III. Mankind in the Universe

Radio Astronomy: Peeking into the Infinite

by Janet G. West

Feb. 3—The recent success of China in landing the Chang'e-4 on the far side of the Moon opens the door to the deployment of radio telescopes there—on the far side. The lander sits within the Moon's Von Kármán crater, which in turn is within a large plain (the South Pole-Aitken basin near the South Pole), which is an ideal site for a lunar radio telescope (LRT). It can create the basis for an outpost (and perhaps later a colony).

The projected mining of helium-3 (He-3) for use as a fusion energy source on Earth, will later be also the source of fusion energy for the first colony on Mars. These possibilities could be the basis for reviving a proposal by Lyndon H. LaRouche in 1985, for a "Moon-Mars crash program mission." Just such a "crash-program" is urgently needed today, not only to kick-start globally an economic recovery, but also a renaissance of classical culture.

'The Woman on Mars'

In 1988 LaRouche proposed, during his then presidential campaign, an ambitious and inspiring crash-program mission to the Moon and Mars, as part of an engine to create new technologies to lift the U.S. and the world out of an economic crisis. He set this forth in his video, "The Woman on Mars."

In this video, he shows that just as the Apollo program returned ten times the value of what was spent on it, to the economy, a Moon-Mars crash-program will return even greater benefits to the physical economy and the average standard of living, as well as enabling the cultural and moral uplifting of mankind. The reader is encouraged to watch the video in its entirety.[1]

As part of that program, largely automated mining and manufacturing facilities will be built on the Moon. The program will also respond to the necessity for astrophysical scientific studies, for which mankind will need new, very large array radio telescopes. The first step in that journey will be lunar radio telescopes (LRT), followed by even larger arrays in stable orbits around Mars.

"But," you ask, "don't we know all we need to know already? Why go to the Moon, anyway?"

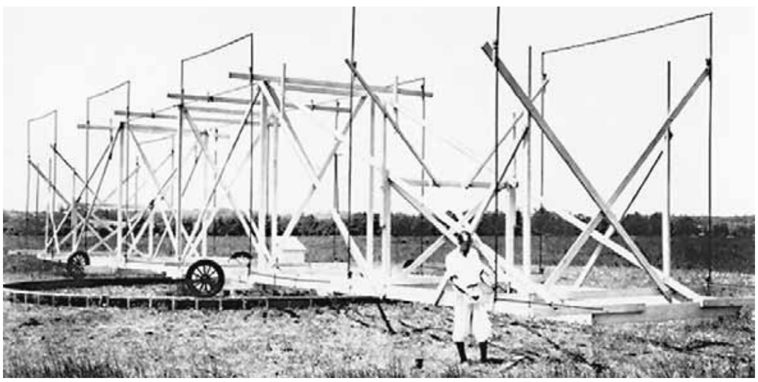
This, and other similar questions will be addressed as we proceed.

Citizen Scientists: Pioneers on the Edge

Like many scientific discoveries over the centuries, radio astronomy was discovered by—and the first radio telescope built by—amateurs, not by the so-called professional, "bona fide scientists."

The first to discover radio waves being transmitted by the Milky Way was Karl Jansky (1905-1950). While he was investigating static that might interfere with "short wave" (about 10-20 meters) radio voice transmissions for Bell Laboratories, he discovered three main sources: (1) nearby thunderstorms, (2) distant thunderstorms and (3) a faint steady hiss of unknown origins.

FIGURE 1



NRAO

"Jansky's Merry-go-Round."

In 1930, he constructed an antenna (**Figure 1**) which was designed to receive radio waves at a frequency of 20.5 MHz (a wavelength of about 14.5 meters). It was mounted on a turntable which allowed it to rotate 360 degrees, earning it the name of "Jansky's Merry-go-Round." One could find the direction of any radio signal by rotating the antenna.

