On the Crab Nebula

The Crab Nebula was first observed in 1731. It's right up there, as a smudge, in the constellation Taurus (**Figure 5.1**). Now, you can't see it with your naked eye. So, already we're dealing with something interesting.

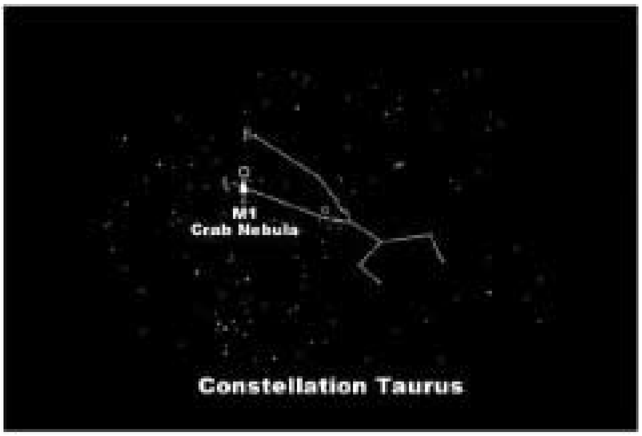
It occupies a swath of approximately 5′ [minutes] of arc in length, and 3′ of arc wide, on the celestial sphere—the sphere that Merv described. To get an idea of the size: A minute of arc—people know you divide a circle into 360°; you can take one of those degrees and divide it again, into 60 minutes—so, 1′ of arc, is one-sixtieth of 1°. So, you can see why this thing is not visible, except as a projection onto our extended Sensorium of astronomical instruments.

But by the middle of the 19th Century, it was already possible, thanks to developments in the technology of telescopes and this sort of thing, to start to see details of it. And you're able to see a detail, sort of irregular legs or filaments in it, which is how it got the name "the Crab." We can see the next (**upper right image, Figure 5.2**). This is a later one. This is a photo taken by the European Southern Observatory.

But you get a sense of what was being seen there, that made people decide to use the term "crab" to describe it.

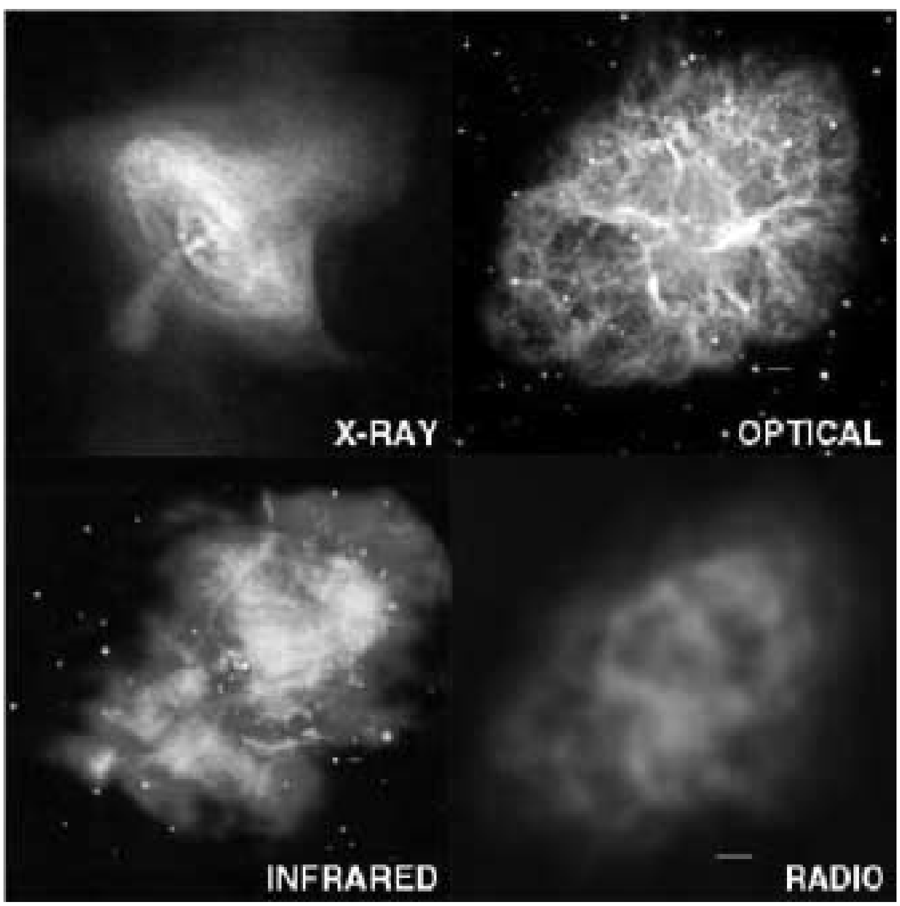
This is one photo of the Crab; but these four images are [all] images of the Crab. . . . Now, it's worth noting that every one of these images is completely different from the others. The one on the top left, is the X-ray photo, which was taken by the Chandra Telescope, the first one that Adam ran through; the one on the right is the optical one; the bottom left, is the infrared; the bottom right is the one taken in the radio-wave section of the electromagnetic spectrum, like what you would get from the second [Very Long-Baseline Array] array that Adam went through.

