Shaking Down the Sun's Long-Period Vibes

The sun vibrates like a gong that has been struck in several different ways at once. Acoustic vibrations of different frequencies can be observed simultaneously. This discovery of acoustic waves on the sun was unexpected by solar physicists generally and has been somewhat difficult for them to take into their consciousness. This is especially so if the period of the vibration observed is relatively long. That is why the announcement in 1976 of a solar vibration with a period of 160 minutes by V.A. Kotov, A.B. Severny and T.T. Tsap of the Crimean Astrophysical Observatory at Nauchny in the USSR started a long controversy.

Confirmation of the finding by joint observations in which the Crimean group collaborated with P.H. Scherrer and J.M. Wilcox of Stanford University (SN: 4/21/79, p. 270) only seemed to raise the temperature of the dispute. Now, according to an announcement by Stanford University, the finding has also been confirmed by the French astronomers who were the severest critics of the claim, E. Fossat and G. Grec of the University of Nice, working with Martin Pomerantz of the Bartol Research Foundation in Newark, Del. The latest work was done at the South Pole.

Acoustic or mechanical vibrations in the sun with a number of different periods are now generally accepted. The short-period ones, such as the five-minute vibrations associated with the observations of Henry Hill of the University of Arizona, can be attributed to events in the outer layers of the sun. A wave of two hours and 40 minutes is too long for that. It must come from deep within the sun, upsetting the basic notion that the sun's structure is neatly layered (rather like an onion). The long wave is an efficient way of carrying large amounts of energy quickly from the interior to the surface of the sun and so tends to upset theoretical calculations of the balance and transfer of energy in nuclear processes inside the sun.

There was also an experimental reason for being suspicious of this result: 160 minutes is exactly one ninth of a day. Critics immediately proposed that the cyclic effect was not in the sun but in the motion of the earth or of the earth's atmosphere.

The observations are done by a technique developed by Kotov, which involves observing a particularly bright emission wavelength of the sun, the 5,124-angstrom line of iron (it's bright green). The observers record this line as it is emitted from a patch near the middle of the solar disk and from a patch at the edge. There will be a slight difference in the exact wavelength of the two measurements due to Doppler shift because the two parts of the sun are moving relative to each other. The trick is to subtract out the Doppler shifts due to known solar motions and detect, over a period of observations, the cyclic contribution as the long-period wave pushes the edge of the sun in and out.

When the motion was first found, it was easy for critics to claim that the cyclic change that had been found was due to some unrecognized diurnal motion of the earth or of the atmosphere over Nauchny and had nothing to do with the sun. Therefore, joint observations between Nauchny and Palo Alto were undertaken. A terrestrial effect should have had different phases at two such widely separated locations. The results showed the same phase at both stations, indicating, to the observers anyhow, that the effect was on the sun. They found further that the period was not exactly 160 minutes. There is a drift over years of observations that yields something like 160.01. Fortunately, according to Scherrer. "If the oscillations were exactly one ninth of a day, I don't think we'd ever believe it was real."

Even that didn't satisfy everybody. The French group were now in the picture, observing at Nice and not finding anything at all, strengthening the hand of critics. But they didn't leave it at that. They decided to go to the South Pole, where the sun is visible in summer 24 hours a day at a constant elevation above the horizon. This is a safeguard against various diurnal and atmospheric events. When the French observers had completed these observations, they sent a telegram to the Stanford observers, "160 minute oscillation is present in South Pole data. The amplitude is 33 centimeters per second and phase is in perfect agreement with yours." Their further results will be published by the Royal Astronomical Society in Great Britain. □

Viking: The people take a hand

Last week, at just about 1 p.m. PDT on Aug. 7, a radio command from Jet Propulsion Laboratory in Pasadena shut off the Mars-circling Viking 1 orbiter after four years and seven weeks of studying the planet. The order was sent because officials feared that the spacecraft, already low on steering gas, would finally run dry during its next orbit, leaving no way to ensure that its antennas would stay pointed at earth to receive the final word. Viking's other orbiter and one of its two landing craft on the surface had already expired. The project is not over, but it has long been down to a tiny fraction of its original 800 people.

