steps, produces signals that show numbers of positive ions in 32 energy bands from 30 to 10 000 eV. With it, experimenters have been able for the first time to make observations all the way through the earth's bow wave at a distance of 34-35 earth radii.

Although this instrument has been able to resolve hydrogen and helium plasma components more accurately than predecessors and to produce reasonably accurate values of solar-wind velocity, a recalibration was required so that data recorded after the first week would be meaningful. The cause was a resistor failure, which, for a time, left experimenters uncertain of the manner in which the energy sweep was occurring.

Another negative result from an attempt to find the earth's wake came from a helium magnetometer especially designed for space probes. It observes the amount of circularly polarized light passing through ionized helium, a quantity affected by direction and intensity of magnetic field. Among its positive results are significant field changes at 48-60, 84-100, and 140-152 thousand miles from earth. All three transitions separate different regions of interaction between earth's field and solar wind and are consistent with expansion of the earth's field as the sun became quiet and solar wind decreased. Strong disorderings found in the interplanetary field are associated with irregularities in plasma emission from the sun, interactions between slow and fast moving plasma and plasma instabilities. The magnetometer has also revealed some periodic variations that can be associated with the sun's 27-day rotation.

A time-of-flight spectrometer with 20 million miles between two detectors observed the February 5 flare. The event could be seen at the sun and detected by arrival of energetic protons at the IMP II satellite circling earth and later by protons turned back into a Mariner IV cosmic-ray telescope looking away from the sun. Observers concluded that extensive irregularities in the magnetic field beyond the earth's orbit scatter charged particles back into the Mariner telescope. A puzzle arises from an unusually low, essentially zero helium-to-hydrogen ratio in the particles detected. Some of the acceleration mechanisms one would expect to find at the sun apparently aren't there.

The Mariner IV cosmic-dust detector has been recording micrometeorites at an average of one every 1.5-2 days and at a rate that is increasing as the vehicle moves outward from the sun. The instrument is an aluminum plate acting as a microphone diaphragm. On its surfaces is a layer of insulation covered by evaporated aluminum, and by recognizing which surface is penetrated it can record which way a given particle comes in. The system responds to any particle bigger than 10^{-11} gm. Records of particles by size show that about once every 40 days a particle big enough to crack the glass (10^{-5} gm) would be expected to hit the solar panels powering the probe.

Whatever Mariner IV learned at encounter and whatever information it sent back in subsequent weeks would embroider a record that is already substantial. As for the future, the probe has confirmed an earlier conclusion: radiation encountered is no serious hazard for astronauts and manned space flight. (A large solar proton event might be an exception if one occurred.) Moreover, one can assume that Mariner IV data will encourage pursuit of recommendations that came from last year's study by the Space Science Board of the National Academy of Sciences: vigorous exploration of Mars between 1969 and 1973, landing of an automated laboratory by 1973 (perhaps by 1971), study of Mars physics, chemistry, geology, and biology (if there is any). For the physicist, this will mean a new, big laboratory in which the radiation fields may hold clues to relations between relativity and the quantum. And somewhere in this laboratory he may catch his first graviton.

Mars experiments solicited

The National Aeronautics and Space Administration has set August 1 as the deadline for preliminary proposals of experiments to be carried on its 1971 Voyager mission to Mars. The program will use the Saturn-

Centaur launch vehicle, which will be capable of delivering much larger scientific payloads than have previously been possible.

The mission plans to put a vehicle in orbit around Mars and to land payloads on the surface of the planet. Experiments relevant to Martian biology, atmospheric composition and characteristics, and planetary properties (seismic activity, topography, radioactivity, and chemical composition) are especially suggested, along with in-flight studies of cosmic radiation, solar plasma, magnetic fields, and micrometeoroids. However, all proposals will be seriously considered.

A formal "Announcement of Flight Opportunity" for the 1971 Voyager contains further information regarding the characteristics of the spacecraft and the mission. Those interested in proposing experiments are invited to request copies from NASA Headquarters, Code SL, Washington, D. C. 20546, attention Dr. Robert F. Fellows, Voyager Program Scientist (Acting).

Ultraviolet photography in orbit

As part of a project to obtain ultraviolet spectra of selected stars and planets, Gemini astronauts will take photographs through an open hatch in their spacecraft with a hand-held camera. The experiment is under the management of Karl G. Henize, professor of astronomy at Northwestern University; the pictures will be taken during the last three Gemini flights, whose dates are still classified. Professor Henize expects to complete the analysis of the results in 1968.

For the experiment, Professor Henize will employ prism and grating attachments for a standard NASA camera to analyze the light from the photographed objects. The study will concentrate on radiation in the range between 2000 and 3000 Å, and will focus on seven bright stars, between fifty and one hundred other stars, mainly in the constellation Orion, and one or two planets (e. g., Jupiter and Venus) if there is time. The seven bright stars are Sirius, Gamma Velorum, Zeta Puppis, Beta Centauri, Alpha Virginis, Beta Crucis, and Beta Orionis.