EIRFeature

LaRouche Youth on 'The Crab Nebula and The Complex Domain'

The Labor Day conference of the Schiller Institute and International Caucus of Labor Committees met simultaneously in Reston, Virginia and Burbank, California on Aug. 30-31, for the first-ever "two-coast" videoconference of the LaRouche movement. EIR *published the speeches by Lyndon and Helga LaRouche, and by Indian leader Dr. Chandrajit Yadav, in recent issues. Here, we present one of the highlights of the conference: the Aug. 31 panel on science and creative discovery, by members of the LaRouche Youth Movement from Philadelphia and Los Angeles.*

*The panel took on the conceptual challenges which Lyndon LaRouche threw out in his paper on "Visualizing the Complex Domain" (*EIR*, July 11, 2003), including notably his discussion of the method by which man can uncover the truths that lie behind the "Sensorium" of the world perceived by the senses. The young scientists concentrated on the anomalous growth, radiation, and processes in the Crab Nebula, a scientific great project for the 21st Century; they reviewed both the technological breakthroughs which could make that project possible, and the more important Socratic scientific method necessary: "You must first realize that no human being can know anything, without realizing that sense experience deceives." The speeches have been edited, and some of the graphics have been omitted for space reasons.*

1. Merv Fansler

On the Sensorium

What we're going to start with here, is an introduction to the Sensorium, and what the Sensorium really is. And so, I think the best way to get this started, is to have everyone go through a nice, little, Romantic pedagogical with me. But, it's not like any of these "pedagogicals" that were developed with the Baby Boomers in the '60s, so you don't need to worry about any side-effects, like flashbacks, or pregnancies, or

Merv Fansler leads off the youth panel on creativity and scientific discovery: "How do we really know that there is anything which lies outside our senses?" Seated is Adam Sturman, who spoke on "Extending the Sensorium"—through the breakthroughs in telescope technology for exploring the heavens.

some increased need to consume things.

So, what I'd like you to do, is, everybody just sit still, and look forward. Now, I want you to become aware of what you're actually seeing; go through your vision first, and keep your eyes straight. You can see on the sides of you, without having to turn your eyes, right? So, you have this peripheral vision. Everybody can keep looking forward; don't move. So, that's your visual domain, this is what you can see with your visual.

Second, let's add another sense in here. Let's look at your hearing. Listen to what you're hearing—everything that you're actually hearing. Try to focus both on what you're seeing at the same as what you're hearing. Because you're being presented with two different things, at the same time. You're going to hear some background noises—people coughing, people walking around you; predominantly my voice is what you're going to hear.

So, after this, now we can add in the third and the fourth: We can add in, what you're smelling, what you can taste. Everybody probably just had dinner, so you can taste all the food that you've just eaten, and there's some smell. (This room is not very pungent, so it's not very distinct.)

So, we have all these four senses going on. And, let's add the fifth one, and so, let's see what you can feel. What are you feeling right now? Just focus on all these senses, all these things which you're actually being presented with. So you can feel the clothes on your body. You can feel the pressure of your feet on the floor; the chair pushing on your body. You can feel all these different things: the air going in and out of your lungs.

These are your basic five senses. This is what your presented with. These five senses are separated, but they're together. Everybody can relax now—not that you weren't already relaxing.

And so, this is your immediate Sensorium. This is the "now." This is what you're currently being presented with. And so, what you have is, just all these different feelings that are coming, all these different senses that are coming in. I'm sure the Baby Boomers are very used to this state, because they've been indulging in the "now" for most of their lifetime.

Paradoxes

So where are we going with this? What we have to begin with, is, we have these five different senses; and how are these five senses working together? And how you can think of these five senses, is sort of like a polyphony. If you remember back to the [Bach] Chorale that was sung last night: You had four different voices, and all these different voices were all singing about the same idea, right? But, none of them had the direct idea, of what the idea actually was, but they were "projections," you may say, of an idea onto different voices. And this is what you have with your senses: It's like a projection of something which might lie outside of there. You don't know if there is anything outside of your senses—or, at least, we haven't established that yet. So, you can think of these five senses, as a sort of a polyphonic thing you're being presented with.

And, what you'll find with these five senses, is certain paradoxes that might arise, if you start to play with the things that you're actually being presented with.

FIGURE 1.1

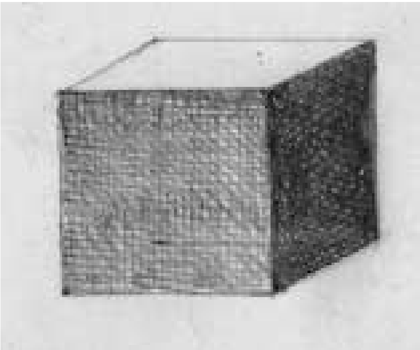


FIGURE 1.2

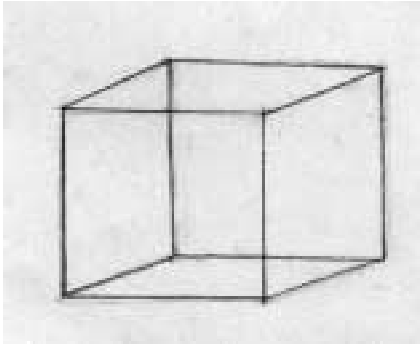
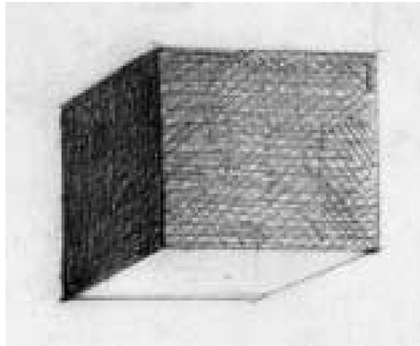


FIGURE 1.3



And so, the first thing I wanted to look at is just a cube (**Figure 1.1**). And then a wire-frame of that same cube (**Figure 1.2**). Now, **Figure 1.3** is another cube—and Figure 1.2 is the frame of that cube, also.

So, both of those two cubes—the first one and the third one—are two different things, but this one in the middle has an ambiguity about it, because you don't know whether it's the first cube, or the third cube: It can be both. And so, there's something going on in this visual Sensorium, such that this ambiguity is arising.

So, what I'd like to do now, is to try another example of this, and do it in music. I'm going to play something very quickly on the piano. I'm going to play a melody, and then I'm going to play a key with that melody. [C-D-E-F-D-E-C-$F^{\sharp}$]. Now, that last note that I played, has a certain type of sound to it, right?

Okay, now I'm going to play another melody [C′-D′-E′-F′-D′-E′-$C'^{\sharp}F^{\sharp}$]. Now, it has a different sound. It's the same note, right? But, it sounds differently.

And, so you can see, that in that note—what I'm actually playing is an $F^{\sharp}$ there—in that one note, you're finding that it's really ambiguous about what it really is. I'm playing the same note, but in respect to what's happening, it's having two different meanings arise in it. And so, that's another example of one of these little paradoxes that are arising in our Sensorium.

What we'll find then, if we continue to explore what we're presented with—if we begin to explore these different things—we'll find a lot of small, little paradoxes like this; but we'll also find some things, that are going to stun us, that we can't really explain.

One of the first things that we're really presented with, and what ancient man was presented with—and this is really where the beginning of modern science came from—was the nighttime sky, and what was happening with the stars; and looking upon this, and being amazed by what we were seeing. What I have is a quote from Schiller "About Man." He says: "The view of the unlimited distance, in incalculable heights, the wide ocean at his feet and the greater ocean above him, snatch his mind away from the narrow sphere of the real and oppressive imprisonment of the physical life. A greater measure of estimation is held before him, by the simple majesty of nature. And, surrounded by its great forms, he no longer endures the small way of his thinking."

FIGURE 1.4

So, what I'd like to do is, work through a little about what's going on in this Sensorium, or what we're presented with in the nighttime sky.

Figure 1.4 shows a picture of the nighttime sky, with some stars, some constellations marked out. If you would look out into the sky, what you'll find is, you'll have around you, you'll have a sort half-sphere. And in this half-sphere, you're going to notice a few things going on: You're going to notice that you have stars there, and there are certain relationships between these stars—you have this idea of a constellation. What happens is, you say, "Okay, I want to map what's going on in these stars. I want to find out what's happening here."

So, if you look up, and you try to measure the stars, you can do so, by taking angles between stars. What I'd like every-

FIGURE 1.5

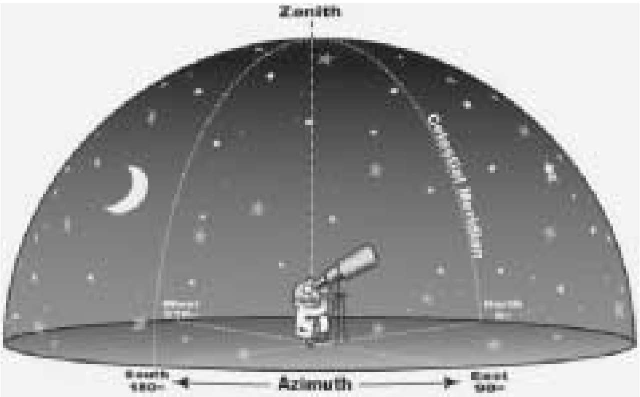
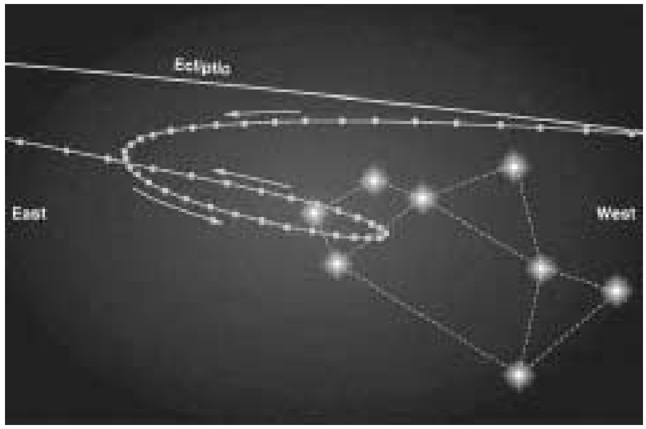


FIGURE 1.6



body to do, is just look at the center of this room back here, and then look to the back of the room there. And what I'd like you to do is, then point to the front of the room, here, and then follow the line back to [the back of] the room. (So, everybody's just looking very ridiculous.)

Now, I want everybody to do it again, but look what the other people around you are actually doing. Look how they're doing it. Now, it seems like everybody on this side of the room is saying, "Well, okay: I'm pointing in this direction [toward center-line of room]; I'm going like this." And then, everybody on the other side of the room, is saying, "Well, it's on the other side of my sphere [also toward center-line]!" And so, if everybody says, "Well, I'm the center of the universe," everybody is going to have a different sphere that they're looking at! So, at every point on the Earth, you actually have a different perspective, you have a different "sphere" of what you're going to run into. What you can do, with your own sphere, is, you can measure out these angles, as I was saying before, to find the relationships between the stars (**Figure 1.5**). Like, if you point here, and then follow it back, you have a certain arc-length that I'm going to be tracing with my arm, in my sphere.

All around the Earth, you have a total sphere, right? But, the problem is, how do you reconcile the difference between what the individual person is seeing, when he goes out on one point on the Earth and looks at the stars, sees his own little half-sphere, and the person that goes out on the other side of the Earth, or at a different latitude or a different longitude, and sees another half-sphere? And, so how would you actually construct this celestial sphere, and find the relationships between these stars?

In constructing this sphere, you begin to notice a few things. You'll notice different motions going on in the sky. To begin with, you'll have this background, this mapping on the background, on the inside of the sphere that you're looking from; you're going to notice that this is going to move, slightly, and it's actually going to move, at a rate that it moves around the Earth once a year.

