
II. Science and Scientific Method

The Parker Solar Probe: Rendezvous with Our Exuberant Sun

by Janet G. West

“Ad astra per aspera.”

It is a rough road which leads to the stars.

Oct. 12—If you’ve seen a picture of a total eclipse of the Sun, or a video clip, or had the great, and truly awe-inspiring privilege of experiencing one—at the point of totality, the corona becomes visible, bursting out from behind the disk of the Moon. It is to this corona region that the Parker Solar Probe, launched on August 12, 2018, has been deployed; it is scheduled to arrive around November 1.

As of this writing, the Probe has successfully transmitted “first-light data” from each of its four instruments, demonstrating that they’re working well (the data serves for calibration by using celestial landmarks), and has had its first flyby past Venus on October 3.

Humanity has waited many centuries for this kind of mission; waiting for technology, design and materials to catch up with the dream of “touching the Sun.”¹

Who is Dr. Eugene Parker?

The solar wind (as we understand it) is shot out from the Sun’s corona at speeds approaching one million mph and can represent about one million tons of matter being emitted per second, in all directions. We experience it (most commonly) in the spectacular effects of its interaction with Earth’s magnetic fields and atmosphere in the

Aurorae (the Northern Lights and Southern Lights).²

It was Johannes Kepler (1571-1630), the Father of Modern Astronomy, who first hypothesized that there was some sort of “wind” or “pressure” emanating from the Sun, which caused the tails of comets always to point away from the Sun in their orbits.

But sunlight “pressure” itself couldn’t account for all of the behavior of comets and their tails; a fuller ex-

FIGURE 1



NASA

Eugene N. Parker as a young man.

planation would wait until 1943, when Cuno Hoffmeister (1892-1968), a German scientist, hypothesized the existence of a “solar wind.” Later, in 1947, Ludwig Biermann (1907-1986) also independently pointed to the existence of “solar corpuscular radiation.”

Dr. Eugene N. Parker hypothesized in 1957 how the solar wind functions,³ and developed concepts to de-

1. The concept for a “Solar Probe” dates back to “Simpson’s Committee” of the Space Science Board (National Academy of Sciences, 24 October 1958).

2. “Unlocking the Secrets of the Aurorae,” *EIR*, Vol. 45, No. 17, April 27, 2018.

3. Dr. Parker coined the term, “solar wind.”

scribe the cascade of energy from the Sun in a complex and dynamic system of plasmas, magnetic fields and high-energy particles. His theory has also suggested the existence of small and persistent “nanoflares” on the surface of the Sun which could help explain the superheated corona. He has explained that in his observations of the behavior of comets and the Sun, he immediately saw the interactions as hydrodynamic (in a spherical geometry). He worked out four lines of “simple” algebraic formulae to describe it and wrote up his findings in his first paper in 1958, “Dynamics of the Interplanetary Gas and Magnetic Fields.” He was 30 years old. [Figure 1]

Among his assertions was that the solar wind *had to be supersonic*, and this led to the development of the Sweet-Parker theory of magnetic reconnection to account for it.⁴

When he submitted his paper to the *Astrophysical Journal* (whose editor was astrophysicist Subrahmanyan Chandrasekhar), one of the reviewers commented, “This is ridiculous! Before you write a scientific paper, you should at least take the trouble of going to the library and reading up on the subject!” Dr. Parker’s response to Chandrasekhar was, “Well, he couldn’t find anything wrong with it—it must be pretty good!” Chandrasekhar overrode the reviewer’s objections and put the paper through for publication.⁵

Still, Dr. Parker’s ideas were considered very controversial at the time. Some claimed that it would be impossible for anything supersonic to be generated from the Sun, while others insisted that there was nothing but Newton’s “empty space” between the planets and the Sun. “It was something most people couldn’t seem to swallow. They expressed stern disbelief,” Parker said in an interview earlier this year.

But, it was the physics of hydrodynamics that convinced Parker that the solar wind *had to exist*, not empirical evidence per se (although that became available as space exploration expanded).⁶ Most of his peers

4. Magnetic reconnection refers to the breaking and reconnecting of oppositely directed magnetic fields lines in a plasma. In the process, magnetic field energy is converted to plasma kinetic and thermal energy. Observed in solar flares, controlled thermonuclear fusion devices (especially tokamaks) and magnetospheres of planets. In hydrodynamics a similar effect is called “reconnection of vorticity” or “reconnection of quantized vortex elements.”

5. See https://youtu.be/WH_TC9VzMUA

6. Once Mariner II got outside of the bow shock of Earth’s magnetosphere, it was able to observe solar activity and magnetic field around the Sun and confirmed the existence of the solar wind.

FIGURE 2



NASA

Dr. Parker watches the launch of the Solar Probe.

didn’t believe him, but that didn’t deter him, and with the help of some allies in the scientific community, he forged ahead.⁷ He went against the “popular opinion” of his time.

Recently, not only did NASA rename the Probe after him (the first spacecraft ever named after a living scientist), but also awarded him the Distinguished Public Service Medal—the highest honor by NASA for an individual who isn’t a government employee, recognizing excellence in scientific work for NASA and the nation.

Dr. Parker has made clear that he’s deeply honored, and that he’s very happy that he’s been proven right, but at the same time he congratulates the engineers, technicians and scientists who made it possible: “They’re the *real* heroes!” He has also said that he considers the Probe itself to be “heroic” and a “brave spacecraft” that got so close to the Sun. [Figure 2]

One of Dr. Parker’s collaborators, Dr. Angela Olinto, the University of Chicago’s Dean of Physical Sciences, commented “This represents science at its best—when you can create a theory about something, and then go out with an experiment and prove that it’s right. . . . Most of the time, we don’t get it right.”

Dr. Parker has emphasized the reality that just because you’re right, that doesn’t mean you can expect to have an easy path; he acknowledges that most science is made by someone’s standing up and proposing something very, very controversial.

If you look to the leading scientific minds of the

7. Parker jokes about the irony that he’s still here—sixty years later—and the people who disagreed with him are not.

past—going back to Plato—from Kepler to Einstein, from Madame Curie to Rosalind Franklin, from Leibniz to LaRouche—those who have made fundamental breakthroughs in scientific thought have always had to oppose the prevailing “popular opinion”—which can sometimes appear to be as strong as solar wind, but usually just winds up as a lot of hot air.

