# Fifty minutes of data from the surface of Venus

Venus has been a prime target of the Soviet unmanned space program during the last 10 years. The results of the Soviet efforts are now paying off. Venus 4, 5, 6 and 7 all descended through the dense Venusian atmosphere on the night side of the planet. Venus 8 landed July 22 on the daylight side (SN: 7/29/72, p. 72).

This week Soviet scientists reported analyses of Venus 8's measurements of the physical and chemical characteristics of the atmosphere and surface. The reported surface pressures and temperatures are similar to those found by Venus 7. The redesigned Venus 8 craft found the surface rocks at the site to be similar in composition to terrestrial granite.

According to Tass, the spacecraft parachuted through the atmosphere for nearly an hour before softlanding. It continued to transmit data for 50 more minutes from the surface. The report details the complexities of landing on the small section of the planet that was both in daylight and facing earth. At the time, Venus was between the sun and earth, and only a narrow crescent of the lighted portion was visible from earth. The target landing site was therefore limited to an area less than 500 kilometers in diameter.

From results of earlier Venus probes, Soviet scientists had devised a model of the Venusian atmosphere and surface, including temperatures and pressures at varying altitudes down to the surface. Although the Venusian day lasts nearly four terrestrial months, their calculations indicated that daily changes in the surface temperatures are not large. Venus 8 verified this hypothesis.

Measurements began at an altitude of 55 kilometers and continued to and on the surface. From these data, the scientists conclude that "there are no noticeable differences in temperatures and pressures at [given] altitudes on the day and night sides of Venus. The temperature at the surface was 470 degrees C. (about 880 degrees F.) and the atmospheric pressure, about 90 times that of earth. Although the atmosphere and clouds block much of the sunlight, Venus 8 verified that some sunlight does reach the surface. The atmosphere is composed of 97 percent carbon dioxide, not more than 2 percent nitrogen, less than 0.1 percent oxygen and less than 1 percent water vapor close to the layer of clouds. Measurements at altitudes of 46 kilome-

## A hint of what holds the proton together

When physicists do experiments in which they drive beams of accelerated particles against various targets, they have traditionally concerned themselves with measuring the debris that comes out of the collision in more or less the same direction as the original beam was going. It is reasonable to assume that most of what comes off, whether fragments of the target or the probe or newly generated particles, will be pushed forward by the momentum that goes into the impact.

However, important things can come off with large amounts of momentum in the transverse direction, especially in experiments with colliding beams. Study of these is beginning. An experiment done in the intersecting storage rings at the CERN Laboratory in Geneva by a group from CERN and Brookhaven National Laboratory shows that measurement of collision products with high transverse momenta will be an important experimental technique in time to come. It gives an important clue to structural arrangements deep within the proton.

The experiment took advantage of an important feature of the clashing beams of a storage ring: When two beams of protons going in nearly opposite directions collide head-on they bring each other to very nearly a dead stop. From the point of view of the colliding protons vast quantities of energy are brought into such a collision and a large portion of it is available to generate the masses of new particles. Thus, particles of extremely large mass could be made.

If very heavy particles were produced they would be nearly stationary; they would just sit there for a microscopic fraction of a second until they decayed radioactively into a pair of something else. Then members of the pair would fly off in opposite directions, possibly transverse to the line of the original proton collision. The CERN experiment was designed to look for such unique products as evidence of the existence of any of a number of very heavy particles that theorists have proposed, including the intermediate vector boson (SN: 11/16/68, p. 500), T. D. Lee's B particle (SN: 10/9/71, p. 252) and various heavy leptons. In any event the experiment found positive evidence for none of these.

What it did find was evidence of processes within the proton itself, a hint of what holds the proton together. As reported by Rodney Cool of Rockefeller University at the 16th International Conference on High Energy Physics, held at the University of Chicago and the National Accelerator Laboratory over the last two weeks, the experiment found a spectrum of pi-zero mesons on which crucial points were 100 units away from what would have been expected if they were produced by an electromagnetic interaction in the proton-proton collision. An explanation is possible if the parton model of the interior of a proton is correct. The parton model is the result of a number of experiments which seem to show that the proton is composed of distinct subentities (SN: 11/20/71, p. 346). These may or may not be identical to the long-sought quarks.

Cool's high meson spectrum can be explained as a result of some interaction between partons. In the opinion of Victor F. Weisskopf of Massachusetts Institute of Technology, former director general of CERN, who heard the talk, the result hints at the existence of a new and very strong fundamental interaction—the process that holds partons together inside the protons. Such an interaction would have to be very strong since it takes very high energy even to get evidence of the individuality of partons, let alone to pull them apart. A number of theorists have speculated about its nature and have even proposed an intermediate particle for it called a gluon. Future experiments are sure to follow up the hint in the present ISR experiment to see whether this is in fact the parton-parton interaction and if so to find what they can of its nature.