But then, you run into a second motion. You'll see this main motion, where the whole sphere, all the background stars, are going to be rotating around you, in an East-to-West pattern. And then, secondary to that, you're going to find these other stars that just seem to move around on this sphere that you're seeing. These were known in the ancient times as the "Wanderers," which today, we know as planets. And these planets bring some problems into how we assume how the universe works, or how the heavens are actually operating.

We run into the problem that we get some funny things going on in the motion of the planets—particularly Mars (**Figure 1.6**). Mars is going to follow a path on the background of this celestial sphere; it's going to come around, and make a loop. So, how are you going to explain that? What is really occurring, to generate some form like that? What I have next, is a film showing the actual motion of this. It looks like it's actually stopping, almost, and then launching off in different directions.

When confronted with this, the empiricists say, "I can sort of explain this. I know what's going on."

Now, let's look at what Kepler did, using the data from Tycho Brahe. Before, he had this model of what was happening with respect to the Earth (**Figure 1.7**). If you have the Earth in the center, and then you have all these spirals and things going around—this is the pattern that Mars is moving in, with respect to the Earth, in a year. So, this is very complicated, especially when you take into consideration, that most people consider everything moving in the celestial sphere, to be moving in circular orbits, because—well, why not? "Circles are the most perfect thing in the universe, so everything is going to follow a circle."

A few people came up with different models for this: First, is Ptolemy (**Figure 1.8**). Ptolemy said, "Well, the Earth is at the center of the universe." It's like everyone says, "I am the center of the universe. So the rest of the universe must be

FIGURE 1.7

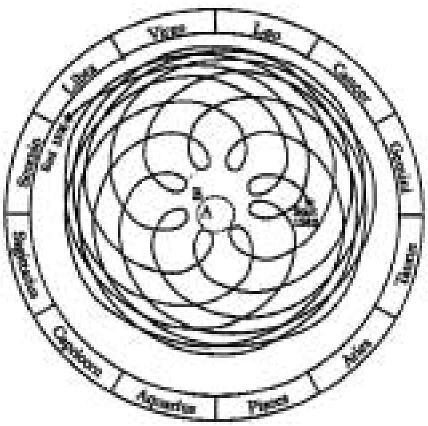


FIGURE 1.8

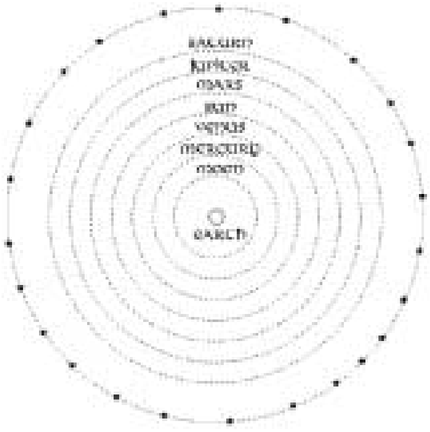


FIGURE 1.9

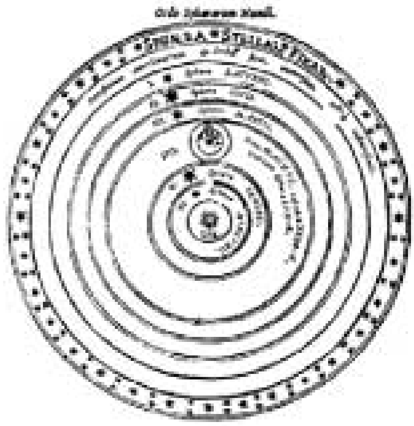


FIGURE 1.10

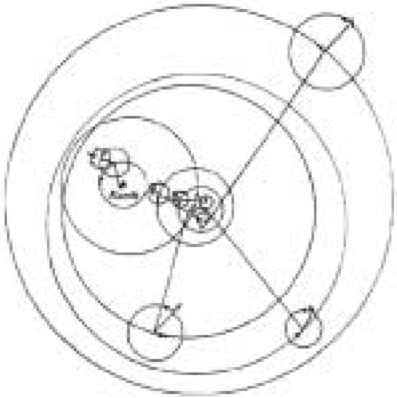
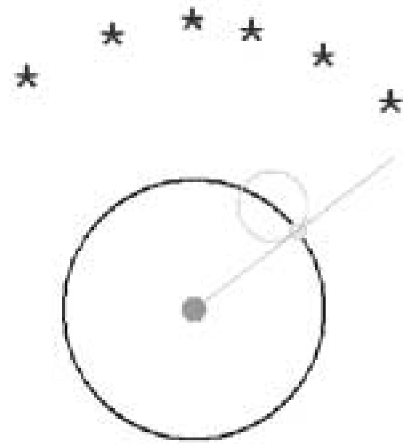


FIGURE 1.11



around me." And he says, "Everything just follows a circular path, around the Earth." Next (**Figure 1.9**) is Copernicus. The Copernicus model says, "Well, okay, the Sun is at the center of the universe, and the Earth goes around the Sun." But, then you had all the religious fanatics say, "Well, this is impossible. The Bible says that this is impossible. So, we're not going to believe you." And it was heresy, to actually believe that this was true.

So then, we have the third one, which is Brahe's. And Brahe's gets a little complicated (**Figure 1.10**). The Earth is still at the center of the universe—he has the Earth out to the side, but it's still the center of the universe, everything is revolving around the Earth. Brahe is just compromising with everyone in the Church, to say, "Well okay, the Earth is still the center of the universe. And the Sun goes around the Earth; but all the other planets go around the Sun, then."

And, finally, I have one of the models of how Ptolemy actually constructed this (**Figure 1.11**), and how Ptolemy is trying to explain the motion here. The Earth is at the center, and Mars is going around the Earth, on little epicycles. On the backdrop of the stars, the celestial sphere, you would see this retrograde motion of Mars: It moves back and then it moves back again, and then it moves forward. So, this is how Ptolemy's model is supposed to explain this problem.

But what comes up is, that all of these models can *statistically* explain what is going on here. But, can any of them *really* explain what's going on? You're presented with things which are really just approximations, shadows, and you're trying to find out, how do you actually explain these shadows? What is really going on? You're finding different projections of what is really going on, different shadows of things.

And so, what Kepler said, about this motion of Mars, in particular, he said: "The testimony of the ages confirms that the motions of the planets are orbicular. It is an immediate presumption of reason, reflected in experience, that their gyrations are perfect circles. For among figures, it is circles, and among bodies, the heavens, that are considered the most perfect. However, when experience is seen to teach something different to those who pay careful attention, namely, that the planets deviate from simple circular paths, it gives rise to a powerful sense of wonder, which at length, drives men to look into causes. It is just this, from which astronomy arose among men."

And so, I'd like to ask a question then: How do we really know that there is anything which lies outside our senses? And, what I'm presented with, or what is a very good question to present you with, is this thing back here [indicating the podium banner], that says, "World at a Turning Point." Now, is this a question? How do you know, that it's at a turning point? You can't "see" a turning point. You can't "taste" the turning point. You can't smell it. So, how do you know that it's at a turning point?

I think that this is the challenge that we're presented with. Thank you.

2. Jason Ross

Two Means Between Two Extremes

We're going to go into, through what means can we peer beyond our senses? How is it that we *can* know, that what we're not seeing is impacting what we do? And, how is it that we, as people here in the LaRouche movement, how are we going to turn around this Dark Age into a Renaissance? How are we going to develop the power and the means to do that?

So, what is a Renaissance? If you speak French, you know that means rebirth, but—what's being reborn? I don't mean fundamentalist Christians. Although, some mystics of a similar ilk, the Synarchists, have ideas of giving birth to fascism (**Figure 2.1**).

Now, we're against single-issue politics, but this is something we definitely should abort. So, let's get rid of these midwives. Let's get rid of them!

So, let's turn to the real mid-wife of the Renaissance: Plato's Socrates, who tells us, in his *Thaeatetus*, that he delivers ideas, not babies. But, how do we deliver ideas from the senses?

We can understand the limitations of sense-perception, by trying to act in it, and finding the problems that we encounter; and we'll situate this with Plato's conception of "power" and of "means." We'll start with the *Meno* dialogue, which contains the famous exercise and demonstration of the doubling of the square. It's here that Plato, using one of Meno's slave boys as a subject, demonstrates, only through asking questions, that the understanding of the correct method for doubling the square, already exists in the boy's mind, as a potential; it merely has to be uncovered, or recollected. So, let's put up the solution to that (**Figure 2.2**).

We've got our original square, the dark square on the bottom left. The first attempt made is to double each side of the square, in the same way that you would double a length, giving us the large exterior square, that's four times as large. But, the doubled square is the crooked square that you see in the middle, which contains four triangles, of which the original square had two.

Let's look at performing this process again (**Figure 2.3**). We've got this action of doubling, that goes from that original square to the doubled square; and then, from that doubled square to a quadrupled square in black.

Now, here's where the idea of a "mean" comes in. The word "mean" has a number of meanings, actually: It means not only a middle, but also a method of effecting a certain result in English, German, French, Russian, Spanish (I imagine), and probably more languages, too. This philological observation indicates that there's this concept of creation and generation, as inherent in any existence. English also uses "mean," in the sense of "meaning." And, these different

FIGURE 2.1

FIGURE 2.2

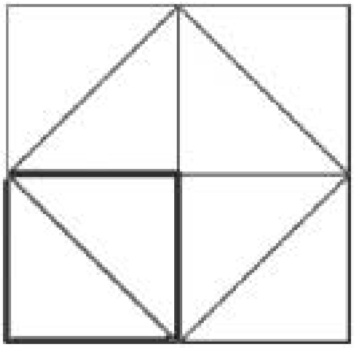
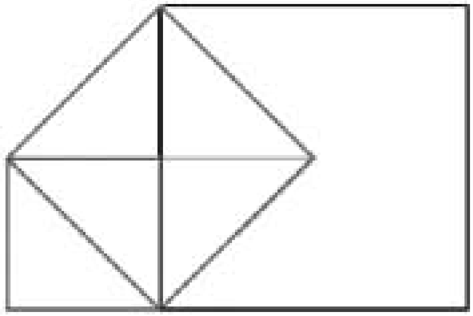


FIGURE 2.3



meanings of "mean" show how you can mean things, outside the dictionary meanings of your language.

So, now that you know what I mean, let's investigate what these means are.

The same process that took us from the small square to the doubled square is taking us from the doubled square to the quadrupled square. So, what's this process? It's doubling, but what is the change, in the line that is the side? Now, this can be a difficult question. If we're looking in the domain of the sizes of the one-sided length of the original square, we've got kind of a domain that we can act in to get magnitudes. We can double lengths, we can triple them, all based on an idea of a unity; quadruple; you can cut things into five pieces; add in half again; take out a seventh. Things like that.

So, let's see, based on this kind of scalar action, what the relationship is between the original square and the doubled square—that is this mean, this *means* of doubling. You can think about this—I don't want to use the term—but it's like a fraction, this relationship between the sides of these squares. And so, okay, if you have a fraction, you've got one number in relationship to another.

So, let's investigate. Since numbers are odd or even, let's first think about the large square being odd, on its side. **Figure 2.4** shows blocks. There's a yellow square that's 5 × 5 on each side, and it's kind of extended into this red square, that's 7 × 7. So, if this were our scalar relationship of doubling, this large 7-sided square would be twice as big as the yellow. But, how many squares are in a 7 × 7 square? 49, right? An odd number. That couldn't be double anything. Any odd-number square is odd; it can't be double something else.

So, scratch that. Let's say that both squares are even on each side (**Figure 2.5**). Now, we learn in math class, if you've got a fraction that's even over even, you could cut both the top and the bottom in half. We'll just look at it physically: This is a relationship of 6 to 8, but it's also completely the same thing as the relationship between 3 and 4. So—it doesn't make much sense to think about both squares being even. One of them is really odd, in some regard to the other.