1. Lyndon LaRouche, "The Woman on Mars."

At first, Jansky thought that the source of the interference was the Sun, but after a few months of monitoring the signal, he discovered that the most intense point had moved away from the position of the Sun, to an area in the fixed stars. He noticed that the wave pattern changed in form every six hours or so, and he was mystified for many months. He changed his hypothesis—he reasoned that the radiation was coming from a variety of sources, concentrated at the center of our galaxy, the Milky Way; it wasn't coming from the stars themselves, but from the material between the stars, particularly charged particles.

This discovery was widely publicized during May 1933, and Jansky wanted to follow up with more investigation—he proposed to Bell Labs the construction of a 100-foot diameter dish antenna. But Bell Labs now knew all it wanted to know about static—they knew that this static would not be a problem for transatlantic radio communication—so, why bother? Jansky was promptly re-assigned to another project and did no more work in radio astronomy. (However, history has had the last word—Jansky is now remembered as "the Father of Radio Astronomy.")

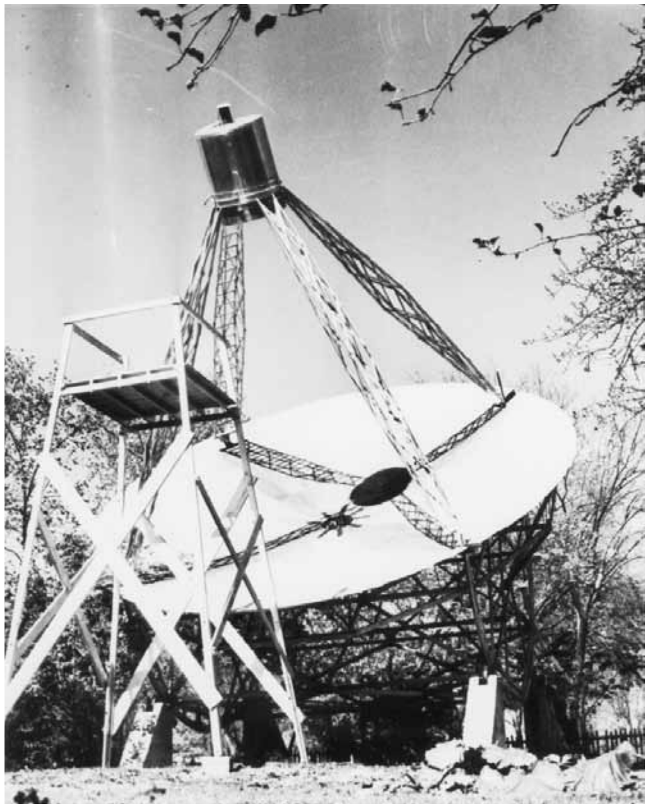
A young man—a ham radio operator and amateur astronomer, who had just gotten a degree in electrical engineering—heard about Jansky's work. He contacted Jansky and learned that he wasn't going to pursue further research. The young man checked with people at Harvard, Caltech, and others in the "scientific community"; he was aware that at least one physics professor at the University of Chicago was adamant that Jansky had made a mistake about the source of the static. Suddenly realizing that *no one* was moving forward with the discovery, he decided, "Well, if nobody else is going to do anything, maybe I'm the guy to do something about it!" His name was Grote Reber (1911-2002). He was the first person to build a radio telescope.

This demonstrates the power and importance of an individual summoning the gumption to see, as it were, the mere shimmering of an idea, of a discovery, and to decide through one's free will to step forward and make a unique, world-historical contribution to the future of mankind.

To Unfurl Wondrous Discoveries

At that time, radio antennae were simply wires, sensitive to particular frequencies determined by their lengths. Reber figured that he would need an antenna that would be receptive to a wide range of wavelengths—and directions of origin. He then reasoned that if this radiation had characteristics of black-body radiation, as was widely assumed, then its intensity per unit bandwidth should increase proportionally to the square of the frequency. In addition, for an antenna system of any given size, the resolution would increase proportionally to the size of the system. So, he decided that he had to go to the highest frequency that was detectible at that time, and he determined that he would build a dish, designing the mounting system for it as well (**Figure 2**).

FIGURE 2



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The first radio telescope—built by Grote Reber in his yard.