FIGURE 5.1



Now, if all of these look completely different, the question should come up immediately: Which one of these is the real Crab Nebula? I know some people might be inclined to say, "Of course, it's the one on the top right. It's the optical one. It's the one you see." Because if you take a photo of a person, that's a real person. If you take an X-ray of a person, you know, that's not them, right? That's just their skeleton, that's not real. If you take a picture in the infrared, you'd see some colored splotches, or whatever, and you'd say, "Well, that's not them, obviously." So, it must be the one you can see, right? That's the real one?

FIGURE 5.2
Four Images of the Crab Nebula



How Reason Creates 'Seeing'

But, if you remember what we said at first, you don't even see the one on the top right. The one on the top right, you only get to see that as a projection onto the surface of an instrument. It's something that happens at the lens of your telescope; it's not something that happens out there. You're not seeing what takes place *at* the Crab Nebula; you're seeing what happens on your instrument.

So, that might send people into some kind of existentialist fit. "God didn't mean us to go into space, anyway. You're never going to see anything, and that's why we're here. Why don't you just stick to the ground, and worry about something else?" But, that shouldn't be too big of a paradox—.

Or if it is, that should send you into a real fit. Everything else you see, is just a projection also, right? Every other image you get, isn't taking place out there. Like you guys are looking at me: You're not seeing me over here. You're seeing something happening on the back of your retina. It's a series of colors, that you guys have figured out how to recognize, and you can say, "Well, okay. If I see a certain change in size, if I see a certain change in other characteristics, well that must translate into some kind of distance from me."

And, because you figured that out, when you're very young, you're able to say, "Okay, so what I'm looking at must be taking place out there." And, you've seen babies try to figure this out, right? I don't know if my nephew's here again yet—. If you watch, they're working out—initially, they don't know what the hell's going on. They're looking at things, but they're not seeing—it's what's called purblind, they've got no attachment; this idea of distance isn't connected to what they're seeing through their eyes, the kind of effects they're getting on the back of their retina.

And, over time, they can develop that. They can develop a certain relationship between certain properties of that phenomenon that they're seeing in their eyes, and in other things that they can observe: They start to *reason* before they even have a sense of sight. That's something that you develop through reason, even as a baby.

So, that kind of deepens the question: What does it mean to say something is "real"? It's not being able to "see" something, at least not in that sense. Your ability to know reality doesn't depend on that. There are famous examples that prove that case efficiently: Helen Keller, other things like that. We're not uniquely dependent upon any kind of sense, not a specific sense organ, at least, not in that sense. So, what's real? How do we get to what's really going on at the Crab Nebula?

What we've got there [Figure 5.2], is a gateway that's going to help us here. We've got, already—looking at the images, that we've got here, with these four distinct images—what Riana was talking about. We've got that coincidence of opposites; or maybe, just a coincidence of things that don't seem to have anything to do with each other at all. But, it's in that coincidence—it's in the fact that you've got one principle behind all these; they're all looking at the exact, same splotch in the sky; they're all looking at the exact, same kind of area on the celestial sphere—it's that fact, that can let you get to a higher reality than just, "Okay. What's a picture of this? What does it look like?"

The example that Friedrich Schiller uses, is similar. He discusses the same point in his *Aesthetical Letters*, as he describes a flower. And, he describes this flower, and he says: Well, okay. It sprouts; it grows; it blooms, and then it fades. But, all the while, you're looking at a flower. You don't say, "Well, I'm looking at something different," every time that flower looks different. You might say, you're looking at a "dying flower," or a "growing flower," or a "blooming flower." But, you know that you're looking at that exact, same flower. There's one object that orders everything that you see with your senses. And what's more, you can only get to that one object by all those different stages of it.

The idea you had of a flower, if it's a developed idea, is that entire process of development: It's something that's not *in* any one of those stages, but it's what orders all of them.

The Growth of the Crab

And so, we'd like to look at that. We want to get to what that really is, behind the Crab Nebula. That's going to be our way out of the cage of our senses. Now, the way we're going to do it, isn't with a simple description, not a mathematical model of it, not an explanation of the phenomenon—in that sense. Because that explanation is just restating a paradox given to you, in terms that you already understand: It's just sort of a way to say, "Well, I'm going to come up with a new decoration; I'm going to come with some new furniture for the inside of my prison cell." You can sort of pick your décor—"I like Carl Sagan on the inside of my universe-prison. I like Stephen Hawkins on the inside of my universe."

But, if we really want to escape, we're going to have to pass through the paradox. We're going to have to actually look at the metaphor that the universe is giving us, and figure out what's on the other side. But, to do that, we're going to have to refine the paradox a bit, because there's more to it, than just diverse images.