The large square was an odd. So now, we're left—after [travelling] this road—that the large square must be even, and the small square odd. But, Now, how's that going to work? Because, if the doubled square is even in regards to the small one—meaning each half of the even square is the same surface as the smaller square; but each half of any even square still must be even on one of the sides, so it's even! It's not odd. Neither half of it can be odd.

So, wait. That's all of our choices, though. That's all of our options. This whole domain of making magnitude: Nowhere inside of that, existed this relationship that we're looking for.

So, if you're a mathematician, you've got this drawing of the square, the doubled square, and the quadrupled square. Maybe we'll just make a new symbol (**Figure 2.6**). Hey! Just

FIGURE 2.4

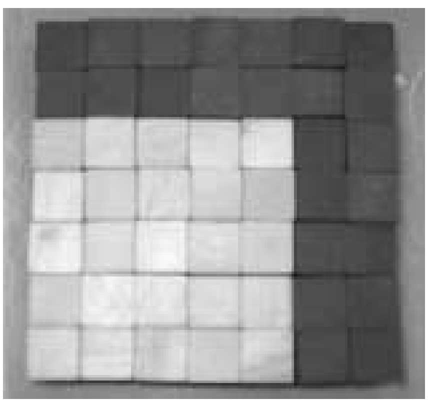


FIGURE 2.5

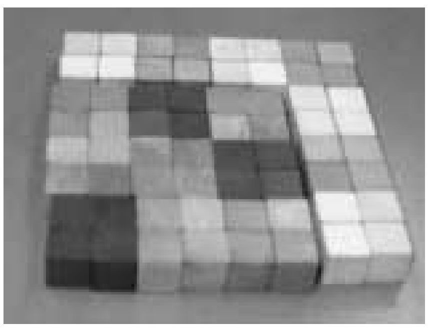


FIGURE 2.6

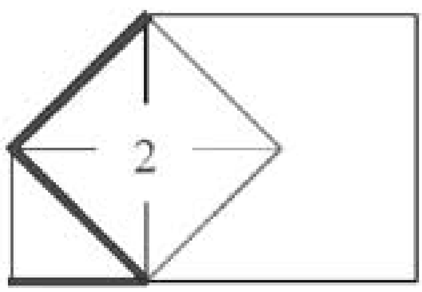


FIGURE 2.7
Doubling of a Square

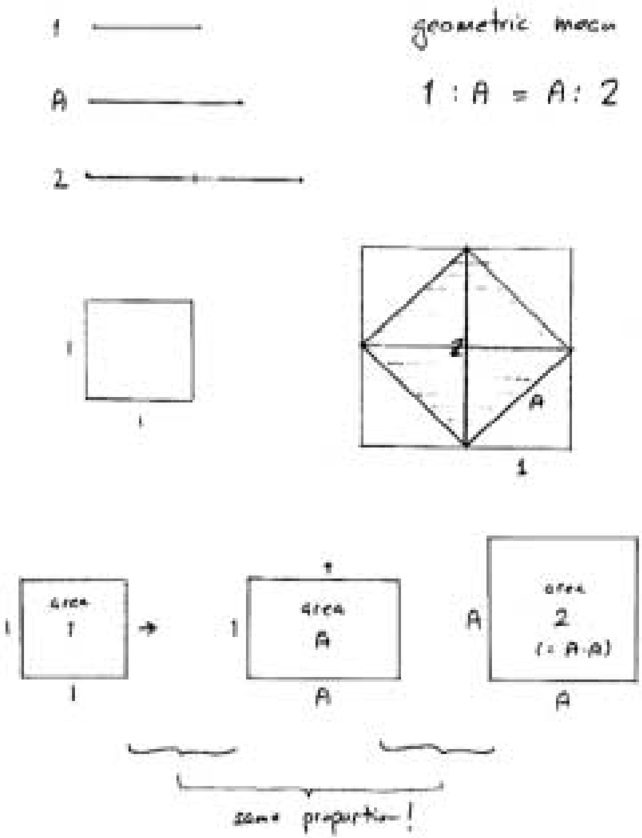
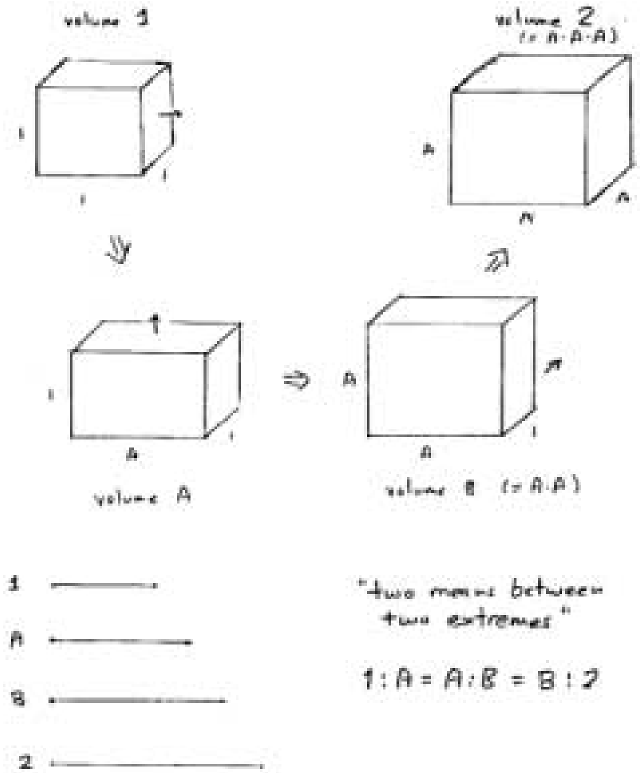


FIGURE 2.8
Doubling of a Cube



bold those lines, and you've got your square root, right? Fine, but now, the $\sqrt{2}$—fine that's just a question. The $\sqrt{2}$ doesn't tell you how big it is, it just tells you it's the "root" or the foundation of a square of 2. And, thinking of that as some sort of real existence is the root of a lot of problems in mathematics. Because it's all meanings of powers and means to make something.

So, just make sure it's hammered in: That this magnitude, this side of the red square, doesn't exist on the number line. If you generate the number line through these simple scalar extensions and contractions.

So our mean doesn't exist in the same domain that the extremes exist in. But, think about it: That's true for any process. How do the extremes appear to you? You sense them: You've got a perception of them. You've got an idea of what is the state of the world, right now? What would I like the state of the world to look like? And you might push and shove on each of these specific properties you're trying to change, but you're going to be completely impotent to change it like that. Like, if you're on a desert island, and you see land over there, you don't see the raft. You've got to know how to make it.

Same with politics. If you look at the political situation, you don't see the Martinists having a meeting. You don't see Warren Buffett meeting with the flabby guy [Schwarzenegger] with the shrunken nuts; you don't see any of these things. You have to really find out, how do you get a crack into this domain, where the generating processes are really occurring?

So, we've got a kind of a peek of this, with the square, with the action of doubling the square. There's this *rotation* involved: going from the base to the diagonal, and then 45 more degrees, to the quadrupled square. And, this is even better illustrated, when we look at actual physical, solid objects. Because, unlike squares, they have a volume. Plato says, in his *Timaeus:* "If the universal frame had been created a surface only and having no depth, a single mean would have sufficed to bind together itself and the other terms; but now, as the world must be solid, and solid bodies are always compacted, not by one mean, but by two. . . ."

Doubling the Cube

So, we'll take the most famous historical example of the specific problem of an absolute necessity for an understanding of means. We'll go to the not-so-far-away, and not-so-long-ago city of Delos, in Greece, which was afflicted by disasters. Plague was ravaging the city; drought was haunting the farmers; unregulated utilities led to power outages across the town; and one of the poorer actors was running for mayor. So, greatly concerned, and not knowing what to do, the leaders of the city decided they would go to their oracle, to ask the gods, "What do we do? Why are we having this plague? What do we do about it?"

And the oracle said, "Tell you what you do: This altar I've got here? I want you to make it twice as big." So, here's what Eratosthenes writes about what happened, then—as reported by Theon of Smyrna: "Their craftsmen fell into great perplexity, in trying to find out how a solid could be made double of another solid. And they went to ask Plato about it. He told that the god had given this oracle, not because he wanted an altar double the size, but because he wished, in setting this task before them, to reproach the Greeks for their neglect of mathematics and their contempt for geometry."

So, setting to work, one of the first things they tried, was doubling the size of each side of the cube. Here's some more Eratosthenes—he says: "The craftsmen doubled each side of the altar, but they seemed to have made a mistake. For when the sides are doubled, the surface becomes four times as great, and the solid eight times. It became a subject of inquiry among geometers, in what manner one might double the given solid, while it remained the same shape. And this problem was called 'the duplication of the cube,' for, given a cube, they sought to double it.

"When all were, for a long time, at a loss, Hippocrates of Chios first conceived that, if two mean proportionals could be found in continued proportion between two straight lines, of which the greater was double the lesser, the cube would be doubled."

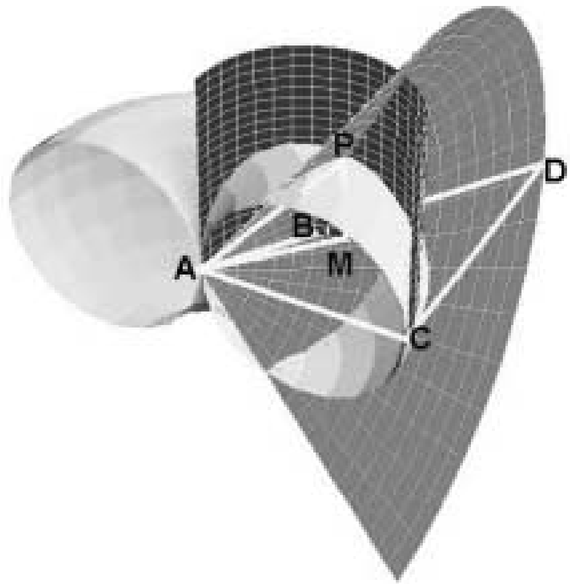
So, actually, think again, what Plato said about this, in terms that, if the universe wants you to make a discovery, it might have to give you a really hard time, to force you to make that discovery. And this is what the people of Delos faced.

Okay, so this idea of finding two means seems, ostensibly, like the problem of doubling the square; but here, we desire two means, instead of just one, between the known extremes.

So, here (**Figure 2.7**), you've got this idea of the mean to double the square; on the bottom of the screen there, you've got the square first being extended along one mode of extension, and then along the other, to get your doubled square. And then (**Figure 2.8**), you've got the cube with the three means, that this magnitude or this relation have done once along one mode of extension; again, along another; and then, finally along the third: You've filled out, and doubled your whole cube.

Sounds simple, but it's not. You can't just draw a diagonal of the cube and get a double—it's over five times as big! Now, you might say, "Why don't you just try it out. Make another one, see if it weighs twice as much. See if it displaces twice as much water, something like that, right?" Well okay, you might get close to it that time, but again, you're completely missing the domain that the answer exists in: the domain of, what are the *means* to knowably double this cube, which tells you more about space, than simply making an altar twice as big.

