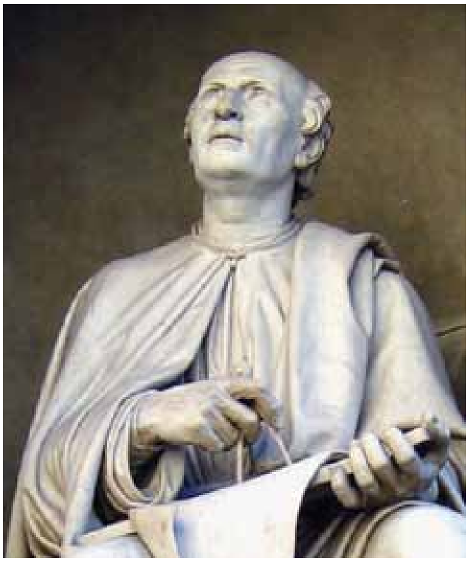
But beyond this or some other examples, the project goes to some very fundamental areas of science. Today I want to focus primarily on the method of approach going into this whole project. In preparing for today's presentation, a series of discussions we had with Mr. LaRouche in the summer of 2014 came to mind.

## Vernadsky and the Biosphere

We were talking about the role of Vladimir Vernadsky, the leading Russian scientist, contemporary of Einstein—the role of Vernadsky, situated in the longer arc of the development of modern science. Mr. LaRouche defined what he called his triad conception of the development of science. He said, if we want to look at where we need to go with science today, look at the initiation of modern science through the work of Cusa (1401-1464) and Filippo Brunelleschi (1377-1446), and then carried through with the work of Kepler (1571-1630). With this triad of scientific thinkers, you define the initiation of modern science. And he defined a concluding "book-end" triad of recent scientific thinkers that exemplifies the farthest we've gone in the development of scientific thought: namely, Max Planck (1858-1947), Albert Einstein (1879-1955), and Vladimir Vernadsky (1863-1945).

We talked about looking at the development of modern science, book-ended by these two triads of thinkers. I thought his reference to the role of Vernadsky in that development was useful for the current project. I want to highlight one passage about Vernadsky from that discussion with Mr. LaRouche and then see how it plays into the current Galaxy Project. Mr. LaRouche said:

> You have to look at Vernadsky in parallel with the previous triad. Kepler discovered the Solar System, but the Solar System was not the concept of systems. Kepler had solved a problem, but he does not solve *the* problem. The idea of the Solar System was not a concept of systems, and what you get with Vernadsky is the systems. We don't get systems as such, with Vernadsky, but we get the implications of the systems. In other words, you can project from Vernadsky—you can go to the idea of a general principle of systems.
>
> And that is what I wanted to concentrate on. In other words, it seems on first pass—you say, "Oh, how nice, Vernadsky has produced something which fits everything that is required for a new system." But you say, "Wait a minute; this is not just a new system, it is a model for systems." This is the standard you use for trying to



*Modern science was founded by this triad of scientific thinkers from the Fourteenth to Seventeenth Centuries: from left to right, Italian architect Filippo Brunelleschi, Cardinal Nicholas of Cusa, and Johannes Kepler.*

> find new evidence which will tell you what the key is for the higher order systems.

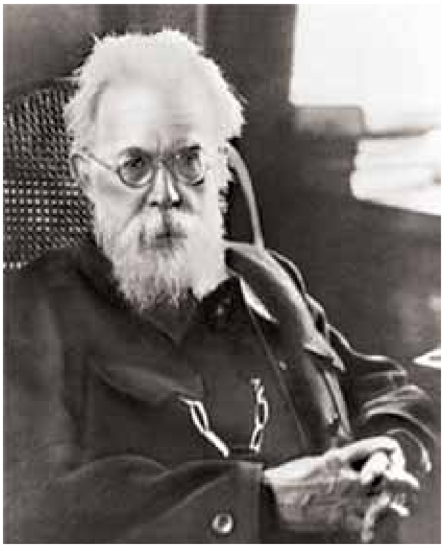
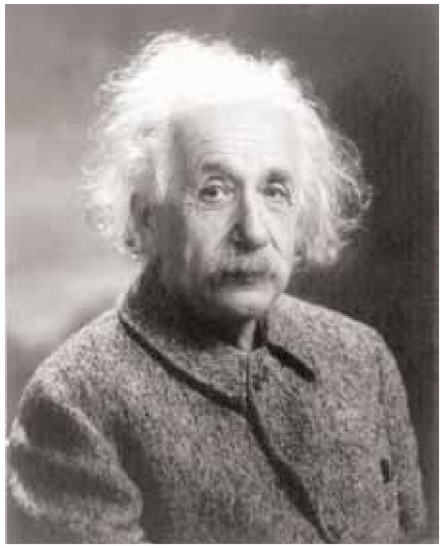
I thought this was a provocative conception that Lyn had put forward. Coming from that quote in particular, and from some of the context of our discussions with him at the time, was his idea of looking at the Universe, the larger astronomical processes, as a nesting of successively higher ordered systems, and the question of what we can take from Vernadsky's approach; where Vernadsky had taken scientific thought, scientific investigations, as a more generalized investigation of systems of processes; and how we can use that insight in approaching some of the new questions about the Solar System and the relation of the Solar System to the Galactic System.

We were discussing with Mr. LaRouche the concept of the Earth being a subsumed part of the Solar System as a whole, and the Solar System being nested within the larger process of the Galaxy as a system. And then—going to an even higher order—super-galactic structures on a scale of maybe tens of galaxies to even much larger scales, and looking for principles of organization and development, even on these much larger scales.

What I took from this quote and our discussions with Mr. LaRouche, and my understanding of Vernadsky's work, was the ability to begin to look at systems generally in a non-reductionist fashion. Vernadsky did this in a clear initial way in his work on the biosphere, and that is what he's most famous for, as the originator of the conception of the biosphere. He was fascinated with the distinction between life and non-life. He was fascinated with a lot of things. He was an amazing thinker. He covered an immense area of different fields, different sciences, including fields he created.

Especially towards the end of his life, Vernadsky was fascinated with the qualitative, infinite distinction of life from non-life, and how you understand and demonstrate that, and thereby better understand life. And he came very clearly to his conception of the biosphere—his idea that you can't *just* study individual organisms themselves. That can be done. You can find some useful things in doing it. But if you want to get at the principle of how life is expressed on the planet Earth, the distinction of life from non-life as expressed on Earth, you have to go beyond individual organisms.

