SCIENCE NEWS of the week

Comet Halley Encounters Earth's Space Age

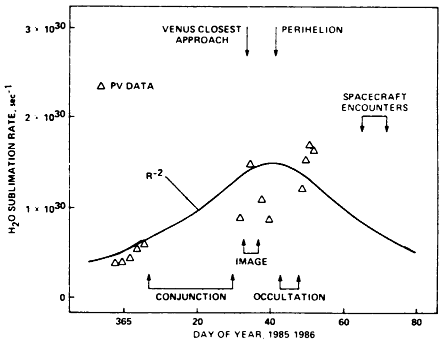
After visiting the earth every three-quarters of a century or so for millennia, Comet Halley has at last been met by a reception committee. First came the Soviet Union's Vega 1 spacecraft on March 6, followed three days later by Vega 2, as Japan's Suisei and Sakigake looked on from a distance. On March 13 came the most daring attendee of all, Europe's Giotto, which passed only 605 kilometers from the comet's dusty nucleus. And as the unprecedented spacecraft assemblage reported in detail to its earthbound mentors, the guest of honor more than lived up to its reputation.

Scientists had long been aware that the reception might turn out to be more of a confrontation. Besides the general dust hazard, earth-based observations had already shown a number of extended "jets" spurting forth from the nucleus, as the sun's heat freed concentrations of ice, dust and gas.

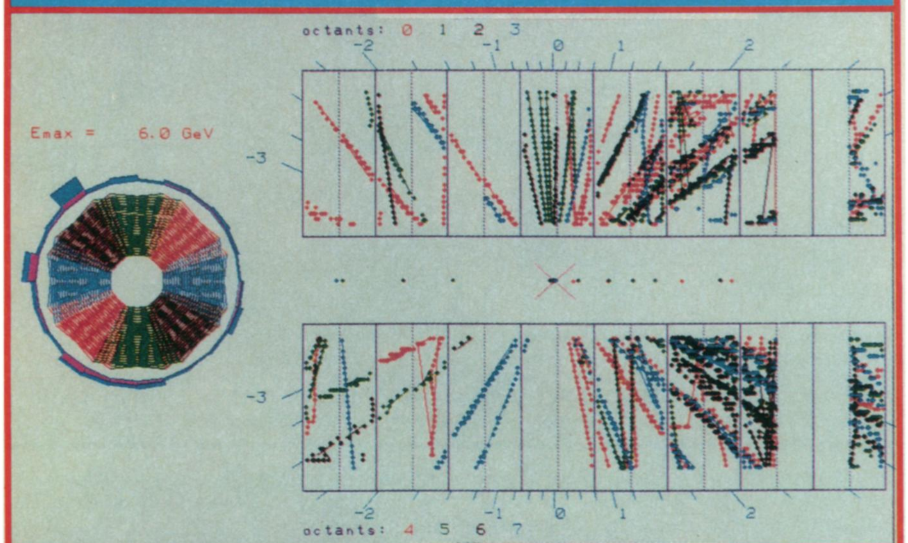
Furthermore, the Venus-orbiting Pioneer spacecraft, which in January had experienced the closest view of the comet's closest approach to the sun, had revealed that the amount of water vapor coming off of the nucleus did not vary smoothly with the changing heat input. Instead, it would double or drop by half from one day to the next, with hints that the variations could be even more rapid. "It turns on so suddenly," said Jeffrey Cuzzi of the NASA Ames Research Center at Moffett Field, Calif. "Like popcorn." Commented principal investigator Ian Stewart of the University of Colorado in Boulder (who is now refining his data to see how big the changes were from hour to hour), "There's a tremendous amount riding on that Giotto camera."

Illustrations: NASA

The orbiting Pioneer Venus (PV) spacecraft in January got the best view of Comet Halley's closest approach to the sun. Water-vapor brightness measurements yielded the image above (ring shapes are result of processing) and showed (triangles below) that the amount of water vapor coming from the comet's nucleus was varying by factors of two from day to day.



Protons meet antiprotons at 1,600 GeV



Fermilab

X marks the spot (between top and bottom octants) where a proton with 800 billion electron-volts (800 GeV) energy collided head-on with an antiproton of equal energy in the Tevatron (SN: 9/28/85, p. 202) at the Fermi National Accelerator Laboratory in Batavia, Ill. This is one of the first collisions at that energy, the highest in the world and nearly three times that of the nearest competitor.

The very high multiplicity of things produced in the collision is immediately apparent on the plot. Each line of dots represents the track of some kind of particle made in the collision. As the detector is three-dimensional, the tracks are color-coded according to the octant of the third dimension in which they appear. The circle at left divides the third dimension into octants and indicates the color assigned to each.

This is a test run, and its importance, according to Roy Schwitters of Fermilab, is to show that "the apparatus really works." Right now the apparatus is down while the detector is being completed and adjustments are made to permit actual experimental runs, which Schwitters expects to start in November. When the Tevatron is working at its design capacity, about 50,000 of these collisions will occur every second. At that time, ironically, a trigger on the detector will throw out the ones that look like this, which is quite ordinary. The physicists are interested in rare particles like Ws and Zs that appear only once in many thousands of collisions. In three months of running they anticipate recording about 100 Ws. —D.E. Thomsen

But even the Vegas, aimed to miss the nucleus by larger, safer distances and intended in part to provide targeting information for Giotto, turned out to have a couple of rough rides. Vega 1 passed 8,889 km away, yet particle impacts reduced the power output from its solar panels by 45 percent. Fortunately, the panels were there merely to charge the craft's batteries, which saved the day — by design — when the going got heavy.

Vega 2 went closer, flying by at 8,030 km from the nucleus and suffering an *80 percent* power loss. Yet officials gathered at the Space Research Institute in Moscow were puzzled. Although Vega 2 had gone closer, data from dust detectors aboard the two craft (particularly a pair of instruments designed by John Simpson and colleagues from the University of Chicago and included at Soviet invitation) seemed to indicate that Vega 1 had flown through one of the comet's jets, while Vega 2 had not. Early looks at the data, in fact, suggested that Vega 2 had been struck by three to four times *fewer* dust particles than its predecessor. Aided by photos from the two craft, scientists concluded that by the time Vega 2 went by, the comet's nucleus had rotated