In the current culture that dominates most of North America and Europe, in which the wacky pagan-environmentalist paradigm prevails, it can take some courage to stand up for what one *knows* to be true (in the Platonic sense of knowing)—but the future of humanity depends upon it. One of our biggest challenges isn’t the environmentalists themselves, but that many among us would prefer to be fooled, to be humored into meaningless and wasteful activity such as “recycling,” and to believe that the world is “overpopulated”—because by not thinking for yourself, you manage to shirk your responsibility for the future of mankind. Humanity needs courageous people to step forward now and help lead America (and other nations) into a New Paradigm. We can learn a lesson by deliberating on the writings of the great German poet, Friedrich Schiller:

Dare to be wise! A spirited courage is required to triumph over the impediments that the indolence of nature as well as the cowardice of the heart oppose to our instruction. It was not without reason that the ancient myth made Minerva issue fully armed from the head of Jupiter, for it is with warfare that this instruction commences. From its very outset it has to sustain a hard fight against the senses, which do not like to be roused from their easy slumber. The greater part of men are much too exhausted and enervated by their struggle with want, to be able to engage in a new and severe contest with error. Satisfied if they themselves can escape from the hard labor of thought, they willingly abandon to others the guardianship of their thoughts. And if it happens that nobler necessities agitate their soul, still they cling with a greedy faith to the formula that the state and the church hold in reserve for such cases. If these unhappy men deserve our compassion, those others deserve our just contempt, who, though set free from those necessities by more fortunate circumstances, yet willingly bend to their yoke. These latter persons prefer this twilight of obscure ideas, where the feelings

have more intensity, and the imagination can at will create convenient chimeras, to the rays of truth which put to flight the pleasant illusions of their dreams. They have founded the whole structure of their happiness on these very illusions, which ought to be combatted and dissipated by the light of knowledge, and they would think they were paying too dearly for a truth which begins by robbing them of all that has value in their sight. It would be necessary that they should be already sages to love wisdom: a truth that was felt at once by him to whom philosophy owes its name.

It is therefore not going far enough to say that the light of understanding only deserves respect when it reacts on the character; to a certain extent it is from the character that this light proceeds; for the road that terminates in the head must pass through the heart. Accordingly, the most pressing need of the present time is to educate the sensibility, because it is the means, not only to render efficacious in practice the improvement of ideas, but to call this improvement into existence.⁸

The Measure of Man

Mankind developed navigation by using his mind and powers of observation, using the Sun by day and the stars by night. He used the rising and setting of the Sun and the yearly cycles to *orient* cities and major monuments. Humanity expanded the science of astronomy in very ancient times; there is evidence of sea-faring peoples successfully sailing from the regions of Polynesia to the coasts of South America; much later, the Vikings were renowned for their ability to navigate on cloudy days by using the unique properties of the Iceland Spar (or Sun Stone).

Astronavigation uses angular measurements (“sights”) between a celestial body (Sun, Moon) and the visible horizon, to locate one’s position on Earth. There are several methods of doing this, which the reader may explore on your own.

A unique feature of Earth lies between the Tropic of Cancer and the Tropic of Capricorn, over which the Sun’s rays reach the surface at a point which is perpendicular to it. This is called the “subsolar point” (or Lahaina noon, in Hawaii), which may not occur exactly at

8. Letter III of *Letters on the Aesthetic Education of Man*, by Friedrich Schiller. Translator unknown. S.E. Cassino and Company, 1884.

FIGURE 3



plus.google.com

At the Subsolar Point, there are no shadows for vertical objects.

noon, but in which an object eerily casts no shadow. [Figure 3]

The approximate measurement of the circumference of the Earth was first executed by Eratosthenes of Cyrene (276 BC - 194 BC), using this astronomical event. His method was to use an observation first in Syene (now Aswan, Egypt), known to be a certain distance from Alexandria, Egypt. On the summer solstice

at noon, a vertical measure in a sundial cast no shadow in Syene but cast a shadow of about 7.2 degrees from the vertical in Alexandria at the same time and date. Knowing the distance of the two cities, and assuming that due to the great size and distance of the Sun, that its rays to the two points were practically parallel, he calculated that the circumference of the Earth was about 250,000 stadia, or roughly 24,500 miles—very close to current measurements, which show it to be in the range of 24,860 to 24,901 miles.

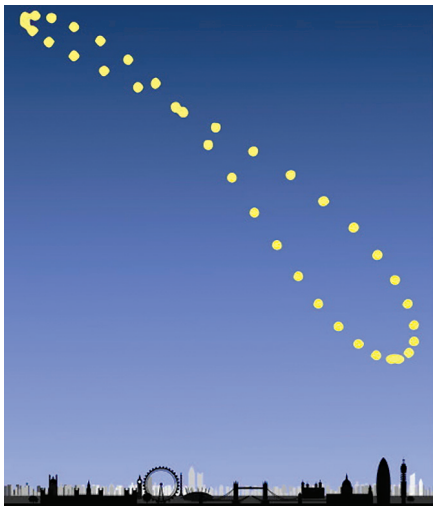
With some thought and effort, this could be replicated in schools in different cities of a known distance apart, such that the students would then actually come to know the Earth’s approximate circumference. So, why isn’t this being done?⁹

In a similar way, anyone in the Northern Hemisphere can notice that the days after the Autumnal Equinox become shorter, and in December we’ll experience the Winter Solstice, the shortest day of the year.

Using either a camera, or daily sightings on a fixed object (such as a window), if you note the position of the Sun in the sky at the same time of day throughout the year, the Sun traces out a figure-eight (analemma) in the sky above, like a string of pearls flung across the firmament. In one’s mind’s eye, imagine: What would the relationship of the Earth be to the Sun in order to account for this? What is the tilt of the Earth, in relation to the plane of its orbit around the Sun? What causes the change of the seasons? [Figure 4] and [Figure 5]

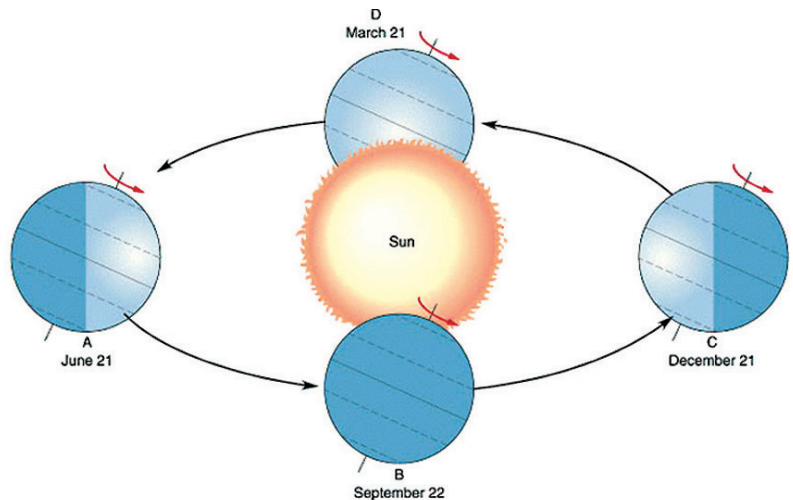
9. LaRouchePAC Live, “[How the Empire Gets You Not to Think...](#)”

FIGURE 4



The annual path of the Sun—the analemma.

