

Catching waves in the solar wind

Blinded by the outpouring of light from the surface of the sun, astronomers can't peek directly inside the star, where hydrogen burns to make helium and a cauldron of hot gases seethes and churns. However, these violent motions hint at internal solar activity by generating vibrations that make the sun ring like a bell. The traveling oscillations, akin to seismic waves that propagate through Earth's crust, cause the sun's surface to rise and fall periodically by small amounts.

By monitoring the solar surface, scientists have tracked some of these oscillations since the 1960s (SN: 4/3/93, p.213). But except for a lone observation that follow-up studies failed to confirm, the tiniest oscillations, which originate in the deepest layers of the sun, have eluded detection. Now, scientists report that they have found strong evidence of this most subtle of vibrations in the solar symphony.

To the astonishment of many scientists, the finding comes from the discovery of tiny, periodic variations in the intensity of the solar wind, the stream of charged particles that blows out from the sun's outer atmosphere. No one had imagined that the wind could retain the pattern of solar vibrations as it travels through turbulent regions of interplanetary space.

The finding may ultimately improve forecasting of solar storms, which can wreak havoc on communication networks on Earth. It might also help explain why the sun emits far fewer neutrinos, a type of subatomic particle, than theory predicts.

Analyzing solar wind data, David J. Thomson, Carol G. MacLennan, and Louis J. Lanzerotti of AT&T Bell Laboratories in Murray Hill, N.J., report their results in the July 13 NATURE.

Theory suggests that the sun shows two types of oscillations. The p-mode, or pressure-mode, vibrations move like sound waves and originate as heat-driven currents just beneath the sun's visible surface. The more elusive g mode, or gravity mode, resembles the bobbing up and down of water waves. It's these vibrations, generated when a low-density gas pushes against a high-density gas closer to the core of the sun, that the scientists believe they have now detected.

The researchers weren't looking for waves when they began analyzing the intensity of the hydrogen and helium ions in the solar wind recorded by the Ulysses craft between 1992 and 1994. Rather, they were hoping to find a correlation between solar activity and the failure of several communications satellites. To their surprise, the data revealed that the intensity varied at two characteristic sets of time intervals—one about every 5 minutes and the other ranging from several hours to several days.

The 5-minute variation corresponds to the well-known p mode; the longer variations seemed to represent the long-sought g mode. Doubting their own result, the researchers turned to similar data, taken in 1985 by the Voyager 2 craft. They found the same g mode pattern.

The scientists speculate that the magnetic fields at the sun's surface sense the g-mode vibrations and communicate them to solar wind ions that travel with the fields. Supporting that argument, an analysis of data collected by other spacecraft from 1977 to 1981 shows that the magnetic field oscillates in synchrony with the g-mode waves. Nonetheless, says Thomson, "we've uncovered more puzzles than solutions."

The findings offer both good news and bad news about the troublesome effects of the solar wind on Earth, the team notes. The wind may have stronger surges than expected, but their periodicity makes them more predictable.

Discovery of the g mode may bring predictions about the emission of solar neutrinos more in line with observations, Thomson says. In addition, these waves may cause gases at the sun's core to mix, which could alter neutrino production.

Support eases cancer's mental pain

Depressed cancer patients derive lasting psychological benefits from social support groups, which give them a chance to express their feelings and encourage one another, a new study finds. Cognitive-behavioral group therapy, which teaches such patients how to reduce stress and change depressive ways of thinking, also improves their mental condition—but less effectively than support groups, researchers assert in the May-June PUBLIC HEALTH REPORTS.

Earlier investigations of cancer patients suggested that those in social support groups become less anxious and depressed, experience less physical pain, and even live longer (SN: 11/4/89, p.302). But scientists hadn't compared cancer patients' responses to different types of group therapy.

Ron L. Evans, a social worker at the Veterans Affairs Medical Center in Seattle, directed psychiatric assessments of 95 cancer patients scheduled to undergo radiation treatment. Of that number, 78 suffered from at least moderate symptoms of depression and received either eight weekly sessions of supportive group therapy, eight weekly sessions of cognitive-behavioral group therapy, or no group sessions (with access to individual counseling if desired). Men made up more than half the sample. All participants had cancer of comparable severity, usually in the lungs, bladder, or prostate.

Both forms of group therapy yielded similar declines in depression, anxiety, and preoccupation with physical pain after 8 weeks; supportive therapy yielded the largest drop in psychiatric symptoms of all kinds. The control group showed a milder decrease in symptoms.

Six months after sessions ended, only social support participants cited marked drops in depression, anxiety, and physical complaints, Evans says. Pressures to learn specific skills in cognitive-behavioral therapy may have proved so stressful that they reversed initial improvement, he suggests.

More important, opportunities to vent feelings and obtain encouragement in social support groups probably lessen the sense of isolation and anxiety regarding death that gnaw at many cancer patients, writes David Spiegel, a psychiatrist at Stanford University School of Medicine, in an accompanying comment. Married cancer patients tend to live longer than their single counterparts, another sign that support from others can play an important role in cancer treatment, Spiegel notes.

Suicide shows cross-cultural roots

Major depression and alcoholism play an important role in suicides in Taiwan, just as they do in North America and Europe, according to a report in the July ARCHIVES OF GENERAL PSYCHIATRY.

"Despite widely different rates of depressive illness and alcoholism in different cultures, the psychiatric antecedents of suicide are the same in the East and the West," contends Andrew T.A. Cheng, a psychiatrist at Academia Sinica in Taipei. Chinese communities report much lower rates of depression and alcoholism than Western nations.

Cheng directed psychiatric interviews of close relatives and friends of 113 people, each belonging to one of three ethnic groups in eastern Taiwan, who killed themselves in the period from July 1989 to December 1991. For each suicide, Cheng's team also interviewed two randomly selected people of the same sex and age who lived in the same area.

Evidence of prior mental illness emerged for all but two of the suicide victims. The other 111 had most often suffered from major depression and alcoholism or drug abuse. A family history of suicide or depression also appeared to be linked closely to suicide, as it is in the United States and elsewhere.

The new study "reveals a more universal nature of suicide than could previously have been assumed," Cheng argues.