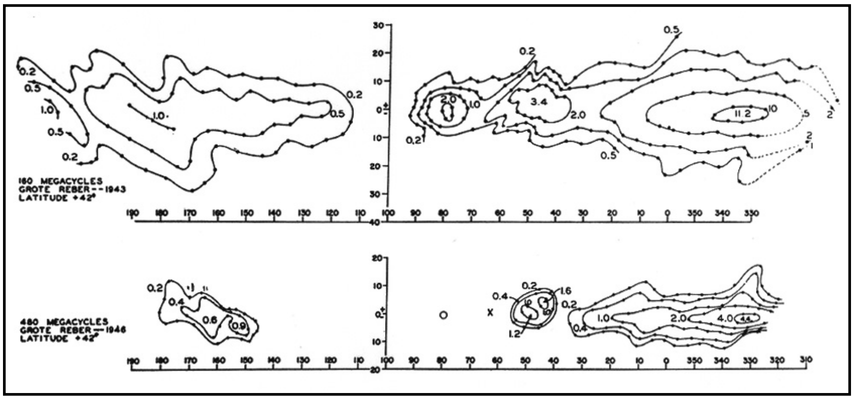
Buying the longest available lumber (20 feet) and using a local machine shop for tooling, he built the telescope *in his yard* in 1937 with the help of a couple of friends. They assembled the dish in one day, and the supporting parapet and mount took a few more weeks. The dish measured 31.5 feet across, and as soon as it was operational he began running a series of tests, scanning the sky, looking for some kind of pattern in the test results.

He experienced failure after failure and kept changing different specs on the telescope to try to detect the frequencies that Jansky had observed. After modifying the design somewhat, he began making observations every minute for several hours—and success! He was able to plot out a change in amplitude of the frequency with the relative position of the Milky Way. After securing an automatic recording device for these observations, from those measurements he developed a radio map of the sky. But, without his love of discovery and passionate persistence, it would not have happened. His telescope was the only one of its kind on the planet until the 1950s (**Figure 3**).[2]

It would seem that love, and most especially the love of mankind (*agapē*) is a key element of courage.

A friend of Reber related a story about "a young student who once asked Reber how to go about making new discoveries. Reber replied, 'Pick a field about which very little is known and specialize in it. But don't accept all current theories as absolute fact. If everyone else is looking down, look up . . . you may be surprised at what you find.' "[3]

FIGURE 3



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Grote Reber's contour map of the Milky Way Galaxy, showing constant intensity at 160 MHz and 480 MHz, taken at Wheaton, Illinois.

It was assumed, from the turn of the century into the 1930s, that the pervasive radiation of the galaxy could not be due to black-body radiation—the distribution of light wavelengths that is given off by all hot bodies. The prevailing theory was that there would be considerably more high-energy light than low-energy radiation, due to the stars and other hot celestial objects. However, Reber discovered that *the reverse is true*—that there are large amounts of low-energy radio signal—but it wasn't until the 1950s that synchrotron radiation was theorized to be the source. (Synchrotron radiation is generated when charged particles are accelerated in a curved path or orbit.) And, what wondrous discoveries would unfurl themselves as man's reach extended further into space!

2. Reber's first telescope and a replica of Jansky's antenna are on display at the Green Bank Observatory in West Virginia. See https://greenbankobservatory.org

3. Source: http://amazing-space.stsci.edu

NRAO

Grote Reber at his radio controls.

The Hydrogen Emission Line

Hydrogen is the most abundant element in the Universe; it has one electron and one proton. It has two forms: neutral hydrogen and ionized hydrogen. The so-called "ground state" of neutral hydrogen is more complicated than what first meets the eye—this has to do with the direction of spin of the proton and the electron. When their spins are parallel, it's known as the "high-energy" level, and when they're anti-parallel, it's known as the "low-energy" level. When a high-energy hydrogen atom converts to the low-energy state, the energy difference is given off as a photon, and the wavelength of that photon is 21 centimeters, corresponding to a frequency of 1,420 MHz.