Measurements of the Crab over time, demonstrate that you've got a certain growth. Now, you can see, we've got [Cardinal Nicolaus of] Cusa right here, looking out from the inside of his Sensorium, looking out at his celestial sphere (**Figure 5.3**). And, you can see that whatever objects you've got, that you're observing projected on your celestial sphere, take up a certain amount of arc, and that's the way you can measure them. You want one measurement—you can't really give any kind of linear distance between objects; at least, not yet, not by observing them, not by looking at their simple relationships in distance from your standpoint. But, you can

FIGURE 5.3

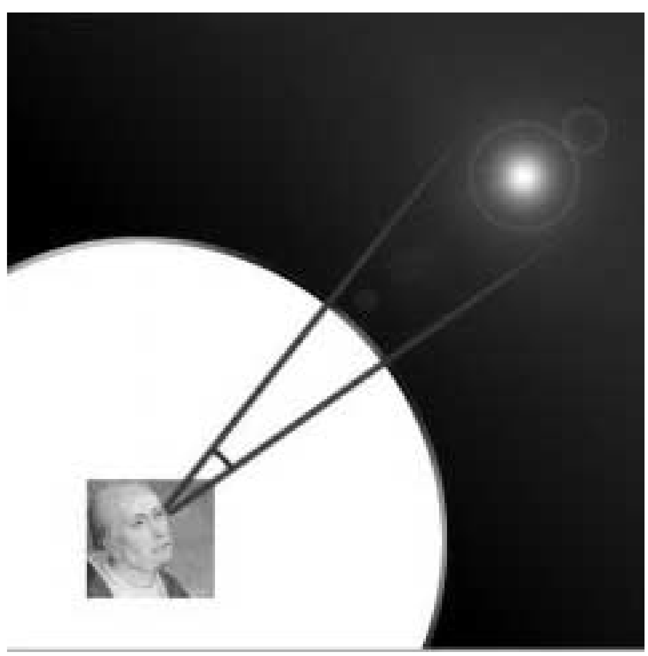
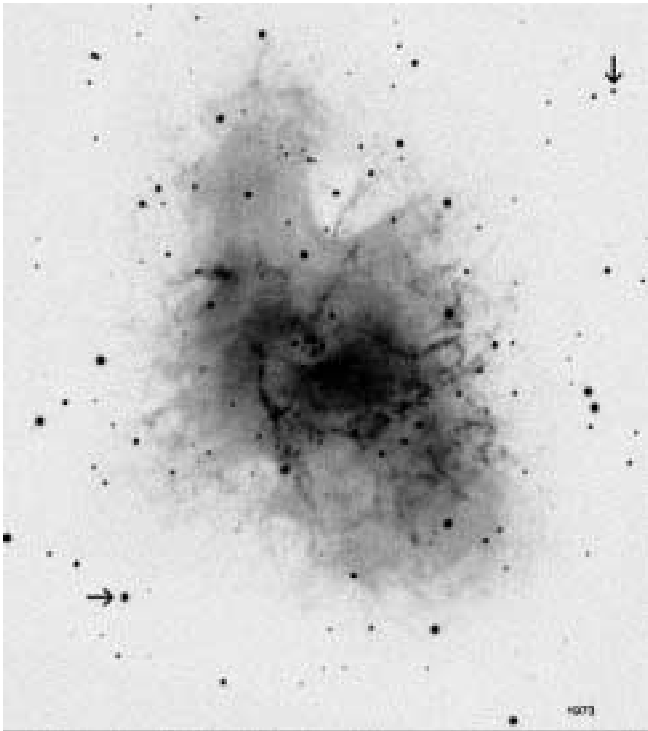
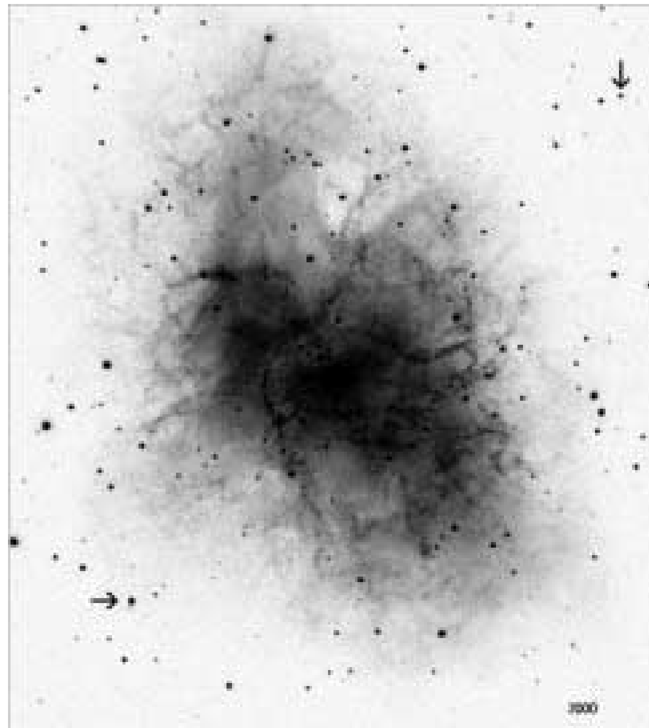


FIGURE 5.4
Crab Nebula Expanding at Expanding Rate





see a change in how much distance they occupy on the inside of your Sensorium, your celestial sphere, here.

