KERIMOV, B.K.

PA - 2007

AUTHOR: SOKOLOV, A.A., KERIMOV, B.K.

TITLE: On the Theory of the Scattering of Particles by a Steady Center in Consideration of Damping.

PERIODICAL: Zhurnal Eksperimental'noi i Teoret.Fiziki, 1957, Vol 31, Nr 6, pp 1080-1081 (U.S.S.R.)
Received: 1 / 1957 Reviewed: 3 / 1957

ABSTRACT: The theory of damping proves to be the stage that follows according to the perturbation theory and allows the calculation of the cross section $\sigma$ not only within range of the long DE BROGLIE wave lengths ($\sigma < \lambda^2$), but also within the range of smaller wave lengths ($\sigma \gg \lambda^2$). The relation $C^+C + \sum_{k'} C'^+C' = 1$ set up in connection with the development of the theory of damping indicates that the total sum of the inciding and scattering particles stays constant at any moment. Some preparatory works on this matter are cited. At first the exact formula for the cross section of the elastic scattering of particles with the momentum $\hbar k (k = 2\pi/\lambda)$ is given: $\sigma = (4\pi/k^2) \sum_{l=0}^{\infty} (2l+1) \sin^2 \eta_l$. The perturbation theory allows the determination of the phase of $\eta_l$ in the case of $\eta_l \ll 1$. However, the theory of damping supplies the following more exact approximation for phase shift: $tg\, \eta_l = -(\pi K/c\hbar) \int_0^{\infty} rV(r) J^2_{l+1/2}(kr)dr$, and this expression at $\eta_l \ll$ goes over into the one given by the perturbation theory for this phase. Next, a rather voluminous expression for the differential cross section of elastic scattering is given. It was found by means of the damping
CARD 1 / 2





theory. The above given formulae allow the investigation of scattering of spinless particles in the presence of short range forces. The same authors (Doklady Akademii Nauk SSSR, 1955, Vol 105, Nr 961) were able to generalize their results for DIRAC particles (i.e.particles with spin) only in the case of $\sigma$-interaction. The scattering of particles is then investigated according to the damping theory in connection with the following form of potential energy of interaction: $V(r) = B = 3V_0/4\pi a^3$ at $r < a$ and $V(r) = 0$ at $r > a$. The expression resulting in this case for the phase $\eta_l$ is given. In the limiting case $ka \ll 1$ scattering is practically determined by the s-phase, while damping is important only in the case of $2BKa^3k/3c\hbar \gg 1$. The expression for $\sigma$ applicable in the other limiting case $ka \gg 1$ (range of high energies) is also given. Accordingly, the cross section is the fourfold of its classical value. According to G.MASSEY and C.MOHR the nonconformity of the classical and quantumlike value is caused by the occurrence of a diffraction. The results of both theories agree in the range $ka \gg 1$. Furthermore, the authors were able in recent times to compare the results of the damping theory with those of other theories by means of the example of scattering at a $\sigma$-center. The paper ends with a short discussion of the last-mentioned investigations.

ASSOCIATION: Moscow State University.

PRESENTED BY:

SUBMITTED:

AVAILABLE: Library of Congress.

CARD 2 / 2

Levi-Klein's Potential of the Pseudoscalar ?eson Theory and Nuclear Saturation. PA - 2694

the interaction of fourth order $V_4 = V_4^{(a)} + V_4^{(b)}$ due to the exchange of two mesons causes weak attraction.
The present paper completes the two-nucleon potential mentioned above by a repulsory "core" with the radius $r_C$:
$V_{12} = V_2 + V_4^{(a)} + V_4^{(b)}$ at $r > r_c$, $V_{12} = \infty$ at $r < r_c$. By means of the usual computing method a term for the average potential energy of the nucleus is obtained in the approximation of the homogeneous density of the nuclear matter. The kinetic energy of the FERMI gas of nucleons (which are regarded as impermeable spheres with the radius $r_c$) amounts to $T = 14{,}7\ A(\eta^{-2} + 2{,}16\ b\eta^{-3})$MeV. Here $\eta$ is a parameter, which denotes the deviation of the nuclear radius R from its equilibrium value $R_s = A^{1/3}/\mu$. Further it holds that $b = \mu r_c$. For the total energy of the nucleus $E = \langle V_{12}\rangle + T$. The results of the computations discussed here demonstrate the following: By applying the two nucleon potential mentioned here it is unnecessary in the pseudoscalar theory to introduce a three-particle repulsion. The Levi-Klein potential defined here does not correspond to the requirements of saturation neither with or without a three-particle repulsion. (1 illustration)

Card 2/3

...ary of Congress.

Card 3/3



KERIMOV, B.K.

56-3-57/59

AUTHORS: Sokolov, A.A., Kerimov, B.K.

TITLE: The Influence Exercised by Damping in the Polarization of Dirac's Particles on the Occasion of Scattering (Vliyaniye zatukhaniya na polyarizatsiyu dirakovskikh chastits pri rasseyanii) (Letter to the Editor)

PERIODICAL: Zhurnal Eksperim. i Teoret. Fiziki, 1957, Vol. 33, Nr 3 (9), pp. 827 - 829 (USSR)

ABSTRACT: The elastic scattering of Dirac's particles and of the spinless particles by an immobile center of force were investigated by the authors in 4 previous papers by means of the theory of damping. The polarization occurring on the occasion of the elastic scattering of Dirac-particles is computed in the present paper by means of the theory of damping. The principal integral equation of the theory of damping for the determination of the scattering amplitudes $f'_{s'} \equiv f_{s'}(\vec{k}')$ has the form
$(f'_{s'} - b'^{+}_{s'} b_s f_s)\ V_{\vec{K}'\vec{K}'} = (kK/8\pi^2 c\hbar i)\sum_{s''}\oint d\Omega'' V_{\vec{K}'\vec{K}''}\ V_{\vec{K}''\vec{K}}\ b'^{+}_{s'}$
$b''_{s''} f''_{s''}$. Here $E = c\hbar K$ denotes the total energy of the par-

INOPIN, Ye. V.

AUTHOR: Varshalovich, D. SOV/53-65-4-7/13

TITLE: The VIII Annual Congress of Nuclear Spectroscopy (VIII yezhegodnoye soveshchaniye po yadernoy spektroskopii). I

PERIODICAL: Uspekhi fizicheskikh nauk, 1958, Vol 65, Nr 4, pp. 721 - 722 (USSR)