FIGURE 5



The annual solstices and equinoxes.

FIGURE 6



Painting by Edwin Henry Landseer, 1851

“Scene from *A Midsummer Night’s Dream*, Titania and Bottom,” (Bottom as a Donkey).

Looking at Figure 4, the upper point on the left is the Summer Solstice, the lower right is the Winter Solstice, and the midpoint represents the equinoxes. On a globe, the northern-most point is represented by the Tropic of Cancer and the southern is the Tropic of Capricorn, where the Sun is directly overhead.

Since all of this is observable to the average person, who is it that wants to prevent you from using your mind?

‘Be Afraid... Be Very Afraid...’

They walk among us ... like the “living dead”... They look human, but they are something quite different. Like the ominous “pod-people” of the 1978 *Invasion of the Body Snatchers*, these counterfeit humanoids can usually be detected by their leech-like attachment to the viewpoint that man is simply a beast and is on a par with the animals. Like the infection of a trematode in a garden snail, the “standards” imposed by the science mafia in order to be recognized (and receive grant money), insidiously poison the budding scientific thinker or researcher, turning him or her into something akin to the zombie-like, parasite-filled snail, slowly proceeding up a stem, doing the puppet-master’s bidding—to be consumed by a predator. Those who resist are punished—their funding is cut, or they are ostracized and banished.

These “standards” are then propagated like spores, through the media, through foundations and academia,

and throughout every level of education down to kindergarten, to further corrupt the general population.

Look at a list of the so-called “most influential scientists” today,¹⁰ and what do you find?

For example, examine the likes of James Watson, Jane Goodall, and the late Stephen Hawking. Who are these “experts”? Are we to behave like that fabled Queen of the Fairies, Titania, in Shakespeare’s play *Midsummer Night’s Dream*, that we can be induced to admire and fall in love with asses? [Figure 6]

Stephen Hawking has been best known for his book, *A Brief History of Time*; Lyndon H. LaRouche demolishes its premises in an article in *EIR*:

Now, to the chapter in question [“The Arrow of Time”]. In the second paragraph of the chapter, Hawking writes: “Up to the beginning of this century people believed in an absolute time. That is, each event could be labelled by a number called ‘time’ in a unique way, and all good clocks would agree on the time interval between two events....” That statement of his, is false.¹¹

LaRouche then discusses the historical division in science—on one side, the real pioneers such as Karl Gauss, Bernhard Riemann, and Gottfried Leibniz (among others); and on the anti-human side, Newton, James Clerk Maxwell and Bertrand Russell. He decorticates Hawking’s “respectable” veneer by exposing the false axioms underlying Hawking’s outlook.

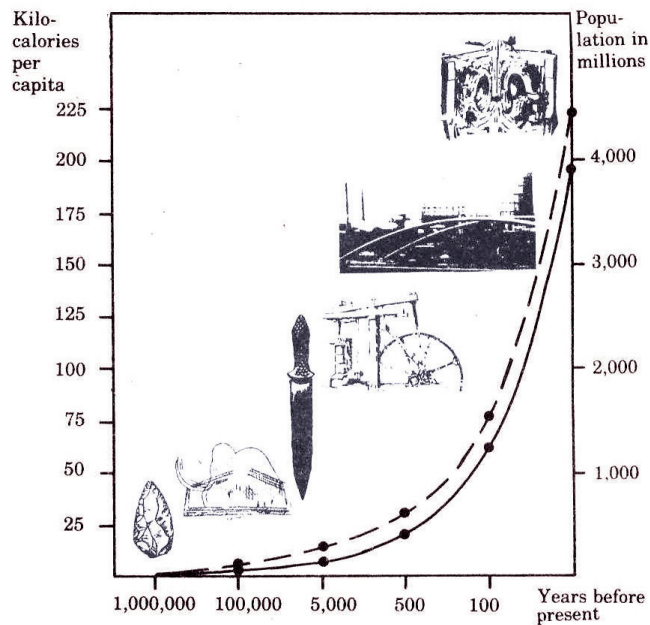
James Watson? Do you really believe he was a “co-discoverer” of the double-helix structure of DNA? This demonstrates how thoroughly various agencies and media cooperate to “airbrush out” anyone they don’t like. The true discoverer was Rosalind Franklin, who created the first X-ray diffraction images of DNA and the interpretation of those images.

And, Jane Goodall? *The “Chimp Lady”*?! A “scientist” who has the insolence to compare mankind to

10. See, for example, the list on www.bigthink.com

11. “Mathematicians Who Can’t Tell Time,” *EIR* Vol. 24, No. 23, May 30, 1997.

FIGURE 7



LaRouche, *There Are No Limits to Growth*

Historical increases in energy flux-density.

apes? According to a recent documentary,

Goodall also admits that her looks, which garnered a lot of attention, helped her get publicity while trying to secure funding for her research projects. As she notes, “And it didn’t harm either that I wasn’t born ugly. I think it helped.”¹²

So, don’t let these “experts” make a monkey out of you!

Every Human Being a Scientist!

“But,” you argue, “shouldn’t science be left to the ‘experts’? And, if a majority of ‘experts’ agree on something, then it *must* be true, right? After all, *who am I* to refute them?”

In reality, mankind’s progress over the millennia is due to our unique creative capabilities, which set mankind superior to and separate from the beasts. One might say that to be human is to think scientifically, or with the gift of Reason.

Going back to at least the time of the Babylonian Empire (about 1792 B.C.), there have been oligarchies

12. See <https://www.yahoo.com/lifestyle/jane-goodall-looks-helped-career-didnt-harm-either-wasnt-born-ugly-120040793.html>

and priesthoods that kept certain types of knowledge secreted away, to rule over men as beasts, and to keep them in darkness. But there has been a different tradition which has implicitly (or explicitly) recognized and encouraged the quality in man which enables and requires creative discovery, upwards in history through the Renaissance, and to the founding of the truly revolutionary United States of America. That quality has led not only to an increase in population, but an increase in *potential relative population-density*, through technological progress. [Figure 7]

As economist and statesman LaRouche wrote in his 1983 book, *There Are No Limits to Growth*:

The simplest of the physical principles involved in choosing among energy sources is that the higher the level of energy-flux density, the more efficient the energy source is. Not only is less heat wasted, but the higher the energy-flux density, the greater the potential of the process-heat to accomplish work.

To appreciate the importance of this ... we must consider another important kind of figure. This figure ... is named potential relative population density. ...

Given a population inhabiting a certain territory, and let that territory be measured in square-kilometers of habitable area. By developing and using the natural resources available in that area, how many people can be maintained through the work of the population’s labor force? On the average, the answer is given as the average number of persons per average square-kilometer. Persons per square-kilometer is population-density.