And, what was observed—we'll show a picture from 1973 of the Crab (**Figure 5.4, left**). Now, show the one, I think it's from 2000 or 2001 (**Figure 5.4, right**): And you've got something that's growing there. It's not staying the same. Whatever it is, as a phenomenon, it's growing over time. And, you've got reason to believe that you've got something that's growing at a faster rate, over time, also. Which is interesting.

You can see some sort of growth. Now, the only way to get a real sense of what the growth is, is by adding another level to it. Can you show the next picture (**Figure 5.5**)? Now, these are the different emission spectra, that you have, that come off the Crab Nebula; which—from what we know about spectroscopy here on Earth—those emission spectra correspond to certain specific elements. Certain elements produce certain kinds of light at certain frequencies, when agitated. And, you can use that, as a way to do a certain analysis of what sort of elements you have, that the Nebula itself consists of. We do it for the Sun and other objects, also.

But, if you look at the next one (**Figure 5.6**), we'll have just the emission spectra for oxygen. Those are the different frequencies at which oxygen can emit light, the different bars there. Now, the distortion comes—the [difference] from top to bottom—comes from scanning the Crab from top to bottom, across the little pulsar, the little star you saw in the middle, in the first image. And you see, that you've got a certain kind of bend there. That's coming from a displacement of the frequency of the light, which is generally considered to be caused by the fact that you've got an increase in the frequency, as you've got the source of the light moving towards you. As you can see, it's increased more near the center, at the pulsar, than near the top, which implies you've got a growth towards us, also: You can see a certain, sort of radial growth.

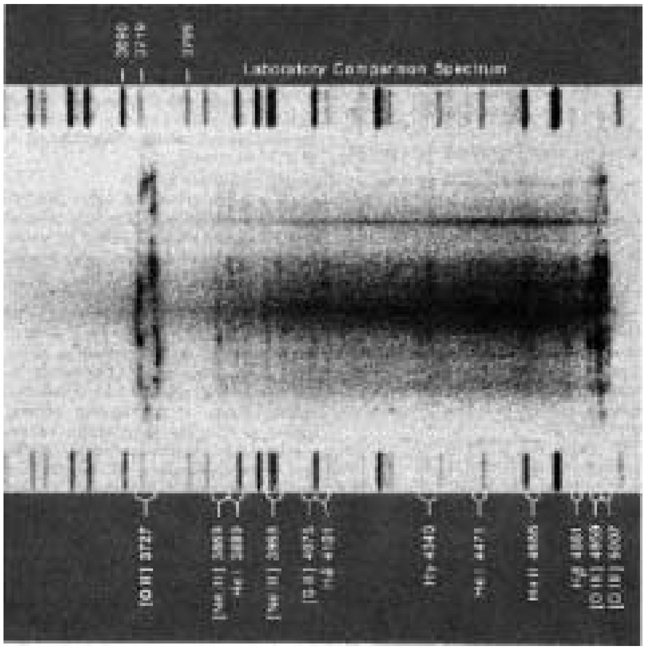
Enter Paradox

Now, the maximum displacement, is on the order of 0.4%, which means that the rate of growth, the speed of growth of that, would have to be—provided that, what we know about the properties of light and space on Earth, hold true at the Crab Nebula—that would mean that you've got a rate of growth that's taking place at 0.4% of the speed of light.

Now, in order for that to be true—and for the measurements that we take on the surface of our Sensorium, on the celestial sphere to be true—the Crab would have to be 6,300 light-years away from us. And, on its longest axis, it would have to be a length of somewhere between 10 and 13 light-years!

Now, again, I stress: That's provided that what we know

FIGURE 5.5
The Spectrum of the Crab Nebula



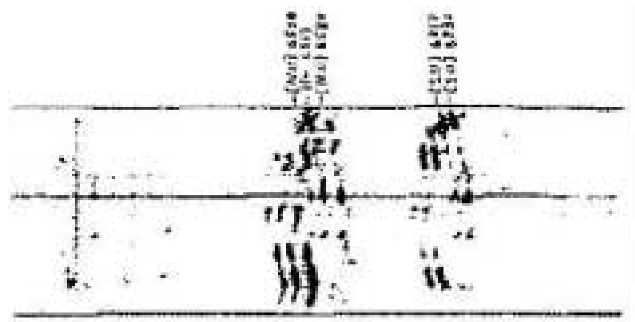
Obtained at Lick Observatory in England. The spectrograph slit was aligned with the major (vertical) axis of the nebula, and showed the differences in velocity of different regions of the nebula along that axis—for example, by the "necklace" shape of the 3,727-angstrom oxygen line at the left.

about the propagation of light and the properties of space, here on Earth—that's provided they hold true at the Nebula; and from us to the Nebula. Which is an assumption we can't *simply* make. But, we'll do it for now, for certain specific reasons. We'll use this, as a negative proof. It's worth going through these things, from the standpoint of standard theory, or an accepted system, only if you're driving that system to the point where it breaks down. You can use that, to bring out the paradoxes in it, and that's what we'll do, in a second.

