

droplets of helium and the surrounding hydrogen, and that the effect would be detectable as a reduced percentage of helium, compared to Jupiter, in the top of Saturn's atmosphere. The trouble was that Pioneer 11's hydrogen-helium data, albeit imprecise, appeared to show no such reduction. Was some unknown process at work in Saturn? Was the excess-heat measurement—which had confirmed earlier ground-based studies—simply wrong? "One outrageous possibility," says Ingersoll, "was that Saturn is only 2 billion years old, and therefore had not lost the expected amount of heat. Such a possibility, if true, would shatter our understanding of solar-system formation, which is based on known physical principles and observation of star-formation elsewhere in the galaxy."

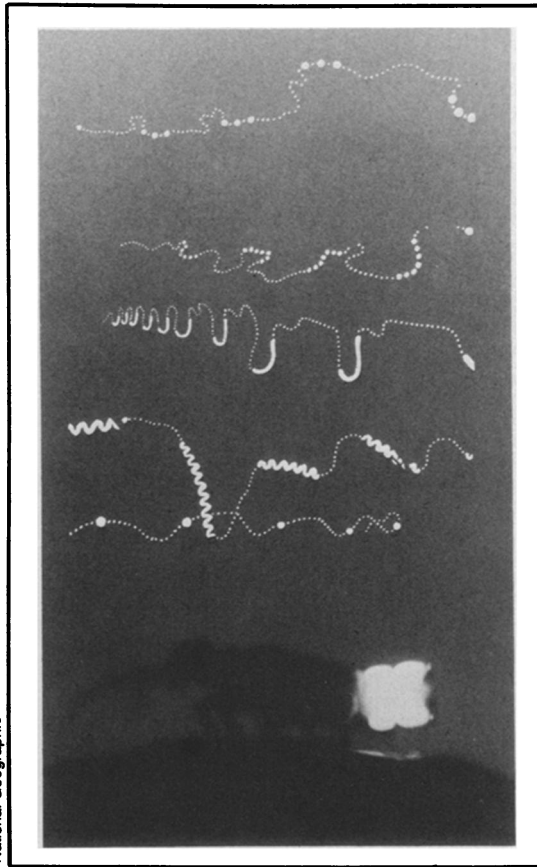
Last November, the far more sophisticated Voyager 1 spacecraft flew by for a better look at the planet. Its infrared sensor again confirmed the high heat excess, but it also seemed to show, at least at first look, a hydrogen-helium ratio the same as Jupiter's—90 percent to 10. The puzzle (SN: 11/29/80, p. 343) loomed larger.

But analysis of data from Voyager's infrared instrument is a time-consuming process, and refined results appear to have resolved the quandary. The infrared team, headed by Rudolf Hanel of the NASA Goddard Space Flight Center, has revised their quick-look estimate of the helium abundance downward to 4 percent—just what would be expected if gravitational separation has indeed been taking place. "The net result," Ingersoll says, "is that both Saturn and Jupiter have the right ages, the right amount of internal heat, and the right hydrogen-to-helium ratio."

The relevant difference between the two giant worlds is merely that Jupiter is more massive, and has thus held onto enough of the original heat from its formation to prevent the helium from condensing into droplets that would sink into the Jovian depths. Even at Saturn the separation process probably did not start with the planet's birth. Some researchers have estimated that Saturn did not get cool enough for the helium to condense until about 2 billion years ago, and that Jupiter may just be reaching the point at which condensation will start there too. This does not mean that Jupiter will start to get warmer, Ingersoll points out, merely that its cooling rate will slow down.

Saturn, meanwhile, has plenty of other questions that still need answering, some of which may be directly related to the amount of heat rising from within it. Why, for instance, do its equatorial winds whip past at four times the speed of Jupiter's? It is possible, but far from certain, that a major mechanism is the transfer of energy from huge eddies of the sort that are much more prominent on Jupiter. Voyager 2, which will fly by Saturn in August, may provide some of the answers. It will certainly provide more questions. □

Light treachery among fireflies



National Geographic

The visual Morse code of fireflies can be used for deceit as well as for honest communication, says a scientist who has studied more than 100 species of the luminescent beetles during 18 years of research. James E. Lloyd of the University of Florida finds that in at least 12 species females can mimic the courtship response of up to five other species, to lure foreign males, which they devour. Male fireflies strive to get an edge in the mating game by imitating other species, by interjecting flashes in another male's courtship dialog, by flashing in synchrony with a rival male to confuse the female and by mimicking a female to throw a rival off the track. Competition is intense because, at least in a Florida grasslands firefly, most females take only six minutes to emerge from their burrows and mate. Males typically need more than a week to find a partner. The glowing silhouette of a firefly was photographed in Southeast Asia. The beaded trails above it illustrate illuminated flight paths of four species as they might appear in a time exposure photograph.

Strong reprimand to gene-splicer

In July 1980 a Los Angeles scientist violated federal regulations for protection of human subjects and also the guidelines for use of recombinant DNA. This conclusion, reported May 26 by the director of the National Institutes of Health, is the result of an investigation by an NIH committee appointed last October (SN: 10/18/80, p. 245).

In controversial experiments Martin J. Cline of the University of California at Los Angeles injected recombinant DNA into bone marrow cells, and returned the altered cells to each of two young women patients, one in Israel and the other in Italy. The experiments attempted to provide a missing gene to the women, both of whom have a fatal blood disease called beta-thalassemia. A proposal for similar experiments was under consideration, and subsequently rejected, by the UCLA Human Subject Protection Committee.

The several punitive measures now being taken against Cline comprise the most severe penalty ever imposed by the NIH. During the next three years Cline must receive prior NIH approval for any research with human subjects and any research using recombinant DNA. Each of the four NIH institutes currently funding Cline's research has been instructed to

consider before next October whether its grant should be withdrawn. In addition, the just released NIH report on Cline's conduct will be considered during the review of applications for future research funds from NIH.

"My examination of the report of the committee and of the larger record upon which its decision was based leads me inexorably to agreement with the conclusion that Dr. Cline has violated both the letter and the spirit of proper safeguards to biomedical research," says Donald S. Fredrickson, director of NIH.

A strong factor leading to Cline's reprimand is a decision he made unilaterally before operating on the Israeli patient. A proposal approved by the Israeli hospital's human subject protection committee described use of purified human genes, not attached to genetic material from any other organism. The committee contacted the NIH to ascertain that such genes are not considered recombinant DNA under the guidelines. But on the morning of the operation Cline says he decided to inject the human gene linked to other genetic material, as well as pure genes. A similar procedure was later performed on a 16-year-old girl in Italy.

Cline told the NIH committee, "I decided