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IONIZATION EXPERIMENT

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Measurements made by the ionization experiment on radiation entering our solar system from galactic sources are higher than reported during the Mariner II mission to Venus in 1962.

This experiment has two functions: A Geiger-Mueller tube counts individual particles and an ionization chamber measures the effect of these particles on matter (argon gas). Combining this information with the count from the Geiger-Mueller tube yields the average energy and electrical charge of the particles in the energy ranges above 10 million electron volts for protons, ½ million electron volts for electrons and 40 million electron volts for alpha particles.

The particles measured are principally galactic cosmic rays. Other particles measured would be solar cosmic rays or trapped radiation.

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It is believed that the higher radiation levels detected by this experiment are related to the fact that the Sun is in a quiet period of its 11-year cycle. In an active period the Sun's magnetic field would be carried outward by a strong solar wind forming a strong interplanetary magnetic field and would deflect energetic particles away from the solar system, as was the case with Mariner II. Mariner IV, however, is being subjected to a heavier rain of galactic particles because the interplanetary magnetic field is not serving as a shield as it did for Mariner II.

Conversely, the trapped radiation detector measuring protons from the Sun is recording less radiation than did the same type of experiment on Mariner II because of the quiet Sun period.

One part of the ionization experiment, the Geiger-Mueller tube, failed March 3 shortly after a class two solar flare on the Sun. Its counting rate increased during the solar flare period and then failed to return to a normal level and further data had to be discounted. It is possible that the solar flare is related to the failure.

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On March 17, the ion chamber portion of the experiment also failed. At that time both parts of the experiment ceased to provide any data. As both had a common power supply it is believed that the failure was in this area.

Earlier, however, the experiment had reported measurements on the solar flare of February 5, and on expected high readings in the Earth's magnetosphere before entering a relatively lower radiation area in interplanetary space.

During the solar flare on February 5, the Geiger-Mueller tube reported an increase in radiation 80 times above the normal interplanetary intensity and the ion chamber reported readings 200 times normal in the total amount of radiation at the levels measured by this experiment. The difference in the increase recorded by each part of the instrument is due to the ion chamber being more sensitive to the solar flare particles than the Geiger-Mueller tube.

A period centered around January 28, was of interest because the spacecraft was at inferior conjunction with the Earth, with the Earth between the spacecraft and the Sun. It was hoped that data returned during this period might provide measurements on the Earth's wake formed by interaction of the solar wind and the Earth's magnetic field. The spacecraft was approximately 12 million miles from Earth and approximately 200,000 miles above the Sun-Earth line. The wake was not detected by the ionization experiment nor was it detected by other instruments on the spacecraft.

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This suggests that the wake does not extend that far from Earth or the wake might have been below the spacecraft.

IONIZATION CHAMBER EXPERIMENT

The ionization chamber is a five-inch stainless steel sphere with a wall thickness of 1/100th of an inch. The metal serves as a shielding that will only allow radiation above a given level to penetrate.

The sphere is filled with argon gas. Particles that penetrate the sphere leave a trail of ions in the gas. The ions are detected and an electric pulse is produced that is proportional to the rate of ionization in the argon gas. This pulse is processed and telemetered to Earth.

The Geiger-Mueller tube is also shielded to allow penetration by particles in the same range as detected by the chamber. The tube consists of an enclosed volume of gas with two electrodes at a different electrical potential.

The tube generates a current pulse each time a charged particle passes through the tube. The tube can count particles at a maximum rate of 50,000 per second.

This experiment weighs 2.9 pounds and is located on the spacecraft's mast.

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