Assuming that that size, or anything close to it, is true—the idea of something in the order of 13 light-years, 10 light-years across—then what's about to follow, should be exceptionally anomalous.

Can we play the next (**Figure 5.7**)? This is a video—it's spliced together from a series of time-lapsed photos, taken by the Chandra telescope. Now, what you can see is, what gets discussed as an anomalous feature of the Crab: That events that are taking place: throughout those two concentric toroidal shapes—the donut-like shapes around the outside of the star; and what takes place at the center of that, the center of that pulsar; those seem to be synchronized. You can sort of see it here; if you look at the evolution of the hotspots, the little bright areas around the inside of the torus, and things that are taking place at the star: You've got a synchronous motion.

FIGURE 5.6
Displacement of Oxygen Spectrum From the Crab



You've got something that's synchronized.

From the standpoint of what we know about the propagation of light, and these other things here on Earth, that shouldn't be possible. At least from the standpoint that *communication* can't be taking place from one point inside the Crab Nebula, to any other point. That's not being communicated from the inside out, from the center out. That's not being communicated from the sides, into the middle of it. You've got something that seems to be acting upon the whole Nebula—from the top down, in a sense; not above it, but from the top down, like outside-in.

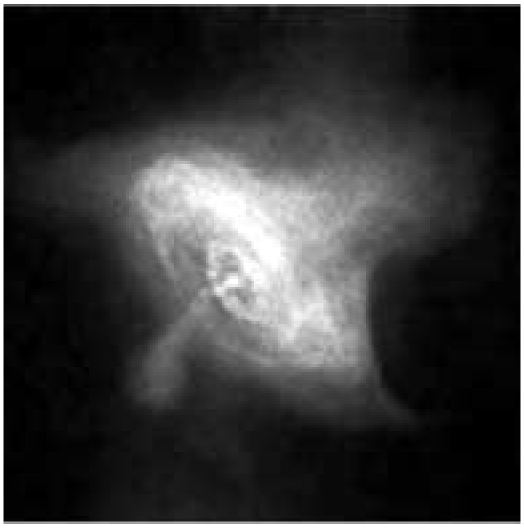
Something's acting on the Nebula, on every point of the Nebula at once; which, to begin with, is already something that's interesting. You don't have simple, linear causality taking place.

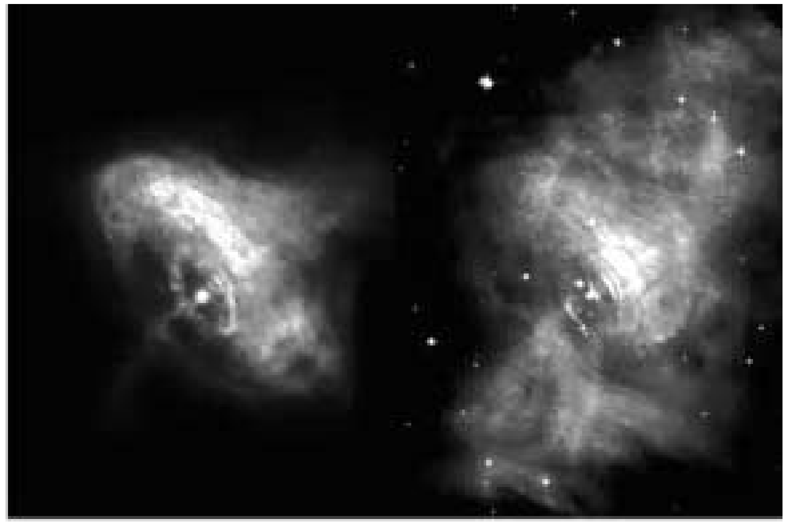
Three Time-Scales in the Same Universe

Now, those two things, by themselves, aren't completely anomalous, new to us; they're not new properties of any system. For instance, they both apply to what we can reason about the evolution of the Biosphere, here on Earth. That you've got, first off, a process that has that character to it. If you know what the famous biogeochemist Vernadsky—when he talks in his book *The Biosphere*, about the evolution of the planet Earth, he describes three things; two in that book, and then one elsewhere, and Lyn refines his idea of the Noösphere. But, [Vernadsky] compares time: geological time, biological time, and then cognitive time—human time, human history. And the relative scales are orders of magnitudes in difference.

You people know the scale of geological time, for instance. You know, how long does it take for a mountain to erode? Or how long does it take, through rain and wind, to get a mountain to change its shape? Or, how long does it take to raise mountains, with the collision of continents, or the action of different plates in the surface of the Earth, to actually raise new mountains, create beaches and this sort of thing?

FIGURE 5.7





It's incredibly slow, compared to, say, biological time, in which case we're talking about the development of new species. Or time measured on the scale of any living animal on the planet, which is relatively fast, compared to geological time; but slow in the same degree, compared to human history, the time in human history. . . . The development in human history, that's equivalent to the change in animal species, genetically, is a human creative breakthrough: We're a species on this planet; when we change the characteristics of our behavior, we can do it within the course of one generation; or a couple of times within one generation.