But as we look farther and farther out into space, there is a continuous shift in frequencies in known, relative positions in the spectrum, and they have been measured to be lower—that is, further toward the red end of the spectrum. The hydrogen line in the spectrum, measured at 1,420 MHz in the laboratory, is no longer so, but is recognized by its more or less constant strength (brightness) relative to neighboring spectral lines that also preserve their mutual relationships of strength, even while all lines are shifting. This is the "redshift."

No one yet knows why this shifting occurs. If the Universe were expanding and everything were moving away from us, then we could say the redshift is like the siren of a passing fire engine, whose pitch seems to fall so long as it continues to move away from us. (But there are other proposed explanations.) When looking out into furthest intergalactic space, the hydrogen line will eventually be measured at 30 MHz, which is the high end of what we call the Very Low Frequency (VLF) part of the electromagnetic spectrum that we can't see from Earth. The VLF range is from 30 MHz down to 3 MHz.

Radio telescopes enable us to see thermal radiation (ionized gas), polarized synchrotron radiation (pulsars, cosmic rays), cyclotron radiation (planetary magnetic fields), other spectral lines (neutral hydrogen, masers), and other, as yet unknown mysteries. Radio telescopes penetrate the clouds of interstellar dust and gas that block the light as seen through optical telescopes. Since hydrogen is plentiful and has a known wavelength (21 cm) that can be seen through these clouds, it is used as a marker to help map the universe. Radio telescopes will also offer us increased insights into the heliosphere—the plasma bubble blown by the Solar wind—in different ways than that of the current Parker Solar Probe mission.

FIGURE 4

NRAO

The Very Large Array radio telescope near Socorro, New Mexico.

Radio waves can be observed from the ground, but the waves in the VLF range cannot penetrate our ionosphere without distortion. Beginning in the 1950s, Reber pushed to the limits of ground-based, low-frequency observing by building a large radio telescope in Tasmania, where the electron density in the ionosphere is very low, allowing observation of low frequency radio waves with less interference.[4]

Benefits of Radio Interferometry

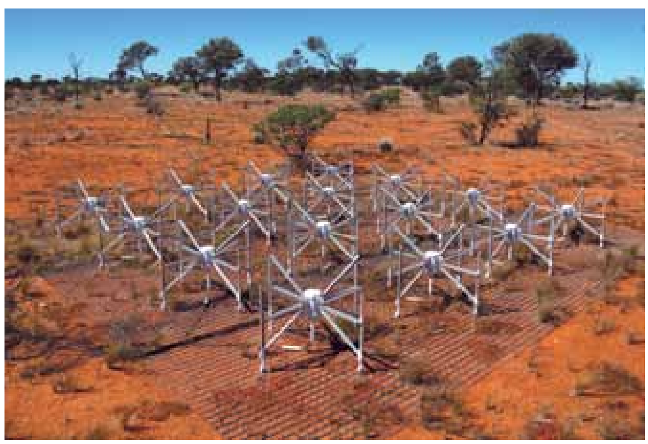
Using interferometry, in which large numbers of small devices are arrayed on the ground and electronically combined, greater and greater detail can be seen in radio-wave images. An example of this technology is the Very Large Array (VLA) near Socorro, NM (**Figure 4**). The *Cosmos* website explains how interferometry works:

> A radio interferometer is an array of radio antennas or "elements" that are used in astronomical observations simultaneously to simulate a discretely-sampled single telescope of very large aperture. To put it another way, a radio interferometer can be thought of as a single telescope with a very large and incompletely-filled aperture, of maximum size equivalent to the maximum spacing, or baseline, between any two of its component elements. This large "synthesized" aperture is only sampled at the locations at which an element exists, and this is aided by the rotation of the Earth, which effectively moves the elements within it, hence increasing the sampling. This is known as "Earth rotation aperture synthesis." The size of the synthesized aperture dictates the resolution or "beam size" of the array; the larger the aperture, the smaller [finer] the resolution.[5] (**Figure 5**)

4. In an article Reber wrote for *21st Century Science & Technology* ("The Big Bang is Bunk," March-April 1989), he describes (p. 45) his decision to move to Tasmania in 1954, where he observed at wavelengths in the neighborhood of 100 meters.