ABSTRACT: The 8th Congress of Nuclear Spectroscopy took place in Leningrad from January 27 to February 5, 1958. It was attended by 300 scientists from the USSR, further by scientists from China, France, Poland, Czechoslovakia, Hungary, Eastern Germany, Yugoslavia, and the Mongol Democratic Republic. 4 main lectures and about 90 reports were heard. The main lectures dealt with problems concerning nuclear models, the α- and β-decay, γ-radiation, internal conversion, and nuclear isomerism. B.S.Dzhelepov, Corresponding Member, Academy of Sciences, USSR, opened the conference. Lectures were held by: V.Yu. Gonchar, Ye. V. Inopin, S.P.Tsytko (FTI, AS UkrSSR) on light nuclei and generalized nuclei models; L.K. Peker (BAN SSSR-Library AS USSR); Yu.M.Shirokov (MGU-Moscow State University), L.A.Sliv (LFTI-Leningrad Physical-Technical Institute) et al. on levels in $Mg^{24}$, $Mg^{25}$ and $Al^{25}$; D.G. Alkhazov, A.P.Grinberg, G.M.Gusinskiy, K.I.Yerokhina and I.Kh.Lemberg (LFTI) on having found no rotational levels at E(1 MeV in Cr, In, and Mn nuclei. The same research workers also reported on the discovery of vibrational γ-levels in $W^{182}$, $W^{184}$, $W^{186}$- nuclei by means of the method of the Coulomb (Kulon) excitation at $E_{exc} \sim 1$ MeV. L.K.Peker (BAN SSSR) gave a survey report: "Concerning Some Particulars in Vibrational Levels of Deformed Nuclei". Lectures were held also by: D.F.Zaretskiy (AN SSSR - AS USSR) on radiation transitions in deformed nuclei with the spin = 1/2; V.S. Shpinel' 2 NIFI MGU (2nd Scientific Research Institute of Physics, Moscow State University) on the level displacement and the probability of corresponding β - and γ - transitions in odd nuclei; D.F.Zaretskiy (AN SSSR - AS USSR) on the influence of the spin-orbital coupling upon the magnetic moments of the nuclei, A.I.Baz' (AN SSSR -AS USSR) on the existence of light nuclei with high neutron or proton excess; V.A.Kravtsov (LPI-Leningrad Polytechnic Institute) on the formation of nucleon pairs in nuclei; L.L. Gol'din, A. D. Piliye, G.N.Novikova, K.A.Ter-Martirosyan (TTL AN SSSR) on alpha decay on rotational levels of odd nuclei; V.G. Nosov (AN SSSR - AS USSR) on alpha decay of nonspherical nuclei (survey); A.I.Alikhanov, G.P.Yeliseyev, V.A.Lyubimov, V.V.Ershler (TTL AN SSSR) on polarisation measurements at electrons emitted in the β-decay of $Tm^{170}$, $Lu^{177}$, $Ag^{198}$, $Sm^{153}$, $Re^{186}$ (ΔI= 0,1, ≠ = -1) as well as in that of $Sr^{90}$ and $Y^{90}$ (ΔI= 2, ≠ = -1); V.P.Rudakov (AN SSSR - AS USSR) on measurements of the (β-γ) angular correlations in $Ba^{139}$-decay; N.A.Burgov and Yu.V.Terekhov (TTL AN SSSR) on investigations of the electron-neutron correlations and the resonance scattering of γ-radiation; N.K.Karimov and I.M.Nadzhafov (MGU-Moscow State University) on the bremsstrahlung of longitudinally polarized electrons; A.I.Mukhtarov and Yu.S. Perov (MGU) on the effective cross section of the scattering of polarized electrons and positrons at polarized electrons; Ya.E.Chudars and I.Ya.Taure (Riga) on the determination of the intensity of the components of the complex β-spectrum according to the Fermi diagram; I.M.Band, L.N.Zyryanova, and Yu.P.Suslov, LGU (Leningrad State University) on the computation of the probability of the permitted and of the forbidden capture of electrons by a nucleus.

KERIMOV, B.K.; NADZHAFOV, I.M.

Bremsstrahlung of an electron with oriented spin. Nauch. dokl. vys. skoly; fiz.-mat. nauki no.1:95-100 '58. (MIRA 12:3)

1. Moskovskiy gosudarstvennyy universitet im. M.V. Lomonosova.
(Bremsstrahlung) (Electrons)

KERIMOV, B.

C-3

EAST GERMANY/Nuclear Physics - Elementary Particles

Abs Jour : Ref Zhur - Fizika, No 4, 1958, No 5079

Author : Sokolow A., Kerimow B.
Inst : Moscow State University
Title : On the Theory of Dirac Particles with Oriented Spin

Orig Pub : Ann. Physik, 1958, 2, No 1-2, 46-53

Abstract : The theory of Dirac particles with oriented spin (Referat Zhur Fizika, 1959, No 1, 175) is applied to an investigation of the β decay of nuclei and the π → μ + ν decay. Certain results are obtained relative to the polarization of the electrons in β decay of unpolarized nuclei and the polarization of muons in the decay π → μ + ν. -- G.V. Frolov

Card : 1/1

KERIMOV, B. K., SOKOLOV, A. A., and GUSEYNOV, I. I.

"Damping Theory Study of Elastic Scattering of Particles with Account of Polarization Effects," Nuclear Physics, Vol. 5, No. 2, Jan 1958 (North Holland Publ. Co., Amsterdam)

Physics Dept, Moscow State Univ, Moscow, USSR

Abst: Elastic scattering of Dirac particles by a short-range force centre is considered from the standpoint of radiation damping theory. The expression for the scattering amplitude is determined. The integral equation thus obtained for the scattering amplitude permits one to investigate polarization effects.

21(7)

AUTHOR: Kerimov, B.K. SOV/155-58-5-26/37

TITLE: On the Question Concerning Angular Distribution and Polarization of Electrons During the Dissociation of an Oriented Neutron

PERIODICAL: Nauchnyye doklady vysshey shkoly. Fiziko-matematicheskiye nauki, 1958, Nr 5, pp 151-157 (USSR)

ABSTRACT: The present paper continues the investigation [Ref 4] of the author and of A. Sokolov. Starting from the theory of the Dirac particles polarized in longitudinal direction the author calculates the angular distribution and polarization of electrons arising during the ß - dissociation of a free polarized neutron. For the determination of the matrix elements of the dissociation with consideration of the polarization he uses the method applied in [Ref 4,6].
The author thanks Professor A.A. Sokolov and A.I. Muratdinov for discussion.

Card 1/2

26

On the Question Concerning Angular Distribution and Polarization of Electrons During the Dissociation of an Oriented Neutron SOV/155-58-5-26/37

There are 12 references, 5 of which are Soviet, 6 American, and 1 German.

ASSOCIATION: Moskovskiy gosudarstvennyy universitet imeni M.V.Lomonosova (Moscow State University imeni M.V. Lomonosov)

SUBMITTED: August 29, 1958

Card 2/2

AUTHORS: Kerimov, B. K., Nadzhafov, I. M. SOV/48-22-7-26/26

TITLE: Bremsstrahlung From a Longitudinally Polarized Electron (Tormoznoye izlucheniye prodol'no-polyarizovannogo elektrona)

PERIODICAL: Izvestiya Akademii nauk SSSR, Seriya fizicheskaya, 1958, Vol. 22, Nr 7, pp. 886 - 892 (USSR)

ABSTRACT: A formula, which is deduced in this paper, determines the dependence of the circular polarization of bremsstrahlung photons on the angle and the energy. The formula obtained in this paper for the effective cross-section of bremsstrahlung is a generalization of the formula of Bethe-Heitler (Bete-Gaytler). It takes into account the longitudinal polarization of the electron spin and of the photon. In 1945 the theory of Dirac (Dirak)-particles with an oriented spin was developed by Sokolov (Refs 12, 13). This theory permits to find the dependence of the effective cross-section of a number of processes on the directions of the particle spins. According to this theory the quadratic forms of the matrix elements expressing the transition of the electron from the state (k,s, $\varepsilon$) to the state (k',s', $\varepsilon$') (Ref 12) are computed with formula (2). In a Born (Born) approximation the effective cross-section of the bremsstrahlung of electrons, which

Card 1/3

are polarized parallel or antiparallel to the direction of motion can be determined by formula (3). Using (2), (3) and (4) the effective cross-section of the bremsstrahlung through a longitudinally polarized electron can be determined. In order to investigate the circular polarization of the bremsstrahlung the amplitude of the vector potential of the photon field is split into two components: Formulae (5) and (6). Taking into account (2) and (5), formula (10) is obtained for the effective cross-section of the bremsstrahlung of the longitudinally polarized relativistic electron, after the final spin states of the electrons has been summed up. Only electrons which are polarized parallel or antiparallel to the direction of motion are able to produce "brems" photons with a circular polarization. The degree of circular polarization of the bremsstrahlung is determined from formula (14), wheras the degree of the circular polarization of the "brems" photons is determined from formula (20). The curves show, that the polarization P increases considerably with an increase of energy of the "brems" photon. The maximum polarization P increases with the increase of the electron energy and $T_k = 3,5$ MeV ($E=8m_0c^2$) reaches $\sim 100\%$. The bremsstrahlung of an electron polarized antiparallel to the

Bremsstrahlung From a Longitudinally Polarized Electron SOV/48-22-7-26/26

direction of motion partly shows a left-handed circular polarization. A.A.Sokolov discussed the paper with the authors. There are 2 figures and 13 references, 4 of which are Soviet.

ASSOCIATION: Kafedra statisticheskoy fiziki i mekhaniki Moskovskogo gos. universiteta im.M.V.Lomonosova (Chair of Statistical Physics and Mechanics at the Moscow State University imeni M.V.Lomonosov)

Card 3/3

KERIMOV B K

56-1-17/56

AUTHORS: Sokolov, A. A., Guseynov, I. I., Kerimov, B. K.