That figure is not an adequate measurement. Land varies in quality, so that one square-kilometer is not of the same quality for human habitation as another square-kilometer. Those desirable qualities of land, which express such differences, are variable qualities. Man may improve the land or deplete it.

The quality of land is the net result of combined depletions and improvements of its qualities. Therefore, we say that the value of all square kilometers are not the same; they are different, and they are variable. Therefore, we must measure population-density in terms of relative qualities of the land inhabited: relative population-density.

The present level of population is not necessarily a measurement of what the population level could be. We must determine what that population could become, as a maximum, given the kinds of production technologies presently in use. What is the potential level of population, given those technologies? That is the general meaning of potential relative population-density.

We have already indicated that the potential relative population-density of primitive society is about 0.06 to 0.10/square kilometer: about 10 millions maximum population. There exist today approximately 4.5 billions individuals,¹³ more than 100 times the levels of primitive man. Since a factor of “10” is called one order of magnitude, this means that mankind has raised its potential relative population-density by two orders of magnitude. With full use of existing levels of technology, combined with the thermonuclear, directed-beam, and bio-technology coming into existence now, our planet could sustain a population of tens of billions of persons, and at an average standard of living higher than that for the United States during the early 1970s: a rise above primitive society by three order of magnitude.

No beast, or any other lower form of life could willfully increase in potential relative population-density by even one order of magnitude. [Emphasis added] Man is fundamentally different from the beasts. Man is not merely a creature of instinctive potentialities, a mere creature of animal-like perceptions of pleasure and pain. Man is somehow very different. Man has the potential of Reason, the power to make creative discoveries which advance his scientific knowledge, and to convert such scientific advances into advances in technology. We are able to uncover, with increasing perfection, the lawful, universal principles which order universal creation, and to master nature with increasing power, through guiding ourselves to change our ways of behavior in accordance with universal laws.

The successive technological advances accumulated by human culture ... have increased man’s potential relative population density by between two and three orders of magnitude.

This technological progress, this increase in human potential, has been accomplished by an increasing command over energy. Beginning with the agricultural revolution, and ocean fishing in boats earlier, mankind has increased the amount of useful energy available to the average individual, and has increased the number of kilowatt-hours’ value of the amount of usable energy obtained by society per square-kilometer. Today, we can roughly measure the fertility of agricultural land by the amount of “artificial energy” used per hectare by the farmer: chemical energy of fertilizers, trace element additions, pesticides, and electrical and other industrially produced energy forms used for irrigation, powered machinery, and so forth. Similarly, in industry and transportation, the productive powers of the average member of the labor force are measured in first approximation by the amount of industrially-produced energy used per capita.

This technological progress is not merely an available option. The authors of the *Limits to Growth* are right on one point, although perhaps this was an unintentional feature of their book. *If, at any point, we halt technological progress, the society foolish enough to do such a thing condemns itself to die.* [Emphasis added]

There is no such thing as the “balance of nature”; the idea of a “homeostatic” universe is a fraud. Anyone who promotes “zero-growth” for mankind is proposing a genocide that would dwarf that of the Nazis. The world needs more people, living at a higher living standard than the most advanced areas of the world currently enjoy. This can be done through technological progress, and the development of new resources and energy sources with a high energy-flux density, such as controlled thermonuclear fusion.

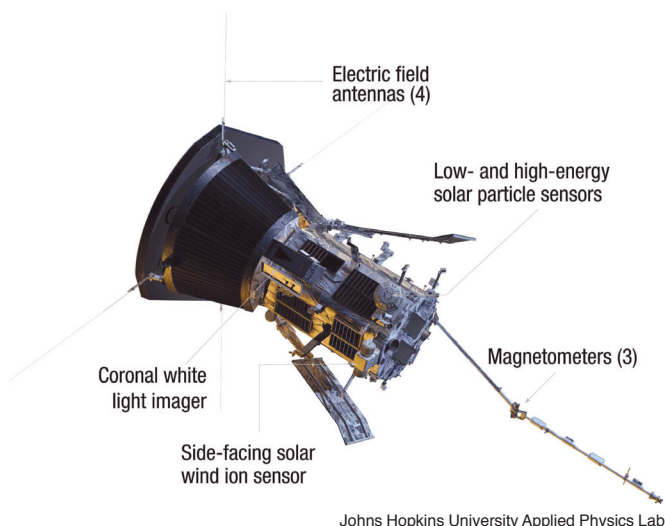
It is especially through space exploration that we can advance our civilization, and better understand nonlinear events and man’s true purpose and mission in the universe.

The Spacecraft with Attitude

The Parker mission is part of NASA’s “Living with a Star” program, and our Sun is the only star to which we can get very close, allowing observations of the corona—and the solar wind, which accelerates rapidly

13. We are now edging close to 8 billion people on Earth.

FIGURE 8



The Parker Solar Probe.

from subsonic to supersonic—and a better understanding of the complex dynamics that affect space weather. The mission to send a probe to the Sun has been in development for about ten years, and has involved hundreds (if not thousands) of engineers, technicians, and other scientists to bring it to the launch pad. [Figure 8]

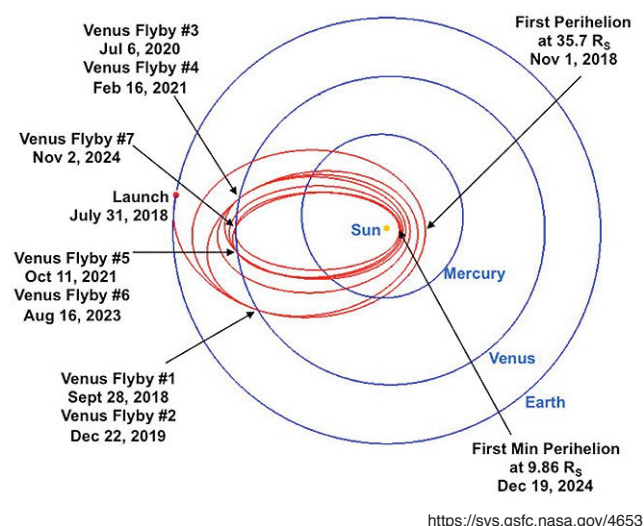
The Probe will be traveling at 430,000 mph in its journey around the Sun. By comparison, the Earth is moving at about 67,000 mph in our orbit around the Sun (and the entire galaxy is moving at about 1.3 million mph through space).

The original plan was to have the Parker Solar Probe orbit over the poles of the Sun, and to use Jupiter for gravity assist, but this would have meant only two solar passes. However, the then project manager for the mission, Andy Dantzler (who passed away in 2011 at age 49), intervened, and suggested that instead the mission move to an orbit on the ecliptic, which allows more robust readings of the solar wind. This new trajectory allows *over 900 hours* within about 8 million miles of the Sun! This underscores the key role that an individual leader can have, at the right moment.