He had famously said, you can't abstract an organism from the biosphere as a whole. It doesn't exist in isolation. It exists as a component, a part, of the biosphere that sustains it—that it contributes to, and that in turn sustains it. In the opening pages of his book, *The Biosphere,* his seminal work on this subject, he explicitly defines what we would call a non-reductionist approach to the biosphere, saying we're going to investigate the biospheric system as a whole as a single harmonious process, a single harmonious mecha-

*The most advanced level of scientific thinking to date has come from what LaRouche has identified as a second triad of scientists from the late Nineteenth into the Twentieth Century: from left to right, Max Planck, Vladimir Vernadsky, and Albert Einstein.*

nism—these are the terms he uses—without assuming that we can just explain it away on the basis of the component interactions in the small.

### 'Biogenic Migration of Atoms'

What I see Mr. LaRouche referring to in Vernadsky, is a breakthrough demonstration of how to study a larger organized system, as a system, as a single process, and not just a collection of parts—studying it from the anti-entropic standpoint. We get a very interesting perspective for the investigation of the Galaxy, these larger-scale systems, when you look at Vernadsky's scientific insights into evolution, into the development of the biosphere, in particular, what Vernadsky defines as his Second Biogeochemical Principle. He says:

> This Biogeochemical Principle, which I will call the Second Biogeochemical Principle, can be formulated thus: The evolution of species, leading to the creation of new, stable, living forms, must move in the direction of an increasing of the biogenic migration of atoms in the biosphere.

And he goes on to say:

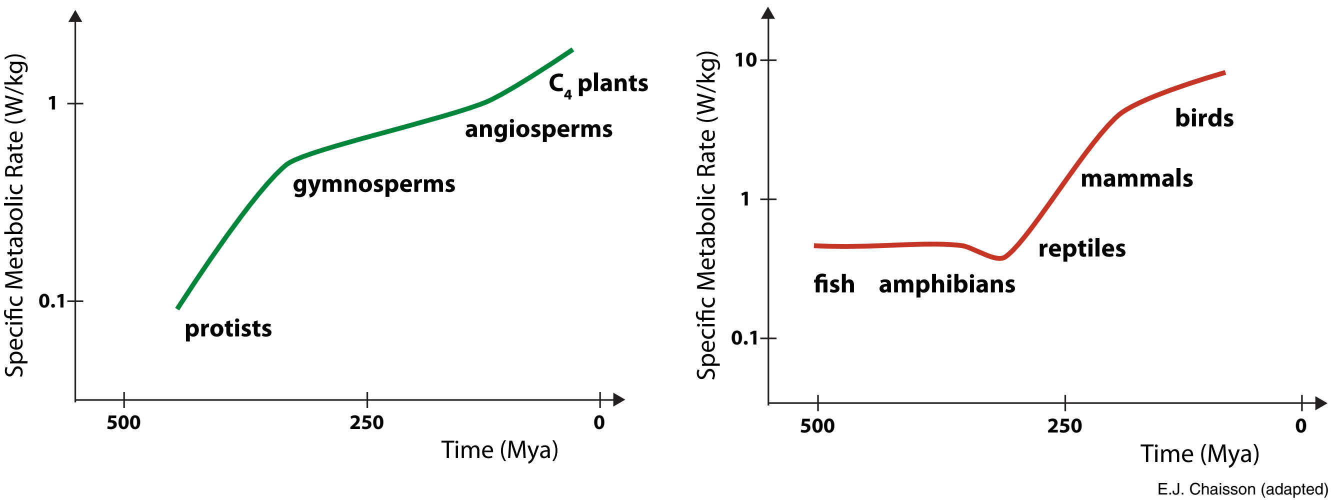
> This Second Biogeochemical Principle indicates, in my opinion, with an infallible logic, the existence of a determined direction in the sense of how the processes of evolution must take place.

Now this was in the mid-1920s. Studies of the fossil record were relatively young at the time, and we certainly have a much better understanding of the evolution of different forms of life now, nearly a century later. But even at this early time, Vernadsky was able to develop this clear insight into not just the biosphere as a process at any one time, but what are certain governing characteristics of how the biosphere has developed over time as a system. A key concept that he developed for investigating life, the activity of life on the planet, is what he calls the biogenic migration of atoms. That is, how biological processes, living processes, incorporate and move the chemical elements around the surface of the Earth. This is a metric of how living processes, living organisms, reshape and reorganize the medium of the surface of the Earth, creating the biosphere, creating forms of life.

Vernadsky often spoke in these terms, and examined the biosphere as a state of organization of the geochemical medium, the Earth's crust. He would investigate this from the standpoint of how much life, living organisms, is transforming, acting on, the surface of the planet. And his insight into evolution, the development of life, the development of the biosphere over time, is that this process must increase. That is how evolution must necessarily take place, he says, and it is intimately tied to, and governed by, the increase in the rate of activity of life.

This has been confirmed in a number of ways in more recent studies now, nearly a century later, and we see very clearly various indications that this is the principle of evolution. This is the principle of the development of life, the increasing rate of activity, the increas-

FIGURE 1




*From these charts, showing the increase of the rate of energy flow per kilogram of body mass, for both photosynthesizers and animals, one can very clearly see the evolutionary direction of life, toward increased energy-flux density. In the diagram, metabolic rate is expressed as watts per kilogram. The time scale is expressed in millions of years ago.*

ing biogenic migration of atoms. We see that species now living have replaced earlier species, and that new types of life have emerged with characteristically higher rates of activity, higher rates of biogenic migration of atoms than earlier forms of life. A lot of the more recent work is completely consistent with the thesis that Vernadsky developed earlier.

## Energy-Flux Density

We could introduce another term, energy-flux density, a conception that Mr. LaRouche developed in his study of another type of system, another process, human economic processes. Energy-flux density is the energy flow through a surface or a volume, the density or the rate of the flow of energy, the transformation of energy. It has an intimate connection to Vernadsky's idea of the biogenic migration of atoms. They're very closely connected ideas. In some of the work we've done in the Basement, you can see very clearly the evolutionary direction of life, and you can study it with these metrics. You're really looking at evolution of life being governed and driven by this process of increasing energy-flux density. (**Figure 1**)

Those are a few elements providing insight into the characteristics that we can derive and define from the earlier Vernadskyan anti-reductionist approach to the conception of systems. Perhaps what we want to define a bit more precisely is, how do we study anti-entropic developing processes? Vernadsky had laid an initial groundwork for studying the development of the biosphere as a characteristic anti-entropic developing process.

