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Space & Physics

Galactic Wormholes

DOES THE MOVEMENT OF STARS AT THE CENTER OF THE MILKY WAY REVEAL TUNNELS THROUGH SPACETIME?

WITH COVERAGE FROM nature

Plus:

A QUANTUM-COMPUTING GOLD RUSH

GRAPHENE ELECTRONICS BOOM

WATER ON EXOPLANET 124 LIGHT-YEARS AWAY

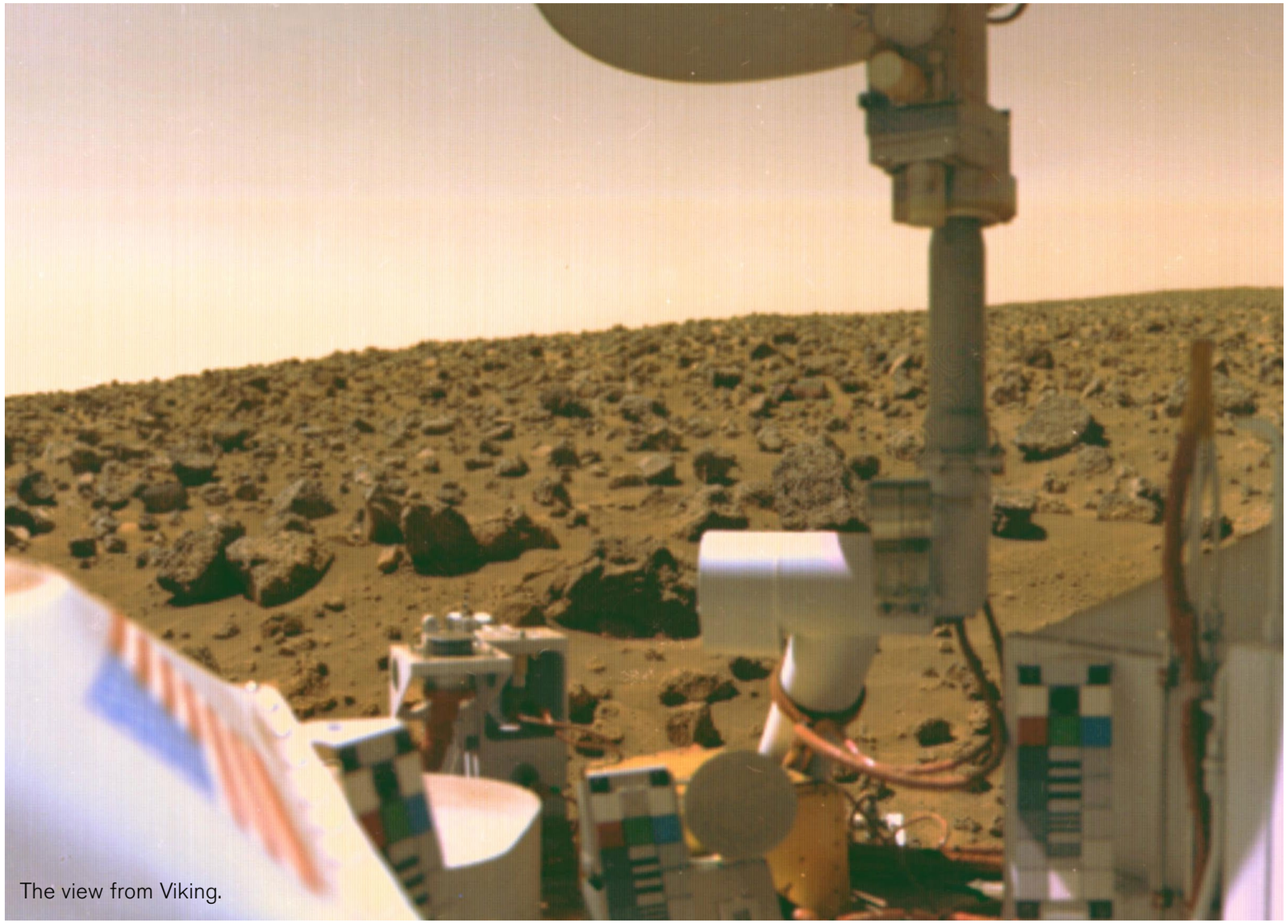
WE'RE DUE FOR A GEOMAGNETIC SUPERSTORM

Gilbert V. Levin is an engineer and inventor. He was the principal investigator of the Labeled Release experiment on NASA Viking missions to Mars in the 1970s.