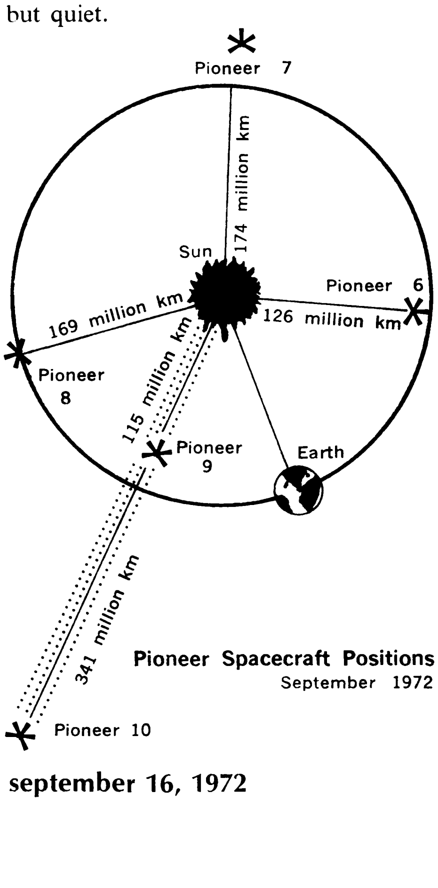
ters and 33 kilometers revealed small quantities of ammonia—between 0.01 and 0.1 percent. In a preliminary report in July, the scientists mentioned short-lived substances in the clouds that appeared to be indicative of "stormy volcanic activities on the surface." No such mention was made this time.

Venus 8 also measured wind velocities. At an altitude of 45 kilometers, the wind was moving horizontally at 50 meters per second. It decreased during descent to less than 2 meters per second. At 10 to 12 kilometers, the measurements indicated "there is a zonal, latitudinal wind directed from the terminator to the day side" in the same direction of the planet's rotation.

The surface layer of Venus appears loose and has a density of slightly less than 1.5 grams per cubic centimeter. A gamma-ray spectrometer indicated the surface soil to be "relatively rich in potassium, uranium and thorium." It contained 4 percent potassium, 0.0002 percent uranium and 0.00065 percent thorium. Tass likened these radioactive concentrations to the composition of terrestrial granite. □

## 5 Pioneer spacecraft observe solar storm

Plasma physicists got an extra bonus last month from five Pioneer spacecraft. John Wolfe of NASA's Ames Research Center and other scientists had planned to use a unique alignment of Pioneers 9 and 10 to measure the solar gases in a quiet state. At the time Pioneer 9 was about 115 million kilometers from the sun; Pioneer 10, about 341 million kilometers. What they saw was anything but quiet.



**Pioneer Spacecraft Positions**
September 1972

A solar storm was in progress (SN: 8/19/72, p. 119). Three explosions occurred on Aug. 2 and a fourth on Aug. 7. During one one-hour period, the sun produced energy equal to the U. S. electrical power consumption for 100 million years at the present rates. It caused a temporary but violent warping in the earth's magnetic field which caused power and communications blackouts on earth.

Pioneer 9 saw the highest solar wind speeds ever recorded—1,000 kilometers per second. The typical solar wind velocities are from 400 to 700 kilometers per second. The highest previously observed had been 800 kilometers per second.

By the time these solar wind particles had reached Pioneer 10, 76 hours and 226 million kilometers after they passed Pioneer 9, their velocity had decreased by half. But their temperature had risen to 2 million degrees K., far above the usual 100,000 degrees K. What happened, Wolfe believes, is that the kinetic energy of the particles was converted into thermal energy. "We've never seen anything like this before," he says of the event.

Pioneer 9's sensors also saw 4,000 times more solar cosmic rays than normal. This was confirmed by Pioneer 6 (at the time about 126 million kilometers from the sun), which recorded the greatest number of high-energy particles ever seen. At the peak of the storm, these cosmic rays reached Pioneer 9 in less than one hour, compared with the 33 hours for the solar wind particles. At Pioneer 10 the interplanetary magnetic field was 100 times higher than normal.

"Space is a fantastic plasma laboratory for observing on a huge scale how charged particles and magnetic fields act in a vacuum," Wolfe notes. "We've never been able to observe how these disturbances move out into the interplanetary medium before."

The stormy solar region 331 has now rotated away from the earth, but measurements by the other Pioneers indicate the sun is still spouting out particles and X-rays in massive amounts. Pioneers 6, 7 and 8 will continue to observe the source area, although the amount of data scientists will get from these craft are severely limited due to other demands on the use of the huge space antenna, the 210-foot dish at Goldstone, Calif.

Meanwhile, Pioneer 10, heading for Jupiter, was moving safely through the asteroid belt. In fact, says Wolfe, it has so far seen no significant increase in the number of the small particles one-millionth of a gram or smaller. This week there were indications that the count might be going up a bit. □

## Prostaglandin complicity in rheumatoid arthritis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*Prostaglandin-researcher Weissmann.*

More than five million Americans, the Arthritis Foundation estimates, are victims of rheumatoid arthritis, a potentially crippling disease characterized by persistent inflammation, usually of the joints. Treatment can help relieve the symptoms of the disease but not cure it. However, scientists are relentlessly closing in in the causes of inflammation, and they anticipate the work will eventually, lead to better drug therapy.

Ordinarily, immune responses are essential to health. Antibodies or other natural body chemicals participate in these reactions. But abnormal immune responses, many researchers believe, are capable of causing tissue inflammation. In other word, normal defense mechanisms of the body turn against the body itself. This autoimmune theory for rheumatoid arthritis is today a predominant one, according to John L. Decker of the National Institute of Arthritis, Metabolism and Digestive Diseases, and president of the American Rheumatism Association.

During the past five years or so, and especially in recent months, prostaglandins have become more and more suspect of triggering inflammation. Prostaglandins are hormone-like substances that act locally in many tissues of the body. A year ago, John Vane, J. Bryan Smith and Anthony Willis of the Royal College of Surgeons in London found that aspirin can prevent laboratory synthesis of prostaglandins (SN: 7/17/71, p. 39). Since then, other researchers have confirmed the discovery in patients. The Sept. 1 NATURE reports, for