We see a very similar thing if we look at another type of process involving another principle, human economic activity. I will come back to that later. But Vernadsky's work—his work on the biosphere, the work he started to do on evolution, and the work he began on the study of human life as distinct from animal life—led to what he defined as the Noösphere, the domain of human activity directed by human thought; it's a very similar thing. You have an investigation of a larger scale process of organization and development, which you want to understand as a whole, and discover its characteristics. What can we define as the internal metrics which tell you about that thing as a system, without assuming we can just explain it away by reductionist methods? This is where Mr. LaRouche's work really comes in on a higher level—studying human economic processes.

Coming back to the quote from Mr. LaRouche, his emphasis on the importance of Vernadsky's work provides an important and unique perspective for orienting the Galactic Science Driver Program. And as we discussed with Mr. LaRouche at the time, one thing we want to look at is how to apply this framework of thought, this Vernadsky-LaRouche approach to defining, studying, and understanding the development of anti-entropic systems. We want to take that as a basis for thinking about generalizing to the larger-scale astronomical processes. That was part of the discussion with Mr. LaRouche that I quoted from.

FIGURE 2

ESA/NASA Hubble

*A giant molecular cloud, with a few regions blown up to show the kind of detail not visible at this scale. Our Galaxy has many such clouds. Spectroscopic analysis of the light received from such clouds shows a predominance of molecular hydrogen ($H_2$) and carbon monoxide (CO). But there are also much more complex molecules, including organic compounds such as $CH_3OH$, $C_2H_5OH$, and $CH_3OCH_3$.*

from something like this giant molecular cloud (**Figure 2**). We always thank NASA for the nice images. A giant molecular cloud—very exciting descriptive name, I know. Giant, it's big. Molecular, it's got a bunch of molecules in it. It's like a cloud. But the Galaxy is filled with them. In our Galaxy and other galaxies, you get these giant cloud structures of gas and dust. And in these you can see what—as far as our present knowledge tells us—are the initial processes of new stars forming, of new stellar systems, with new planetary systems around new stars.

Hopefully, the United States can get its financing act together and finally put up the James Webb Space Telescope as the successor to the Hubble; then we'll be getting some even nicer images of these things. But we can actually peer into the very early stages of something pretty remarkable: some large, relatively homogeneous, relatively unstructured clouds of gas and dust, mostly hydrogen, some helium, and then a sprinkling of other stuff, as the raw material for forming something like a solar system, highly organized, highly differentiated, highly structured, going from a fundamentally lower state of organization, to a much higher state of organization. New types of physical chemistry, new types of processes, are occurring. You have the potential to get a much greater dimension of physical chemistry, of types of minerals, types of molecular structures.

You even get the development of the array of elements of the periodic table out of these processes through nucleosynthesis. To our present knowledge, the array of elements comes from the processes associated with the development and life cycle of stars. I would argue that it is an anti-entropic process. Stellar nucleosynthesis is the idea that the heavy elements have been produced by nuclear fusion reactions occurring in stars, beginning initially with mostly hydrogen, some helium, and maybe a little bit of lithium, and then developing the

## Solar System as a Process

Now today we are looking at the existence of the Earth within the Solar System as a process, and the Solar System within the Galaxy. But what are these things? People just think of a collection of objects. The Solar System—you get the picture in your textbook. The big ball of the Sun and the planets with their orbits drawn in. You get this sense-perceptual picture of it, this set of bodies, but what is the process underlying that? What is it as a process of change? What is it as a process of development?

I think there's a lot to pull from the method used by Vernadsky and Lyn in studying life, in studying human economic processes, to start to look at other aspects of these higher order systems from a similar standpoint. Don't just see it as a collection of objects. Where did it come from? Where is it going? What are the governing characteristics of it as a process of change, as a process of development? How is it then situated within the next higher order system? You won't apply it in the exact same way, but in general, we could approach the idea of what is our Solar System in this way.

To the best of our knowledge, our Solar System came whole array out of that through fusion processes.

There are also some interesting studies indicating that even the life cycle of a single star—again, assuming we have a decent understanding of the life cycle of a star—is characterized by increasing energy-flux density (**Figure 3**). You are measuring the energy of the star per unit of time per unit of mass as it changes during the star's evolutionary changes (shown in giga-years, Gy). As stars go through the life cycle, their energy-flux density increases while they are building us a nice periodic table out of some basic raw materials.

## A New Era of Science

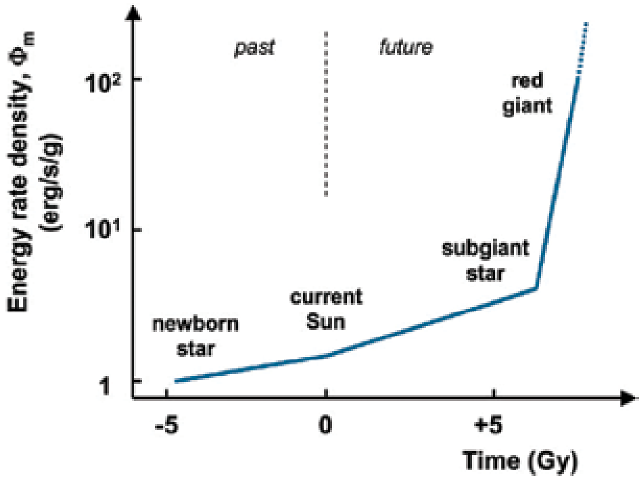
This, then, is the direction that I think we want to go in, in continuing a LaRouche-Vernadsky approach to studying these larger-scale systems to lead to a new era of science. In modern science today, these phenomena are all just explained away as a consequence of a certain set of fixed laws, a certain fixed set of properties of interactions. But what is completely ignored is the approach that Vernadsky took in studying the biosphere. What is the system as a whole? What is it doing? Where does it come from? Where is it going? Without assuming that we can reduce everything to its parts, what is this thing as a process of development of change? And how do we begin to think about it from that standpoint? And how do we understand what is the principle governing it? And where do we go from here?

