# Venus: On the nose at last

Numerous spacecraft have been studying Venus for nearly a quarter century, beginning with the first one ever sent to another planet, the United States' Mariner 2 in 1962. Yet only now has such a probe finally been able to answer a key question about the planet's interaction with the sun, an exotic relationship that may be unique among all the planets of the solar system.

At the heart of the matter is a single measurement: the distance from Venus of the "nose" of the huge shock wave formed where the planet is struck at supersonic speeds by the sun-spawned outpouring of charged particles called the solar wind. The resulting shock wave resembles a vast, blunt cone whose sides trail out into the distance like the wake of a blunt boat facing into a rapid stream. Venus is atypical among the planets studied from spacecraft in that it has a substantial atmosphere but only a very weak magnetic field. At earth, Jupiter and Saturn, the field keeps the solar wind from ever reaching the atmosphere, but at Venus, it strikes the atmosphere directly. The question has been, how close does it get to the planet's surface?

The answer has come from the U.S. Pioneer Venus Orbiter spacecraft, which has been circling the planet since late 1978 but whose orbit has only recently risen enough to measure the shock wave where it directly faces the sun. According to Christopher T. Russell and his colleagues at the University of California at Los Angeles, writing in the October Geophysical Research Letters, the altitude of the shock wave at that point is about 2,280 kilometers.

Several months ago, notes Russell, a Soviet researcher predicted that the measured altitude would be about 30 percent greater than that. This idea was based on the expectation that the sun's extreme ultraviolet (EUV) radiation would increase the ionization of neutral atoms from Venus's upper atmosphere and thus raise the height of the obstacle to the solar wind. The lower altitude measured by the spacecraft, Russell says, suggests that another factor must also be involved: the neutralization of some of the incoming ions by a process called "charge-exchange" with the atmospheric atoms. As a result, the solar wind can penetrate closer to the planet.

This same balance of forces — EUV ionization vs. charge-exchange — may also govern the solar wind's interaction with comets. Surprisingly, it may even be the case at Uranus, for which the approaching Voyager 2 spacecraft has so far failed to reveal signs that would indicate a magnetic field. *—J. Eberhart*

# Olympic asthmatics breathing easy

Ginny Gilder developed asthma as a preteen, and didn't have much trouble with it through high school. But at college in 1975, she discovered rowing, and rediscovered her asthma.

After she had made several trips to the emergency room for epinephrine to stop an asthmatic attack, the health clinic doctors told her they would no longer allow her to compete on the varsity team unless she took medication to control her asthma, instead of dealing with it only when it became life-threatening.

She complied, and went on to join a four-member rowing team that took a silver in the 1984 Summer Olympics.

Gilder, now living in Seattle, was far from the only asthmatic on the U.S. Olympic team. "With treatment, [asthmatic] athletes can achieve world-class performance," says William Pierson of the University of Washington in Seattle.

Pierson and his colleagues last week presented data on the 597 members of the 1984 U.S. Summer Olympic team in Washington, D.C., at the International Conference on Allergology and Clinical Immunology. After administering pre- and postexercise lung tests and questionnaires, they identified 67 athletes on the team as asthmatics. Many had been unaware that they had the condition.

The athletes' asthma evidently didn't hurt their performance: Asthmatics comprised 11 percent of the team but were responsible for 13 percent of the medals.

About 80 percent of asthmatics are subject to exercise-induced bronchospasm, which can cause coughing, chest tightness, wheezing, stomachache or headache within 15 minutes of exercise. The condition can be prevented with drugs and careful warm-up, says Roger Katz of the University of California at Los Angeles. another researcher in the study. The asthma drugs approved by the International Olympic Committee do not affect performance, Pierson says.

Says Katz, "For many years we've been dealing with the myth that if you have asthma you sit on your duff and become a spectator." Asthmatic children who wanted to compete in sports used to be guided to swimming, where the warm moist air and absence of allergens like pollen that can trigger an asthma attack seemed to help. But now, says Pierson, with appropriate management, asthmatic athletes "are limited only by their desire and will to succeed."

Says Gilder, "I'm a very good example of what their research has found. My asthma was just another factor I had to deal with." *—J. Silberner*

# Probing deeper into quasicrystals

Less than a year ago, the term "quasicrystal" was practically unknown. Now, hundreds of researchers throughout the world are energetically poking into what many scientists believe is a new kind of crystalline matter. This week, the topic of quasicrystals was highlighted in Washington, D.C., at a National Academy of Sciences symposium featuring significant advances in materials research.

Until recently, most crystallographers believed that atoms within crystals had to be arranged in blocks that stacked evenly to create a regularly repeating pattern. The discovery at the National Bureau of Standards (NBS) in Gaithersburg, Md., of "shechtmanite," an aluminum-manganese alloy that shows a noncrystallographic, fivefold symmetry in electron diffraction patterns, shattered this belief (SN: 1/19/85, p. 37; 3/23/85, p. 188).

"You're talking about a kind of physics in which it's easy to do the experiments," says Paul J. Steinhardt, a physicist at the University of Pennsylvania in Philadelphia. "Once this material was reported, there were many laboratories that were immediately able to reproduce the result."

Recent studies reveal that this icosahedral structure turns up in dozens of alloys, says NBS materials scientist John W. Cahn, who was involved in the initial discovery. These include many aluminum alloys and unusual combinations like uranium, palladium and silicon.

Almost all of these forms are "metastable." A touch of heat, for instance, nudges the atoms of a quasicrystal into a more stable periodic arrangement. However, evidence has emerged that sometimes, at least in the case of an aluminum-lithium alloy, the icosahedral form is the stable phase at room temperature.

Researchers are also finding new ways of making quasicrystals. In the Oct. 7 Physical Review Letters, a team from Cornell University reports that using a xenon ion beam to bombard a thin film of an aluminum-manganese alloy can produce the quasicrystalline phase. Previously, quasicrystals had been created by methods like "splat cooling," which involves rapidly freezing molten metal.

"The advantage of the ion beam technique is that we can control everything," says Cornell's James W. Mayer. This allows researchers to do careful experiments. "The big push is to understand the structure," he says. Cornell graduate students David A. Lilienfeld and Michael Nastasi, who did the ion beam work, are now trying the technique on other materials and exploring the range of alloy compositions that can be jostled into a quasicrystalline state.

Other studies are unveiling nonperiodic symmetries beyond the fivefold, icosahed-