TITLE: On the Scattering of Dirac Particles by a Short Range Force Centre According to the Damping Theory (K rasseyaniyu dirakovskikh chastits korotkodeystvuyushchim silovym tsentrom s uchetom zatukhaniya)

PERIODICAL: Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, 1958, Vol. 34, Nr 1, pp. 110 - 112 (USSR)

ABSTRACT: In the present work the elastic scattering of Dirac particles by any short range force centre is investigated according to the damping theory. The wave functions are subdivided here according to the value of the projection of the spin onto the z-axis ($m_s = \pm 1/2$) and not according to the value of projection of the spin onto the direction of motion. The integral equation for this case is written down explicitly. A formula is also given for the matrix elements of the transitions on which occasion the spin proportion of the matrix element is given still more precisely. Moreover, the authors use various recurrence formulae. The expressions for the components of

Card 1/2



On the Scattering of Dirac Particles by a Short Range Force Centre According to the Damping Theory

56-1-17/56

the matrix element obtained after some further transformations are written down. It is possible to produce the orthogonal character of the matrix elements necessary for the damping theory. The thus found differential cross section of the elastic scattering and an expression for the amplitude of scattering are given. Concluding, the total cross section of the elastic scattering is written down. There is 1 reference, which is Slavic.

ASSOCIATION: Moscow State University (Moskovskiy gosudarstvennyy universitet)

SUBMITTED: July 10, 1957

AVAILABLE: Library of Congress

Card 2/2

KERIMOV, B.K.

Angular asymmetry and polarization of particles in the decay of a polarized neutron. Izv. vys. ucheb. zav.; fiz. no.4:111-118 '59. (MIRA 13:3)

1.Moskovskiy gosuniversitet imeni M.V. Lomonosova.
(Neutrons--Decay)

24 (5)

AUTHOR: Kerimov, B. K. SOV/48-23-7-30/31

TITLE: On the Problem of the β-Decay of the Neutrons With Oriented Spin (K voprosu o β-raspade neytrona s oriyentirovannym spinom)

PERIODICAL: Izvestiya Akademii nauk SSSR. Seriya fizicheskaya, 1959, Vol 23, Nr 7, pp 924-928 (USSR)

ABSTRACT: In the present paper, the angular asymmetry and the degree of longitudinal polarization of electrons occurring in the β-decay of polarized free neutrons are calculated by the theory of the Dirac particles with oriented spin. By equation (3), the Hamilton interaction of this decay is described, and the equation (5) is indicated for the probability of the decay of a neutron in the unit of time. In agreement with a previous paper (Ref 1), the matrix elements of the decay are calculated by equation (7). In the nonrelativistic approximation of the interaction, the equation (8) is obtained for determining the direction of the spins of the electrons and antineutrinos. Finally, the formula (11) is obtained from equation (8) for the angular distribution of the electrons in the decay of polarized free neutrons, and from this again, the equation (13) is obtained for the degree of longitudinal polarization of the electrons. On the basis of

Card 1/2

experimental results, the equation (15) describes the angular distribution of the electrons. Finally, four variants of the binding are investigated, and the coefficient of the angular correlation between the momenta of the electrons and the spin of the neutrons is calculated for these four variants. The author thanks Professor A. A. Sokolov for the discussions carried on with him. There are 9 references, 2 of which are Soviet.

ASSOCIATION: Moskovskiy gos. universitet im. M. V. Lomonosova (Moscow State University imeni M. V. Lomonosov)

24 (5)

AUTHORS: Sadykhov, F. S., Kerimov, B. K. SOV/48-23-7-31/31

TITLE: The Formation of an Electron-positron Pair in the Collision of Two Polarized $\gamma$-Quanta (Obrazovaniye pary elektron-pozitron pri stolknovenii dvukh polyarizovannykh $\gamma$-kvantov)

PERIODICAL: Izvestiya Akademii nauk SSSR. Seriya fizicheskaya, 1959, Vol 23, Nr 7, pp 929-932 (USSR)

ABSTRACT: In the present paper, the effective cross section in the formation of an electron-positron pair by the collision of two polarized $\gamma$-quanta is to be calculated by the theory of Dirac particles. The Dirac equation in the form of formula (2) is used as a basis. By the equations (3) the operators occurring in formula (2) of the interaction of the electrons with $\gamma$-quanta are indicated, and by the equations (6) the two functions describing the initial and final state in formula (2) are indicated and discussed in detail. The probability of formation of an electron-positron pair is then investigated, and formula (9) is indicated for the total effective cross section of the formation of an electron-positron pair. This formula shows that in the collision of two $\gamma$-quanta with right-hand or left-hand polarization, an electron and a positron with right-hand or left-hand polarization are formed. For the

Card 1/2

The Formation of an Electron-positron Pair in the Collision of Two Polarized $\gamma$-Quanta

SOV/48-23-7-31/31

ultrarelativistic case, the equation (13) is indicated for the effective cross section; this equation shows that in the collision of two $\gamma$-quanta of high energy, the electron and the positron always show only right-hand or left-hand polarization. Finally, formula (14) is indicated for the cross section of non-polarized $\gamma$-quanta. The authors thank A. A. Sokolov for his continuous help in the work. There are 9 references, 3 of which are Soviet.

ASSOCIATION: Moskovskiy gos. universitet im. M. V. Lomonosova (Moscow State University imeni M. V. Lomonosov)

Card 2/2

24(5) SOV/56-36-4-63/70

AUTHORS: Sadykhov, F. S., Kerimov, B. K.

TITLE: On Pair Formation in a Collision Between Two Longitudinally Polarized γ-Quanta (Ob obrazovanii pary pri stolknovenii dvukh prodol'no polyarizovannykh γ-kvantov)

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1959, Vol 36, Nr 4, pp 1324-1326 (USSR)

ABSTRACT: The present "Letter to the Editor" describes the results obtained by calculating electron-positron pair formation in collisions of longitudinally polarized γ-quanta in consideration of the longitudinal polarization of the produced pair. Such an investigation is of interest, because it is today already possible to obtain γ-beams of sufficiently high energy ($E_\gamma = 0.5 - 1$ Bev) by bremsstrahlung of longitudinally polarized electrons of high energies or by the β-decay of nuclei. The authors investigated the process $\gamma + \gamma' \rightarrow e_- + e_+$ by means of the equation (1) by which it is described $D\psi_2 = \left\{U(\varkappa)D^{-1}U(\varkappa') + U(\varkappa')D^{-1}U(\varkappa)\right\}\psi_0$; $\psi_0$ denotes the wave function of the initial-, $\psi_2$ that of the final state,

Card 1/3

D = Dirac operator, $U(\varkappa)$ and $U(\varkappa')$ are the operators of electron-γ-interaction; the γ-quanta have the momenta $\hbar\varkappa$ and $\hbar\varkappa'$. On the basis of formula (3) derived by Sokolov and Ivanenko (Ref 5) for the total $e_+e_-$-pair production cross section, conditions are discussed in detail in consideration of particle spin (which is explicitly written down). $\vec{a}_l \equiv \vec{a}_l(\varkappa)$ and $a'_{l'} \equiv a'_{l'}(\varkappa')$ are the polarization vectors of the γ-quanta. From formula (3) it follows that: 1) At a collision of two right-longitudinal ($l = l' = 1$; γ-spin is in the direction of motion) and two right-longitudinal ($l = l' = -1$; γ-spin is opposed to the direction of motion) polarized γ-quanta both an electron and a positron with right ($s_- = s_+ = 1$) as well as with left ($s_- = s_+ = -1$) longitudinal polarization can be produced with different probability. 2) At a collision of right ($l = 1$) and left ($l' = -1$) longitudinally polarized γ-quanta (also $l = -1$, $l' = 1$) the formation is possible: a) of $e_- + e_+$ with right ($s_- = s_+ = 1$) as well as with left ($s_- = s_+ = -1$) longitudinal polarizations with the same

SOV/56-36-4-63/70

On Pair Formation in a Collision Between Two Longitudinally Polarized γ-Quanta

probability and b) an electron with right ($s_- = 1$) and a positron with left ($s_+ = -1$) longitudinal polarization and vice versa ($s_- = -1$, $s_+ = 1$) with the same probability. Finally, (3) is written down for the ultrarelativistic case and for the case of unpolarized γ-quanta. The authors finally thank Professor A. A. Sokolov for his interest and valuable remarks. There are 6 references, 2 of which are Soviet.

