

physical sciences notes

ASTRONOMY

Three Undiscovered Satellites Predicted

The solar system may hold at least three undiscovered satellites, one each for Jupiter, Saturn and Uranus.

Existence of the three is suggested in the Nov. 18 NATURE by Drs. E. L. G. Bowell of the Observatoire de Meudon and L. Wilson of the University of London Observatory. Their conjecture concerning the unseen satellite circling Saturn supports the suggestion made in the November ICARUS by Dr. Hannes Alfvén of the Royal Institute of Technology, Stockholm.

Dr. Alfvén's predicted satellite of Saturn would be smaller than the tenth satellite, Janus, discovered a year ago (SN: 1/14) and would revolve around Saturn in a circular orbit in 19.5 hours. Drs. Bowell and Wilson also predict an eleventh moon for Saturn, but calculate it would circle in about 15 hours.

Based on a formula derived from Saturn's satellites, Drs. Bowell and Wilson also predict undiscovered satellites for Jupiter and Uranus. Jupiter's would swing between Amalthea and Io, completing an orbit in about 20 hours; that of Uranus would orbit between the present inner pair, Miranda and Ariel, with a period of about 40 hours.

SOLID STATE PHYSICS

Sphere Used to Pump Laser

The most efficient way of pumping a laser rod may well be to bathe it in light from all directions in the center of a hollow sphere. The light energy stimulates the laser to emit an intense beam of coherent light.

One common pump design uses a reflector in the form of an elliptical cylinder, with the laser rod and lamp placed side by side and lengthwise along its center (SN: 12/2). Another type uses several lamps placed in a reflector system shaped like a four-leafed clover.

The spherical design was developed by Drs. Charles Church and Irving Liberman of Westinghouse Research Laboratories in Pittsburgh.

MATHEMATICS

Pendulum's Accuracy Calculated

The requirements of accuracy for a pendulum as a vertical reference have increased considerably with the advent of missiles. Using the best techniques available, it is still not possible to eliminate entirely the vibration transmitted through the supporting structure to the pendulum's point of support.

Dr. T. K. Caughey of California Institute of Technology has examined mathematically the effect of such residual vibration on the accuracy of a pendulum type vertical reference. He finds that if the vertical and horizontal components of acceleration of the pendulum's point of support have a related rhythm, then the mean position of the pendulum does not coincide with the local vertical axis.

Dr. Caughey reports details of his mathematical treatment of this "zero-shift" in the September JOURNAL OF APPLIED MATHEMATICS, a publication of the Society for Industrial and Applied Mathematics.

NUCLEAR ANNIVERSARY

25 Years of Atomic Energy

The 25th anniversary of the first controlled release of nuclear energy, on Dec. 2, 1942, called for a special celebration, including the participation of five Nobel Prize winners.

The scientists and technicians who took part in the historic experiment beneath the since-demolished west stands of Stagg Field at the University of Chicago gathered again. Particular tribute was paid to the late Enrico Fermi, the Italian-born physicist and Nobelist; the success of the first self-sustaining chain reaction is due to him more than to any other person.

The observance came at the end of a year marking a turning point in both commercial use of nuclear power and the proliferation of weapons. By 1980, if proposed plants are built, one-third of all electricity generated in the United States will come from the atom.

As China graduated from fission to fusion bombs, discussions leading to a non-proliferation treaty became more urgent—and, seemingly, less fruitful.

GEOPHYSICS

Gravity Changes on Earth's Surface

Gravity gradients are widely used in geophysics for the analysis of complex geological structures. Mass defects, for example, are easily recognized in a gravity gradient field even in cases where purely gravimetric data fail to show a clear picture.

To extend the procedure to a worldwide scale, scientists at the Smithsonian Astrophysical Observatory have computed the variation of gravity on the earth's surface in three mutually perpendicular directions—the horizontal variations along both latitude and longitude, and the vertical component along the plumb line.

Details of Dr. Walter Köhlein's calculations are reported in the Smithsonian's Special Report #249.

Upper Atmosphere Models

In another report, Dr. Manfred P. Friedman reveals a theoretical formulation that can be used to construct three-dimensional models of the upper atmosphere for temperatures and densities over the entire earth from 120 to 800 kilometers up. The equations are derived from the laws of conservation of mass, momentum and energy, with the main input being solar radiation heating. Preliminary results of the calculations are presented in the Smithsonian's Special Report #250.

BIBLIOGRAPHY

Cumulative Nuclear Index

To aid scientists in what might otherwise be a difficult literature search, the Atomic Energy Commission's division of technical information in Oak Ridge has prepared and is distributing a 12,000-page "Index to Nuclear Science Abstracts."

Beginning with "A-1 Reactor," the index covers more than 15,000 subjects in the field of nuclear science, ending with "Zymosan," an enzyme used in evaluation of immunity. Some two million computer punch cards were processed in preparing the 19-volume Index.

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