Still working on Mars, however, is the Viking 1 lander in Chryse Planitia, programed to take occasional photos and weather data until as late as December of 1994. It may make no major new discoveries, but it offers the chance of providing an 18-year "data base" on the subtler changes in the planet's weather, climate and surface. And hoping to help that happen is a group of people unique in the history of U.S. planetary exploration. They are not part of the National Aeronautics and Space Administration (except perhaps incidentally as individuals), nor, in the conventional sense, of Project Viking. Yet there are now about 5,500 of them, and the number is growing. They are contributors to the Viking Fund.

There is a growing number of pro-space grassroots organizations such as the L-5 Society or the National Space Institute, whose members collectively advocate various aspects of space exploration and development with the aid of newsletters, meetings, lobbyists and dues. But the Viking Fund is pointedly not an organization at all, says California rocket engineer Stan Kent, who initiated the idea last year. It is literally just a fund, accepting (and encouraging) donations from anyone interested in making a real, specific contribution to the advancement of planetary research: extending the analysis of Viking's data about Mars. The fund, so far containing about $55,000, will be turned over to NASA later this year to support Viking's activities. Kent hopes that it will contain about $100,000 by that time, and that it will be possible to make a similar contribution annually while the surviving lander lives. NASA says that it will not be the fund that determines how long the lander's data are collected, but the money — and the public involvement — are welcome. One Viking official has estimated that $100,000 could pay for up to a year of the communications "downlink" procedures by which the data from the spacecraft are returned to earth.

When the idea was initially proposed to NASA, the response was negative. Federal agencies can accept private contributions (and sometimes do), but only those given for unrestricted uses — there would be no way to guarantee that the Viking Fund would be spent for its intended purpose. Last month, however, NASA reported to Kent that the same goal could be achieved if the agency acted in effect as a contractor to the Viking Fund, agreeing in advance to conduct certain data-gathering and analysis functions as a "service" and then carrying out the service for a fixed fee — the amount of the fund. This would be similar to the arrangements under which NASA launches satellites for other agencies or governments.

The Viking Fund (Dept. R, P.O. Box 7655, Menlo Park, Calif. 94025) was established as a project of the San Francisco section of

the American Astronautical Society, Kent says, and contributions to it are tax-deductible. Kent calls the contributors "a do-something group," maintaining that even people who are disinclined to take pro-space activist roles or join advocacy organizations are sometimes moved to help in the conduct of a specific research program. Donations have come not only from individuals, but from organizations such as the Oregon State University chapter of the L-5 Society, whose members raised funds by selling back their old textbooks to the campus bookstore. "Some of the contributions are only a dollar or two," says Kent, "but they're really getting a return." □

The wrong virus: Gene clone mistake

A San Diego scientist working on rare insect viruses cloned one virus when he thought he was cloning another. Samuel Ian Kennedy of the University of California has been ordered to temporarily stop the research, and the cloned material has been put in storage. Kennedy had planned to reproduce in bacteria the genes of the virus Sindbis, which is carried by mosquitos in parts of Africa, India and Australia. Sindbis is listed by the U.S. Center for Disease Control as a Class 2 agent. It can cause a skin rash and fever in humans.

Confusing results obtained last March led Kennedy to the discovery that he actually had transferred into the bacteria, instead of Sindbis genes, the genes of another mosquito-borne virus called Semliki Forest virus. Semliki virus is rarely associated with human disease but occasionally causes fever and headache. It is listed by the CDC as a more dangerous Class 3 agent.