5. Source: http://astronomy.swin.edu.au/cosmos/R/Radio+Interferometer

FIGURE 5



CC/Natasha Hurley-Walker

A segment of the Murchison Widefield Array radio telescope in western Australia.

Destination: Moon!

Who are we, and where did we come from? How and when did "black holes" first develop? What are Fermi Bubbles? Why do only parts of the Moon have a magnetic field? How do galaxies create new stars at a rate that consumes more matter than they have inside them? How does cosmic ray acceleration occur within the heliosphere? Radio telescopes could be among the first instruments by which we may be able to answer these and other burning questions.

The Moon is the best site available to us—particularly its far side—for a VLF radio telescope, since it is always shielded from Earth's noisy radio environment, and from the Sun for about two weeks at a time. It offers a number of advantages:

- There are relatively flat, level areas available in the area of the Moon's South Pole, which allow for the deployment of a very large number of antenna elements in stable positions over tens or hundreds of kilometers' separation.
- The initial telescope can be of modest size and modular, such that thousands of antenna elements can be added over time.
- The dry, dielectric lunar surface regolith allows for simply laying out the short, thin-wire antenna elements on the surface. NASA has already designed several potential configurations which would be simple to set up.
- The lunar rotation provides a monthly scan of the sky.

The individual antenna elements would probably weigh about 50 grams each; their associated amplifiers, digitizers, transmitters and solar batteries, along with packaging, could still weigh less than 50 kilograms. Laying out the initial system could be a matter of only a few days' work by future astronauts on site, and some designs also allow potential robotic deployment.

The South Pole of the Moon provides many craters that are in total darkness; these may be ideal sites for an LRT. Additionally, the Shackleton Crater's rim is in permanent sunlight, and solar cells could be sited there to power the LRT.

The fact that a significant amount of water has been found on the Moon is a true "game-changer." It not only allows shielding capabilities for an outpost on the surface, but it could be split into hydrogen and oxygen for fuel.

The Crab Nebula

One of the most mysterious objects in our sky is the Crab Nebula. What could radio telescopes on the Moon reveal about it? This fascinating supernova was first documented by the Chinese, when it exploded in 1054 near the constellation that we know as Taurus the Bull, visible in the Northern hemisphere in the autumn and spring, and in the Southern hemisphere during the summer months. Except for the Moon, it was the brightest object in the sky—*for two years!*

Over the centuries, astronomers made drawings of what they observed, and in the 20th century, it was noted that not only was the Crab remnant growing, but at an increasing rate. It presents many anomalies. If we look to great discoveries in the past, by such people as Johannes Kepler, Louis Pasteur and Marie Curie, we can see that it will be through persistent and passionate investigation of apparent anomalies that new discoveries will be made.

The ruling authorities in modern science—which has been perverted by the genocidal oligarchical-British ideology—observe anomalies, whether in the microscopic or macroscopic realm, and dismiss them with a wave of the hand. They attempt to hack their observations into pre-selected "explanations" or "theories," a process that becomes increasingly tortured, much as in the infamous Bed of Procrustes, or the Ptolemaic model of the Solar system. The veritable tyranny of "accepted" theories, based on the fallacious assumption of an entropic Universe—such as the "Big Bang" theory—has suffocated and intimidated true creative thought among our "scientific community."

Like high priests of a gnostic religious cult, these ruling authorities intone solemnly what Albert Abraham Michelson, 1907 Nobel Prize winner in Physics, attributed to an unidentified "eminent physicist," who "remarked that the future truths of physical science are to be looked for in the sixth place of decimals."