ASSOCIATION: Moskovskiy gosudarstvennyy universitet (Moscow State University)

SUBMITTED: January 10, 1959

Card 3/3

21(8)

AUTHORS: Kerimov, B. K., Mukhtarov, A. I., Gadzhiyev, S. A.

SOV/56-37-2-47/56

TITLE: Polarization Effects in the Decay $\pi^0 \rightarrow e^- + e^+ + \gamma$

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1959, Vol 37, Nr 2(8), pp 575-576 (USSR)

ABSTRACT: Recently (Refs 1,2) cases of a charge exchange scattering of negative pions on hydrogen ($\pi^- + p \rightarrow \pi^0 + n$) with a subsequent decay of the neutral pion according to the Dalitts scheme into an electron-positron pair and into a $\gamma$-quantum were recorded. In the present paper the results of a calculation of the decay of the neutral pion according to the above scheme taking into account the spin states (of the longitudinal polarizations) of the electron-positron pair produced and of the $\gamma$-quantum are presented. The Hamiltonian of the direct interaction for the process mentioned above takes the form $H_{int} = eg\psi_{\pi^0}\left\{\psi^+_{e^-} O_i D^{-1}(\vec{\alpha}\vec{A}^+)\psi_{e^+} + (\psi^+_{e^-}\vec{\alpha}\vec{A}^+ D^{-1})O_i\psi_{e^+}\right\}$. In this equation $\psi_{\pi^0}$, $\psi^+_{e^-}$, $\psi_{e^+}$ and $\vec{A}^+$ denote the wave functions of the $\pi^0$ meson, the electron, positron, and of the

Card 1/3

$\gamma$-quantum. D represents the Dirac operator, $\vec{\alpha} = \rho \vec{\sigma}$ the Dirac matrices, $O_i = \rho_2$ holding, if the $\pi^0$ meson is pseudoscalar, and $O_i = \rho_3$, if it is a scalar particle. In the sequel an expression for the probability of the decay in question $\pi^0 \rightarrow e^- + e^+ + \gamma$ is derived

$$dW(s_-, s_+, l, \theta) = \frac{e^2 g^2}{\hbar^2 c 4(2\pi)^3} \frac{k_+^2 d\Omega_+ (dk_-)}{k_{o\pi} k_+ K_- (k_{o\pi} - K_-) + k_{o\pi} K_- k_- K_+ \cos\theta} \cdot$$

$\cdot \left\{ \Phi_1 + s_- s_+ \Phi_2 + l s_- \Phi_3 + l s_+ \Phi_4 \right\}$. The rather lengthy expressions occurring in this equation for $\Phi_1$, $\Phi_2$, $\Phi_3$, and $\Phi_4$ are written down explicitly. The formula for $dW(s_-, s_+, l, \theta)$ gives the angular dependence and the energy dependence of the degree of longitudinal polarization and of the correlations between the polarizations (the terms $\sim s_- s_+, l s_-, l s_+$) in the decay $\pi^0 \rightarrow e^- + e^+ + \gamma$. This may be of use in the collection of data on the properties of the neutral pion. According to the

Polarization Effects in the Decay $\pi^o \longrightarrow e^- + e^+ + \gamma$ SOV/56-37-2-47/56

formulas derived herein the decay probability in $\pi^o \rightarrow e^- + e^+ + \gamma$ for the extreme relativistic decay electrons and positrons (if $k_-, k_+ \gg k_o$ and $\Phi_1 = \Phi_2, \Phi_3 = \Phi_4$ is true) differ from zero only if the electrons and the positrons of the pairs exhibit either a left or right polarization. The authors express their gratitude to A. A. Sokolov for the constant interest shown in this work. There are 5 references, 2 of which are Soviet.

ASSOCIATION: Moskovskiy gosudarstvennyy universitet (Moscow State University)

SUBMITTED: May 16, 1959

Card 3/3

KERIMOV, B.K.; MUKHTAROV, A.I.; GADZHIYEV, S.A.

Longitudinal polarization of an electron-positron pair in the decay of a neutral $\pi$-meson. Izv.vys.ucheb.zav.;fiz. no.2:26-30 '60. (MIRA 13:8)

1. Moskovskiy gosuniversitet im. M.V.Lomonosova i Azerbaydzhanskiy gosusiversitet im. S.M.Kirova.
(Mesons--Decay)

05606

S/056/60/038/006/028/049/XX
B006/B070

24.6520

AUTHORS: Kerimov, B. K., Arutyunyan, V. M.

TITLE: Polarization of Electrons in Elastic Scattering Taking Into Account the Finite Dimensions of the Nucleus

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1960, Vol. 38, No. 6, pp. 1798-1802

TEXT: The object of the present work was to calculate the scattering phase shifts and the polarization of elastically scattered electrons when allowance is made for the finite size of the scattering center. It is known that when a partially polarized electron beam is scattered by nuclei, the angular distribution has an azimuthal asymmetry. As Mott has shown, such an effect can appear on double scattering of an electron at a point center. This effect has been observed experimentally many times but only for low energies where the electron wavelength is large compared to the dimensions of the nucleus which may then be considered as a point scatterer. It may be expected that for large electron energies, the

Card 1/4

85686

Polarization of Electrons in Elastic Scattering Taking Into Account the Finite Dimensions of the Nucleus

S/056/60/038/006/028/049/XX
B006/B070

structural peculiarities of a nucleus of finite size would affect the azimuthal asymmetry considerably. An expression for the azimuthal asymmetry on double scattering is derived in this paper, and corrections are given to the usual Mott formula for the second and fourth nuclear charge density moments. The azimuthal asymmetry, $\varphi_2$, on double scattering through the angles $\theta_1$, $\theta_2$ is characterized by $\delta(\theta_1\theta_2) = 2\Delta(\theta_1)\Delta(\theta_2)$; $\Delta(\theta) = i(fg^* - f^*g)/(ff^* + gg^*)$, where f and g are the Dirac scattering amplitudes. In first approximation $\Delta(0) = 0$; in second approximation formula (10) is obtained. As is seen from this formula, the nuclear dimensions affect the polarization properties of the electron beam for large energies. For energies of 50 - 100 Mev, (10) may be simplified to

(14): $\Delta(\theta) = \Delta^T(\theta)\left[1 + \frac{2}{3}k^2\langle r^2\rangle\left(\sin^2\frac{\theta}{2} + \frac{\cos^2(\theta/2)}{\ln\sin(\theta/2)}\right)\right]$. As an example, an estimate of the effects due to the finite dimensions of the $C^{12}$ nucleus is given. The moments of second and fourth order are found to

Card 2/4

85686

S/056/60/038/006/028/049/XX
B006/B070

Polarization of Electrons in Elastic Scattering Taking Into Account the Finite Dimensions of the Nucleus

be $\langle r^2 \rangle = 5.790 \cdot 10^{-26}\,cm^2$ and $\langle r^4 \rangle = 5.061 \cdot 10^{-51}\,cm^4$. The diagram shows $\Delta/\Delta^P$ as a function of the scattering angle for the following electron energies: 1 - 100, 2 - 200, 3 - 300, and 4 - 400 $m_0c^2$. A. A. Sokolov is thanked for discussions. R. M. Muradyan is mentioned. There are 1 figure and 11 references: 5 Soviet, 2 US, 2 British, 1 Dutch, and 1 Japanese.