We are part of this Solar System. We're in the middle of a process of development of change existing within our current Solar System, but we know that that is not the end. We are part of the larger Galactic System. We are part of this larger Galactic process, which, I think, we want to investigate from a similar standpoint. What is a galaxy as a process of change from lower organization to higher organization, as an anti-entropic process of development, of change, something that subsumes the Solar System?

## An Array of Anomalies

In some of these classes, we may get deeper into the fundamental organization of the Universe, potentially at the level of the type of shift that we went through when Einstein realized that energy and matter are a product of the same thing, $E=mc^2$, that space and time are interconnected as a single process. We went through a complete revolution in our fundamental understanding of how the Universe is organized. Some of our most basic conceptions were overturned. A lot of that relates to stellar-scale processes.

FIGURE 3




From "Energy Rate Density as a Complexity Metric and Evolutionary Driver," by E.J. Chaisson

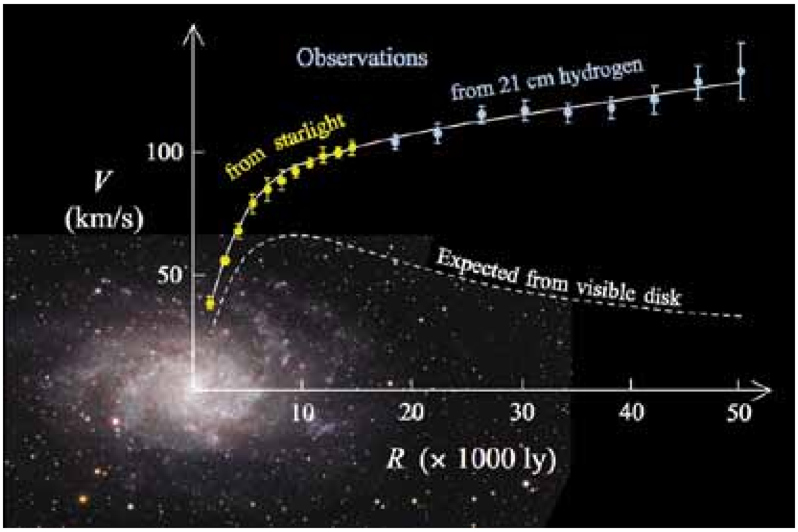
*A star's energy-flux density increases as it evolves. The figure uses our Sun as an example and shows the evolutionary sequence of such a star over billions of years (Gy) as the sequence is currently understood. Energy rate density (energy-flux density) is shown in ergs per second per gram of stellar mass.*

When we investigate galaxies and galactic systems, we immediately run into an array of anomalies, of problems. We can't explain some of the most basic properties of galaxies by extrapolating our current understanding of physics to this larger scale. We will take this up in more detail in the coming classes.

As a teaser, you may be familiar with all the talk about "dark matter." To some extent we can measure the rotation of galaxies—especially by looking at other galaxies, but also at our own to some degree. We can't account for how they rotate. What we observe is a mapping of the change in orbital speed of stars and other matter as you look further and further away from the center of the galaxy toward its periphery (**Figure 4**). Based on our understanding of how much mass is present in volumes at different distances from the center of a given galaxy, we would expect the mass—stars, gas, dust—to orbit at a certain speed, by using our understanding of gravitation as we understand it in our Solar System, and applying it on the galactic scale.

But what we see is that the mass orbits at a much faster speed than we can explain, especially when you move toward the outer regions. This is the basis for the hypothesis that there is something out there that we haven't been able to detect yet, but that's adding an

FIGURE 4




Stefania Deluca

*Stars rotate around the galactic center, but not at the velocities expected from Newtonian physics. The velocities of stars are supposed to vary according to the environment: the amount of mass at the center and the distribution of mass throughout the disk. The velocity of any given star is then supposed to depend on its distance from the galactic center. Astronomers estimate the galactic mass and its distribution on the basis of the emitted light, and then calculate the rotation curve (expected velocities at different distances from the center).*

*In the case of the spiral galaxy M33, shown here, the result is the dashed curve. However, the actual velocities, as directly measured, are shown in the upper, solid curve. (Distance from the center is shown on the x-axis in thousands of light-years; rotational velocity is shown on the y-axis in km/second.) So what's wrong? Popular opinion among astronomers is that there must be mass that we cannot see, so-called dark matter. A halo of dark matter surrounding M33 would fix the problem. There are, of course, other possibilities.*

extra gravitational effect, adding extra mass that makes it orbit at a faster rate. It's called dark matter. That's something that people are looking into. But the point is, we don't know.

We have yet to explain even how a single galaxy rotates and maintains the structure and the type of activity that it does. You have an array of fascinating properties associated with some mysterious, super-massive object at the center, which we think is at the center of basically every galaxy. We've got the best evidence in our own Galaxy, where we've been able to see stars orbiting around some point in space, in the center of our galaxy, where we see nothing; and the expectation is that this is a super-massive black hole.

What is that? It's where our equations go to infinity. It's where space-time goes to infinity. It's where basically our equations literally break down. We don't know. We know there is something going on at the center of our Galaxy that seems to be causing an effect equivalent to a mass of four million times the mass of our Sun, causing stars to orbit on a time scale of 10 or 20 years—stars the size of our Sun, orbiting a point where we see nothing. Is it some kind of super-massive object? Whatever it is, we don't understand the physics of it.

We see relationships in galaxies between the mass of this super-massive object and properties of the galaxy as a whole, which we can't explain. The mechanisms that we know of, by which this super-massive object would interact with the galaxy as a whole, give us no explanation for how they maintain a coherent relationship, a certain coherent resonance with each other. That's another anomaly that we see.

We see some galaxies that look like this one, the galaxy called Hercules A (**Figure 5**). The galaxy itself—hundreds of billions of stars—is entirely in that bright little central region there. So at visible wavelengths, that's what you see as a galaxy. It's not a little tiny galaxy; it's a big one.

But when we look at it in other parts of the electromagnetic spectrum—in radio waves, for example—we see those massive structures of plasma—electrically charged gas—shooting out from the galaxy, that maintain coherence and structure on a scale that dwarfs the size of the galaxy itself. Astrophysicists think this phenomenon is associated with the apparently super-massive object at the center of the galaxy. There have been theories to explain how this happens, and then observational evidence overturning those theories, and then new theories.