I like the image in my head: If you were some space alien, and you came down to Earth, and you wanted to figure out how to fit human beings into an encyclopedia, the way you'd fit a gerbil, or something, right? You'd have a little section on humans in the encyclopedia: Where, next to gerbils, you'd have a list of things they do. You say, this is where they live; these are the sorts of things they eat. Or a penguin: You can be pretty sure that a penguin's diet, on a certain area of the Earth that it lives on, it's got a certain food that it eats. You're not going to find it outside of a certain expected area. If you take a penguin and drop it in the desert somewhere, it's just going to die. You try to take a jellyfish into the desert somewhere; you put a jellyfish in here, it's not going to last very long. It's predictable, where you're going to find an animal species; it's predictable what it's going to eat. There are certain things about it that you can know.

Now, if you try to take those exact same characteristics and describe the human species, you could do it for a moment. If you take a snapshot, you could end up with a fairly good description of it. There's a certain point in our development, where you could have said, "This creature, whatever it is, can only live near large bodies of water. It occupies mainly coastal areas. It's got certain food that it eats." At a certain point, there's certain food that it had to hunt down; it would track buffalo, or whatever; it would hunt those things down, and would eat them.

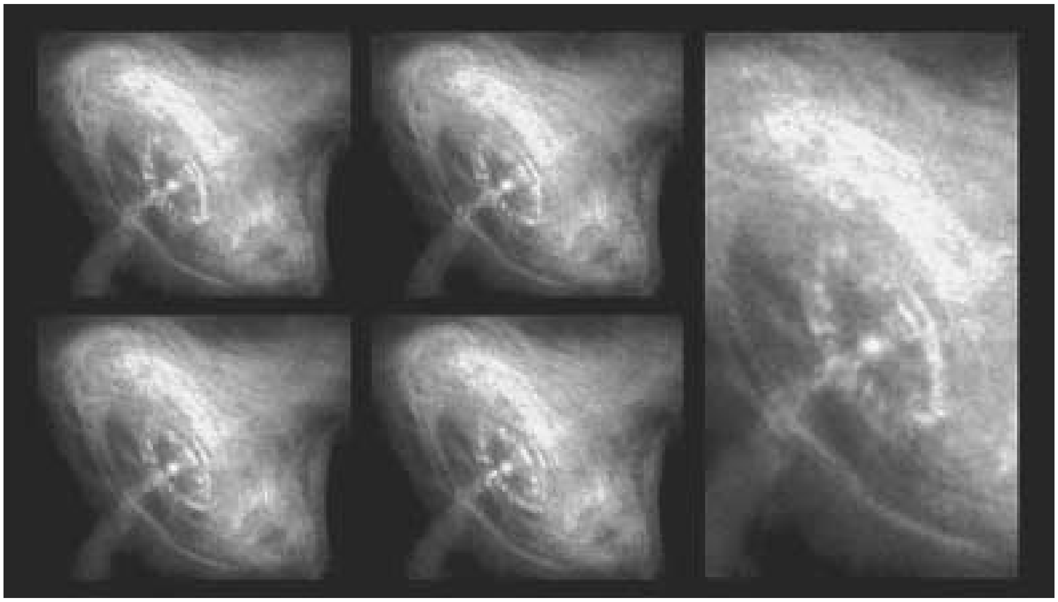
But you take a picture of that same species—us—even 20 years later; but take 100 years later, 200 years later, you've got a completely different behavior pattern. You've got a different area of the planet that we can live on. You've got different planets that we can live on. We've been on Mars and stood on the Moon. That wasn't a characteristic of our species 200 years ago.

The resources that we look for—everybody likes to talk about "natural resources" and how we're wasting "natural resources." You won't find one consistent "natural resource" throughout the course of human history. Oil was not a resource. Now, a good chunk of the functioning of our society, right now, depends on oil—mostly because of political reasons, but, as of now it does—that wasn't the case 300 years ago. You had a different resource, you had a different energy source: mostly things like wood-burning, later on, coal-burning, and then coke and things like that.

You've got an evolving species: Our rate of development is faster than the rate that you get within the Biosphere. Those are equivalent to genetic changes, and those are now compressed into the course of one human lifetime.

Now also, evolution is not, like the events inside the Crab Nebula, evolution is not mediated by individual animal species. This is contrary to the view of evolution that you get from people like Darwin, which people consistently try to press: This idea that evolution from one species to the next, is somehow the product of the prior species. As though you've got that same jellyfish, that wouldn't survive in the desert, you know, sat back and thought: "Well, what I need to do—somehow, I'm going to figure out how to compress my entire nervous system, which is spread throughout this aqueous

FIGURE 5.8



Speed-of-light paradox in the Crab Nebula's pulsing action: Just the inner ring around the pulsar, where the most dramatic changes appear to occur—changes on the time-scale of days, or perhaps even hours—is already one light-year across.

body, I'm going to compress that into one spinal column; form calcium deposit around it, and get a spine; and I'm going to figure out how to walk on land. Because, I think jellyfish should walk on land." That's not the order of the development!