FIGURE 2.9
Solution by Archytas



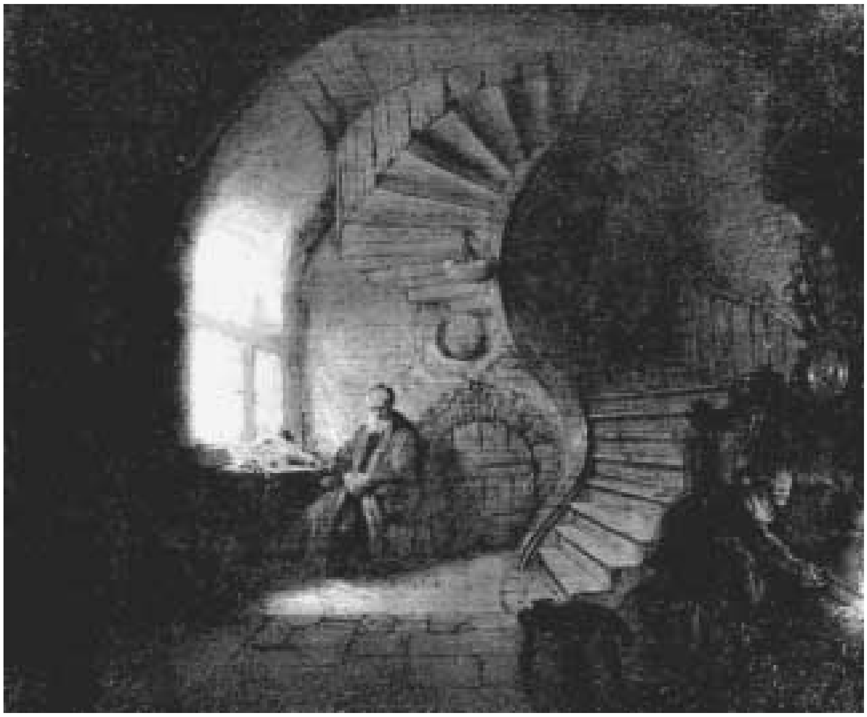
This problem was actually solved not in the domain of the system of extension in which it was posed, but from a higher domain, from the real universe. It was actually figured out by Archytas, the king of a city-state in what's now Italy, who was a collaborator of Plato's. If you haven't seen this before, you might want to imagine some ways of doubling a cube. And then, go ahead and put up the next slide (**Figure 2.9**): Now, you wouldn't just kind of "guess" *that*—pull that out of your hat, and let's see if that doubles the cube. What Archytas has here, is he has half of a cylinder; he's got a circle, that's kind of dancing and spinning around, sweeping out a torus; he's got a line that's circling about, making a cone. And these things are all coming together. Archytas actually uses musical language to describe these things coming together to make a relationship, in the same terms as a musical relationship. It's like a three-voice fugue, hitting at a singularity in the mind of the composer.

We're not going to go into the details of exactly how this doubles the cube, but there's a couple of things that have to be pointed out about it: That, first of all, this solution lies outside of the domain in which the problem was posed. You've got a cube; you want it twice as big. Where did *that* come from? It lies outside that domain, in the same way that Gauss, in his elaboration of the complex domain, went outside the domain of algebra, when he had to answer a question about algebra. This gets you out of the senses, and into the invisible, internal relations of the universe; and what we're seeing—this self-elaborating, rotational aspect, even here, which later gets developed by Bernoulli in a different treatment of power.

Now, another meaning of Archytas' finding of the two means, is that, it is itself a mean: a mean between our sensual understanding, and then the idea of the generative domain of powers and means that was living in Archytas' mind. This image of Archytas' is a means to understanding an actual idea, which you can't see.

Now, this generation behind the scenes, so to speak, of this Sensorium, is not performed by extensions in the Sensorium; and, although we can—yes—make a doubled cube with that, this exists only in the mind. It is a thought-object.

FIGURE 2.10
Rembrandt's 'The Philosopher'



The Creative Hypothesis

It's precisely this reasoning process employed by Archytas, that leads us, as a mean, from our senses, to the universe. And, this is taken up and elaborated by Plato, in Book 6 of his *Republic,* in which he introduces the idea of a division of objects of thought: of one being the visible, and the other the intelligible. Which he then further subdivides each of the two, between the more obscure part, and the clearer part. So, for the visible, for example, you have shadows, reflections, hazy images of things; and then you have the objects, of which these images are the likeness.

In the domain of the intelligible, the first, murkier division, is "understanding." Here's how Plato's Socrates described it—he says of it: "For I think you are aware that students of geometry and reckoning, and such subjects, first postulate the odd and the even, and the various figures, and three kinds of angles, and other things akin to these in every branch of science; regard them as known, and treating them as absolute assumptions, do not deign to render any further account of them, to themselves or others, taking it for granted they are obvious to everybody. In this way, understanding does not proceed to a first principle, because of its inability to extricate itself from, and rise above, its assumptions."

So, we interpret our senses, based on our understanding of how we believe the universe to work, help us to make sense of this mess of light and sounds and everything else that Merv is talking about it. But, how do we get above these assumptions? The higher domain is that which reason itself takes hold of by the power of dialectic, treating its assumption, not as absolute beginnings, but literally as hypotheses, underpinnings, footings, and springboards, so to speak.

So, we have images, objects, understanding, and reason.

Then, Glaucon, whom Socrates is speaking with, says this: "I think you call the mental habit of geometers and their like, 'understanding,' and not 'reason'; because you regard 'understanding' as something intermediate between opinion and reason." "Intermediate": Here you have a mean, again. Again, as a thought-object. Understanding is the mean between your senses and actual reason.

So, this where the passion of being human comes in. Understanding is based on principles, that you use to comprehend the real nature of the universe, but you can't have new thoughts of understanding alone. Reason picks up, where the mean of understanding ends; but how?

The act of reason, the hypothesis, takes us directly to our immortality, to the "undiscovered country, from whose bourne no traveller returns" (see **Figure 2.10**). This puzzles the will. There's no formula, or comfort of the senses, or of understanding here. But it's precisely our human passion to "go there," that allows us to live as human beings in a domain unreachable by animals. And without this determined passion, to seek for, and adhere to the truth, we'll be unable to live as humans, and most of us will die as animals. And you, personally, have to develop, and act, on that passion.

Thank you.

3. Adam Sturman

Extending the Sensorium

So now you're ancient man, staring at the nighttime sky, thousands of years ago. These little points of light—what are they? Where did they come from? How far away are they? Today, when we look to the heavens, we do *not* see paradoxes, but we see—explanations! A little kid stares at the sky, and asks his father, "Daddy, what are those little dots in the sky?" "Oh, those are stars, like our Sun, far away." Living in this so-called "modern world," we have the luxury of scientific popular opinion. And, it appears that the world has lost its desire and passion for new discovery.

But ancient man did look to the sky, and saw paradoxes. They meticulously, over a period of many years, took measurements of these points of light, and one of the first things they must have noticed, are the "Wanderers," today known as "planets." Secondly, future generations of astronomers must have realized, that the measurements of the past were beginning to lose accuracy. The older the observations, the less accurate they were. This paradox, today, is known as the "precession of the equinoxes." And, you will notice about a 1°, change, over a period of 72 years.

Now, some paradoxes are clearly visible to the senses and naked eye, like the refraction of light into water, or the planetary orbits of the sky. But other paradoxes are not visible to the senses. Increasingly, as we begin to break out of the shadow of appearances, our discoveries will come from both the domain of microphysics and astrophysics, which both require the help of various forms of technology.

Take, for instance, telescope technology: In astrophysics, the phenomena we observe do not directly come from our senses. Instead, we receive data and information, from our telescopes and instruments. What your telescope shows you, is not the phenomena that you're looking to in the sky.

Instead, what you see is an intersection between universal physical principles, and the telescope. Some of the principles that are acting on the telescope, are understood and known. What appears to be anomalous or paradoxical, in the data, represents a set of unknown principles, that have yet to be discovered.

So, what are we doing with these instruments? We are extending the senses: For instance, can we detect X-rays with our eyes? Can you feel the temperature of plasma? Would that hurt? Let's look at the difference between man and an animal. Take, for instance, bats: Now, bats have sonar. So do we! Without sonar, a submarine, sitting at the bottom of an ocean would be pretty helpless. Now, take a look at dogs: Dogs have an amazing sense of smell. Well—we do, too, now! Anyone that's been to an airport in the past couple of years, has noticed that we have these bomb-sniffing devices that can smell just one molecule of explosive.

Now, humans don't have these sense organs built in, so to speak; these extended sense organs are not hard-wired into our genetic code. Human nature is not genetically fixed. Take for instance a honey bee: A honey bee will instinctively make a honeycomb for its young, and will do so, in the same, exact way, forever and ever. Take a look at a beaver: Beavers build dams. Are beavers building dams out of concrete and steel yet? Animals are forced to wait for physical evolution, to see a fundamental change in their behavior. Humans are different, of course. Humans evolve, every time we make a discovery, and assimilate that discovery into our culture. Therefore, in a sense, the evolution of humans is dependent on the level of culture. The more developed a culture is, the greater its rate of evolution.

Now, let's compare man to an animal, again: To an animal, the sense organs represents a cage; it is such a cage, that the animal will never be able to see the paradoxes in its sense-perception, like the orbits of the planets. Now, for instance, a bat will always use its built-in sonar. It has no real free will to develop new modes of sensing. But, how about human beings? Are we stuck in that same cage of sense-perception? No! Our special quality of mind, allows us to break out of the box, and see beyond the shadow-world of sense-perception, and in fact, our humanity gives us a continuous development of sense organs. These extended sense organs, in this case, various forms of telescope technology, embody a set of understood scientific principles. If we didn't know what X-rays were, would we be able to detect them or control them?

These new sense organs open up a whole new realm, an extended Sensorium, and extended Sensorium that opens the doors for new paradoxes and anomalies.

Now, economics: This process of extending the Sensorium has direct implications into economics. We use this extended Sensorium to open the door for new paradoxes. It is the application, the principle of Platonic reason, that allows the human species to survive. Take, for instance, X-rays and nuclear processes: Did Mme. Curie understand the full implications of the discovery of X-ray radiation? Years later, we now have the ability to battle cancer; we have the ability to see broken bones, and to look at many types of funny things in the universe. How about nuclear power? What did that do for economics? It revolutionized the possibilities for the generation of electricity, and raised the living standards for people across the world.

Take another example, one of the most basic scientific instruments—an instrument that allows one to measure the two angles required to determine the position of a star in the celestial sphere. Through the journey of all human history, all serious scientific cultures devised devices, that will allow that society to take accurate measurements of the stars. This seemingly simple instrument allowed man to make incredible breakthroughs in the organization of society, and in the arts.

FIGURE 3.1
Chandra X-Ray Telescope

FIGURE 3.2
Chandra's Orbit

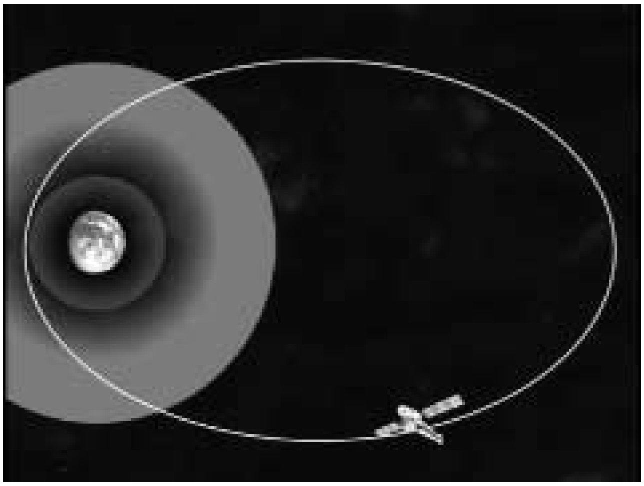
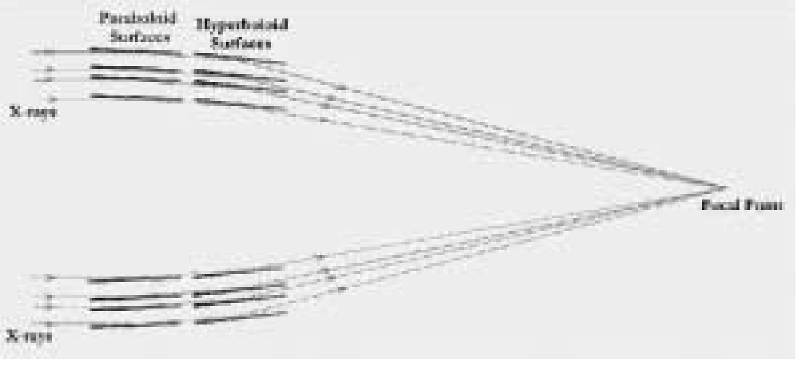


FIGURE 3.3
How the X-Ray Telescope Focusses High-Energy Electromagnetic Waves



Understanding the movement of the stars may seem like a pretty useless discovery, at first; however, it was just this discovery, that allowed for the creation of a calendar—and modern agriculture. Without understanding how long a year was, you would not be able to have modern agriculture. And, in fact, that was just the beginning, because one of the most fun things you can do, with an understanding of the movement of the stars, is, the navigation of the oceans and seas.