SPACE

I'm Convinced We Found Evidence of Life on Mars in the 1970s

The Labeled Release experiment on the Viking mission reported positive results, although most have dismissed them as inorganic chemical reactions



The view from Viking.

NASA

We humans can now peer back into the virtual origin of our universe. We have learned much about the laws of nature that control its seemingly infinite celestial bodies, their evolution, motions and possible fate. Yet, equally remarkable, we have no generally accepted information as to whether other life exists beyond us or whether we are, as was Samuel Coleridge's Ancient Mariner, "alone, alone, all, all alone, alone on a wide wide sea!" We have made only one exploration to solve that primal mystery. I was fortunate to have participated in that historic adventure as experimenter of the Labeled Release (LR) life-detection experiment on NASA's spectacular Viking mission to Mars in 1976.

On July 30, 1976, the LR returned its initial results from Mars. Amazingly, they were positive. As the experiment progressed, a total of four positive results, supported by five varied controls, streamed down from the twin Viking spacecraft that landed some 4,000 miles apart. The data curves signaled the detection of microbial respiration on the Red Planet. The curves from

Mars were similar to those produced by LR tests of soils on Earth. It seemed we had answered that ultimate question.

When the Viking Molecular Analysis Experiment failed to detect organic matter, the essence of life, however, NASA concluded that the LR had found a substance mimicking life, but not life. Inexplicably, over the 43 years since Viking, none of NASA's subsequent Mars landers has carried a life-detection instrument to follow up on these exciting results. Instead the agency launched a series of missions to Mars to determine whether there was ever a habitat suitable for life and, if so, eventually to bring samples to Earth for biological examination.

NASA maintains the search for alien life among its highest priorities. On February 13, 2019, NASA administrator Jim Bridenstine said we might find microbial life on Mars. Our nation has now committed to sending astronauts to Mars. Any life there might threaten them, and us, on their return. Thus, the issue of life on Mars is now front and center.

Life on Mars seemed a long shot. On the other hand, it would take a near miracle for Mars to be sterile. NASA scientist Chris McKay once said that Mars and Earth have been "swapping spit" for billions of years, meaning that, when either planet is hit by comets or large meteorites, some ejecta shoot into space. A tiny fraction of this material eventually lands on the other planet, perhaps infecting it with microbiological hitchhikers. That some Earth microbial species could survive the Martian environment has been demonstrated in many laboratories. There are even reports of the survival of microorganisms exposed to naked space outside the International Space Station (ISS).

NASA's reservation against a direct search for microorganisms ignores the simplicity of the task accomplished by Louis Pasteur in 1864. He allowed microbes to contaminate a hay-infusion broth, after which bubbles of their expired gas appeared. Prior to containing living microorganisms, no bubbles appeared. (Pasteur had earlier determined that heating, or pasteurizing, such a substance would kill the microbes.) This elegantly simple test, updated to substitute modern microbial nutrients with the hay-infusion products in Pasteur's, is in daily use by health authorities around the world to examine potable water. Billions of people are thus protected against microbial pathogens.

This standard test, in essence, was the LR test on Mars, modified by the addition of several nutrients thought to broaden the prospects for success with alien organisms, and the tagging of the nutrients with radioactive carbon. These enhancements made the LR sensitive to the very low microbial populations postulated for Mars, should any be there, and reduced the time for detection of terrestrial microorganisms to about one hour. But on Mars, each LR experiment continued for seven days. A heat control, similar to Pasteur's, was added to determine whether any response obtained was biological or chemical.