Evolution of Noösphere and Biosphere

What's more, Darwin's view of evolution, this idea of natural selection, requires that you have successive developments like that. Same jellyfish now decides, "Well, you know, maybe I'll start laying eggs. That might be a useful way to start producing new jellyfish." And, then well, the egg thing doesn't work: "Maybe I'm going to start live birth." Right? "I'll have it nurse. I'll grow fur. I'll stop with this cold-blooded thing, because it makes it hard to live in certain climates. You stop moving every time it gets below a certain temperature, so we'll go for some warm-blooded development."

It requires sort of consistent miracles to develop. Every step of the way, you need some kind of miracle. I don't care what you call the miracle—I don't care if it's a "genetic mutation" due to some cosmic ray—it's a miracle. Because, when you're looking at animals now, you're not watching a bunch of random genetic mutations that are constantly being selected out, right? Your relatives don't develop new things, like claws or something, and you try to see if they can make it. You don't pit them against the rest of the environment, and say, "Okay now, are you guys gonna survive now?" (The guy who developed gills, doesn't make it. But the guy who's got wings survives.)

You've got a top-down organization, that's acting on that whole process all at once. It's got a certain intention to it. It's not dependent on chance.

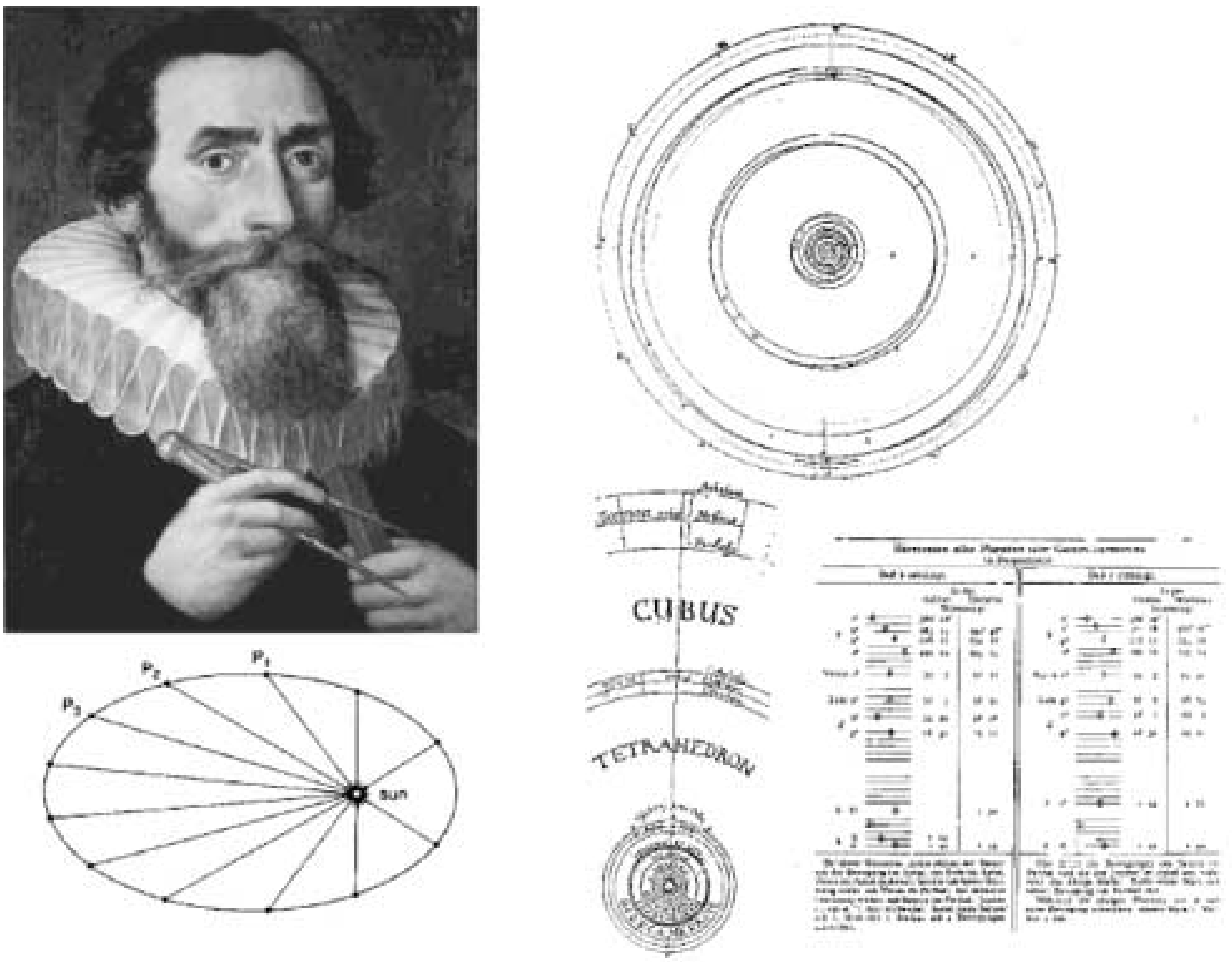
That gives you something that's important—the same thing you get from the [Dr. Robert] Moon model [of the atomic nucleus]: You've got a biological character existing, even in the astrophysical. That's not to say that the Crab Nebula is some animal! It's not a crab. It's not something that's living in space out there, that's got meat or something to it. But, you've got something that embodies that characteristic.