If that weren't bad enough, a so-called modern physicist, Sean Carroll, a professor of cosmology at Caltech, has made the incredibly asinine assertion that—

> The laws underlying the physics of everyday life are completely understood. . . . All we need to account for everything we see in our everyday lives are a handful of particles—electrons, protons, and neutrons—interacting via a few forces—the nuclear forces, gravity, and electromagnetism—

> subject to the basic rules of quantum mechanics and general relativity. . . . Fifty years ago we more or less had it figured out, depending on how picky you want to be about the nuclear forces. *But there's no question that the human goal of figuring out the basic rules by which the easily observable world works was one that was achieved once and for all in the twentieth century*.
>
> . . . Using the framework of quantum field theory—which we have no reason to doubt in this regime—we can classify the kinds of new particles and forces that could conceivably exist, and go look for them. It's absolutely possible that such particles and forces do exist, but they must be hidden from us somehow: either the particles are too massive to be produced, or decay too quickly to be detected, or interact too weakly to influence ordinary matter; and the forces are either too weak or too short-range to be noticed. In any of those cases, *if they can't be found by our current techniques, they are also unable to influence what we see in our everyday lives.* We have very little idea how big the region of our understanding is, compared to all that there is to be understood; but we know that *it's bigger than what we need to understand to make sense of the world we see with our unaided senses.* [emphasis added][6]

What a crock! Even a caveman would know better than that!

It reminds one of Edgar A. Poe's prose poem, "Eureka," in which he scathingly ridicules this kind of thinking. Here the narrator of his story is speaking:

> It appears, however, that long, long ago, in the night of Time, there lived a Turkish philosopher called Aries and surnamed Tottle. [Here, possibly, the letter-writer means Aristotle; the best names are wretchedly corrupted in two or three thousand years.] The fame of this great man depended mainly upon his demonstration that sneezing is a natural provision, by means of which over-profound thinkers are enabled to expel superfluous ideas through the nose; but he obtained a scarcely less valuable celebrity as the founder, or at all events as the principal propagator, of what was termed the *de*ductive or *a priori* philosophy. He started with what he maintained to be axioms, or self-evident truths:—and the now well understood fact that *no* truths are *self*-evident, really does not make in the slightest degree against his speculations:—it was sufficient for his purpose that the truths in question were evident at all. From axioms he proceeded, logically, to results.

It is not by putting one's snout to the earth and rooting in the mud that one discovers the true nature of what it means to be human.

Is the Crab Nebula 'Impossible'?

To gain this insight, we need to pursue the anomalies of our observations from the perspective of, "What can these anomalies tell us about the nature of the Universe? In what kind of Universe could something like the Crab Nebula exist? What is the principle which drives these events? What is the nature of mankind, that we exist in such a universe?"

As the Crab Nebula has been investigated over the years, a pulsar was discovered at its center, and it continuously creates turbulence which powers the expansion. In optical range observations, it was noted that the synchrotron radiation contains fine-filament structures, and that the intensity of the radiation drops off rapidly from the center; the creation of these filaments and the role they may play is unknown, but their structure and morphology appear to be highly organized. Radio wave mapping also shows similar "fibrous" structure to that seen in the optical range. These filaments will show up in photographs taken in the red wavelengths of light, but are absent when photographed in blue light. What can this mean?

The Crab Nebula is a powerful source of radiation, spanning the entire electromagnetic spectrum—from very long radio waves to the extremely short gamma rays. And, this poses the question, "How, then, do you see it?" Only parts of it can be seen in visible light, other parts in X-rays, still other characteristics of it are only seen by radio waves. Furthermore, the radiation isn't generated at a steady rate; areas that are expanding the most rapidly show a decrease, while every few months or so, two bright filaments (or "wisps") flare up from the central part of the nebula and are symmetrical with the pulsar. However, in the X-ray region, no intensity variations have been detected!

