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