ASSOCIATION: Moskovskiy gosudarstvennyy universitet (Moscow State University)

SUBMITTED: January 3, 1960

Card 3/4

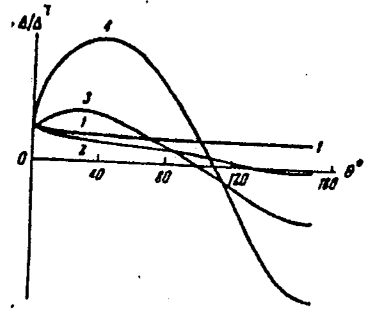
85686

Polarization of Electrons in Elastic Scattering Taking Into Account the Finite Dimensions of the Nucleus

S/056/60/038/006/028/049/XX
B006/B070

$$\Delta(\theta) = \Delta^{T}(\theta)\Big[1 + \frac{2}{3}\sin^2\frac{\theta}{2}\Big(k^2\langle r^2\rangle + \frac{2}{3}k^4\langle r^2\rangle^2\sin^2\frac{\theta}{2} - \frac{1}{5}k^4\langle r^4\rangle\sin^2\frac{\theta}{2}\Big) + \frac{1}{3}\frac{\cos^2(\theta/2)}{\ln\sin(\theta/2)}\Big(2k^2\langle r^2\rangle + \frac{4}{3}k^4\langle r^2\rangle^2\sin^2\frac{\theta}{2} - \frac{1}{3}k^4\langle r^2\rangle^2 - \frac{1}{5}k^4\langle r^4\rangle - \frac{1}{5}k^4\langle r^4\rangle\sin^2\frac{\theta}{2}\Big)\Big], \quad (10)$$

$$\Delta^{T}(\theta) = \frac{2Z}{137}\frac{vc^{-1}(1 - v^2/c^2)^{1/2}}{1 - v^2c^{-2}\sin^2(\theta/2)}\frac{\sin^2(\theta/2)}{\cos(\theta/2)}\ln\sin\frac{\theta}{2} \quad (11)$$




Card 4/4

APPROVED FOR RELEASE: 06/13/2000 CIA-RDP86-00513R000721530002-1"

86831

S/020/60/135/005/020/043
B019/B067

26.2357

AUTHOR: Kerimov, B. K.

TITLE: Energy Distribution of Bremsstrahlung of a Longitudinally Polarized Electron

PERIODICAL: Doklady Akademii nauk SSSR, 1960, Vol. 135, No. 5, pp. 1111-1113

TEXT: In a comprehensive introduction, the author discusses previous papers (Refs. 1-12) in which the polarization properties of particles in bremsstrahlung are experimentally or theoretically studied. The author derives an expression for the energy distribution of bremsstrahlung of a longitudinally polarized electron which, besides the known Bethe-Heitler cross section, contains a correction. This correction is due to the fact that the states of polarization of the initial electron and of the emitted photon have been taken into account. The author proceeds from the formula (Ref. 1) for the angular distribution of bremsstrahlung of a longitudinally polarized relativistic electron in Born's approximation. By integration over the solid angle of the departing photon, he obtains the

Card 1/2

86831

Energy Distribution of Bremsstrahlung of a Longitudinally Polarized Electron

S/020/60/135/005/020/043
B019/B067

integral cross section for bremsstrahlung with fixed longitudinal polarization. Therefrom, he obtains a generalization of the known formula of Bethe-Heitler for the bremsstrahlung of a relativistic electron, and for the dependence of the degree of circular polarization of bremsstrahlung on the energy of the longitudinally polarized electron:

$$P_c(E,E') = s\frac{\varepsilon_\gamma(3E+E')}{3(E^2+E'^2)-2EE'} = s\frac{\varepsilon_\gamma(4-\varepsilon_\gamma/E)}{E(4-4\varepsilon_\gamma/E+3\varepsilon_\gamma^2/E^2)} \quad (6)$$

Here, E and E' denote the kinetic energies of the ultrarelativistic electrons corresponding to the initial and final states. The author thanks Professor A. A. Sokolov for discussing the paper. There are 14 references: 5 Soviet and 9 US.

ASSOCIATION: Moskovskiy gosudarstvennyy universitet im. M.V. Lomonosova (Moscow State University imeni M. V. Lomonosov)

PRESENTED: July 2, 1960, by N. N. Bogolyubov, Academician

SUBMITTED: June 28, 1960

Card 2/2

KERIMOV, B. K.

Doc Phys-Math Sci - (diss) "Studies on the theory of polarized fermions and bosons." Moscow, 1961. 51 pp; (Ministry of Higher and Secondary Specialist Education RSFSR, Moscow State Univ imeni M. V. Lomonosov, Physics Faculty); 150 copies; price not given; bibliography on pp 48-50 (66 entries); (KL, 10-61 sup, 203)

S/048/61/025/001/029/031
B029/B063

24.6100

AUTHOR: Kerimov, B. K.

TITLE: Longitudinal polarization of particles in weak four-fermion interaction

PERIODICAL: Izvestiya Akademii nauk SSSR. Seriya fizicheskaya, v. 25, no. 1, 1961, 157-162

TEXT: Following several previous articles (Refs. 1-4), the author has calculated the angular distribution and the longitudinal polarization of particles during the decay of a flying, completely polarized, free fermion b into three fermions according to the mode $b \rightarrow a + c + d$ and, correspondingly, for the reaction $b + d \rightarrow A + c$. The wave functions in the present mode read $\psi_i$ ($i$ = a, b, c, and d) and enter into the four-fermion interaction (V,A): $H_{int} = \sum_{j=V,A} C_j(\psi_a^+ O_j \psi_b)(\psi_c^+ O_j \psi_d)$; $O_V \equiv \alpha_\mu (i\vec{\alpha}, I)$; $O_A \equiv (\vec{\sigma}, i\,\rho_1)$. They are determined by simultaneous solution of the Dirac equation for the free energy and of the equation $(\vec{\sigma}_i \vec{p}_i - p_i s_i)\psi_i = 0$,

Card 1/4

X

where $\vec{p}_i = \frac{\hbar}{i}\nabla_i$ is the momentum operator of the particle; $\vec{\alpha} = \rho_1\vec{\sigma}$, and $\rho_1$ are the Dirac matrices; $s = \pm 1$ is the eigenvalue of the projecting operator $\vec{\sigma}_i\vec{p}_i/p_i$. This eigenvalue characterizes the chirality of the fermion, and is an integral of motion. If $s_i = 1$, the chirality of the fermion is positive, and if $s_i = -1$, it is negative. The matrix elements of the decay process $b \to a + c + d$ read

$$b_i^+(\vec{k}_i, s_i, \varepsilon_i)\gamma_{\mu'\nu'} b_j(\vec{k}_j, s_j, \varepsilon_j) b_j^+(\vec{k}_j, s_j, \varepsilon_j)\gamma_{\mu\nu} b_i(\vec{k}_i, s_i, \varepsilon_i) = \frac{1}{4}\rho_{\mu'\mu}\sigma_{\nu'\nu} .$$

Bulky expressions for $\rho_{\mu'\mu}$ and $\sigma_{\nu'\nu}$ are explicitly given. The differential probability of the decay process reads

$$dW = \frac{(d\vec{k}_c)(d\vec{k}_d)}{c\hbar^2(2\pi)^5}\left|M_{ba}\right|^2 \delta(K_b - K_a - K_c - K_d),$$ where $\vec{k}_b = \vec{k}_a + \vec{k}_c + \vec{k}_d$ and

Card 2/4

$$\left|M_{ba}\right|^2 = \sum_{j,j'=V,A} C_j C_{j'} (b_b^+ O_{j'}^+ b_\alpha b_\alpha^+ O_j b_b)(b_\alpha^+ O_{j'}^+ b_o b_o^+ O_j b_\alpha).$$

The definite expression for $\left|M_{ba}\right|^2$ is given next. The formulas derived may be used to study, above all, the angular distribution and longitudinal polarizations of particles produced by a decaying polarized neutron and muon during their flight. If the decaying polarized fermion is at rest, expressions are obtained for the angular distributions of the decay of a polarized neutron and muon at rest. The longitudinal polarization of the fermions produced is taken into account for this special case. First, the special case of beta decay of a polarized neutron at rest ($k_n \to 0$) is studied with regard to the proton recoil ($k_p = 0$). A fairly large explicit expression is then given for the square of the matrix element. Next, an expression for the angular distribution of electrons during the decay of a polarized neutron at rest is given, which takes account of the longitudinal polarization of electron, antineutrino, and recoil proton. The formulas derived here may be used to determine the effect of recoil upon the angular distribution and the degree of longitudinal polarization $P(\Theta)$ of particles emitted at an angle $\Theta$ in the direction of the neutron spin. If the proton recoils ($m_{op} \to \infty$)



APPROVED FOR RELEASE: 06/13/2000 CIA-RDP86-00513R000721530002-1"

are neglected, the V-A type of coupling is in good agreement with the results of measurement of the decay of a polarized neutron. Finally, the decay of a muon is discussed. Here again, an expression is given for the square of the decay matrix element. According to the latest measurements (Ref. 9), the negative muons appearing during the decay of negative pions are polarized in their direction of motion. For a polarized $\mu^{\mp}$ meson one obtains $|M_{\mu e}|^2 = \frac{1}{4}\{(1-\eta)(1 \mp S_e)(1 \pm S_e(k_e^o k_{\nu'}^o))\left[1 \mp \frac{k_e(\vec{S}_\mu \vec{k}_e^o) + k_{\nu'}(\vec{S}_\mu \vec{k}_{\nu'}^o)}{k_{o\mu} - k_e - k_{\nu'}}\right]$.

