tance from the satellite to the sun. If the satellite travels on a circular orbit lying in the plane of the earth's orbit, then the distance r can be written in the form $r = r_0 + \Delta r \cos \Omega t$, where Δr is the radius of the satellite's orbit, Ω is its frequency and r_0 is the distance between the earth and sun. The time-dependent part of (1) is then

$$\Delta\nu / \nu = (kM_{\odot} / c^2 r_0^2)\, \Delta r \cdot \cos \Omega t. \tag{2}$$

This experiment could be done by putting a stable oscillator on either an artificial satellite or on the moon.

For a generator on the moon ($\Delta r = 3.8 \times 10^{10}$ cm) the fractional frequency change amounts to 5×10^{-11} (which can be compared with a maximum change of 7×10^{-10} in the earth's field). Although the effect due to the sun is smaller than that due to the earth, the experiment using the sun's field has the advantages that the frequency of the oscillator need not be unaffected by the rocket flight to put the satellite in orbit, and the effect is periodic with the period of the satellite.

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Translated by R. Krotkov
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ON THE APPLICABILITY OF THE FERMI-TELLER "Z-LAW" TO A PHOTOEMULSION CONTAINING URANIUM

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Submitted to JETP editor July 30, 1959

J. Exptl. Theoret. Phys. (U.S.S.R.) **38**, 658-660 (February, 1960)

It has been shown recently[1,2] that the relative probability of capture of slow μ^- mesons by various atoms in chemical compounds, (such as Al_2O_3, AgCl, UF_4, etc) does not follow the expected law (proportionality to Z) obtained by Fermi and Teller,[3] but is proportional to the number of atoms of the given element in the molecule.

This unexpected result dictates a cautious approach to the conclusions previously drawn in many investigations, particularly those devoted to the investigation of fission of uranium by slow π^- mesons. In these works it has been assumed in the calculation of the fission probability P_f that the probability of capture of a π^- meson by various atoms contained in the photoemulsion gelatine obeys the Fermi-Teller "Z-law." In this connection it becomes advisable to clarify the applicability of the Fermi-Teller "Z-law" to an emulsion to which some other substance (uranium) has been added.

To make the experimental data more precise (the previously obtained values of P_f range from 0.18 to 0.5), the experiments on the fission of uranium by slow π^- mesons were repeated in this investigation. The value of P_f was calculated under several assumptions, and it has been demonstrated by comparison with electronically-performed experiments that the capture of π^- mesons by various atoms in a medium comprising gelatine + uranium obeys the Fermi-Teller Law.

NIKFI-R emulsions 200 μ thick and impregnated with uranyl acetate were used in the experiments. The number of uranium nuclei introduced into the emulsions was determined by counting the alpha particles from the natural radioactivity of the uranium. The plates were irradiated in the slow π^--meson beam of the synchrocyclotron of the Joint Institute for Nuclear Research. The μ^--meson admixture was found to be 20%. Since P_f of uranium is very low for μ^- mesons (0.07),[4] the fissions due to the μ^- mesons did not exceed 3% of the total and were taken into account in the final result. The experimental data are listed in the table.

Number of experiments		1	2
Number of fissions		20	61
Number of stopped π- mesons		1445	5560
Number of uranium nuclei per cm³ of emulsion		$1.8 \cdot 10^{20}$	$1.5 \cdot 10^{20}$
Probability of capture of π- mesons in uranium	"Z-law"	$7.3 \cdot 10^{-2}$	$6.3 \cdot 10^{-2}$
	number of atoms	$5.9 \cdot 10^{-3}$	$5.0 \cdot 10^{-3}$
Fission probability	"Z-law"	0.45 ± 0.11	0.42 ± 0.07
	number of atoms	~ 6	~ 6

The probability of uranium fission by π^- mesons was calculated on the following assumptions: 1) the uranium is completely adsorbed in the gelatine, as established experimentally by Lozhkin and Shamov;[5] 2) the probability of capture of the π^- meson by the various elements in the gelatine (with the exception of hydrogen) was calculated under two assumptions: a) the capture of π^- mesons is proportional to Z, and b) the capture of the π^- meson is proportional to the number of atoms of the given element in the gelatine.[1,2] As can be seen from the table, in the former case $P_f \approx 4$ and in the latter case $P_f \approx 6$, which is impossible. This excludes the applicability of item b) to the gelatine + uranium medium.

To the contrary, the applicability of the Fermi-Teller "Z-law" to the gelatine + uranium medium can be corroborated by comparing P_f for the fission of uranium by π^- mesons and the fission of Th^{232} by protons[6] (experiments with thorium were performed electronically). In either case, isotopes of the same substance are first produced (Pa^{238} and Pa^{233}). In the fission of Th^{232} by protons of energies from 10 to 340 Mev, P_f increases rapidly with energy and reaches a constant value, 0.45 ± 0.07, at approximately 50 Mev. At equal excitation energies (noticeably higher than the fission-threshold energies), P_f is smaller for the isotopes with the larger mass number. Therefore P_f (Pa^{238}) cannot be greater than 0.45.

Nor can P_f (Pa^{238}) be noticeably less than this quantity, as will now be shown. The mean excitation energy of uranium upon capture of slow π^- mesons is 60 to 80 Mev. At such excitation energies, fission of the nucleus is preceded by emission of several neutrons. Upon emission of five neutrons, the nuclear excitation energy diminishes by the amount of the binding energy ($\sim$ 25 Mev) and the kinetic energy carried away by these neutrons ($\sim$ 10 Mev).[7] The result is the nucleus Pa^{233} (the same isotope as in the fission of thorium by protons) with excitation energy 25 — 45 Mev. It follows from the experiments on the fission of Th^{232} by protons that at such excitation energies $0.35 < P_f \leq 0.45$. If $P_f \approx 0.35$, then by putting the probability of π^--meson capture by the various nuclei to be proportional to Z^n, a value close to unity is obtained for n ($n = 1.25$).

Thus, the probability of π^--meson capture in a gelatine + uranium medium (which is not a homogenous chemical compound) obeys more readily the "Z-law" than the proportionality to the number of atoms. This conclusion holds also for other types of mesons, since the capture of mesons on the atomic shells does not depend on the nuclear properties of the mesons.

These results, in conjunction with earlier experiments,[1,2] indicate that the probability of meson capture by various atoms in inhomogeneous media depends apparently on the structure of the medium.

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Translated by J. G. Adashko
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DETERMINATION OF THE COUPLING CONSTANT FOR THE PION-NUCLEON INTERACTION FROM CROSS SECTIONS FOR THE ELASTIC SCATTERING OF 630-Mev NEUTRONS BY PROTONS

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Submitted to JETP editor November 17, 1959

J. Exptl. Theoret. Phys. (U.S.S.R.) 38, 660-661 (February, 1960)

IN reference 1, the differential cross sections for elastic n-p collisions, $\sigma_{np}(\theta)$, for $E_n = 630$ Mev and for the center-of-mass angular interval $160° \leq \theta \leq 180°$ were used to determine the pion-nucleon coupling constant f^2 by the Chew method.[2] For this the measured cross sections $\sigma_{np}(\theta)$ were multiplied by the quantity

$$x^2 = (1 + \mu^2/2k^2 + \cos\theta)^2$$

(μ is the pion mass, $\mathbf{k}$ is the nucleon c.m.s. momentum) and the values obtained $x^2\sigma_{np}(\theta)$ by the method of least squares were approximated by a power series of the form

$$x^2 \sigma_{np}(\theta) = A + Bx + Cx^2 + \ldots + dx^m. \qquad (1)$$

According to present meson theory, the coefficient A of this series can be directly expressed