The Viking LR sought to detect and monitor ongoing metabolism, a very simple and fail-proof indicator of living microorganisms. Several thousand runs were made, both before and after Viking, with terrestrial soils and microbial cultures, both in the lab and in extreme natural environments. No false positive or false negative result was ever obtained. This strongly supports the reliability of the LR Mars data, even though their interpretation is debated.

In her recent book *To Mars with Love*, my LR co-experimenter Patricia Ann Straat provides much of the scientific detail of the Viking LR at the lay level. Scientific papers published about the LR are available on my Web site.

In addition to the direct evidence for life on Mars obtained by the Viking LR, evidence supportive of, or consistent with, extant microbial life on Mars has been obtained by Viking, subsequent missions to Mars and discoveries on Earth:

- Surface water sufficient to sustain microorganisms was found on Mars by Viking, Pathfinder, Phoenix and Curiosity;
- Ultraviolet (UV) activation of the Martian surface material did not, as initially proposed, cause the LR reaction: a sample taken from under a UV-shielding rock was as LR-active as surface samples;
- Complex organics, have been reported on Mars by Curiosity's scientists, possibly including kerogen, which could be of biological origin;
- Phoenix and Curiosity found evidence

that the ancient Martian environment may have been habitable.

• The excess of carbon 13 over carbon 12 in the Martian atmosphere is indicative of biological activity, which prefers ingesting the latter;

• The Martian atmosphere is in disequilibrium: its CO_2 should long ago have been converted to CO by the sun's UV light; thus, the CO_2 is being regenerated, possibly by microorganisms as on Earth;

• Terrestrial microorganisms have survived in outer space outside the ISS;

• Ejecta containing viable microbes have likely been arriving on Mars from Earth;

• Methane has been measured in the Martian atmosphere; microbial methanogens could be the source;

• The rapid disappearance of methane from the Martian atmosphere requires a sink, possibly supplied by methanotrophs that could co-exist with methanogens on the Martian surface;

• Ghostlike moving lights, resembling will-o'-the-wisps on Earth that are formed by spontaneous ignition of methane, have been video-recorded on the Martian surface;

• Formaldehyde and ammonia, each possibly indicative of biology, are claimed to be in the Martian atmosphere;

• An independent complexity analysis of the positive LR signal identified it as biological;

• Six-channel spectral analyses by Viking's imaging system found terrestrial lichen and green patches on Mars rocks to have the identical color, saturation, hue and intensity;

• A wormlike feature was in an image taken by Curiosity;

• Large structures resembling terrestrial stromatolites (formed by microorganisms) were found by Curiosity; a statistical analysis of their complex features showed less than a 0.04 percent probability that the similarity was caused by chance alone;

• No factor inimical to life has been found on Mars.

In summary, we have: positive results from a widely used microbiological test; supportive responses from strong and varied controls; duplication of the LR results at each of the two Viking sites; replication of the experiment at the two sites; and the failure over 43 years of any experiment or theory to provide a definitive nonbiological explanation of the Viking LR results.

What is the evidence against the possibility of life on Mars? The astonishing fact is that there is none. Furthermore, lab studies have shown that some terrestrial microorganisms could survive and grow on Mars.

NASA has already announced that its 2020 Mars lander will not contain a life-detection test. In keeping with well-established scientific protocol, I believe an effort should be made to put life-detection experiments on the next Mars mission possible. My co-experimenter and I have formally and informally proposed that the LR experiment, amended with an ability to detect chiral metabolism, be sent to Mars to confirm the existence of life: nonbiological chemical reactions do not distinguish between "left-handed" and "right-handed" organic molecules, but all living things do.

Moreover, the Chiral LR (CLR) could confirm and extend the Viking LR findings. It could determine whether any life detected were similar to ours or whether there was a separate genesis. This would be a fundamental scientific discovery in its own right. A small, lightweight CLR has already been designed and its principle verified by tests. It could readily be turned into a flight instrument.

Meanwhile a panel of expert scientists should review all pertinent data of the Viking LR together with other and more recent evidence concerning life on Mars. Such an objective jury might conclude, as I did, that the Viking LR did find life. In any event, the study would likely produce important guidance for NASA's pursuit of its holy grail.