In the exact, same way, as you can say, for instance: What's cognition in a human individual? The human individual might be sort of a singular manifestation of that cognitive activity, but you *do* find that manifested elsewhere, in the large. For instance, the universe is rational. The universe has reason: That's why we can compare it to our own mind, and figure out what goes in it. Saying that the universe is rational, you're saying that, okay, it obeys principles that can be discovered and understood by the individual human mind. That's a characteristic, that's a property of the universe itself, not just the human individual. We are a singular representation of it; we are a singular manifestation of that process, that's governing the development of the whole universe.

And, so is life. You can see this in the developing of the Crab Nebula; which isn't a surprise, because, in other ways, it resembles what LaRouche has described in his paper "Visualizing the Complex Domain," what he described as the beginning stages of the development of our Solar System [see *EIR*, July 11, 2003]—which people can read; we won't go through it here. But, that's just a beginning, to get a sense.

That's more questions, than answer. But, just so you can see the sort of thing we should be looking at.

FIGURE 5.9



"This is what Kepler did, Kepler's discovery: Looking at the elliptical orbits, figuring out the elliptical orbits. Looking at what he saw, on the surface of that sphere—what seemed to be random motion—and unifying that into being the product of a higher principle; some higher projection onto the surface of this sphere. Kepler invented the field of modern astrophysics: the idea of looking for a physical cause on the astronomical scale."

And Another Paradox

Also, some other things: It's been shown that the Crab Nebula emits—this has been a recent thing—pulses that last only two-billionths of a second, massive pulses of energy, which last two-billionths of a second: two nanoseconds. Now, in order to have that, the source of those pulses, wherever it is, in the center of that pulsar—that star in the middle—would have to be about 60 centimeters across, which is the distance that light travels in the course of 2 nanoseconds.

Now that, to begin with, is interesting. But, now, especially when you consider, that in order to have the observed intensity that we see on the surface of that pulsar, the energy-density in that 60 cm core, would have to be the equivalent of a billion times that of what you have at the core of an H-bomb. How do you get that kind of density? How do you get that kind of energy-density in any process?

That's assuming that what we know about the propagation of light, and this sort of thing, are true, and that they hold true at the Crab Nebula. If they don't, you could get the same effect from some sort of lasing effect. You know how a laser works: You're taking that exact, same frequency, and you're letting it add, you're putting it in phase with itself, so you can amplify it. Now, you could be having that take place, somehow, at the surface of that pulsar; and doing something with space and time, that you hold those, you concentrate them, and then emit them in these 2 nanosecond pulses.

Now, either way, it's an interesting question. Now, what's going on, with space and time, to get that kind of ordering, that energy-density from the center of the Crab Nebula? That's just the beginning of an investigation of this.

At the Limits of Modern Astrophysics

Now, the intent of this panel, was more to pose a question, because this is something that you've got, now, at the frontiers of human knowledge. We really don't know what the Crab Nebula is! I think people may get confused. People ask, "Well, are there other Crab Nebulas out there?" Well, "crab nebula" is a descriptive term. It's nebulous, it's a cloud. It looks like a smudge; and a crab, it looks like it's got legs: so, it's a "crab nebula"—that's where the name comes from. It's not of much more use to us, than the idea of $\sqrt{2}$.

Gauss talks about this: He says, that taking the number 2, and then putting a little thingie on top of it, doesn't answer your question. All you've done is, you've restated the question. Saying, $x^2 = 2$, now what does x equal? Well, x is $\sqrt{2}$. You just found a new way to write it. Even if you'd like to elevate that symbol to some new status, that doesn't give it, suddenly, a meaning, in and of itself. It doesn't have a meaning, apart from its geometrical meaning, and Riana and others went through it.

But, we should think about this: This is something to be tackled for us, as a LaRouche Youth Movement, to take a look at, and to deal with; and it's going to one of the first things we're going to start to introduce, and approach from the standpoint of the work we've been doing with the Gauss [see "How It Is, That Every American Shall Come To Understand Gauss," *21st Century Science and Technology*, Summer 2003].

This is what Kepler did, Kepler's discovery: Looking at the elliptical orbits, figuring out the elliptical orbits. Looking at what he saw, on the surface of that sphere—what seemed to be random motion—and unifying that into being the product of a higher principle; some higher projection onto the surface of this sphere. Kepler invented the field of modern astrophysics: the idea of looking for a physical cause on the astronomical scale.

Now, what we're reaching, right now, are the limits of modern astrophysics. What we're looking at, and what we will continue to look at, are the point where what we know—our current understanding of modern astrophysics—starts to break down. Now, that's going to be our gateway out. That's our doorway out. That's our ability, that is, to revive, to regain our qualities that we should have, has a human species on this planet. And it's going to be combined with all the work that we're doing right now politically, and it's going to be one of our engines for trying to spread this thought-process, back through the population as a whole.

And we should be excited about that. That's what I've got.