Nobel Prize Goes To Enrico Fermi

THE Nobel prize for physics has been awarded this year (1938) to Enrico Fermi. This fact did not surprise his colleagues. It was given to him primarily for the discoveries which he and his co-workers have made in their investigations with neutrons. Fermi has, however, made many other outstanding contributions to various fields of modern theoretical and experimental physics.

Fermi is 37 years old and received most of his education in Italy. There he obtained a solid foundation of classical physics and mathematics. He began his studies at Pisa, lectured at Florence for a few years and since 1926 has been Professor of Physics at the University of Rome, where, for the past few years, he has been working in an excellent new laboratory. He studied for some time at Göttingen and later visited Leyden. At that time Fermi had already completely mastered classical and modern physics, and while at Leyden impressed everyone with the clarity and simplicity of his discussions. At a student group meeting there, it was Fermi's turn to give a nonsense talk. Starting with the most general equation consisting of an equality sign with nothing written on either side of it, Fermi derived interesting formulae in such a convincing manner that Ehrenfest jokingly remarked that he would from then on refuse to believe any of Fermi's physics.

Extreme clarity and simplicity is characteristic of all of Fermi's work as well as his personal life. At Rome, he starts his work very early in the morning which, in itself, is sufficient proof that he is not merely a theoretician. Every afternoon he conducts a seminar with his colleagues and students during which everyone seems to take an active part in the lively discussions. A friendly spirit of cooperation is always present among those who have worked with him.

Fermi is interested in fields of science other than physics but he has no typical hobbies. His recreation consists of sports: he is an expert at tennis, swimming and skiing.

We cannot discuss Fermi's contributions to physics in every detail. His theoretical papers have one characteristic: he takes the laws known from one field of physics and applies them to another part in such a clear and logical manner that the result becomes almost obvious. An example of this type of reasoning is the so-called Fermi-Dirac statistics. When it was found that in an atom no two electrons can exist in the same quantum state, Fermi pointed out that the same rule might govern the motions of the molecules in a gas. This clarified to a great extent the application of quantum theory to statistical mechanics and it became of first rate importance in the treatment as a gas of the free electrons in a metal. Some time later, Fermi pointed out further that the electrons in a single atom, in turn, can also be treated as a gas. He and his co-workers succeeded in deriving many atomic properties by means of this statistical method. Another outstanding contribution is Fermi's theory of the beta-radioactivity. Here again, his program consisted of adapting the theory of radiation to the problem of emission of a beta-particle. According to Fermi's hypothesis, inside a nucleus a neutron can change itself into a proton and the energy gained in this process is emitted in the

form of an electron and a neutrino. It was his beautiful theoretical treatment of this process which quickly revived confidence in the existence of the mysterious neutrino that had been invented earlier by Pauli to explain discrepancies in the conservation of energy in beta-radioactivity. Although his beta-theory is as yet incomplete, it is nevertheless the most important advance in recent nuclear theory.

Fermi's experimental work also excels in its clarity and directness. One of his first experiments was that done with Rasetti dealing with the behavior of atoms in an alternating magnetic field. His recent experimental work, for which he obtained the Nobel prize, deals with neutrons. After the discovery of the neutron by Chadwick, Fermi understood at once that this new particle was the ideal projectile for producing nuclear reactions. Since it has no charge, it is not repelled by nuclei and even very slowly moving neutrons can come near enough to an atomic nucleus to produce an interaction. In fact, it was soon discovered by Fermi and his collaborators that, in many cases, the slower the neutrons the more effective was the reaction. By means of the bombardment of various elements with fast and slow neutrons they produced a large number of new isotopes, most of which are radioactive. An outstanding achievement was the discovery of two new elements which extended beyond the original limit of the periodic system.

In Italy, Fermi is recognized as the outstanding physicist of his country. He has been a member of the Academia d'Italia since its creation by Mussolini in March, 1929. He received honorary degrees from the Universities of Heidelberg and Utrecht. He has been a regular visitor to the United States, his first visit being on the invitation of the University of Michigan to lecture in the Symposium of Theoretical Physics in the summer of 1930. These symposium lectures have been repeated in several subsequent summers. He has also lectured at Stanford University and Columbia University. He enjoys his visits here very much. It was interesting to observe the rapidity with which he learned to lecture in English at the occasion of his first visit to the University of Michigan. In his lectures, he succeeds in making the most complicated problems appear exceedingly simple and students gain the impression that they can easily reproduce the mathematical derivations. The same is true when he describes complicated experimental apparatus.

We cannot conclude this description of Fermi's investigations without mentioning the interest with which Mrs. Fermi follows her husband's work. In addition to educating their two children, Nella and Giuglio, Laura Fermi found the time to cooperate with Ginestra Amaldi, the wife of one of Fermi's collaborators, in writing a delightful little popular book, *Alchimia Del Tempo Nostro* on the modern aspects of radioactivity, which should certainly be published in English.

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