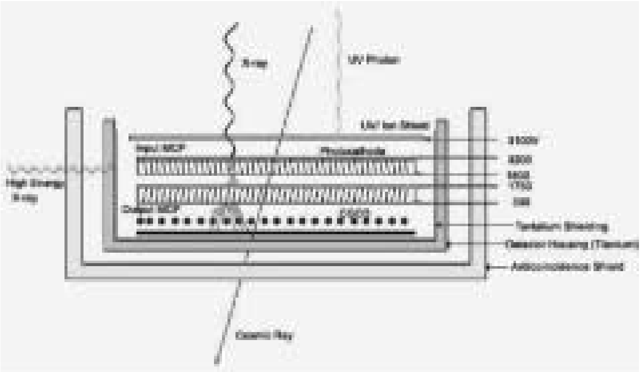
So, all great discoveries required the help of technology. And, how is this technology created? Man first must realize that his senses do not tell him the truth. And, this is evident, in both the nighttime sky and the behavior of light under refraction. The human mind must hypothesize the existence of the real universe lying outside the cage of simple sense-perception. Once these thought-objects are discovered, they are now put into the willful control of humanity, and we can therefore build new technologies that harness these newly discovered principles, detectors included.

So, I want to investigate two of these detectors, that we actually use to look at astronomical phenomena. And these telescopes do represent the cutting edge of technology. I wanted to look at two interesting ways, two generalized sense organs, that we currently use to observe the heavens. Our telescopes pick up anomalies that are represented in the electromagnetic spectrum, and I'll briefly describe an X-ray telescope, which represents the higher-energy register of the spectrum, and a radio telescope, which represents the lower end of the spectrum.

This telescope (**Figure 3.1**) is named Chandra and it is an X-ray telescope. It launched July 23, 1999, so this thing's been in use for about four years now. Now, as you can get a sense, this telescope is not based on the planet, but it actually orbits the Earth, which is very important. **Figure 3.2** shows the orbit of Chandra. You can see the Earth; those two rings represent the Radiation Belts. Now, the farthest part of the orbit, is actually a third the distance to the Moon, and the closest represents about 10,000 miles to the planet. Because of this highly elliptical orbit, it allows for about 85% of its time outside the Radiation Belt, and the reason why this is so important, is because when this telescope is inside the Radiation Belt, it receives quite a bit of X-ray interference. This telescope can take about 55 hours of uninterrupted observations at a time.

Now, the challenge of building an X-ray telescope is hav-

FIGURE 3.4
The X-Ray Telescope's Main Detector



ing the ability to focus X-rays (**Figure 3.3**). What they had to do, in order to focus these higher-energy electromagnetic waves, is they have to bounce the X-ray off a very low angle of incidence, almost in a ricochet angle. The first set of mirrors, on your left, are parabolic surfaces. The next set is a set of hyperbolic surfaces, and it will focus the X-rays onto a focal point. This was one of the main breakthroughs needed to have an X-ray telescope.

Now, there's something very interesting with these mirrors that they use to reflect these X-rays. These mirrors are actually the world's most smooth and cleanest mirrors every produced. And to get a sense of how smooth these mirrors are—it's actually a set of four parabolic and four hyperbolic surfaces. Now, these mirrors are so smooth, it would be like, if you took the Earth and smoothed out the Earth so that the highest mountain was only 78 inches high. So, pretty much these mirrors are smooth to within just a few atoms, which it took them a couple of years to produce.

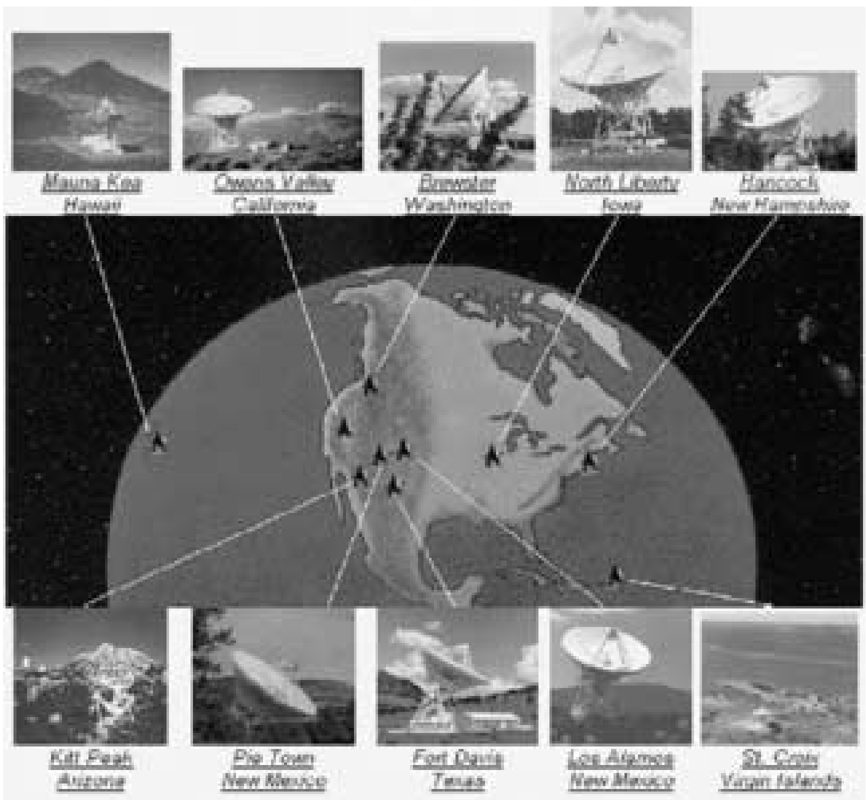
Now, this telescope (**Figure 3.4**) has four detectors. The one we're going to look at, very quickly, is its main detector. You see that squiggly line on the left—that represents an X-ray: What happens is, that X-ray strikes that first plate. Each plate has 69 million, tiny lead-oxide glass tubes. What makes these tubes amazing, is that they are about 10 micrometers in diameter, which is about one-eighth the thickness of a human hair. So, they had to figure out a manufacturing process, to actually make tiny little glass tubes one-eighth the thickness of a human hair. There are 69 million of them, per plate—see it strikes two plates. Now, when an X-ray hits one of these little tubes, it gives off a burst of electrons—and the electrons can be detected, and the direction of the X-ray can be determined quite precisely.

The next instrument I want to look at, is the Very Long Baseline Array [VLBA] (**Figure 3.5**). What the Very Long Baseline Array is, is it's actually not one telescope, it's a group of ten telescopes, from Hawaii to the Virgin Islands. The other eight are located in the United States; they're all identical; the dish is about 82 feet high when it points up.

What's pretty amazing about this array of telescopes, is that, altogether, these telescopes can see an object giving off radio waves thousands of times more accurately than an optical telescope could observe an object giving off visible light.

What makes this array impressive—because radiotelescopes have been around for quite a while—is that they have to combine all ten signals, and that's called "interferometry," which means using several instruments in which you compare the measurements between the instruments. This is where this

FIGURE 3.5
The Very-Long Baseline Array Telescope



array of telescopes gets kind of interesting: They record the observations simultaneously onto magnetic tape; the tapes are then brought to a central location. Now, the tapes have to be synchronized *within one-millionth of a second.* That means, that you have to take ten magnetic tapes, and align them within one-millionth of a second. Now, if you do this—if you have this ability to line up these tapes within one-millionth of a second—you will have the VLBA with a maximum highest resolution of less than 1 milliarc-second—that's about one-thousandth of a second of an arc. If you don't understand what that means, it would be like reading a newspaper in Los Angeles standing in New York City. That's the resolution of this array of telescopes.

So, the exploration of space is now necessary. And we must increase the density of paradoxes and discoveries, if the human race is to survive. It is a project which could show all cultures, that we really are all human. Imagine: A Moon observatory on the dark side of the Moon. That would mean almost no interference from the Sun or the Earth, and our observations of these phenomena would be increased by the order of many magnitudes—therefore, increasing our power to make creative discoveries.

Animals are caged by their senses, and we are not. Let's just have some fun. Thank you.

4. Riana St. Classis

Metaphor and Platonic Creativity

I'm going to have to interject here—sort of like a LaRouchie at a Democratic district meeting.

Because, the problem is this: Without comprehending metaphor, you're not going to understand this panel. And, even though everything has seemed to go along very well, so far, we're going to have to take a break. The problem is, the problem of an idea: Because, I can't describe an idea to you, and have you hear it. And I couldn't paint you a picture and have you see it. And, I couldn't sculpt it, and have you be able to touch it. So, how do I communicate an action inside my mind, a motion, a generation—something that happens inside of me—and how do I know that I've replicated that. inside of you. "Aye, there's the rub," like Hamlet says.

So, let's begin here. I'd like to begin with a joke that Lyn is fond of using as an example. If I make the statement,

FEED THE CAT.

Those of you who aren't familiar with this joke, you immediately think that you know what that means, right? You might think that perhaps I should add some other information to that, to complete it. "Feed the cat"—when? "on Saturday"? What do I feed the cat? Do I feed him tuna? Which cat do I feed? Do I feed the tabby?

So, what happens now? Can I have the next one,

TO WHOM?

So, suddenly, your whole idea about the cat, is changed. The meaning of "the cat" has been changed. It's no longer a question of *bringing* the cat food; it's a question of "making" the cat food. If you weren't familiar with this, you might also have something happen—you feel, you know, maybe a little . . . shocked. Maybe there's an emotional component to this. The first statement was fairly mundane. But, now, all of a sudden, maybe you don't really feel so good about this any more!

This joke isn't exactly a metaphor. But, it certainly has irony; and the irony rests on this question of the verb "to feed," and how that verb changes in meaning when I juxtapose it to a different query. Instead of "when" or "what," I suddenly ask, "to whom?" And that changes the entire meaning of the word.

So in first approximation, our words are just like a primitive map of what we see; and, of maybe simple actions, like running or walking. The words don't actually give me a way of breaking out of the Sensorium. The words might give me a way of describing the bars of the cage. So, the question becomes, "How do I break out of the bars? How do I transcend language, so that I can transcend to understanding something about the Sensorium, other than what I see?"

This is actually the same question that the Greeks were looking at, when they were looking in constructive geometry, but it's posed in a different way. Because constructive geometry, mathematics, is actually a language—just a slightly different one, like music.

Let's look at a quote that Lyn has, from *The Science of Christian Economy;* he gets at this idea.

"Consider a Shakespeare tragedy, *Hamlet* for example. Or Schiller's *Don Carlos.* . . . Is the power of the drama in any of the utterances—even in Posa's 'king of a million kings'? The passion is located in the juxtaposition of essentially simple, more or less stylized words and movements, to force upon the audience a conception, of something which might be said to 'lie between the cracks' of anything said or done onstage. Hence, the form of a dramatic composition is as essential as the form of a non-Euclidean constructive geometry is to the creative thinking in mathematical physics."