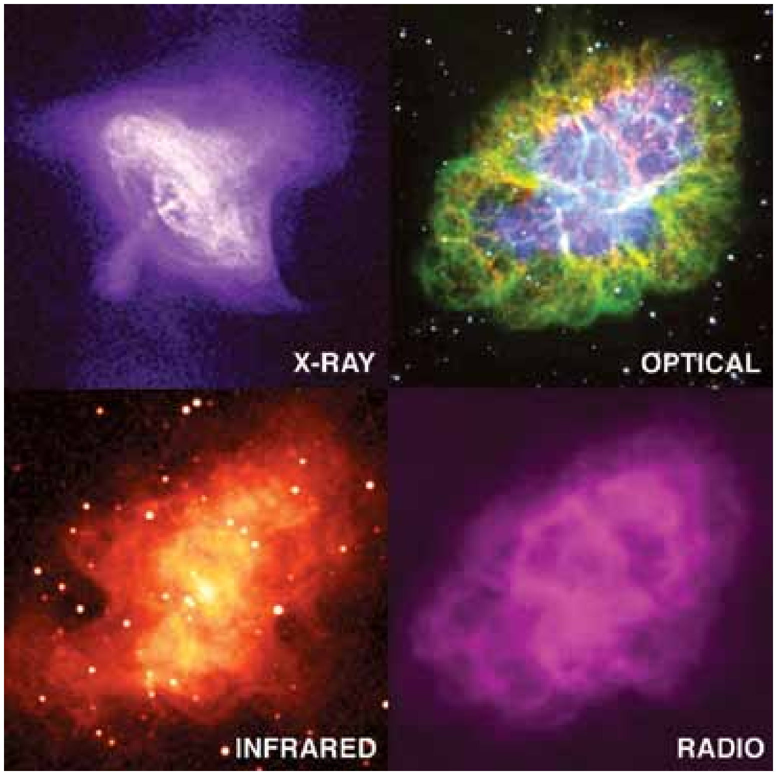
6. See Carroll's posting on the "Cosmic Variance" blog of *Discover* magazine.

Some of the light is polarized along the long axis of the nebula, and other observaions show that the entire nebula is highly magnetized. What causes this?

The most extraordinary image is that produced by the Chandra X-ray telescope, which shows a clearly-defined axis aligned with the long axis of the nebula; overall, it has a toroidal structure with organized concentric rings. The "accepted theories" would indicate that this is "impossible"; that the remnant of an exploded supernova would "naturally" dissipate over time, not become more organized (**Figure 6**).[7]

By bringing radio telescopes to the far side of the Moon we may help to peel away the layers to reveal the truth of this and other marvels of the universe.

FIGURE 6



NASA

The Crab Nebula as seen in different wavelengths of the electromagnetic spectrum.

The Path Ahead

Humanity can explore our entire Universe—from microscopic creatures to galaxies—with wonder and confidence, knowing that the Creator has so designed the Universe, as to make its mysteries accessible to the human mind. One can imagine the Creator designing "puzzles," awaiting a creative human mind to unravel them, and then laughing with delight, as a child does when making an original discovery, no matter how simple.

Our bodies may be mortal, but our spirit and our species-nature touch the Infinite. As we deploy more sophisticated telescopes and other instruments further into our galaxy, perhaps we will discover, as Dante describes in Canto XXX of the *Paradiso* of his *Commedia* (*Divine Comedy*), that the closer we approach the Truth, the closer we are to the Divine:

> O everlasting Light, you dwell alone
> In yourself, know yourself alone, and known
> And knowing, love and smile upon yourself!
>
> That middle circle which appeared in you
> To be conceived as a reflected light,
> After my eyes had studied it a while,
>
> Within itself and in its coloring
> Seemed to be painted with our human likeness
> So that my eyes were wholly focused on it.
>
> As the geometer who sets himself
> To square the circle and who cannot find,
> For all his thought, the principle he needs,
>
> Just so was I on seeing this new vision.
> I wanted to see how our image fuses
> Into the circle and finds its place in it,
>
> Yet my wings were not meant for such a flight—
> Except that then my mind was struck by lightning
> Through which my longing was at last fulfilled.
>
> Here powers failed my high imagination:
> But by now my desire and will were turned,
> Like a balanced wheel rotated evenly,
>
> By the Love that moves the sun and the other stars.

7. See time-lapse video of the Crab pulsar, as seen by the Chandra telescope.