So it's a new area of investigation. Here again we see cases of incredibly energetic activity and incredible masses at a point where our current level of physics just completely breaks down—the equations literally go to infinity.

## The Solar System in the Galaxy

These are just some of the provocative, unanswered questions with respect to the structure of a galactic system as a whole. Another approach, which we've worked on, is to look at how changes on Earth have a remarkable correspondence with the passage of the Solar System through different environments as the

FIGURE 5


NASA, ESA, NRAO, STScI, et al.

*Radio Galaxy Hercules A: Plasma jets in opposite directions are a feature of the supergiant elliptical galaxy at the center. The jets—of subatomic particles in a magnetic field (plasma)—are ejected at relativistic speeds, that is, at some appreciable fraction of the speed of light, and are visible only at non-visible wavelengths such as radio (the color is computer generated, possibly to indicate the temperature gradient). The galaxy itself is a thousand times more massive than our Home Galaxy and its central mass of 2.5 billion solar masses is a thousand times that of the central mass in our Galaxy. This composite was created by superimposing the image in radio waves, taken by the Very Large Array in New Mexico, on an image at visible wavelengths taken by the Hubble Space Telescope.*

Sun and the Solar System orbit the center of the Galaxy. This is most clearly expressed in climate, where we see—in the very, very long-term records of climate on earth—a remarkable correspondence between large-scale climate change (the stuff that makes the greenies really freak out) and different environments within our Galaxy that our Solar System has experienced.

The Solar System bobs up and down, above and below the Galactic plane, as it orbits the center of the Galaxy; we see clear indications of climate changes corresponding to that cycle. The Solar System also passes into and out of the Galaxy's spiral arms. (**Figure 6**) We see very large-scale changes in the climate of our planet that correspond to the record of our passage through the spiral arm structures.

But there are also other, even more provocative correlations between geophysical activity, including large-scale volcanic activity, with some of these cycles. The Basement Team has talked extensively about the seeming resonance of the evolution of life with some of these cycles. In the fossil record, you get extinctions and mass extinctions—wipe-outs of large numbers of species—but also the generation of new species and accelerated rates of the appearance of new species called radiations. There are certain cycles of extinctions and speciations that correspond to the events in our travels through the Galaxy.

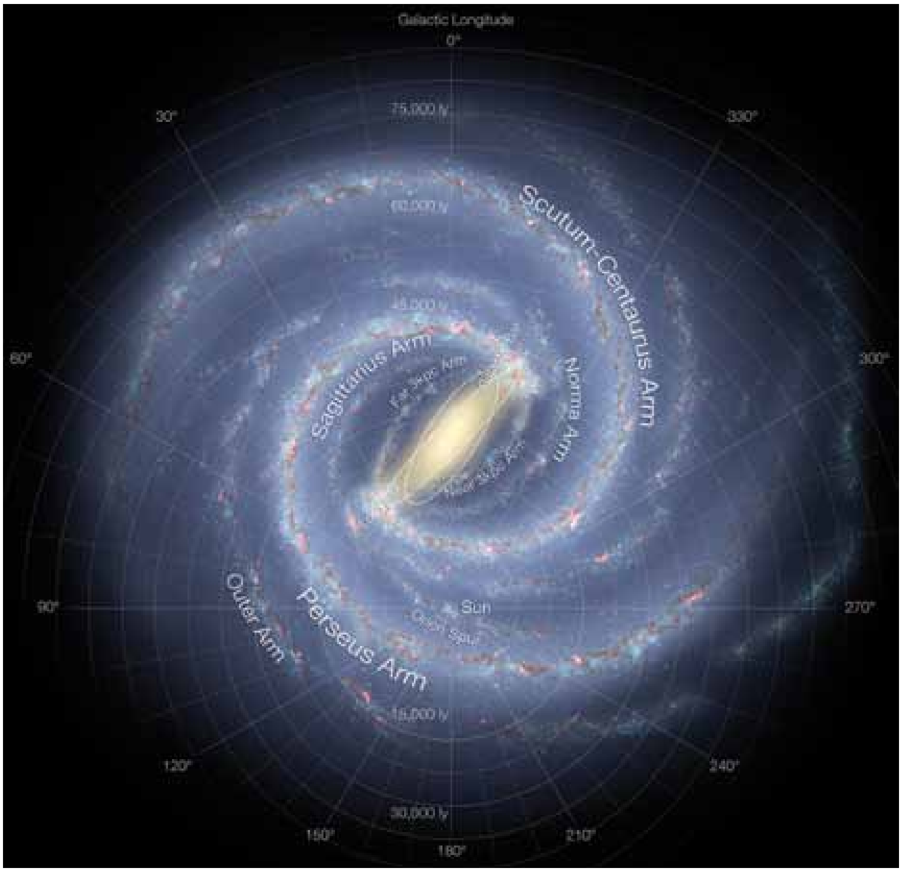
You have, therefore, an array of fascinating questions that should be looked at from the standpoint of a single investigation. What is this Galactic System that we're a part of? What are the principles governing the organization and the structure of a single galactic system? What is the physics? What about the discrepant orbital speeds of stars, and this issue of the relations between the super-massive central objects and the structure of the Galaxy as a whole? And what are the relations between processes on Earth and in our Solar System—climatological, geophysical, biological—and the different environments in our Galaxy that we've experienced?

All of this converges on one question: What is this Galaxy that we're a part of? We are not just seeking some new mathematical laws that will describe how stars orbit the galactic center. If you go online you can find a lot of people who have a lot of theories, loads of explanations. "I got this. I got that. I got it all figured out." The Internet is full of that stuff. But our key question is, how can mankind come to a higher level of understanding of the principles organizing these galactic systems? What would it mean for mankind to understand that?

## Mankind in the Universe

This brings us to the point of asking, what is mankind here in the Universe? What is our "location" in the Universe? Mankind can be seen as moving through a

FIGURE 6




NASA/JPL-Caltech/ESO/R. Hunt

*You are here: The Sun is at the point from which the galactic longitude lines radiate. This is an artist's visualization of the best data we have on the structure of our Galaxy, including visual, radiowave, and other data. (Where would your telescope have to be to obtain such an image?) Note the bar at the galactic center, making ours a barred spiral. The labels use two units of distance: the light year is the distance travelled by light in one year, about 6 trillion miles (see, for example, 75,000 ly), and the kiloparsec or kpc, about 3,260 light years or 19 thousand trillion miles (see, for example, Far 3kpc Arm).*

series of platforms. Mankind's existence, development, and progress in the very early phases, was purely tied to how mankind could improve his understanding of living processes on Earth, and control and improve them to improve his own condition. So we improved our existence by mediating our relationship to the biosphere through our understanding.