A. A. Sokolov is thanked for a discussion. This is the reproduction of a lecture read at the Tenth All-Union Conference on Nuclear Spectroscopy, Moscow, January 19-27, 1960. There are 14 references: 7 Soviet-bloc and 7 non-Soviet-bloc.

ASSOCIATION: Fizicheskiy fakul'tet Moskovskogo gos. universiteta im. M. V. Lomonosova
(Division of Physics, Moscow State University imeni M. V. Lomonosov)



APPROVED FOR RELEASE: 06/13/2000 CIA-RDP86-00513R000721530002-1"

89264

S/048/61/025/001/030/031
B029/B063

24.6900

AUTHORS: Kerimov, B. K., Nadzhafov, I. M.

TITLE: Electron-positron correlation in pair production by a polarized gamma quantum 19

PERIODICAL: Izvestiya Akademii nauk SSSR. Seriya fizicheskaya, v. 25, no. 1, 1961, 163-165

TEXT: The present paper deals with 1) the determination of the production cross sections for electron-positron pairs by photons, which are integrated over all angles, and 2) with electron bremsstrahlung in the nuclear field in the case of fixed longitudinal polarization of all particles involved in the process. Taking account of the longitudinal polarization of electron, positron, and incident gamma quantum, the pair production cross sections integrated over the directions of emission of the electron ($d\Omega_- = \sin\theta_- d\theta_- d\varphi_-$) and positron ($d\Omega_+ = \sin\theta_+ d\theta_+ d\varphi_+$), in Born approximation, take the form

$$d\sigma_{ls_+s_-}(E_+, E_-) = \int d\Omega_+ \int d\sigma_{ls_+s_-}(0_+, 0_-)\, d\Omega_- = \frac{1}{4} d\sigma_{B.-r.}(E_+, E_-) + Z^2\alpha^3 \frac{c^3 p_+ p_- dE_+}{\varepsilon^5_\gamma} \left(s_+ s_- q_1(E_+, E_-) - l s_+ q_2(E_+, E_-) - l s_- q_3(E_+, E_-)\right); \quad (1)$$

Card. 1/5

The eigenvalues $s_+ = \pm 1$, $s_- = \pm 1$ of the projecting operator $\frac{\vec{\sigma}_\pm \vec{p}_\pm}{p_\pm}$ characterize the longitudinal polarization of the electron and positron spins. If $s_+ = 1 (s_- = 1)$, the spin of the positron (electron) has the same direction as the momentum, and if $s_+ = -1 (s_- = -1)$, it has the opposite direction. $l = \pm 1$ is the circular polarization of the incoming gamma quantum ($l = 1$) indicates right-hand circular, and $l = -1$ left-hand circular). $E_\pm$, $p_\pm$ denote the total energies and momenta of the positron and electron, respectively; and $\varepsilon_\gamma = E_+ + E_-$ is the energy of the incoming gamma quantum. The very complicated function $q_i(E_+, E_-)$ is not explicitly given. The above expression is a generalization of the well-known cross section of Bethe-Heitler, which takes the spin correlations $e^-\gamma$, $e^+\gamma$, $e^-e^+$ into account. At extremely relativistic energies (if $\varepsilon_\gamma, E_+, E_- \gg m_0c^2$), the above formula becomes very simple, and the following relation is valid for

89264

Electron-positron correlation ...

S/048/61/025/001/030/031
B029/B063

follow for the relative probabilities of pair production in states with the spin correlations $s_+s_- = 1$ and $s_+s_- = -1$. If the energy of the incoming gamma quantum is symmetrically distributed among electron and positron, then $E_+ = E_- = \frac{1}{2}\varepsilon_\gamma$ and $dW_1 = dW_2$ will hold. Using the substitution $E_+ \to -E$, $E_- \to E'$, $\varepsilon_\gamma \to -\varepsilon_\gamma$, $s_+ \to s$, $s_- \to s'$, $1 \to -1$, the integral cross section for circularly polarized bremsstrahlung ($l = \pm 1$) of a longitudinally polarized ($s = \pm 1$), ultrarelativistic electron is given by

$$dW_1 = \frac{(d\sigma)_{s_+s_-=1}}{(d\sigma)_{s_+s_-=1} + (d\sigma)_{s_+s_-=-1}} = \frac{\varepsilon_\gamma^2}{3E_+^2 + 3E_-^2 + 2E_+E_-}, \quad dW_2 = \frac{(d\sigma)_{s_+s_-=-1}}{(d\sigma)_{s_+s_-=1} + (d\sigma)_{s_+s_-=-1}} = \frac{2(E_+^2 + E_-^2)}{3E_+^2 + 3E_-^2 + 2E_+E_-}$$

if the longitudinal polarization of the latter in the final state ($s' = \pm 1$) is taken into account. Here, $E = cp$ and $E' = cp'$ denote the kinetic energy of the electron before and after emission of bremsstrahlung, and $\varepsilon_\gamma$ is the

Card 4/5

longitudinally polarized $e^+$-$e^-$ pairs:

$$d\sigma_{l s_+ s_-}(E_+, E_-) = \bar{\varphi}\frac{dE_+}{\varepsilon_\gamma^3}\left(\ln\frac{2E_+E_-}{\varepsilon_\gamma m_0 c^2} - \frac{1}{2}\right)\left\{\left(E_+^2 + E_-^2 + \frac{2}{3}E_+E_-\right) - s_+s_-\frac{1}{3}(E_- - E_+)^2 + ls_+\varepsilon_\gamma\left(E_+ - \frac{1}{3}E_-\right) + ls_-\varepsilon_\gamma\left(E_- - \frac{1}{3}E_+\right)\right\}, \quad (2)$$

with $\bar{\varphi} = Z^2 r_0^2 \alpha$, $r_0 = \frac{e^2}{m_0 c^2}$; $\alpha = \frac{e^2}{\hbar c} = \frac{1}{137}$. The integral production cross section of longitudinally polarized pairs, which is averaged over the two polarizations of the gamma quantum, reads as follows:

$$d\sigma_{s_+s_-}(E_+, E_-) = \bar{\varphi}\frac{dE_+}{\varepsilon_\gamma^3}\left(\ln\frac{2E_+E_-}{\varepsilon_\gamma m_0 c^2} - \frac{1}{2}\right)\left\{\left(E_+^2 + E_-^2 + \frac{2}{3}E_+E_-\right) - s_+s_-\frac{1}{3}(E_- - E_+)^2\right\}. \quad (3)$$

(3),

wherefrom the relations

$$d\sigma_{lss'}(E, E') = \bar{\varphi}\frac{E'd\varepsilon_\gamma}{E\varepsilon_\gamma}\left(\ln\frac{2EE'}{\varepsilon_\gamma m_0 c^2} - \frac{1}{2}\right) \times \left\{\left(\frac{E^2 + E'^2}{EE'} - \frac{2}{3}\right) + ss'\frac{(E + E')^2}{3EE'} + ls\frac{\varepsilon_\gamma(3E + E')}{3EE'} + ls'\frac{\varepsilon_\gamma(3E' + E)}{3EE'}\right\};$$

Card 3/5

89264

Electron-positron correlation ...

