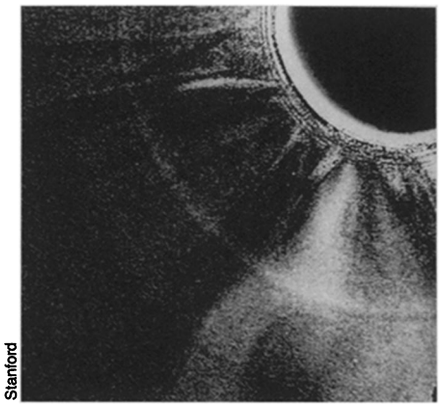
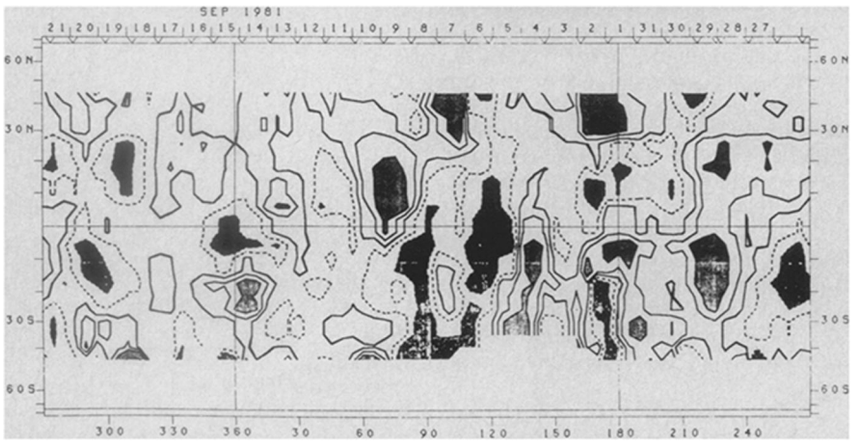
Solar news: Convection and magnetism

Earthlings tend to watch the sun very closely. It is, after all, the ultimate source of nearly all our energy, and what we see there may have a profound effect on us. One way by which energy reaches the surface of the sun from the interior is convection. Astrophysicists have suggested that large amounts of matter are circulating up and down in what they call the sun's convection layer. Recent observations that seem to show the existence of convection cells within such a layer were reported at last week's meeting in Tucson, Ariz., of the Solar Physics Division of the American Astronomical Society. A more surprising development reported at the same meeting is that the sun emits bubbles of magnetism that float off into space.

According to the generally accepted theory of solar dynamics, the sun's convection layer is heated from below by energy produced in thermonuclear fusion reactions. The heated gas rises to the surface, where it is cooled by radiation and then descends again. Such a motion should occur in large cells or pieces of the convection zone's volume. Observers have looked for such convection cells, but according to Philip Scherrer, senior research associate at Stanford University's Center for Space Science and Astrophysics (CSSA), they have not been found before now. Scherrer, with Hirokazu Yoshimura of the University of Tokyo and two research associates at the Stanford CSSA, Richard S. Bogart and J. Todd Hoeksema, used Stanford's Wilcox Solar Observatory to find evidence for convection: gas currents moving east and west across the surface of the sun.



Stanford



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Photograph of the sun's corona shows arc with ends pointing outward. Map of solar surface outlines regions moving west with solid lines, regions moving east with broken lines. Dates over meridians indicate when a given meridian was in the center of solar disk as seen from earth.

These currents move at about 20 meters per second. From earth they are seen added to or subtracted from the sun's surface rotation, which is westward at 2,000 meters per second. The motions of the currents can be compared to plate tectonics on the earth, except that the solar motions take place in an ionized gas and so are much faster than those in the solid earth. Bogart cautions that the observations are not absolute proof of the existence of convection cells, but they are the sort of surface motion that convection cells ought to show.

Motions in the body of the sun generate magnetic fields. The matter in the sun is an ionized gas, and motions in it constitute electric currents, which generate magnetic fields. Yet the interplanetary magnetic field, which originates in the sun, does not reflect this activity. The magnetic field in interplanetary space, according to a number of measurements by spacecraft, remains constant and in fact fairly weak.

The solution to the question of where the magnetism goes, according to Rainer Illing and Arthur Hundhausen of the National Center for Atmospheric Research in Boulder, Colo., is that the sun emits self-contained bubbles of magnetism that float off into space without affecting the overall strength of the interplanetary field. They find the evidence for this in pictures of the solar corona made by the Solar Maximum Mission satellite since it was repaired by a space shuttle crew a year ago.

Occasionally, active regions on the solar surface erupt in large arcs of magnetized matter. Sometimes, says Illing, something pinches these arcs from the sides. Tension of forces in them then causes them to snap like rubber bands and the result is two arcs, the lower one with its ends rooted in the sun's surface, the upper with its ends pointing outward. The upper arc then detaches itself and becomes a magnetic bubble. The earth may occasionally pass through one of these bubbles, Illing says. He is not sure what effect that would have, but suggests that it might cause some disturbance of the magnetosphere.

—D. E. Thomsen

Spermicides given green light

Scientific studies have raised concern as to whether fetuses conceived in the presence of spermicides are more prone to birth defects (SN: 4/11/81, p. 229). The question entered the legal arena earlier this year when an Atlanta court awarded damages in the case of a baby, born despite spermicide use, with birth defects. Now James L. Mills, who recently completed a large study of birth defects, and Joe L. Simpson, a geneticist who has reviewed the published data, say it is time to lay these concerns to rest.

The initial association was no more than chance, said Mills, of the National Institutes of Health, and Simpson, of Northwestern University in Chicago, at a press conference held in Washington, D.C., last week in conjunction with the meeting of the American College of Obstetricians and Gynecologists.

Following the initial positive studies came early reports showing no correlation (SN: 5/15/82, p. 326) — and more recent studies, including Mills's, "have given rise to a clear consensus in the scientific community that there is no substantive increase in birth defects related to spermicide use," says Simpson.

Mills and his colleagues questioned 34,660 pregnant women about spermicide use and assessed the outcomes of the pregnancies; 2,282 of the women said they had used spermicides following their last menstrual period before conception. "There was no increase in major malformations in general or in any organ system in mothers who had used spermicides," reports Mills.

Says Simpson, "The frequency of birth defects is not generally appreciated to be as high as it is—2 to 3 percent of pregnancies result in a child with a major birth defect. If 100 pregnant women walk under a ladder, 2 to 3 will have a child with a birth defect. Cause and effect aren't easy to prove." A researcher on one of the studies showing a positive correlation, who asked not to be identified, says that if there is an effect, it is likely to be small. But, he adds, more data are needed to completely exonerate spermicides.

—J. Silberner