We began to do some interesting things: We began to relate not just to the biosphere as it existed at the time. We began to relate to it as a geological evolutionary process. We began to use fossil fuels, for example, something that is not a product of the biosphere at any arbitrary time. We had burned wood, but wood, unlike fossil fuels, is produced continuously. When society begins to depend on something like fossil fuels—according to the mainstream ideas about how they are created over geological time scales—you are looking at mankind creating his means of existence based on relating to a different process. We are no longer just relating to the process of the biosphere at the given time. We are relating to it as a geological phenomenon.

But then we have the process of moving to a new stage, a new platform, where we begin to sustain ourselves, and create a new level of existence based on processes which have nothing to do with the biosphere, which are not products of the biosphere. In a nuclear stage of existence of mankind, in which it controls the processes of the nucleus—fission and fusion—we exist in a relationship to what I would call a stellar principle, relating to materials and processes that are a product of a stellar principle, of a stellar process. The array of elements of the periodic table is the gift created for us by the stars going through their life cycles and their anti-entropic processes.

## To Fight for the Next Step

So what is next? We have a lot more to do, obviously, on these levels, but we have a whole new perspective of what would it mean for mankind to be an actually Galactic species. And again, to dishonor Star Wars, we're not talking about flying around to different places in the Galaxy. We are describing a sacred process of mankind generating new conceptions that enable the human species to interact with the Universe in a fundamentally different way, in a higher order relationship. You see it in the transition from mankind just existing as an organizing force in the biosphere, to mankind moving to being an organizing force in the Solar System. And it's the discoveries of the science of the Solar System at these deeper levels of physical science which enabled it, which created that, for mankind.

Our mission is to fight for the creation of the next step, to pursue these higher order questions of what is governing galactic systems—what are the principles underlying them, including some of the anomalous phenomena I just breezed through, and others that we may not even know yet. And to address what it is going to mean for mankind to rise to that level.

That is a broad overview. The idea of this series is to get into a number of these topics in more detail, and in a more pedagogical fashion—define what we know, what we don't yet know, what are the questions, what are the assumptions. We will also address the methodological outlook that should really guide our work.

## The Living and the Non-Living

**Question:** On Vernadsky, and his idea of the biochemical migration of atoms, did he think that any atom, let's say, died? Did it ever somehow disappear?

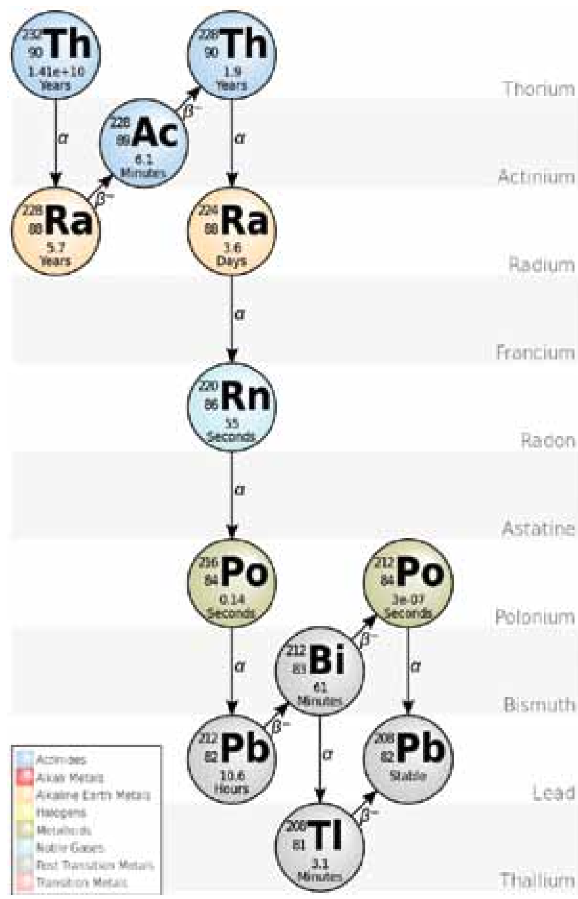
**Deniston:** He was definitely fascinated with radioactivity and radioactive decay. So there you get elements decaying, changing into a different element, so I think that would be the closest you'd get to an element dying, so to speak. (**Figure 7)**

What I find interesting about his approach is that he's asking "what is life?" You have the same chemical elements in living and non-living activities, the oxygen in the atmosphere: We breathe it; it comes in and out of life. The food we eat: Its chemical elements were part of non-living processes and became part of living processes. They are returned to non-living processes. So you have this exchange with this medium, this structure of the Earth's crust, with these certain chemical elements, that exist on the Earth's surface.

What I think is fascinating is, how do you define, not just what the stuff is, but what's the organizing principle? Why does it behave in a certain way, and not in another way? I'm not an expert on all of Vernadsky's work, so I'm not going to say I can completely answer how he thought about this. But from my reading of what is available in English in some of his work, I was fascinated—he seems to be looking for how to narrow down and define and forcefully demonstrate certain processes of change, or states of organization, which tell us that something different is acting to create what we call living; how to find certain states of organization of the Earth's surface, the biogeochemical medium, that you can identify as the footprint of a principle of life—and in a similar way, unique footprints for human life.

We use the same elements. We don't have special elements. But we are able to organize states of organization of the biospheric system that you would never see manifested under the principle of just life, or just animal life. You can define this as the unique footprint of some other principle acting, some human creative

FIGURE 7




Wikimedia Commons/BatesIsBack

*The thorium cascade is an example of the decay of one radioactive atom into another, and another, until a stable atom is the result. The atoms are properly called nuclides, that is, nuclear species, defined by the number of protons and neutrons in the nucleus. Thorium (Th), for example, always has 90 protons, but the number of neutrons is not always the same. Lead (Pb) always has 82 protons, but again, the number of neutrons varies.*

*The thorium cascade, as shown above, begins with thorium-232 (232 is the total of protons and neutrons). Thorium-232 emits an alpha particle (α), that is, a particle of two protons and two neutrons, to become radium-228, which in turn emits a negatively charged beta particle ($\beta^-$, also known as an electron) to become actinium-228. (The alpha-beta terminology was developed when the nature of these emissions was still not known.) The decay process eventually ends with the formation of lead-208, which is stable, that is, not radioactive.*

principle expressed, not in the object, but in the state of organization and in the process.