The mission has three primary science objectives, to—

- Trace the flow of energy that heats and accelerates the solar corona and solar wind;
- Determine the structure and dynamics of the plasma and magnetic fields at the sources of the solar wind; and

FIGURE 9



Successive orbits of the Probe.

- Explore mechanisms that accelerate and transport energetic particles.

It is more difficult to launch toward the Sun than to launch into the outer Solar system. This has to do with orbital mechanics—the study of how natural forces influence the motions of planets and comets, as well as of rockets, satellites and other space-bound technology.¹⁴ It might seem “effortless” to fall toward the Sun—since its gravity is so pervasive—but the Earth is also moving at great speed, and, along with the stability of the orbit itself, it resists the pull from the Sun. To travel from the Earth to Mars only requires a slight increase in orbital speed; but to go inwards to the inner Solar system, the momentum must be slowed down.

Normally, when a “gravity-assist” is used by a spacecraft, it moves on a trajectory into a narrow gravitational band around a planet, to sling the spacecraft out further at a faster rate of speed. But, when moving inwards within the Solar system, the gravity-assist is used to slow down a spacecraft. The Probe will make 24 passes around Venus during its lifetime; on its final passes, it will fly closer than 4 million miles from the Sun. After its mission, the Probe will drop further into the corona, and merge with the Sun. [Figure 9]

The big design issue for the Probe was how to design the instruments such that they can not only withstand

14. Unbeknownst to many, a certain IPCC expert, in a brief moment of sanity, was planning a manned space mission to the Sun; but he decided on a night launch to prevent the spacecraft from burning up.

heat and radiation enough to make significant measurements, but also withstand the coldness of space as it swings out around Venus.

Since some of the instruments measure magnetic fields, the engineers had to ensure as little magnetic interference as possible by the guidance and power systems. As the Probe passes by the Sun, it will be taking measurements, and then as it orbits back around Venus, it will talk to Earth about three times a week to download its data and transmit a beacon tone which indicates spacecraft health and status.

The instruments on the Probe and short descriptions of what they measure are as follows:

FIELDS—This instrument suite of five antennas will measure the scale and shape of the electric and magnetic fields of the Sun’s near atmosphere, including the waves and turbulence within the heliosphere, to better understand its activity, especially magnetic field reconnection, in which magnetic field lines break and then realign explosively.

Four of the antennas will project beyond the heat shield, experiencing temperatures in the range of 2,500°F. The fifth will remain behind the heat shield, and is set perpendicular to the others, so that altogether they can recreate a three-dimensional picture of the solar wind.

WISPR—The Wide-Field Imager for the Parker Solar Probe is the only imaging instrument onboard, taking images of the coronal mass ejections (CMEs). It will look at the large-scale structure of the corona and solar wind before the spacecraft flies through it. The device will be behind the heat shield, and uses specially designed baffles and occulters to reflect and absorb stray light that may be reflected by other parts of the Probe. The WISPR uses two cameras with radiation-hardened Active Pixel Sensor CMOS detectors.

SWEAP—This is the Solar Wind Electrons, Alphas and Protons investigation, and uses two complementary instruments: The Solar Probe Cup (SPC, aka Faraday Cup), and the Solar Probe Analyzers, or SPAN. These instruments will count the particles within the solar wind (such as electrons, protons and helium ions) and measure properties such as velocity, polarization, density and temperature of the solar wind and coronal plasma. This instrument, along with the others, will be able to image the Sun in three dimensions.

IS☉IS—Incorporating the symbol for the Sun in its acronym (pronounced “EE-sis”), the Integrated Sci-

ence Investigation of the Sun uses two complementary instruments to measure particles across a wide range of energies, and will help the investigation of their lifecycles—how they are generated, where they come from, how they become accelerated and how they continue to travel throughout interplanetary space.

However, the real “star of the show” is the design and construction of the systems that protect and power the craft. The Probe has an autonomous computer system onboard that can gauge the heat impacting it, and can move the solar panels behind the heat shield, or bring them forward, depending on the surroundings. When it goes behind the Sun, it can’t receive or transmit data or commands from Earth, so it is also able to detect its orientation, such that if the bulk of the craft isn’t safely behind the heat shield, it will precisely maneuver itself to point the heat shield directly at the Sun, to safeguard the instruments (the center of gravity must be behind the center of force on the shield).

The solar panels have shoulder joints, and so can fold like wings behind the heat shield. They and the entire craft are enveloped in a cooling system, because—ironically—the Sun’s heat and power are too great for solar panels to withstand once it gets close. At its closest point, the panels will fold up almost entirely, with only the tips peeking out from behind the shield—and this will provide more than sufficient power for the craft and all of its instruments.

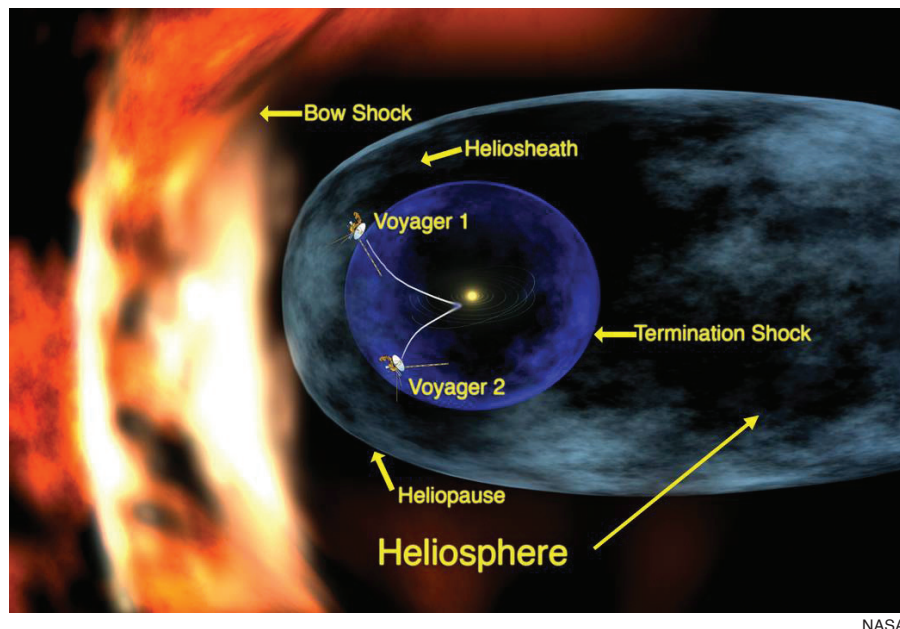
TPS—The Thermal Protection System comprises the heat shield and the cooling system. The heat shield is eight feet in diameter, weighs about 160 pounds, is about 97% air, and must safeguard the entire craft in its shadow. There are two panels of superheated carbon-carbon, sandwiching a lightweight 4.5-inch-thick carbon foam core. The Sun-facing side is also sprayed with a specially formulated white ceramic coating to help reflect as much as the Sun’s heat as possible. This means that although the Sun-facing side will be around 2,500°F, the shaded side will be in the range of 80-85°F.

