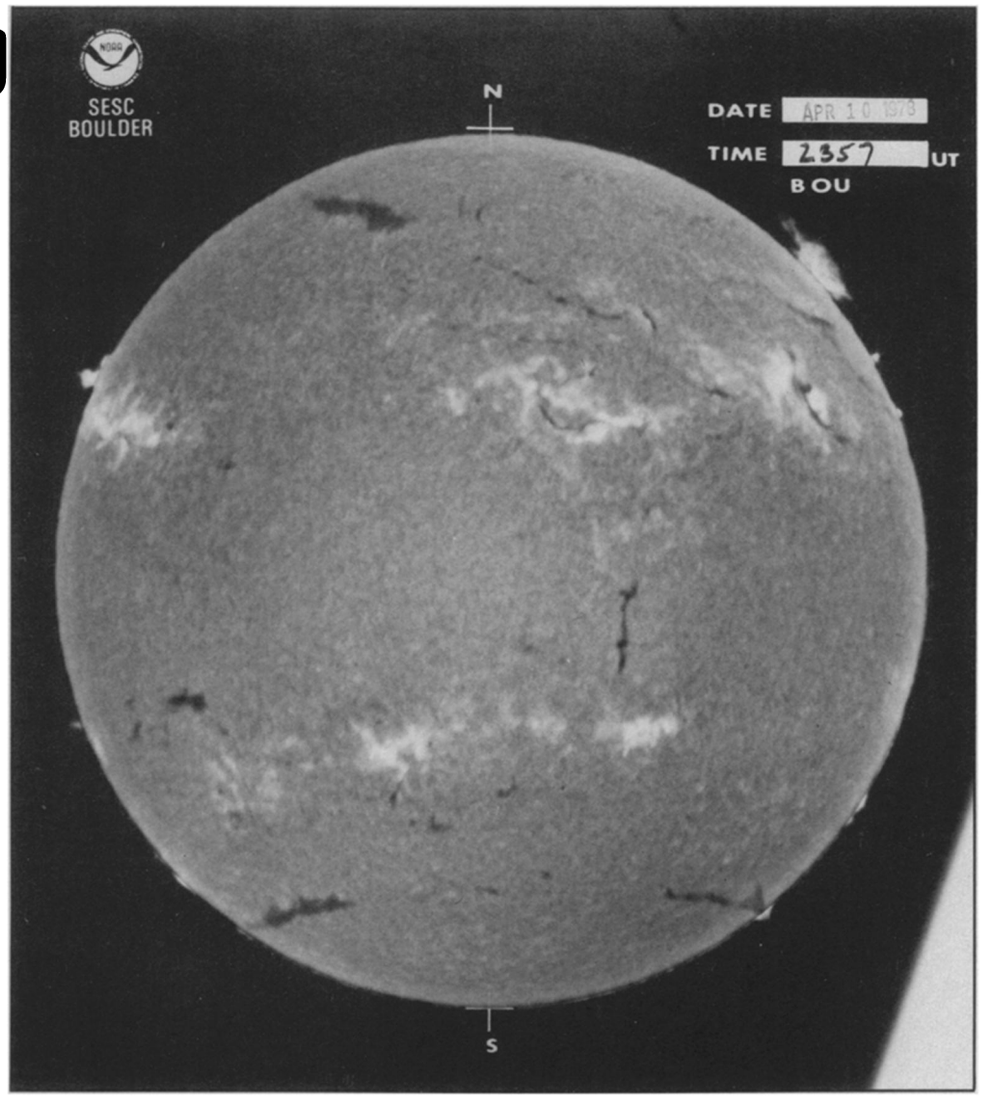
Getting Down to the Sun's Beat



New observations seem to confirm that the sun pulses every 2 hours and 40 minutes — yet another shaking for solar theory if they stand

BY DIETRICK E. THOMSEN

That the sun may vibrate to its own beat — possibly to several of its own beats — is a suggestion entered into the debate over solar physics in recent years. It was inserted first by observers. Henry A. Hill of the University of Arizona had been looking for evidence of solar oblateness when he found what looked like pulsations, and said so. Then, in 1976, A. B. Severny, V. A. Kotov and T. T. Tsap of the Crimean Astrophysical Observatory reported oscillations with a period around 160 minutes.

The response of theorists has been to argue whether such things can exist, and in some cases to suggest that the observers are seeing things. The long period waves of Severny, Kotov and Tsap would be especially damaging to solar theory, and they have undergone a very skeptical reception. Now in the Feb. 22 NATURE is a report by P. H. Scherrer and J. M. Wilcox of Stanford University and by Kotov, Severny and Tsap intended to convince astronomers and physicists that the vibrations are real.

The report concerns correlated observations undertaken over three years at the Crimean Astrophysical Observatory and at the Stanford Solar Observatory. A vibration of this kind causes the sun's surface to move in and out. That will be most evident at the edges of the visible disk. There, it will give the surface a certain velocity in addition to the velocity already present from the sun's rotation. The measuring technique is to find this excess by subtracting the velocity across the line of sight of a patch in the center of the sun from the velocity of one at the edge. The velocity is figured from the Doppler shift in a prominent line of the sun's spectrum, the 5,124 angstrom line of iron. The difference amounts to one meter per second — just within the measurement capability of these observatories.

The period of 160 minutes is exactly one ninth of a day. That ratio has led to suspicion that what was being seen was a terrestrial effect recurring as the earth rotated, something in the atmosphere perhaps, that made it look as if the sun was pulsing. If the effect were terrestrial, it should not have the same phase at the same time at two different stations on earth. Yet the three-year records between California and the Crimea show agreement of phase within the limits of experimental error. That tends to indicate that the effect is in the body they are looking at.

Furthermore, there is a drift in phase over the three years, and it goes the same way at both stations. This would indicate that the computing equipment was not tuned to exactly the period of the oscillation. The period appears to be different from 160 minutes — 160.01 perhaps — and so not really exactly a ninth of a day.

Such vibrations would proceed from deep inside the sun. They are a fast way of transporting large amounts of energy from the interior to the surface that is not envisioned in present theory. They could upset the thermodynamics of the solar interior and so change expectations about the thermonuclear processes that go on there. They could stir up the material inside the sun, which current theory tends to see as well layered, and that could affect the fusion dynamics. If they come to be generally accepted, they will require a reworking of solar theory, and that carries in its train a reworking of stellar theory generally. These vibrations could reverberate throughout astronomy. □