## Galactic Structure

**Question:** I have a question about the idea of the system of the Galaxy. I think you'll probably get into this in future classes, when you start going through these anomalies that we've run into, but can you give an idea of what we're talking about, what we mean by a *system* of a Galaxy? I'm not even sure what we're trying to define. The Solar System seems a little easier because it's fairly simple, in a sense, but the Galaxy is just—I'm not really sure what problems we're trying to solve, what questions we're trying to answer.

**Deniston:** We have a giant blob of stars. (Points to image of spiral galaxy underlying the rotation curves, **Figure 4**.) We see an incredible amount of structure, spiral arms, really nice structures, and beautiful, very thin discs, other components. There is a lot of structure, which is fascinating to investigate in and of itself. But then, there are some outright anomalies about how that structure behaves. In our current understanding of how gravitation works, of how bodies orbit around a mass, the orbit is determined by the distances and the amount of mass they are orbiting. Based upon those conceptions, and what we think we can estimate as the amount of mass that is present, what we see shouldn't be happening. We can't explain why it is happening.

Take a simple example of an anomaly: In a planetary system, all of the planets orbit in the same direction, and you don't expect to see a planet in retrograde motion. It would be an anomaly; it shouldn't be there, based upon your conception about what's actually happening up there.

This is a little bit more sophisticated, obviously. But our current conceptions about gravitation and mass don't seem to work for just the basic question, how do things orbit around the Galaxy? And so the leading idea is that there must be other forms of mass, of matter, out there, which we haven't found yet, and might be very, very hard to detect, so-called dark matter that's adding the extra mass effect, that is causing this deviation in how we see the Galaxy rotate.

Dark matter has not been found. Still, it's the hypothesis most people are pursuing. Some people have other hypotheses. Across the array of issues we want to cover, I think we want to look for new levels of science, new physical principles. We want to further and further refine and demonstrate that there has to be some other principle acting, and then try to track it down, just as Kepler pursued Mars. The way he talked about it was that he thought he had it chained up, and then it broke the chains and got away.

What's the actual cause of the organization, the type of activity we see in these systems? The thesis I'm working from is that our understanding of mankind's position in the Universe is going to give us new levels of ability to interact with the Universe, yielding new domains of science and a potential for new technologies. This means a new, higher level of existence for mankind, based upon redefining our existence from the standpoint of our relationship to the principles of the Universe that are responsible for the existence, structure, development, and governing of galactic systems.

A few of the world-renowned astronomers of the past century were pursuing an idea about how galaxies are created and how they evolve which is very different from the standard, entropic view. It has not been disproven. It has just been pushed aside and disregarded.

The Armenian astronomer Viktor Ambartsumian, based on his observations, developed the theoretical framework of how galaxies are being created and ejected from the nuclei of other galaxies. He was convinced that galaxies exhibit much more of a creative, developing process than is found in the standard Big Bang cosmology, where you get one mysterious instant of creation and everything just unfolds—entropically. Some cosmologists literally say you've got a lot of gas in a really big box, and that's what the Universe is.

Ambartsumian couldn't be *entirely* ignored because he was already respected for much of his earlier work. The American, Halton Arp, was another respected astronomer who turned to the study of certain observed properties of galaxies that conflict with the accepted wisdom. His work seems to show, again, that there are levels of science we haven't yet achieved.

## Are New Principles 'Allowed'?

**Question:** Is it acknowledged by scientists that there might be new principles involved?

**Deniston:** No. The general approach is to work out how to explain everything we observe from the standpoint of just what we know now.

To some degree there are the questions of dark matter, dark energy. Those are open questions. I don't have a full overview on where different people in the academic community stand on introducing new physical principles to explain some of these things. But the work of Arp and

Ambartsumian, for example,—that whole direction of investigation has been pushed aside, because in astrophysics it shouldn't be able to happen, so therefore it's not happening.

It reminds me of the situation in the Nineteenth Century, when scientists began to realize from geological evidence that the Earth has been in existence for hundreds of millions, actually a few billion years. This led to a question about what fuel the Sun is burning. If Earth has existed that long, what must the Sun be burning, such that it could continue to put out energy for that amount of time? Any conceivable energy source known at that time would have been consumed in thousands or hundreds of thousands of years. No chemical reaction or burning process could sustain the Sun for so long. Could you have said," Well then, let's just pretend we didn't find all that geological stuff, because then the problem doesn't arise?" People were thinking that the Sun might somehow get refueled.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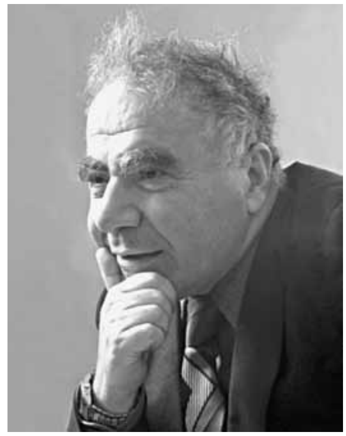
*American astronomer Halton Arp (1927-2013)*


*Armenian astronomer and astrophysicist Viktor Amazaspovich Ambartsumian (1908-1996)*

We didn't have the ability to solve the problem at that time. We didn't have the level of science necessary to enable us to ever answer that question. It's perfectly valid and correct to approach this galactic question in a similar way. We see some super-energetic activity, and incredible structure and organization emanating from the point where our mathematical physics goes to infinity. Maybe there is something more fundamental there that we don't yet understand, that could be as revolutionary as these earlier revolutionary discoveries. That's the type of pursuit we want to reopen.

Then again, recognize that we're looking at developing systems. The whole Universe—these nested hierarchies—what we know is that we see processes moving towards higher energy-flux densities, higher states of organization. We have yet to understand the real nature of our Universe as fundamentally creative.