"There was absolutely no biohazard to the community at large," says a University of California spokesman. Whereas cloning genes from the Semliki virus was forbidden under the National Institutes of Health Guidelines before July 29, the NIH director Donald S. Fredrickson has now approved a change that allows such Class 3 organisms in recombinant DNA experiments. The work must be carried out in a high-containment facility (P3). Kennedy had done his work with Semliki virus genes in a P3 laboratory, just because it was "handy," the UCSD spokesman said.

The NIH has requested a detailed chronology by Sept. 5 of the "apparent violation" of its guidelines. NIH supports the local biosafety committee, which has rescinded all permission for cloning in Kennedy's laboratory.

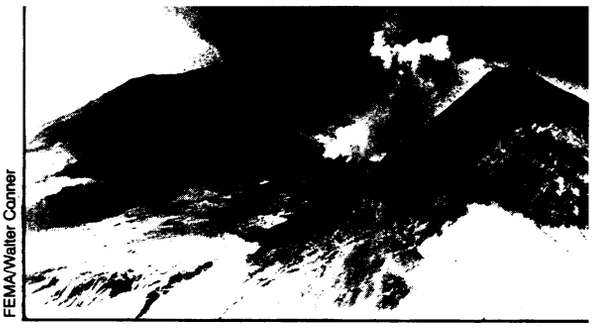
In a strange subsequent development, Sunday night a bottle of rabies vaccine virus was stolen from the laboratory. A telephone call led police to find the bottle unopened in one of the building's stairwells. □

Mt. St. Helens: Fifth time around

For scientists monitoring Mt. St. Helens, each eruption adds something new to their still-evolving ability to predict the mountain's behavior. And they seem to be getting better at it. Before the Aug. 7 eruption of ash and steam, as before the July 22 event, University of Washington seismologists noted unusual seismic activity and the area around the volcano was evacuated.

Unlike the July 22 eruption, however, which was preceded by a series of minor but frequent earthquakes, the Aug. 7 eruption was heralded by a particular pattern of harmonic tremor — the constant, rhythmic activity associated with the movement of magma. According to Steve Walter, a University of Washington spokesman, harmonic tremor began at about noon (Pacific Daylight Time) the day of the eruption. A Richter magnitude 2.3 earthquake occurred at 12:30 p.m. about 5 miles southeast of the volcano, and the harmonic tremor began to increase in intensity.

At that point, says Walter, the area around the mountain was cleared, and the harmonic tremor continued to build while a second quake was recorded at 2:58 p.m. The first eruption of ash — to a height of 44,000 feet — occurred at 4:28 p.m., and



FEMA/Walter Conner

Yawning jaws of the crater created May 18.

smaller blasts continued intermittently, accompanied throughout by harmonic tremor, until about 10:30 p.m.

In hindsight, the mountain — which has since begun to build a dome of thick, sticky lava in its crater, similar to that blasted away on July 22 — may have been providing an additional clue. Scientists measuring the amounts of carbon dioxide and sulfur dioxide — two gases commonly given off by volcanoes — noticed a decrease in the ratio of the two gases on the day before the eruption. Though not immediately interpreted as a precursor, a similar event was later noticed in the records for the days preceding the July 22 eruption. A possible explanation, says U.S. Geological Survey spokesman Tim Hait, is that the release of gas is somehow blocked and pressure is created in the volcano. "It may be that the gas and the harmonic tremor together are a good key," he says. "It may be something to look for the next time." □

The Red River skull: Oldest whale?

LSU

Perhaps the oldest intact whale skull ever found — an estimated 45 million years old — was unearthed July 31 by Louisiana State University geologists Judith Schiebout and William van den Bold. The four-foot-long skull of the Basilosaurus cetoides, *examined here by graduate student Winston Lancaster, was excavated from beneath a few feet of earth along the Red River at Montgomery Landing, La. Researchers say the whale, which had teeth three inches long and lived on fish, was probably about 50 feet long. Also discovered nearby were ribs, teeth, a dozen vertebrae and a humerus, part of the whale's flipper. Shark teeth found close by suggest the whale may have been eaten by sharks as it was dying, or after it was dead.*