At this point, I'd like to elicit a friend of mine, Keats, to get this idea across.

On First Looking Into Chapman's Homer

Much have I travelled in the realms of gold,
    And many goodly states and kingdoms seen;
    Round many western islands have I been
Which bards in fealty to Apollo hold.
Oft of one wide expanse had I been told
    That deep-browed Homer ruled, as his demesne;
    Yet did I never breathe its pure serene
Till I heard Chapman speak out, loud and bold:
Then felt I like some watcher of the skies
    When a new planet swims into its ken;
Or like stout Cortez when with eagle eyes
    He stared at the Pacific—and all his men
Looked at each other with a wild surmise—
    Silent, upon a peak in Darien.

So, where's the poem's meaning? See, the nerds always want you to explain; "I want you to explain t'me, what that poem me-e-a-ans." And, in fact, what you find out, is that most English teachers in our schools today are nerds, and they demand that you do, just what they said, to that poem. This is an example that I found online, of an English teacher who goes through an intensive analysis of this poem, to give a demonstration to her class.

First of all, she says, "You must put the poem into prose form, and make some statement out of it." This is her statement:

"The speaker says, that he had travelled through a lot of golden terrain, had read a lot of poems, and people had told him about the Homeric domain. But, he had never breathed its air, till he heard Chapman's speak out. Then, he felt like an astronomer, discovering a new planet. Or, like an explorer, who discovered the Pacific, whose men, astonished by his gaze, guessed at his discovery." She then goes on to say: Well this kind of meaning paraphrase is necessary, but in a poem, there's often very little by way of plot or character or normal information, in the ordinary sense, and it can usually be quickly sketched. So, if we want to learn things about the poem that are more interesting than simply "What It Says," we have to take it apart, piece by piece by piece.

And, when I'm reading her analysis of this poem—which goes on; they look at the meter, and they look at the climax, and they look at all of these various things about the poem—I start feeling like I did when I was in freshman biology lab, and you have this question about life. You look at an animal, like a cat; and the cat has life. And you think, "Where *is* the life? How do I get to it? Where is the location of the life, in that animal?" So . . . I take it apart! And, in the end, I'm left with a mess—with a dead, dismembered cat. I'm left with cat-burger. And the thing that I was looking for, the life—it's gone. It doesn't seem to be anywhere, at all.

So, the problem of the two means is a problem of going from my sense-perception to understanding, or to the real universe, actually. And, the way in which we do that, is, like going from "understanding" to "reason"; that's what Plato tell us, right? But, in a sense, it's sort of like what Hippocrates of Chios said. I can say that the problem of finding the double of the cube is a problem of finding two means between two extremes, but that's like turning one major puzzle into another . . . major puzzle!

What I'd like to do, is to go back to the poem. And I'd like to point out two striking juxtapositions: First of all, I'd like to point out how Homer, Chapman, Cortez (who, some people will tell you, is actually Balboa, who discovered the Pacific, but anyway—); Homer, Chapman, and Cortez, how they and Cortez all appear together, in this moment of the poem. And, I'd like you to look at Chapman, who was a contemporary of Shakespeare, and how he changes the meaning of Homer. He changes Homer across a vast distance of time and place. And, in a sense, he acts as a means, between Homer and Keats.

Now, in Jonathan Tennenbaum's presentation in Frankfurt [see *EIR*, Sept. 19, 2003], he speaks about a second Sensorium. He calls it "the Sensorium of mind": monads, who populate *our* mind. He calls it, "the celestial sphere of creative human personalities." And these are the people about whom—or some of them—about whom we're speaking tonight, like Archytas, and Plato. And, you can think about them, if you know them. And you can think of them, as hu-

FIGURE 4.1
Rembrandt's 'Aristotle Contemplating the Bust of Homer'

mans who've changed the meaning of our being human. And it's upon *them,* that we stand—it's on understanding. Through them, we get an understanding. But, in the Greek, this question of understanding, the Greek word for it is *dianoia,* which means "through reason": *dia-noēsis.* And so, the celestial sphere of personalities gives us a key to reason, but it doesn't give us reason.

Second, I'd like to look at how Keats emphasizes this question of seeing. It's on "First *Looking* Into Chapman's Homer." Apollo is the god of poetry, but also the god of light. And, you can see, Cortez stares with his "eagle eyes"; the men *look* at each other. But, the fulcrum of the poem, one of the things around which it rotates, in a sense, is Homer—and, Homer was blind, or at least, by tradition he was blind. And this question of seeing struck me, because in Greek, this word *noēsis,* comes from the verb *noëō,* which means "to perceive."

So, why would Plato choose that as the word for "reason"? As the word for this highest quality, which we're trying to get to? And, I thought, it's like Homer (**Figure 4.1**). Here is Rembrandt's *Aristotle Contemplating the Bust of Homer,* and a lot of people in the Schiller Institute have talked about it. But, if you look at Aristotle, he's got these dark, liquid eyes, kind of like an animal; and he's staring off into the distance; and he's groping on the head of this statue. And you notice that the light is actually coming from this dead, marble bust of Homer. You see that Homer looks like he's looking at Aristotle, with this look of pity. It's interesting—the blind, dead bust, and the living Aristotle, who is blind and can't see.

This same blindness seems to underlie the blocked mathematician, who wants to explain Archytas' solution to the cube problem. Every website that I've gone to, and even in the English translation of Eudemus' description of Archytas' solution to this problem, the translator, the mathematician—they can't help themselves. They have to *explain it;* and they have to explain it, with equations. They have to say, "Yes, yes, yes! It's very remarkable, that Archytas came up with this, 1,200 years ago. And if you use the equations for a cylinder, a torus, and a cone, and you make them intersect, and you set them equal to each other, and you do some simple algebraic manipulations—you find out, that Archytas was actually right!"

Thank you, Mr. Algebra! Archytas figured this out 1,200 years ago, and now you're saying, "Oh! But, by *my* equations, I see that he was . . . right." See, the mathematician might actually say, that "though these equations don't actually look like the cylinder, the torus, and the cone," the mathematician *sees* those things *in them.* So, what's the difference?

The difference is: The quality of discovery that Archytas made. How did he actually come up with the solution? What was going on in his mind? How did he actually generate this? See, he didn't use equations; and he was looking at an action. So, what enabled him to see? And, at what was he actually looking?

What I would say is, to these modern mathematicians, "Don't show me that the discovery worked! Show me how to make the discovery! Lead me through the discovery process, or at least give me the clues, on how to do that for myself." So, in Lyn's paper "On the Subject of Metaphor" [*Fidelio,* Fall 1992], he almost immediately jumps into a discussion of the Pythagorean Theorem, as metaphor. And this is what he says: The pupil is "guided to re-experience the mental act of original discovery by Pythagoras himself, thus to reconstruct a copy of that aspect of Pythagoras' creative mental processes within the mind of each of the pupils. This new existence, within the pupil's own mind, is itself an object of a special kind, a thought-object, identified by the metaphorical name 'Pythagorean Theorem.' "

If we look at this from the standpoint of the related problem, posed by Plato's *Meno,* that of doubling the square—can we see Jason's graphic (**Figure 4.2**)?—do we see that the problem is actually one of transformation? How do I transform a square of 1, into a square of 2? And see, it's a problem of relationship: Let's say, of the two sides of a right triangle (so, that right triangle down there, in the lower left), and the hypotenuse. What is the relationship between them, that enables me to have the power to generate the doubled square? And, this solution isn't apparent; it has to be seen. It has to be looked at, by the power of the lines to generate squares on themselves—it has to be looked at from the problem of the squares. You have to go outside of

FIGURE 4.2
Doubling the Square

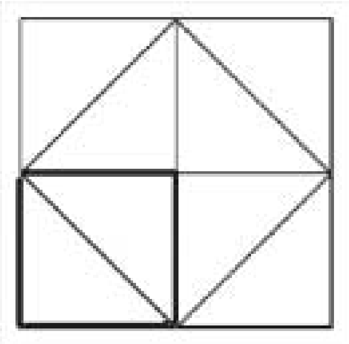


FIGURE 4.3
Cartesian Coordinate System f(x) = x

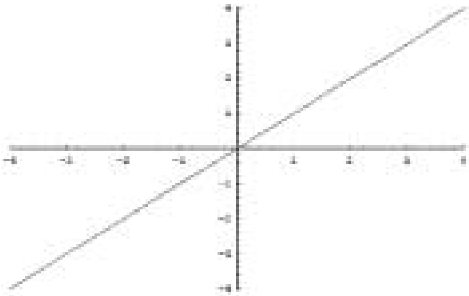


FIGURE 4.4
A Gauss Surface

the domain of the lines, to actually get a sense of this problem. And, what Jason went through, was that that hypotenuse can't be known in terms of the side of its square. So, what he went through was to show you how, the hypotenuse, in terms of the line of the square would have to both be even and odd. That's what Nicolaus of Cusa calls "a coincidence of opposites." And the question is, where does that happen? Where is that line, both even and odd?

So, if we look back at Archytas, and if we look at the description of his solution by Eudemus, we see something striking: He's looking at a process of becoming. He's looking about an action, and so, the way he describes it, is that, you take a semi-circle, and you rotate it up; you rotate that semicircle about a point. You take a triangle, and you rotate that triangle, and the residue of these actions, that are taking place in conjunction with each other, is the solution. The residue of the action of the rotating triangle, is a cone; the action of the rotating semi-circle is a torus. What we're actually looking at, isn't the cone, the torus, and the cylinder—he's not looking at those things. *He's looking at a process.* And when he's looking at the means, he's looking at means in a process of generation. So, he's trying to get a sense of the process of generation, behind our Sensorium.

This solution, as Jonathan Tennenbaum, Bruce Director, and Fletcher James have all pointed out in pedagogicals on this topic, is like a polyphony. And, if you remember what Megan Beets and Matt Ogden demonstrated in the panel last night ["An Evening with the Classics, in Tribute to Graham Lowry"] with Rameau and Bach, you remember, that in Bach, there was this intersection of voices; there were independent voices moving together, elaborating a single idea—like a conversation. And music is a language, like constructive geometry. The real idea lies behind the composition; the real idea lies in the creative principle, in the actual creation; in the process behind the Sensorium, behind what is created.

So, the idea of Archytas, is behind that construction, and the two means are not objects.

When you begin to get a sense of this, you might have a sense of shock—like the joke, or the first six lines of Keats' sonnet, in relation to the last six lines. Like, after Keats has actually discovered Chapman. You have a sense of shock, at the underlying paradox, that you have to go outside of the domain in which you are operating to get your solution.

Now, for anyone who has worked on Gauss's Fundamental Theorem of Algebra paper, you might remember a shock, or a discomfort, when you hit Section 13: because, at first, Gauss states what he means to prove. And then, he goes through and shows what's absurd about the reasoning—or what's actually not so absurd as deceptive, in the reasoning of D'Alembert, Euler, and Lagrange, because they're all rooting around in the realm of algebra to find the solution. And he suddenly throws out this circular function, and he says, it has a particular property, and he proves it. And, you wonder, "Where did these sines come from? Where did these cosines come from? I mean, I was doing what's just a simple x^2, and now I'm dealing with $2r^2$cosinQC. What does that mean?" And, what Gauss is actually getting at, is a relationship, between the real universe, and sense-perception. And he's looking at the process behind the powers. He's making a metaphor.

Here's an example of our Cartesian coordinate system (**Figure 4.3**) and a simple function f(x) = x. With **Figure 4.4,** that's a picture of an approximation of a Gauss surface. See, the left is the cosine and the right is the sine, but that doesn't necessarily have to mean anything. What it is, is an approximation at getting at what Gauss shows is actually going on, in the equation. And that's actually not it, either; but, it's to help you get an approximation of the actual idea.