## Spiral and Elliptical Galaxies

**Question:** Are all the galaxies that spiral type of . . .

**Deniston:** Not all of them. Just for reference, this is a giant molecular cloud within our Galaxy (**Figure 2**). It is a tiny, tiny, tiny little region of our Galaxy. You've got to imagine, this spiral Galaxy (**Figure 4**, background) has probably tens of billions of stars. It's a mind-boggling number. We're looking at something that has an incredible amount of structure and fine resolution that you can't see at this level. Relative to this spiral Galaxy image, the giant molecular cloud is zoomed-in really far. It would be like looking at me and then looking at a picture of one of my cells. It's probably an even bigger difference of scale than that.

There are generally two types of galaxies, but with a fair amount of variation. Large, highly-organized galactic structures are usually either these spiral structures, or what are called elliptical galaxies that are spheroidal. The ellipticals are like giant balls. They don't have the thin disc or the spiral arms. In a two-dimensional projection, they look like elliptical or circular discs because of their spheroidal structure.

There are all kinds of variation within each of type of galaxy. Are the spiral arms wound tightly together? Are they stretched out? Some spiral galaxies have a bar that looks just like a rigid structure, which orbits around the center. You also get a bunch of smaller, more irregular galaxies that are not as presentable—amorphous cloud or blob structures. They are probably just as fascinating. But the larger, more highly organized ones tend to either be spiral or elliptical.

## Time Scales of Cosmic Effects

**Question:** Are you saying that the Galaxy has an effect on climate change and other phenomena? Does it cause the seasons to change? Is the Galaxy changing the leaf colors themselves, or is it because maybe the Sun's blocking—or not blocking?

**Deniston:** If it is, it's doing a really good job. It looks pretty nice this time of year. Climate change tends to be on really long time scales. If you're looking at something you'd call active Galactic influence on climate change, it's a continuous factor that's active at all times. The work of Henrik Svensmark, Nir Shaviv, and others shows, that the cosmic radiation effect—that's penetrating the biosphere at all times, that's coming from the larger Galactic System—plays a significant role in clouds forming. So that's a constant input. It's always there. As our Solar System moves into different parts of the Galaxy, where that input changes, then that changes how much effect we get on Earth from our Galactic input.

For example, if you take the past 500 million years, we've been through four cycles between what are called ice-house and hot-house modes of climate. (**Figure 8**) We're currently in ice-house mode. In hot-house mode, there are no ice caps on the poles at all, no ice caps top or bottom, and the climate is significantly warmer. Shaviv found that our periods of hot-house mode occurred when the Solar System was traveling between two spiral arms, and these are environments where we think we receive less of this Galactic cosmic radiation, meaning less cloud cover and more sunlight coming all the way down and reaching the Earth, not being reflected by the clouds. Because the clouds do a lot; it's like your umbrella, you don't want to get a tan like me. The umbrella can block the Sun. Clouds reflect a lot of the sunlight.

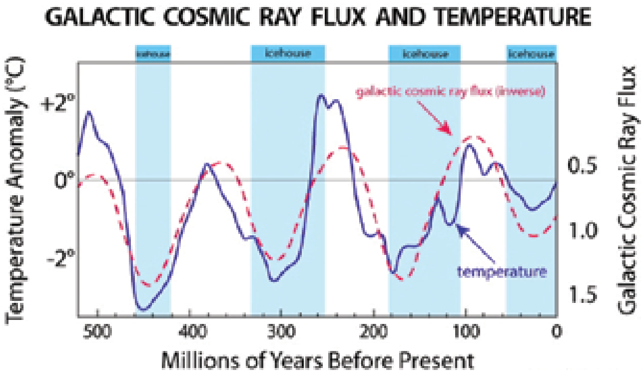
The theory that these guys are working on, is that with fewer cosmic rays, there is less contribution to cloud formation. You get fewer clouds. You get more sunlight coming down and hitting the Earth. You get a warmer climate overall. And you get the inverse effect when we're traveling through regions of the Galaxy where we have a lot of cosmic radiation coming in, causing a lot more cloud cover, which reflects sunlight much more, contributing to an overall cooler climate. So there are periods when the ice caps move much farther towards the Equator—huge ice caps covering big chunks of the Earth.

So these are massive changes, with climate going from everything being Southern California and hotter, to everything being Boston—frigid and cold. Very large-scale changes in climate tend to coincide with the passages into and out of spiral arms.

That's an example of the large-scale climate change effects. You see it over very long time-scales. Then you get smaller effects on shorter time-scales when the Sun gets more magnetically active, or less active, and that magnetic field shields Earth from some of the Galaxy's cosmic rays. So that can contribute to changes on shorter time scales such as decades or a few years.

I don't know if the Environmental Protection Agency has yet considered cosmic radiation a pollutant, or not. We're inquiring about that. (Laughter) Physicists are worried they're going to have to shut down the Large Hadron Collider for emitting pollutants.

FIGURE 8




*Earth's temperature fluctuates inversely with the flow of cosmic rays from the Galaxy, as shown here. The low points correspond to what have been called Ice Ages.*

## $CO_2$ Not a Climate Changer

The study of 500-million-year hot-house and ice-house modes was famous, because over that time, the Earth's climate went through four of the big changes from hot-house—no ice caps at all, much higher sea level—down to ice-house—a lot colder, big ice caps. It went back and forth four times, and the $CO_2$ level only changed twice. This was shown about 20 years ago, that on these longer time scales, $CO_2$ does not look like a major contributor to climate change at all. It's just doing its own thing. The climate's doing one thing. The $CO_2$ is doing something else. That upset a lot of people, because $CO_2$ is supposed to be the *only* thing that causes change, according to the current propaganda paradigm.

It was Jan Veizer in Canada who showed that, and then Nir Shaviv, the American-Israeli researcher, found that study, and then said, "Oh, look, not only is $CO_2$ not correlated with climate change, but the climate change in these records is closely correlated with the spiral arm travels of our Solar System." And that was one of the key studies that went into launching the investigation of galactic effects on climate change.

Meanwhile the plants are screaming for more $CO_2$.

So, that may be good for tonight. It's getting a little bit late. I would like to take up various elements of this presentation in a little more detail and in a more pedagogical way, to sink our teeth into how we know some of these things. What do we know about how our Solar System is trucking through the Galaxy? What do we know about these properties?