GEOPHYSICS

Earth's Air Shakes Like Jelly

Scientists are learning about the outer atmosphere by studying vibrations of the earth's magnetic field triggered by nuclear explosions or solar winds—By Ann Ewing

➤ THE EARTH'S ATMOSPHERE shakes like a huge bowl of jelly once every four or five seconds after it has been struck a great blow by a nuclear explosion or a barrage of particles from the sun.

This vibration of the outer atmosphere is similar to the way in which the entire earth "rings like a bell" when jarred by a major earthquake or underground atomic blast.

The research that led to this finding, reported in the Journal of Geophysical Research, was done by Drs. Ari Ben Menahem, geophysicist at California Institute of Technology in Pasadena, Calif., and Robert L. Kovach, a geophysicist now at Stanford University.

With the support of the U.S. Army Research Office, they studied vibrations triggered in the earth's magnetic field by a nuclear explosion 240 miles above Johnston Island in the Pacific on July 9, 1962.

"Just as waves generated in the earth by 'quakes and nuclear explosions can serve as tracers to inform us about the composition of the earth's interior, so can waves generated in the atmosphere by nuclear explosions and solar outbursts tell us about the outer atmosphere," Dr. Ben Menahem explained.

He said it was as though the explosion over Johnston Island "had plucked the strings of the earth's magnetic field." The shape of the waves, or vibrations, depends upon the density of the particles trapped in the atmosphere by the field.

The bell-ringing effect of the outer atmosphere is short-lived compared with that of the earth when it is struck by a big earthquake. The earth's vibrations, at the rate of one about every 54 minutes, persist for several weeks. The atmosphere shaking damps out in less than an hour.

A computer was used to help identify the atmosphere's ringing signals, which have only one-thousandth the strength of the earth's magnetic field.

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TECHNOLOGY

42 Minutes to Anywhere

➤ MOST OF THE LARGE cities on earth are only 42 minutes from each other, if deep "mole-hole" tunnels are used to travel between them.

Falling through the earth in a long tube is a method of transportation that men have thought and dreamed about for thousands of years, although it is not possible now, and may never be.

Nevertheless, Dr. Paul W. Cooper of Sylvania Electronic Systems in Waltham, Mass., was intrigued by the idea. He therefore calculated the time it would take to travel between any two points on the earth's surface. He found that the time is always 42.2 minutes from one point on earth to another, no matter where.

Dr. Cooper also calculated that traveling through the moon would take 53 minutes, while whizzing through Mars would take only 49. Deep tunnels for transit between two places on the moon could be the best method of lunar transportation, since the moon has no atmosphere to support aircraft and may be covered with a dust layer making surface travel difficult.

Although man now speculates about rocketing half way across earth in a semi-satellite or ballistic missile, a free fall through a mole-hole requires much less expenditure of energy, once the tunnel is built.

Dr. Cooper suggests that earth could be criss-crossed with frictionless tubes for rapid intercontinental travel. Transit times would be comparable with those of a space vehicle, he reported in the American Journal of Physics, 34:69, 1966.

He envisages a transportation system without timetables, linking the world's major cities, with departure time universally on the hour and arrival time 42 minutes later. It would take only 42 minutes to traverse a mole-hole 5 miles deep between Boston and Washington.

Whether on the earth, moon or Mars, the method of transportation is "merely to fall into a hole, exchanging gravitational potential for motion and eventually reversing the exchange."

Dr. Cooper computed the earth travel time on the basis of a planet having a radius of 3,955 miles and a surface gravitational attraction of 32 feet per second each second. The lunar and Martian travel times were calculated on models for those bodies.

The same mathematical equations could be used to calculate the travel times in deep tunnels between points on other planets. The surface gravitational attraction and the radius are the determining factors in such calculations.

Dr. Cooper notes that a skeptic could probably think of many problems standing in the way of a such a free, rapid-transit system, including many geophysical phenomena he conveniently ignored. Nevertheless, man has already begun to look downward for his future transportation, as testimony at Congressional hearings has shown.

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ASTRONOMY

One of Dimmest Stars Is Also Among 25 Closest

➤ ONE OF THE three dimmest stars known, perhaps the dimmest, is also one of the 25 closest to earth's own star, the sun.

The new faint star, known as LP 9-231, was discovered by Dr. W. J. Luyten of the University of Minnesota. The two stars rivaling or possibly even somewhat brighter than the new find are known as Van Biesbroeck, after its discoverer, Dr. George Van Biesbroeck of Yerkes Observatory, Williams Bay, Wis., and Ross 614-B.

Dr. Luyten reported his discovery to the Smithsonian Astrophysical Observatory in Cambridge, Mass., clearing house for astronomical information in the Western Hemisphere.

The distance of LP 9-231 is believed to be 10.5 light years, one light year being the distance covered in a year by light traveling at 186,000 miles a second, or six million million miles. However, this distance has not yet been accurately measured, so the new star could be the tenth closest to the sun.

Its brightness on the astronomer's scale of absolute magnitude is plus 17.4; therefore, it can be photographed only with very large telescopes.

Ross 614-B was first photographed with the 200-inch Mt. Palomar telescope in 1955 after astronomers at Swarthmore College's Sproul Observatory in Pennsylvania, directed by Dr. Peter van de Kamp, had calculated exactly where the giant instrument atop Mt. Palomar should be aimed. It was then the second faintest star known.

Dr. Kaj Aa. Strand, director of the U.S. Naval Observatory in Washington, D.C., said that astronomers at the Flagstaff station were observing the new faint star. However, it will take about a year before they can confirm the distance reported by Dr. Luyten, which is the basis for calculating the absolute luminosity.

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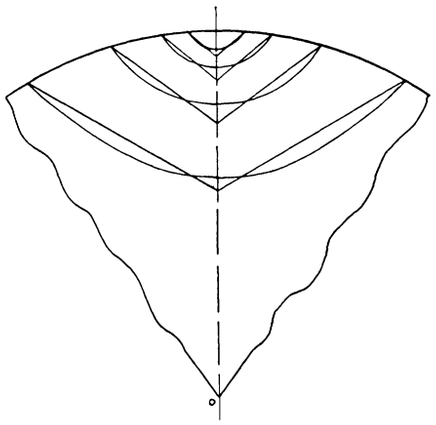

American Journal of Physics

FAST TRAVEL ANYWHERE—This diagram shows some computed curves for either straight-line or arced underground travel between any two points on earth in the least possible time.