This is a quote from Gauss, which Bruce Director is fond of using, and I am, too: "These investigations lead deeply into many others; I would even say, into the metaphysics of the theory of space; and it is only with great difficulty, that I can tear myself away from the results that spring from it, as, for example, the true metaphysics of negative and complex numbers. The true sense of the $\sqrt{-1}$ stands before my mind fully alive; but it becomes very difficult to put into words; I am always only able to give a vague image that floats in the air."

So, the reality isn't out there. The reality isn't in the equation; the reality isn't in the surface; and the reality isn't in the words. So, this is like the metaphor that Kepler makes, when he's looking at the paradox of the motion of Mars from a higher standpoint. And see, Kepler is different than the blocked mathematician, because he's happy when he finds the paradox. Because it means that that's a gateway into making a real discovery. It means that the universe, through that crack, is going to let him perceive what's going on behind.

I'm going to read this Kepler quote—pay attention to his wording at the beginning, as well: "It is permissible, using the thread of analogy as a guide, to traverse the labyrinths of the mysteries of nature. I believe the following arguments can not be put aside. The relation of the six spheres to their common center, thereby the center of the whole world, is also the same relation, as that of unfolded Mind (*dianoia*)—understanding—to Mind (*noös*)—to reason. On the other hand, the relation of the single planets' revolutions from place to place around the Sun, to the unvarying of the rotation of the Sun in the central space of the whole system, is also the same as the relation of unfolded Mind to the Mind; which is, that of the manifold of dialectics, to the most simple cognition of the Mind. For as the Sun, rotating into itself, moves all the planets by means of the form emitting from itself, so too, as the philosophers teach, Mind stirs up dialectics, by which it understands itself and in itself all things, and by unfolding and unrolling its simplicity into those dialectics, it makes everything known. And the movements of the planets around the Sun at their center, and the unfolded dialectics are so interwoven and bound together, that, unless the Earth, our domicile, measured out the annual circle, midway between the other spheres changing from place to place, from station never would human cognition have worked its way to the true intervals of the planets, and to the other things dependent from them, and never would it have constituted astronomy."

So, without paradox—without the paradox of Mars, and those motions upon motions—we never would have been led into actually making discoveries, into investigating what is actually behind the Sensorium. So, if we must communicate to each other through metaphor, how does the universe communicate to us?

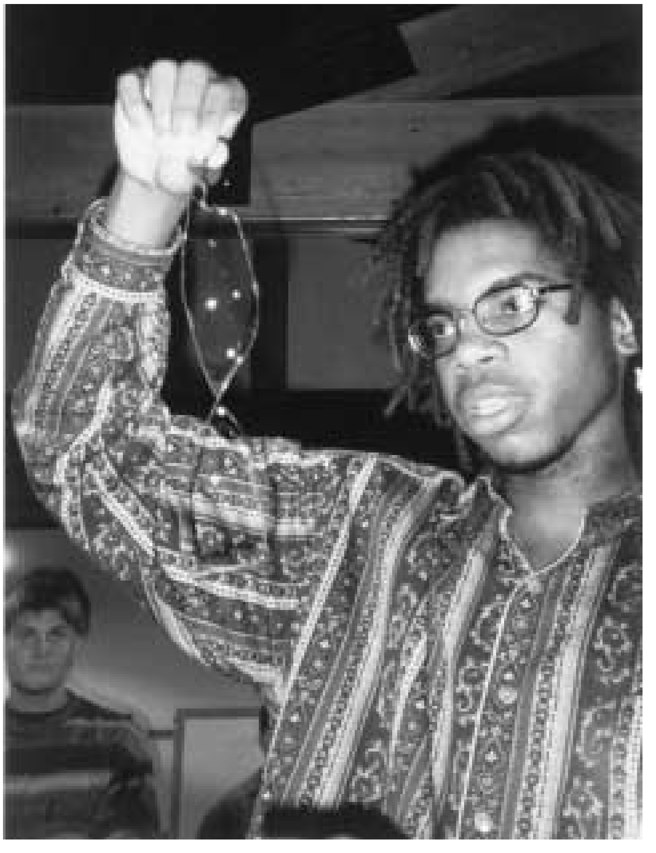
5. Sky Shields

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.

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 5.1

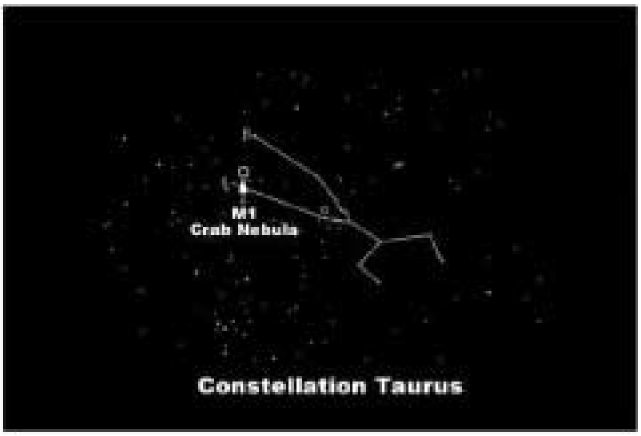
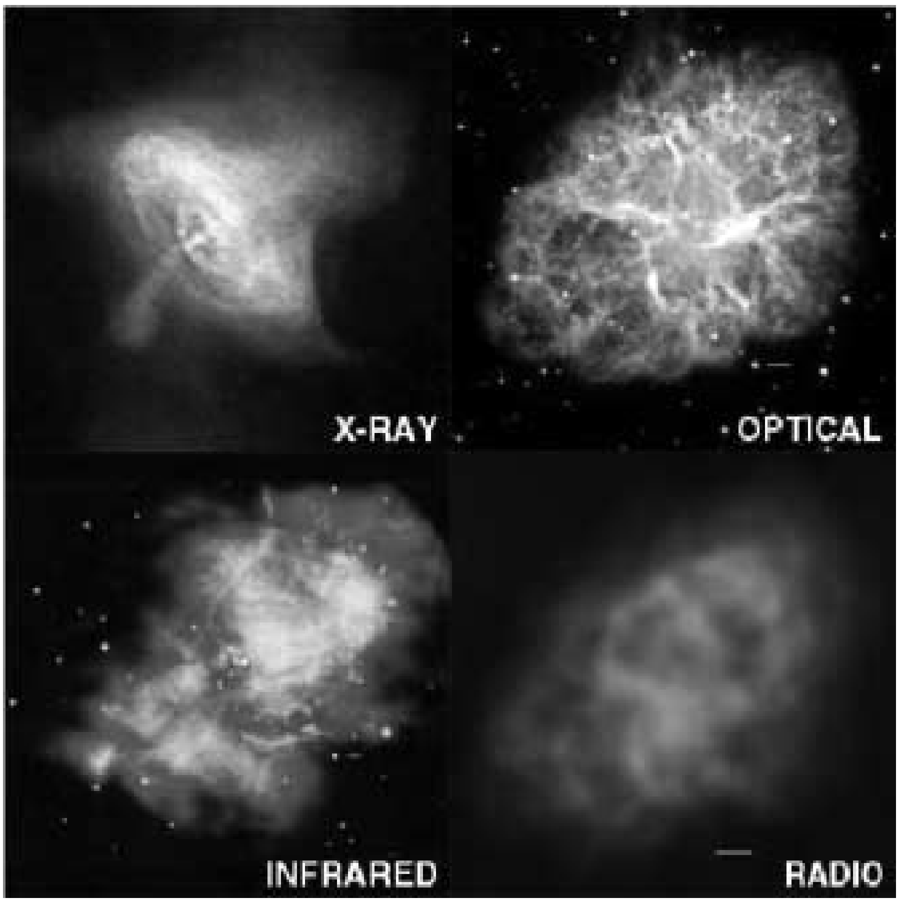


FIGURE 5.2

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

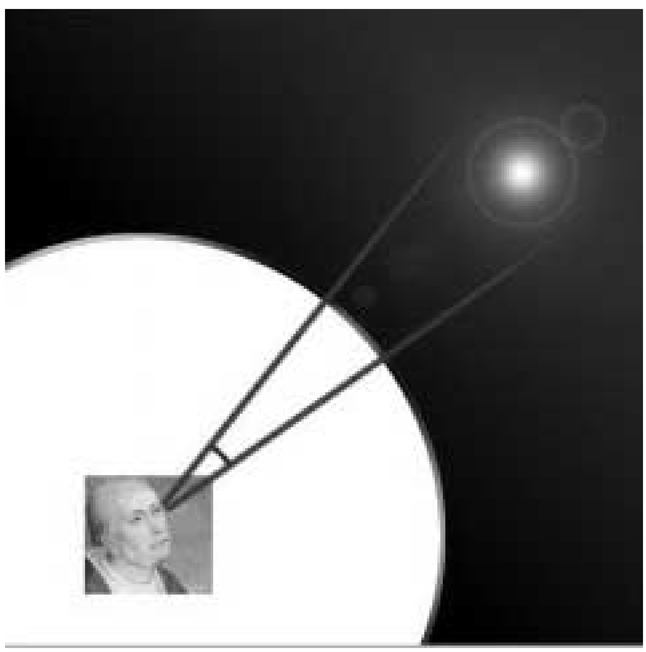
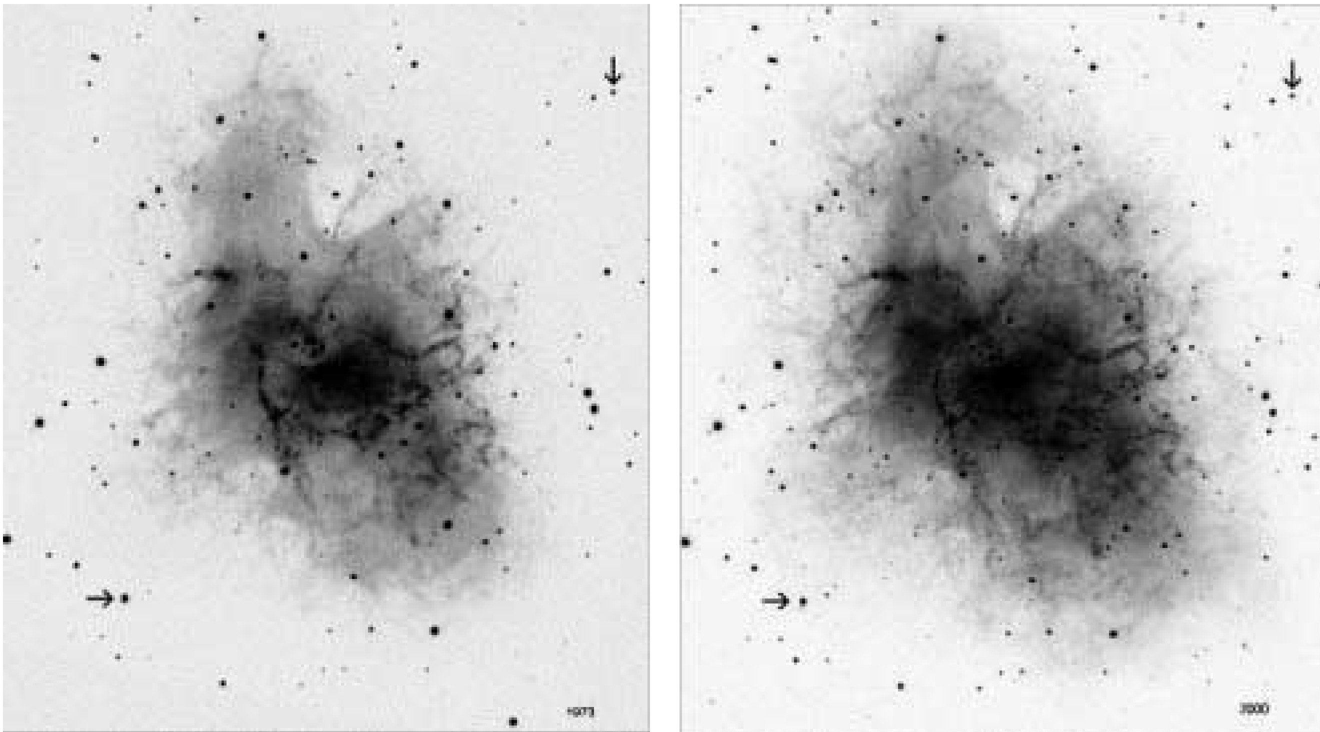


FIGURE 5.4
Crab Nebula Expanding at Expanding Rate



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.