S/048/61/025/001/030/031
B029/B063

energy of the emitted gamma quantum. A. A. Sokolov is thanked for interest and a discussion. This is the reproduction of a lecture read at the Tenth All-Union Conference on Nuclear Spectroscopy, Moscow, January 19-27, 1960. There are 7 references: 3 Soviet-bloc and 4 non-Soviet-bloc.

ASSOCIATION: Fizicheskiy fakul'tet Moskovskogo gos. universiteta im. M. V. Lomonosova
(Division of Physics, Moscow State University imeni M. V. Lomonosov)

Card 5/5

S/048/61/025/001/031/031
B029/B063

24.6900

AUTHORS: Kerimov, B. K. and Sadykhov, F. S.

TITLE: Electron-positron polarization correlation in pair production with regard to the finite nuclear dimensions

PERIODICAL: Izvestiya Akademii nauk SSSR. Seriya fizicheskaya, v. 25, no. 1, 1961, 166-168

TEXT: The dependence of the cross section for longitudinally polarized electron-positron pairs on the angle of emission of the positron has been studied in consideration of the finite nuclear dimensions. The cross-section formula derived here may be used to study the effect of finite nuclear dimensions on the angular correlation and the longitudinal electron-positron spin correlation in pair production. The form factor $F(q)$ of the density distribution of the nuclear charge $\varrho(r)$ at moderate energies is given as $F(q) = \int_0^\infty \varrho(r) \frac{\sin(qr)}{qr} 4\pi r^2 dr \approx 1 - \frac{1}{6} q^2 \langle r^2 \rangle$, where $\langle r^2 \rangle$ is the mean

Card 1/4

89265



square radius of the nuclear charge distribution, and $\hbar\vec{q} = \hbar\vec{\varkappa} - \hbar\vec{k}_+ - \hbar\vec{k}_-$ is the momentum transferred to the nucleus in pair production. For the production cross section of longitudinally polarized pairs, which is averaged over the polarizations of the incident gamma quantum and integrated over the angle of emission of the electron ($d\Omega_- = \sin\Theta_- \, d\Theta_- d\varphi_-$), the following expression is obtained in Born approximation when taking finite nuclear dimensions into account:

$$d\sigma_{s_+s_-}(\Theta_+, \langle r^2\rangle)d\Omega_+ = d\Omega_+\int |F(q)|^2 d\sigma^T_{s_+s_-}(\Theta_+, \Theta_-)d\Omega = d\sigma^T_{s_+s_-}(\Theta_+)d\Omega_+ - \eta_p\left\{\langle r^2\rangle F_0(\Theta_+) + s_+s_-\langle r^2\rangle F_2(\Theta_+)\right\}d\Omega_+ \quad (2).$$

Next, bulky explicit expressions are presented for the functions $F_0(\Theta_+)$ and $F_2(\Theta)_+$. The presence of a spin-correlation term, $\sim s_+s_-$ in (2), is taken as an indication that even a polarized gamma quantum of high energy is capable of forming a pair with a longitudinally polarized electron and a positron.

Card 2/4

Electron-positron polarization ...

S/048/61/025/001/031/031
B029/B063

The resulting electron and positron may have longitudinal polarization of equal ($s_+ = s_-$, $s_+s_- = 1$) and opposite ($s_+ = -s_-$, $s_+s_- = -1$) direction. In the general case, Eq. (2) can be used to study the effect of $\langle r^2 \rangle$ of the nucleus on the angular distribution of longitudinally polarized electron-positron pairs which are formed by unpolarized gamma quanta of high energy. Eq. (2) is thus a generalization of the well-known formula of Bethe-Heitler for pair production, which takes account of the longitudinal spin correlation ($s_+s_- = \pm 1$) between electrons and positron of the formed pair and the finite dimensions of the nucleus. Summation of Eq. (2) over the longitudinal polarizations of the electron and positron of the forming pair leads to the relation

$d\sigma(\theta_+, \langle r^2 \rangle) d\Omega = d\sigma_{B.-H.}(\theta_+) d\Omega_+ - 4\eta_p \langle r^2 \rangle F_o(\theta_+) d\Omega_+$, where

$d\sigma_{B.-H.}(\theta_+)$ is the Bethe-Heitler production cross section of an unpolarized pair at a point nucleus. The second term, $\sim \langle r^2 \rangle$, is then the correction to the production cross section of an unpolarized electron-positron pair which is due to the consideration of the finite dimensions of the nucleus.

Card 3/4

89265

Electron-positron polarization ...

S/048/61/025/001/031/031
B029/B063

A. A. Sokolov is thanked for interest and assistance. This is the reproduction of a lecture read at the Tenth All-Union Conference on Nuclear Spectroscopy, Moscow, January 19-27, 1960. There are 9 references: 4 Soviet-bloc and 5 non-Soviet-bloc.

ASSOCIATION: Fizicheskiy fakul'tet Moskovskogo gos. universiteta im. M. V. Lomonosova
(Division of Physics, Moscow State University imeni M. V. Lomonosov)

Card 4/4

21612
S/188/61/000/002/007/010
B108/B209

24.4500

AUTHORS: Kerimov, B. K., Nadzhafov, I. M.

TITLE: Polarization in electron-positron pair production by gamma quanta

PERIODICAL: Vestnik Moskovskogo universiteta. Seriya 3, fizika, astronomiya, no. 2, 1961, 41-53

TEXT: The present paper was read at the tenth annual conference on nuclear spectroscopy, Moscow, January 1960. The authors calculated, in Born approximation, the angular and energy distribution of longitudinally polarized electron-positron pairs produced by circularly polarized gamma quanta in the nuclear Coulomb field. This article is based on an earlier paper on bremsstrahlung (Ref. 1: Kerimov, B. K., Nadzhafov, I. M. Izv, AN SSSR, ser. fiz., 886, 1958; NDVSh No. 1, 95, 1958). In the calculation of the polarization, the authors adopted a method suggested by A. A. Sokolov (Ref. 12: Vvedeniye v kvantovuyu elektrodinamiku (Introduction into quantum electrodynamics). M., 1958, section 21). For the differential production cross section of $e^+ - e^-$ pairs, integrated over the solid angle of departure

Card 1/11

21612

S/188/61/000/002/007/010
B108/B209

Polarization in ...

of the electrons $d\Omega_- = \sin\theta_- = \sin\theta_- d\theta_- d\varphi_-$ and taking into consideration the direction of the particle spins and of the incident gamma quanta, the following expression is obtained

$$d\sigma_{s_+s_-}(\theta_+)\,d\Omega_+ = d\Omega_+ \int d\sigma_{s_+s_-}(\theta_+, \theta_-)\,d\Omega_- =$$

$$= \frac{Z^2}{\pi^2}\left(\frac{e^2}{c\hbar}\right)^2 \frac{K_+K_-k_+k_-dK_+d\Omega_+}{\varkappa} \int \frac{1}{q^4}|M_p|^2 d\Omega_- =$$

$$= 2\pi\eta_p\,[\Phi_0(\theta_+) + s_+s_-\Phi_1(\theta_+) - ls_+\Phi_2(\theta_+) - ls_-\Phi_3(\theta_+)]\,d\Omega_+, \quad (2)$$

$$\cos\theta_+ = \frac{\vec{k}_+\vec{\varkappa}}{k_+\varkappa}, \quad \eta_p = Z^2\left(\frac{e^2}{c\hbar}\right)^2 \frac{k_+k_-dK_+}{4\pi^2\varkappa^2}.$$

..., where $E_\pm = c\hbar K_\pm = c\hbar\sqrt{k_\pm^2 + k_0^2}$, $\vec{p}_\pm = \hbar\vec{k}_\pm$ denotes total energy and momentum of positron and electrons, respectively, $\varepsilon_\phi = c\hbar\varkappa = E_+ + E_-$, $\vec{p}_\phi = \hbar\vec{\varkappa}$ energy and momentum of the incident gamma quanta, $\hbar\vec{q}$ - the momentum transferred to the nucleus, $k_0 = \frac{m_0c}{\hbar}$ - the

Card 2/11

electron mass at rest, $s_+ = \pm 1$, $s_- = \pm 1$ - the eigenvalues of the vector projection $\frac{\vec{\sigma}_\pm \vec{p}_\pm}{p_\pm}$ that characterizes the longitudinal electron and positron spin, $l = \pm 1$ determines the circular polarization of the incident gamma quanta. $M_p$ is the matrix element of the polarized-pair production. In the cross section of Eq. (2), which depends on the angle $\theta_+$ only, the spin correlation terms $\sim s_+ s_-$, $ls_+$, and $ls_-$ are a correction to the known Bethe-Heitler cross section, due to polarization. Integration of Eq. (2) over the solid angle of positron departure, $d\Omega_+$, yields the following expression for the integral cross section of pair production:

$$d\sigma_{ls_+s_-}(E_+, E_-) = \int d\sigma_{ls_+s_-}(\theta_+)\, d\Omega_+ =$$

$$= 4\pi^2 \eta_p \left(\frac{\hbar}{m_0 c}\right)^2 \{Q_0 + s_+ s_- Q_1 - ls_+ Q_2 - ls_- Q_3\}. \qquad (6)$$

21612

Polarization in ...

