

PHYSICS

# A.A.A.S. \$1,000 Prize Given For Research on the Atom

## Ingenious Method for Obtaining Exact Information On Spin of Nucleus Brings Honor to Prof. I. I. Rabi

**F**OR USE of ultra-short radio waves in an ingenious method for obtaining information, more exact than ever obtained before, on what goes on within the atom, Prof. I. I. Rabi, of Columbia University, was honored with the annual thousand-dollar prize of the American Association for the Advancement of Science.

Prof. Rabi is another physicist to whom distinction has come at an early age. Only 41 now, he was awarded the Sigma Xi prize in physical science in 1936 and joined the faculty of Columbia University in 1930 when he was in his very early thirties. Prof. Rabi was born in Austria, but came to the United States as an infant.

Atoms can act like little radio transmitters broadcasting on ultra-short waves between 40 centimeters and 1.5 meters in length, Prof. Rabi told the American Physical Society in his prize report at the meeting of the American Association for the Advancement of Science in Columbus.

The atom "broadcasts," Prof. Rabi said, are being used to detect the energy difference within the atom for different atomic states. Not only does an atom transmit such waves but it can absorb them. By applying these short radio waves to atoms passing down his apparatus Prof. Rabi and his colleagues find specific energies absorbed which make the atoms go from one atomic state to another; states in which they possess detectable differences in magnetic properties. The transition point is sharp and very exact. It provides knowledge of the spins of the atom nucleus and its associated electrons with an exactness 100 times greater than ever before.

The powerful research method, called radio frequency spectrum analysis, also gives indication of the magnetic moments of atoms for it is known that the nuclei of atoms behave like tiny magnets.

At the meeting Prof. Rabi, with Drs. P. Kusch and S. Millman, described studies on the radio frequency spectrum of the two varieties of lithium having mass six and seven. With these and other scientists Prof. Rabi has previously reported other investigations, particularly

studies on heavy hydrogen. They have found that the electric charge of the heavy hydrogen nuclei is egg-shaped or possesses a quadrupole moment.

In these experiments a stream of neutral atoms in the form of a narrow ribbon moves through a high vacuum so that the atoms suffer no collisions with one another or with atoms of a different species. Their speed is just the speed of their natural thermal motion. This stream of atoms passes by two magnets successively in which they are deflected first in one way and then in the opposite direction, and finally impinges on a detecting device which measures the numbers of atoms which arrive per second. In the space between these two magnets the atoms are subjected to the action of radio waves. When the wave length of the radio waves corresponds to the energy difference between two of the possible atomic states, the atom passes from one of these states to the other. It thereupon undergoes a change in magnetic properties. As a result, it no longer pursues the same path, when it passes by the second magnet, as it would have without this change, and no longer strikes the detector. The effect of the radio waves is thus observed as a decrease in the number of atoms which arrive at the detector.

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### To Probe Radio Spectra Of Radioactive Atoms

By DR. I. I. RABI

Columbia University, Winner of A.A.A.S. \$1,000 Prize

**T**HE new field of research recognized by the prize, concerned with the radio spectra of atoms and molecules, was developed by the study of fine details of atomic, molecular and nuclear structure. By this means the strengths of nuclear magnets of many atoms were measured.

The shape of the deuterium (heavy hydrogen) nucleus was also determined. Contrary to expectation it turned out to be like a football spinning on its long axis.



PROF. I. I. RABI

In the future other nuclei, including those of radioactive elements, will be studied. These studies will give fundamental information about the forces that govern nuclear properties. The use of radio waves in studying molecular structure will reveal details which cannot be detected by other means. This is shown by the results obtained with hydrogen molecules.

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BACTERIOLOGY

### Bacteria Digest Shells Of Lobsters and Crabs

**L**OBSTER and crab shells, which are deposited in the ocean by billions of tons every year as their owners moult or die, are composed of one of the toughest and most indigestible organic substances known, chitin. Yet there are bacteria that do the useful work of disposing of this waste material and returning its chemical elements to general circulation.

This was described to the American Association for the Advancement of Science at Columbus.

Dr. Charles W. Hock of the Woods Hole Oceanographic Institution, who described these bacteria, stated also that they are found in the digestive tracts of various kinds of fish, as well as squid, sand crabs and oysters. He suggested that they may aid in the digestion of the shells of crustacea eaten by these sea creatures, which might otherwise prove a bit troublesome as "roughage."

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