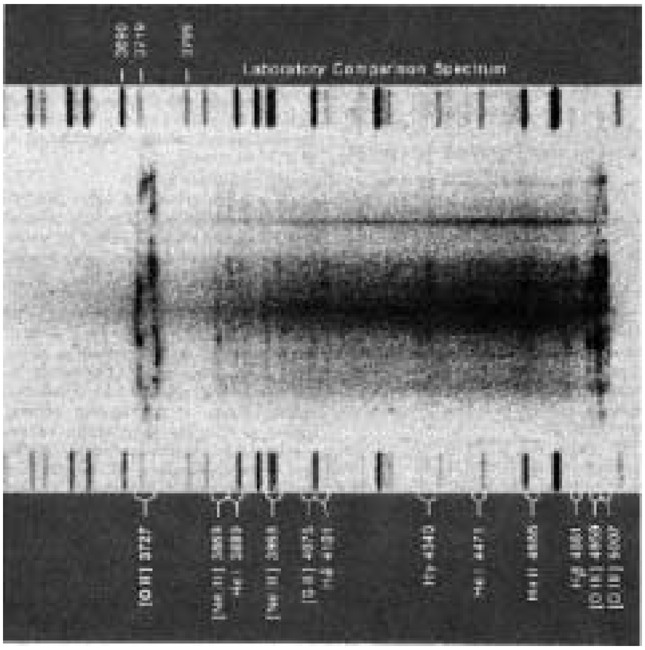
Enter Paradox

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



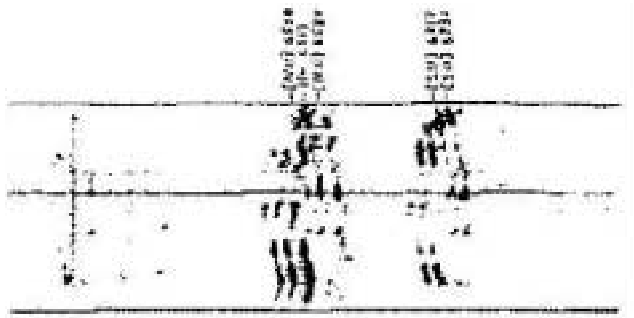
Obtained at Lick Observatory in England. The spectrograph slit was aligned with the major (vertical) axis of the nebula, and showed the differences in velocity of different regions of the nebula along that axis—for example, by the "necklace" shape of the 3,727-angstrom oxygen line at the left.

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.

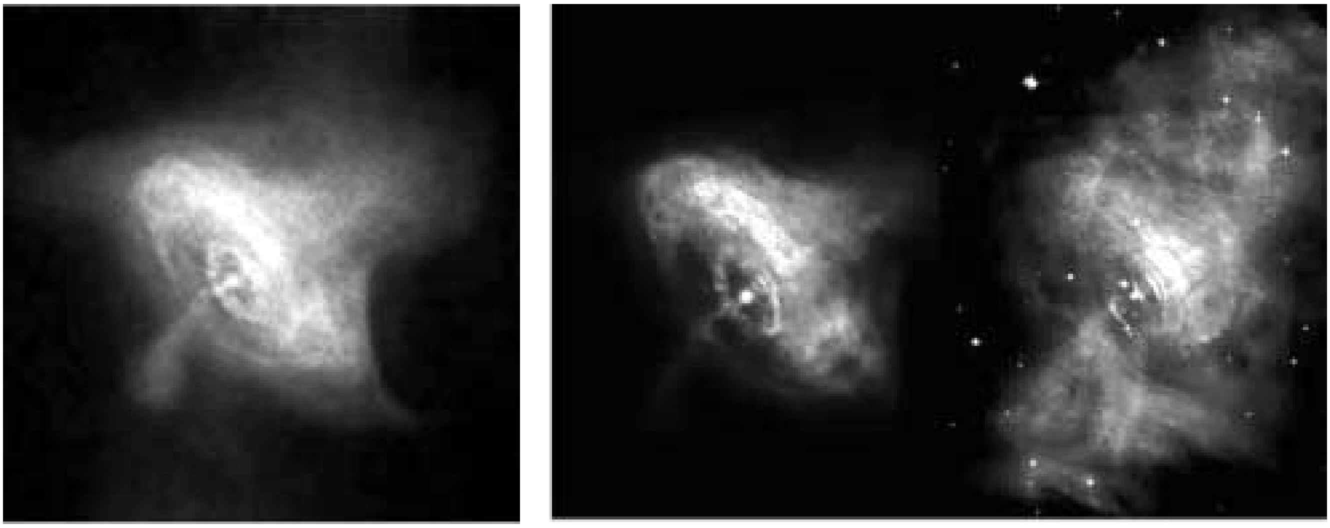
Something's acting on the Nebula, on every point of the Nebula at once; which, to begin with, is already something that's interesting. You don't have simple, linear causality taking place.

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.

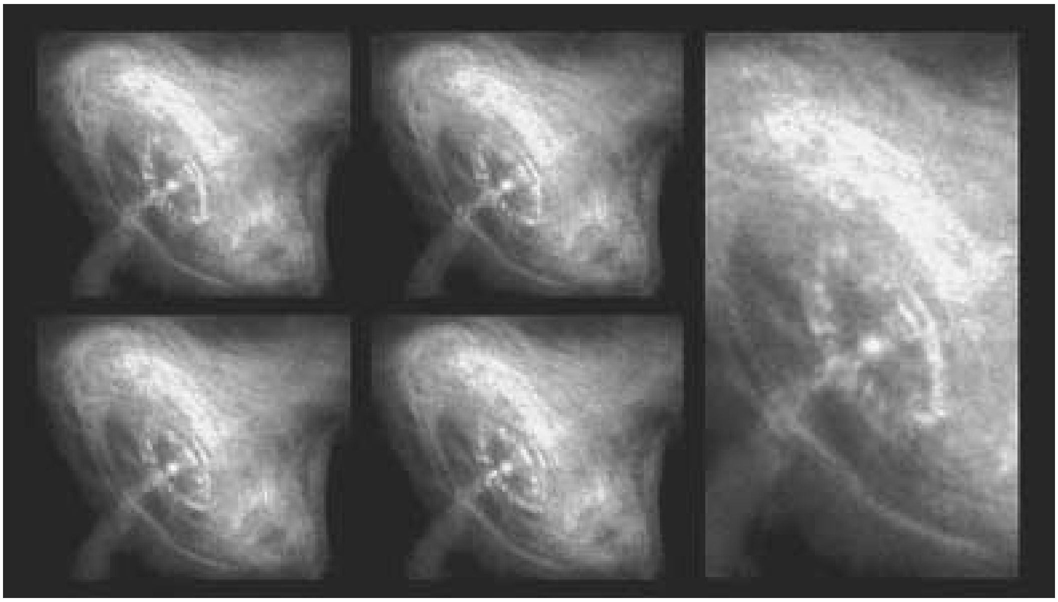
But you take a picture of that same species—us—even 20 years later; but take 100 years later, 200 years later, you've got a completely different behavior pattern. You've got a different area of the planet that we can live on. You've got different planets that we can live on. We've been on Mars and stood 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.

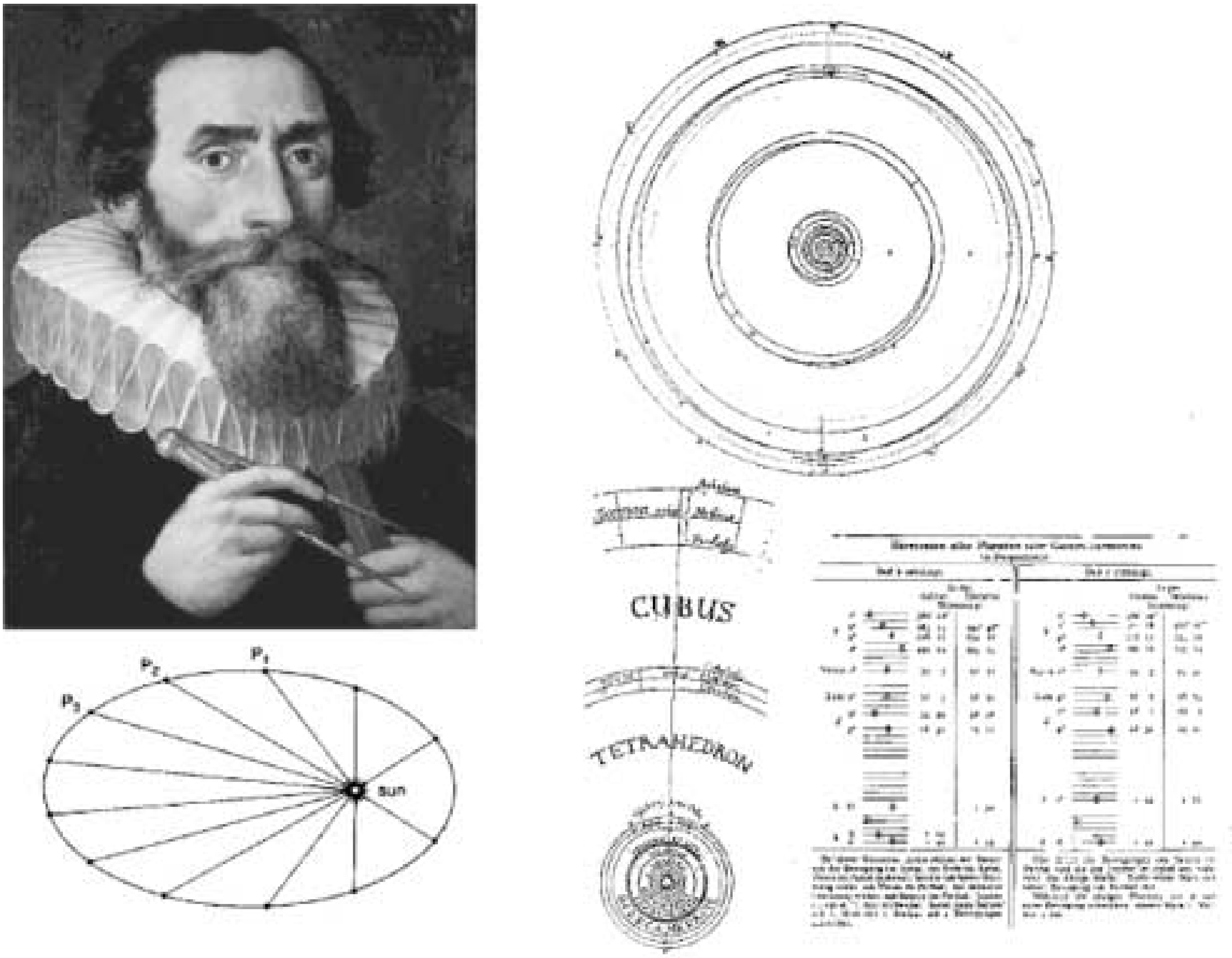
That gives you something that's important—the same thing you get from the [Dr. Robert] Moon model [of the atomic nucleus]: You've got a biological character existing, even in the astrophysical. That's not to say that the Crab Nebula is some animal! It's not a crab. It's not something that's living in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