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Fifth Lectureship, Physics Department, Kyoto Imp. Univ.

Key Personnel:

Hideki Yukawa, Dr. Sc., Professor of Theoretical Physics, Member of Imperial Academy.

Assistant Professor Matsuhei Tamura, B. Sc.

Activity or Work Program of Target:

1. Current Activity: Main research items are the theory of the mesotron and the general theory of elementary particles, which are central problems of contemporary physics.

Prof. Yukawa succeeded in 1935 to establish a new theory of nuclear forces, predicting thereby the existence of the charged particle, which has the mass about 200 times as large as that of the electron and which changes spontaneously into an electron in a very short time. In 1937 the particles with such properties were found in cosmic rays by American physicists. This particle is now known under the name "mesotron" or "meson". The theory of the mesotron was further developed by Yukawa, Prof. Sakata of Nagoya Imperial University and others and was able, at least qualitatively, to account for the nuclear forces, -decay and various phenomena concerning the hard component of the cosmic ray in a unified way. Although the theory is not yet complete and has several defects, it contributed considerably to the progress in the whole branch of nuclear physics.

Yukawa and Sakata also predicted the phenomenon of the orbital electron by nuclear transformation, which was verified afterwards by the experiment of American physicists and is now known as "K₁ electron capture".

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2. Future Activity: Prof. Yukawa and his collaborators want to continue the investigation into the theory of the mesotron above mentioned and to revise the original theory so as to reach the quantitative agreement with the whole experimental facts relating the atomic nucleus and the cosmic ray. In order to carry out this program, the establishment of the general theory of elementary particles, which is devoid of divergence difficulties, is needed at the same time.

3. Past Activity: List of more important papers published since 1935.

- 1) Yukawa, On the Interaction of Elementary Particles, I. (Proc. Phys.-Math. Soc. Japan, 17(1935), 48.)
- 2) Yukawa and Sakayta, On the Theory of the -Disintegration and the Allied Phenomenon. (ibid. 17(1935), 467.)
- 3) Yukawa and Sakata, On the Nuclear Transformation with the Absorption of the Orbital Electron. (Phys. Rev. 51(1937), 677.)
- 4) Yukawa, On a Possible Interpretation of the Penetrating Component of the Cosmic Ray. (Proc. Phys.-Math. Soc. Japan, 19(1937), 712.)
Yukawa and Sakata,
5) On the Interaction of Elementary Particles, II. (ibid. 19(1937), 1084.)
- 6) Yukawa, Sakata and Taketani, On the Interaction of Elementary Particles, III. (ibid. 20(1938), 319.)
- 7) Yukawa, Sakata, Kobayashi and Taketani, ~~Prop.~~ On the Interaction of Elementary Particles, IV. (ibid. 20(1938), 720.)

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- 8) Sakata, Connection between the Meson Decay and the π -Decay.
(Phys. Rev. 58(1940), 576.)
- 9) Sakata, On the Theory of the Meson Decay. (Proc. Phys.-Math.
Soc. Japan, 23(1941), 283.)
- 10) Sakata, On Yukawa's Theory of π -Disintegration and the Life-time
of the Meson. (ibid. 23(1941), 291)
- 11) Tanikawa and Yukawa, On the Scattering of Mesons by Nuclear
Particles. (ibid. 23(1941), 445.)
- 12) Tanikawa, Note on the Life-time of the Neutral Meson. (ibid.
24(1942), 610.)
- 13) Sakata and Inoue, On the Relation between the Meson and the
Yukawa-Particle. $\langle \psi \bar{\psi} \rangle / \psi \bar{\psi}$ (Nippon Sugaku- Butsurigaku Kaishi
16(1942), 232.)
- 14) Yukawa, On the Foundation of the Field Theory. (KAGAKU 12(1942),
251; 282; 322.)
- 15) Tanikawa, On Generalized Transformation Function (in press.)