But, the instruments will only tell part of the story; the issue is: what is the mindset of those interpreting the data?

Heavenly Magnetism

Using your Reason, take an astronomical step back from Earth, as if we were viewing it from many millions of miles out in space; we see that our globe, as well as much of the Solar system, lives *within* the atmo-

FIGURE 10



NASA

Artist's representation showing our Solar system as a blue sphere with the yellow Sun in its center, surrounded by the lighter blue, oval-shaped Heliosheath, within interstellar space.

sphere of the Sun. There are complicated relationships between the orbits, the solar wind and the magnetospheres of the planets, which are still under investigation.

Figure 10 shows the immense environment within which the Earth is bathed. The solar wind extends far out beyond the Solar system; beyond it is interstellar space. Earth and all the planets of our Solar system are in constant interaction with the solar wind, as well as

FIGURE 11A



NASA

Static representation of the heliospheric current sheet with inner planets.

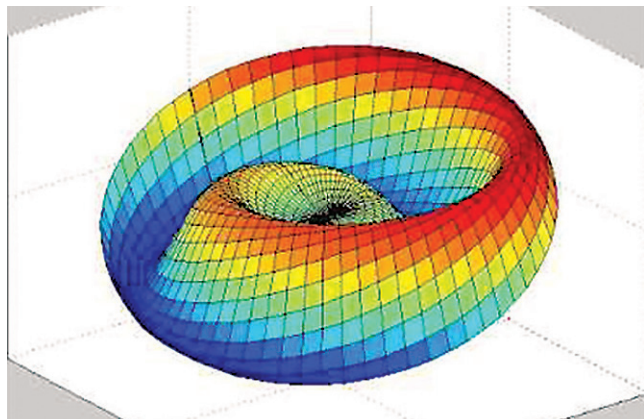
cosmic rays from various origins.

Dr. Parker hypothesized the nature of the magnetic field generated by the Sun, and the shape that it takes as the Sun rotates (also known as the “heliospheric current sheet”). Figure 11A and 11B show first the static picture of the electromagnetic sheet (not so smooth in reality), and the dynamic view demonstrating how the field changes with the 11-year minimum-maximum activity cycle of the Sun (view the 15-second animation of Figure 11B). This has been generally associated with increasing and decreasing activity of sunspots, but the details of that interaction are currently unknown.

The Sun's magnetic field is reversing in polarity when this occurs; the waves increase in size during this reversal every 11 years. Within these cycles, the shape and intensity of the Sun's magnetic fields, sunspots and solar wind are also changing, which in turn affect the intensity of thunderstorms and the frequency of lightning bolts here on Earth, as well as other space weather.¹⁵

15. “Sun's magnetic field affects frequency of lightning strikes on Earth,” <https://physicsworld.com/a/suns-magnetic-field-affects-frequency-of-lightning-strikes-on-earth/>

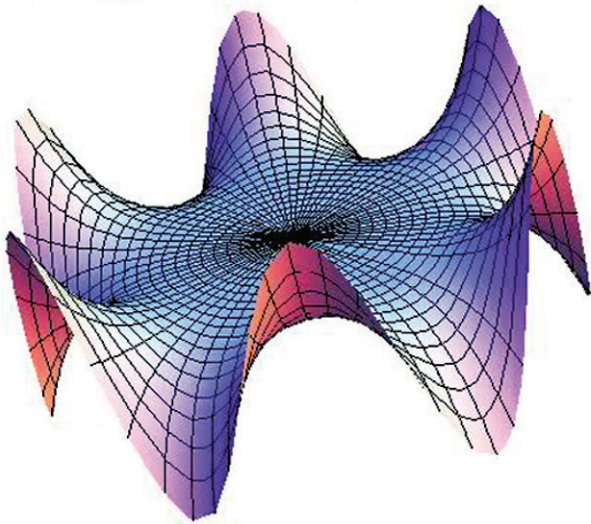
FIGURE 11B



Benacor on YouTube

Screenshot from a computer animation of the heliospheric current sheet during the Sun's 11-year magnetic cycle.

FIGURE 12



mathforum.org

Representation of a constant negative Gauss curvature.

It is currently unknown exactly how these variations occur; currently, there's no known correlation between the flipping of the Sun's magnetic poles and the Earth's. Ironically, although cosmic rays are an ever-present challenge to space travel, the sheath has a dampening effect on them, such that the inner Solar system is somewhat shielded; ongoing research is investigating this activity to answer these questions.

Figure 11B reminds one of the topography of a Gaussian Surface [**Figure 12**], especially if one imagines such a surface in rotation. What relationships could there be between these two representations, in terms of gravity and the electromagnetic fields?

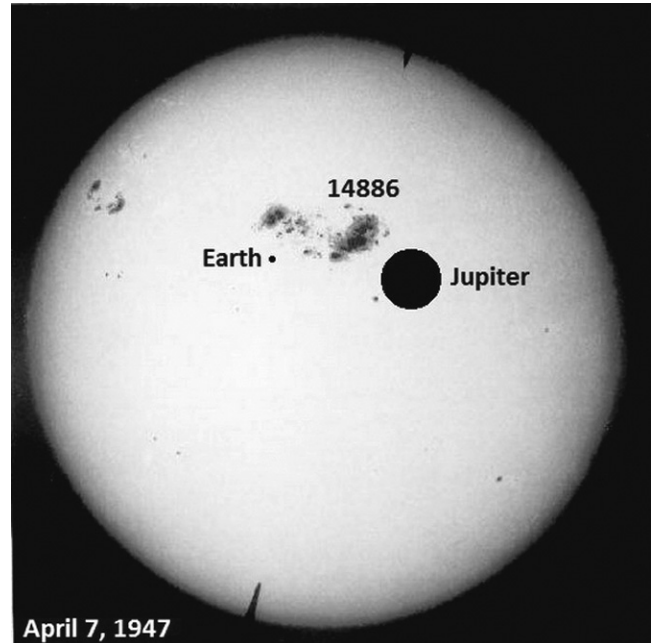
And, it is important to bear in mind that our Solar system is also rotating within and around our entire galaxy, and so is subject to many influences. It is obvious that man's activities—such as “carbon emissions”—are minuscule compared to these massive dynamics. [**Figure 13**]

We have to get “up close and personal” with the Sun to begin to answer the many questions we have about the corona, solar flares and CMEs. As the Parker Solar Probe begins transmitting data, we anticipate breathtaking new discoveries and challenges.

