

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.