Burning Questions

A schematic of the Sun's generalized structure can be found in any basic astronomy book

FIGURE 13

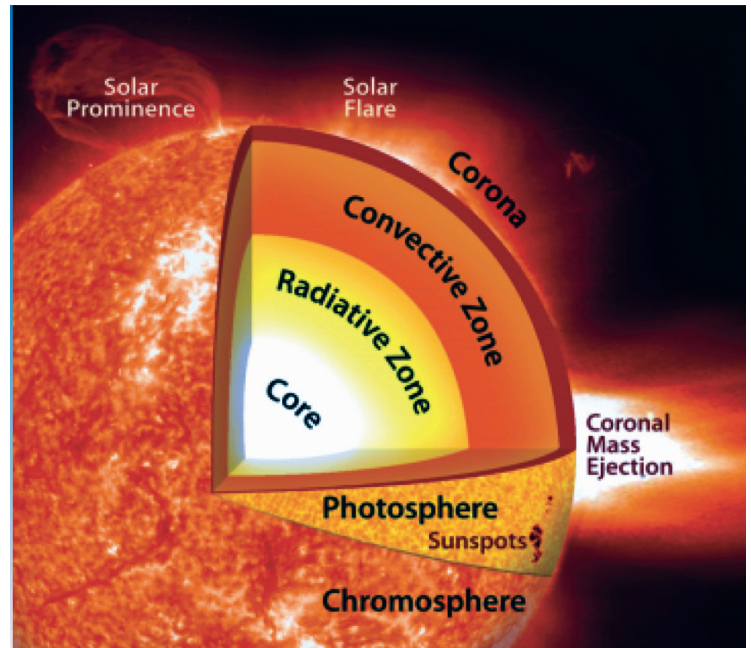


San Jose Astronomical Society

Size of the Earth compared to that of Sunspot 14886 on the white disk of the Sun.

or on many websites; an illustration is included here for quick reference. [**Figure 14**] And, even though illustrations and scientific articles refer to “the Sun's surface,” it should be understood that no star truly

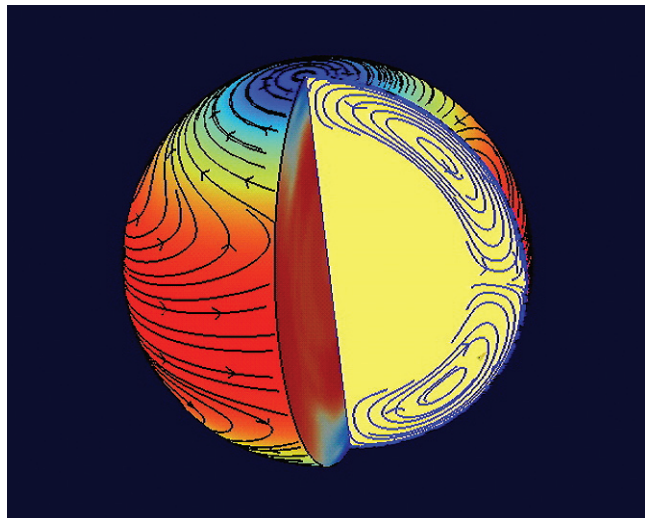
FIGURE 14



AGI/Kathleen Cantner

Representation of a cutaway of the Sun.

FIGURE 15



Utah Physics Department

Representation of a cutaway of the Sun, showing differential rotation in iso-rotation contours.

has a “surface,” in our normal sense of the word.

The Sun accounts for 99.86% of the total mass of the Solar system. Its internal engine is fueled by nuclear fusion at its core; the Sun’s magnetic field is generated by a hydromagnetic dynamo operating in its interior. It has been well-known that the Sun rotates differentially—the equatorial portion spins faster than the polar portion. [Figure 15] Additionally, the different layers within the Sun rotate at different speeds, and because of these motions a transition region is formed (a shearing effect), called the solar tachocline. This region lies between the radiative interior and the differentially rotating outer convective zone; it is believed to have a thickness of less than 0.05 solar radii, and is subjected to extreme radial and latitudinal shearing.

The mechanisms behind the formation of the tachocline are still disputed, but overall, scientific research attempting to forecast its behavior has had more success with a magnetohydrodynamic, over a merely hydrodynamic, representation. A particular quality of the tachocline is that it tenaciously defies the Second Law of Thermodynamics¹⁶—it remains stable

16. The Second Law of Thermodynamics is a political fraud, explaining neither the development of the biosphere nor the mind of Man. For further discussion, see “Toppling the Tyranny of the 2nd Law of Thermodynamics,” *EIR*, Vol. 39, No. 11, March 16, 2012.

amidst turbulence both above and below it. Could something like this dynamic be replicated on Earth with an intent to assist the effort for controlled thermonuclear fusion?

Although still under intense research, the tachocline plays a key role in the process of magnetic field generation, not only in our Sun, but also in other stars. It seems to have the function of a dynamo in generating or amplifying magnetic fields, but it is beyond the scope of this article to discuss it in detail.

The Sun’s convection zone generates sound waves continuously, due to this turbulence. The sound waves themselves will usually start at the surface and travel into the interior; due to the changing temperatures as they near the core, the sound waves bend, and are refracted back toward the surface. This continuous internal bombardment of the solar surface causes the entire Sun to vibrate, like a bell or a drum.¹⁷ The sound waves form what is known as a “standing wave”; how might this relate to experiments done with a [drum surface sprinkled with sand](#), in which different configurations develop spontaneously based on the frequency played? [Figure 16] Could this be fruitful line of work, possibly in relation to work on controlled fusion? Could a “standing wave” of plasma be generated to create a region of stability that could augment the fusion reaction? Could a plasma be “tuned?”

Recent research has shown that these sound waves are eventually conducted to the surface along magnetic field lines, which could help answer the question as to why the corona is so much hotter than the surface. Once at the surface, they propel fountains of hot gas (spicules) thousands of miles into space, overcoming a gravity pull which is about 27 times that of Earth’s. They may also be a part of sunspot activity, although at this time the details are unknown.¹⁸

These sound waves are not transmitted into space, and are not heard, although NASA scientists have

17. See <https://www.cora.nwra.com/~werne/eos/movies/oscillate.mpeg>. This is a short and exaggerated animation of these sound waves. The regions of the Sun that are moving outward are red, and the blue are moving inward. If you were on the surface of the Sun, you would go up and down, like riding a wave. This only shows a single vibration mode; the Sun has many modes. Another short animation shows some actual motions of the Sun’s surface: https://www.cora.nwra.com/~werne/eos/movies/hr_V_short.mpg

18. See <https://www.space.com/3882-sound-waves-travel-sun-magnetic-field.html>

“translated” some of the electromagnetic activity into audible sound.¹⁹

Coronal Mass Ejections

The corona is unstable and produces the solar wind, solar flares and coronal mass ejections (CMEs); millions of tons of highly magnetized plasma can erupt from the Sun, varying in speed from about 9,000 mph to over a million mph.²⁰

As described on the website of the National Oceanographic and Atmospheric Agency (NOAA):

The more explosive CMEs generally begin when highly twisted magnetic field structures (flux ropes) contained in the Sun’s lower corona become too stressed and realign into a less tense configuration—a process called magnetic reconnection. This can result in the sudden release of electromagnetic energy in the form of a solar flare; which typically accompanies the explosive acceleration of plasma away from the Sun—the CME. These types of CMEs usually take place from areas of the Sun with localized fields of strong and stressed magnetic flux; such as active regions associated with sunspot groups. CMEs can also occur from locations where relatively cool and denser plasma is trapped and suspended by magnetic flux extending up to the inner corona—filaments and prominences. When these flux ropes reconfigure, the denser filament or prominence can collapse back to the solar surface and be quietly reabsorbed, or a CME may result. CMEs travelling faster than the background solar wind speed can generate a shock wave. These shock waves can accelerate charged particles ahead of them—causing increased radiation storm potential or intensity.²¹

Although Earth is currently unprepared to withstand a powerful CME—which would blow out electrical transformers and severely disrupt satellite communications—one obvious solution would be to rebuild and upgrade our power grid and other technol-

ogies to make us less vulnerable. Power companies might opt to take transformers offline before a storm strikes, resulting in inconvenient blackouts, but not long-term devastation.

“Coronal holes” are another area of interest; they appear as dark areas in extreme ultraviolet (EUV) and soft X-ray solar images. They appear dark because they are cooler and less dense than the surrounding plasma, and are regions of open, unipolar magnetic fields. This allows the solar wind to escape more readily. When sighted by astronomers, they are monitored very closely by several agencies; if a major CME were to be expelled through this region, it could impact Earth massively. Larger, more expansive coronal holes can often be a source of high solar wind speeds that buffet Earth and its magnetosphere for several days.

Bringing Mysteries to Light

Adding to the mysteries of the Sun, recent research²² has revealed that there is not one, but two types of solar wind (using the highly technical terms of “fast” and “slow”). The “slow” solar wind moves at around 700,000 mph, and it appears to be originating from the activity of the magnetic reconnections occurring constantly across the Sun. Understanding the source of the solar wind will also contribute to better forecasting of space weather. The fast solar wind can travel up to 1.7 million mph, and through study of its composition, scientists know that it emanates from the interior of “coronal holes”—areas in which the corona is darker and cooler.

The Goddard Space Flight Center team found something stunning about the slow wind:

“We found that the density and charge state composition of the slow solar wind rises and falls every 90 minutes, varying from what is normal [for] slow wind to what is [normal for] fast,” Viall said. “But [its] speed was constant at a slow wind speed. This could only be created by magnetic reconnection at the Sun, tapping into both fast and slow wind source regions.”²³

19. See <https://www.nasa.gov/feature/goddard/2018/sounds-of-the-sun>

20. The largest solar storm on record on Sept. 1-2, 1859, known as the “Carrington Event,” named for the British amateur astronomer Richard Carrington.

21. See www.swpc.noaa.gov

22. “Implications of L1 observations for slow solar wind formation by solar reconnection,” <https://agupubs.onlinelibrary.wiley.com/doi/full/10.1002/2016GL068607>. The “L1” refers to a point in space between the Earth and Sun where the SOHO and Deep Space Climate Observatory are stationed. It gives an uninterrupted view of the Sun.

23. Nicholeen Viall, solar scientist with Goddard Space Flight Center; www.nasa.gov/feature/goddard/2016/swept-up-in-the-solar-wind

Another team member noted:

“It has been thought that the magnetosphere rang like a bell when the solar wind hit it with a sudden increase in pressure,” said Larry Kepko, a magnetospheric scientist at Goddard. “We went in for a closer look and found these periodicities in the solar wind [itself]. The magnetosphere was acting more like a drum than a bell.”²⁴

“If we can understand this phenomenon here, where we can actually measure the magnetic field, we can get a better handle on how these fundamental physics processes take place in other places in the Universe,” Viall said.

The physics of the corona and inner heliosphere connect the activity of the Sun to the environment and the technological infrastructure of Earth; discovering more will drive the physical understanding of the heliosphere, aurora, and magnetosphere of Earth and other planets; and it will help us to improve satellite communications, power grid issues, pipeline erosion, radiation exposure on airline flights, and astronaut safety.

What Lies Ahead

What the Probe will unveil about the nature of our Sun and our Universe in the coming seven years, can propel the economies of many nations of the world into increased productivity, and increase the optimism of young people to look forward to the future with excitement.

The larger mission is that we Americans must defeat the current British-led attack against President Donald Trump, so that he is free to carry out his election mandate; we must now bring all of humanity into the New Paradigm for Civilization, and address the fundamental economic questions which can provide a grand future. If we do not—and that rapidly—then the data transmissions from the Probe will fall upon deadened ears; our civilization will be incapable of responding.

As the economic genius Lyndon H. LaRouche reminds us:

Man is fundamentally different from the

24. Ibid.

beasts. . . . Man has the potential of Reason, the power to make creative discoveries which advance his scientific knowledge, and to convert such scientific advances into advances in technology. We are able to discover, with increasing perfection, the lawful, universal principles which order universal creation, and to master nature with increasing power.²⁵

It is notable that several of the engineers, technicians and scientists in leading positions in this mission are younger people in their twenties and thirties. What an optimistic perspective it would be to see this as the future of our youth, globally, instead of drug addiction, or worse—a job on Wall Street. One young astronomer summed it up beautifully: She remarked that some people look up at the stars and feel very small, but when she looks up at the heavens, she marvels that mankind is the only species able to contemplate and comprehend the Universe. The youth of America has a vital role to play in the creation of a new economic and cultural Renaissance, led in large part by the youthful thinkers within the LaRouche political movement worldwide.

China is already making great strides to help develop several African nations; think of the young adults in the many nations of Africa, and how they could be a part of a mission to develop our entire planet. If we don't address the question of economic and technological development, under present conditions they won't live long enough to participate in these opportunities.

Just as past generations have struggled and fought passionately—in a variety of ways—to ensure that we the living have the potential for a future, so we can also call up those strengths—and a quality of *agapē*—in ourselves and in others, to lay the foundations for those yet unborn to have a future worthy to be called human.

Editor's note: As we go to press, the Parker Solar Probe is due to make its first (and closest) of its 24 approaches to the Sun on November 5. It is already closer than any previous spacecraft.

25. *There are No Limits to Growth*, by Lyndon H. LaRouche. Club of Life, 1983.