S/188/61/000/002/007/010
B108/B209

This formula represents the cross section in terms of the particle energy only. In the case of relativistic energies, $E_+$, $E_- \gg m_0c^2$, the complicated functions $Q_i$ (i = 0, 1, 2, 3) become simpler, converting Eq. (6) into

$$d\sigma_{ls_+s_-}(E_+, E_-) = \bar{\varphi} dE_+ \frac{1}{\epsilon_\Phi^3}\left(\ln\frac{2E_+E_-}{\epsilon_\Phi m_0c^2} - \frac{1}{2}\right)\Big\{\left(E_+^2 + E_-^2 + \frac{2}{3}E_+E_-\right) - s_+s_-\frac{1}{3}(E_- - E_+)^2 + ls_{+}e_\Phi\left(E_+ - \frac{1}{3}E_-\right) + ls_{-}e_\Phi\left(E_- - \frac{1}{3}E_+\right)\Big\}, \quad (10)$$

where $\bar{\varphi} = Z^2r_0^2\alpha$, $r_0 = \frac{e^2}{m_0c^2}$, $\alpha = \frac{e^2}{\hbar c}$. [Abstracter's note: The functions $\Phi_i(\theta)$ and $Q_i$ for i = 0, 1, 2, 3, given in an appendix, are too voluminous to be cited in full in this abstract]. The spin correlation between electron and positron is more likely to be $s_+s_- = -1$ than $s_+s_- = 1$. The degree of longitudinal polarization, according to the two types of spin correlation, is given by the formulas

Card 4/11

$$P_1 = \frac{\{[d\sigma]_{s_+ = s_- = 1} - [d\sigma]_{s_+ = s_- = -1}\}}{\{[d\sigma]_{s_+ = s_- = 1} + [d\sigma]_{s_+ = s_- = -1}\}}, \qquad (12)$$

$$P_2 = \frac{\{[d\sigma]_{s_+ = -s_- = 1} - [d\sigma]_{s_+ = -s_- = -1}\}}{\{[d\sigma]_{s_+ = -s_- = 1} + [d\sigma]_{s_+ = -s_- = -1}\}}. \qquad (13)$$

For any general case, these expressions are transformed into

$$P_{1,2}(0_+) = -i\,\frac{\Phi_2(0_+) \pm \Phi_3(0_+)}{\Phi_0(0_+) \pm \Phi_1(0_+)}, \qquad (14)$$

$$P_{1,2}(E_\pm) = -i\,\frac{Q_2 \pm Q_3}{Q_0 \pm Q_1}. \qquad (15)$$

the upper signs holding for $P_1$, and the lower ones for $P_2$. Figs. 1 and 2 show the results of a numerical computation. The relative probability of pair production in states with spin correlation $s_+s_- = \pm 1$ may be determined

21612

S/188/61/000/002/007/010
B108/B209

Polarization in ...

from the following formulas:

$$N_1(0_+) = \frac{[d\sigma]_{s_+ s_- = 1}}{[d\sigma]_{s_+ s_- = 1} + [d\sigma]_{s_+ s_- = -1}}, \qquad (16)$$

$$N_2(0_+) = \frac{[d\sigma]_{s_+ s_- = -1}}{[d\sigma]_{s_+ s_- = 1} + [d\sigma]_{s_+ s_- = -1}} = 1 - N_1(0_+). \qquad (17)$$

or, simpler, from

$$N_{1,2}(0_+) = \frac{\Phi_0(0_+) \pm \Phi_1(0_+)}{2\Phi_0(0_+)}, \qquad (18)$$

$$N_{1,2}(E_\pm) = \frac{Q_0 \pm Q_1}{2Q_0}. \qquad (19)$$

This is illustrated in Fig. 4. For ultrarelativistic energies, the formation of ($s_+s_- = -1$) pairs is the more probable one. For the differential

Card 6/11

and integral bremsstrahlung cross sections, the authors obtain the following expressions:

$$d\sigma^T_{lss'}(\theta)\,d\Omega = d\Omega\int d\sigma^T_{lss'}(\theta,\theta')\,d\Omega' = \frac{Z^2}{\pi^2}\left(\frac{e^2}{c\hbar}\right)^2 \frac{KK'k'\varkappa d\varkappa}{k}\int\frac{|M_T|^2}{q^4}\,d\Omega' =$$

$$= 2\pi\eta_T\{\Phi_0^T(\theta)+ss'\Phi_1^T(\theta)+ls\,\Phi_2^T(\theta)+ls'\Phi_3^T(\theta)\}\,d\Omega \qquad (21)$$

$$d\sigma^T_{lss'}(E,E') = 4\pi^2\eta_T\left(\frac{\hbar}{m_0c}\right)^2\{Q_0^T+ss'Q_1^T+lsQ_2^T+ls'Q_3^T\}$$

$$\eta_T = Z^2\left(\frac{e^2}{\hbar c}\right)^2\frac{k'd\varkappa}{4k\varkappa}. \qquad (22)$$

Here, $\theta$ denotes the angle at which the gamma quanta of the bremsstrahlung are emitted, $d\Omega'$ - the electron scattering angle; $E$, $\vec{p}$, $E'$, $\vec{p}'$ - the electron total energy and momentum before and after the bremsstrahlung. After summation over the final spin state of the electron ($s' = \pm 1$), the expression

$$d\sigma_{ls}^{T}(\theta)\, d\Omega = 4\pi\eta r \{\Phi_0^T(\theta) + ls\ \Phi_2^T(\theta)\}\, d\Omega. \qquad (23)$$

is obtained for the angular distribution of circularly polarized bremsstrahlung caused by longitudinally polarized relativistic electrons. For ultrarelativistic energies ($E, E' \gg m_0c^2$), the integral bremsstrahlung cross section reads as follows:

$$d\sigma_{lss'}^{T}(E, E') = \frac{1}{2}\ \bar{\varphi}\ \frac{d\epsilon_\Phi}{E}\ \frac{E'}{\epsilon_\Phi}\left(2\ln\frac{2EE'}{\epsilon_\Phi m_0c^2} - 1\right)\left\{\left(\frac{E^2 + E'^2}{EE'} - \frac{2}{3}\right) + \right.$$

$$\left. + ss'\frac{(E + E')^2}{3EE'} + ls\frac{\epsilon_\Phi(3E + E')}{3EE'} + ls'\frac{\epsilon_\Phi(3E' + E)}{3EE'}\right\}. \qquad (24)$$

where E and E' denote the kinetic energies before and after emission. The authors thank Professor A. A. Sokolov for his interest and help in this work. There are 5 figures and 19 references: 9 Soviet-bloc and 10 non-Soviet-bloc. The latest two references to English-language publications

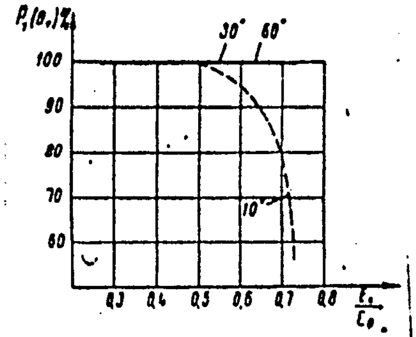
S/108/61/000/002/007/010
B108/B209

Polarization in ...

read as follows: Page L. A. Rev. Mod. Phys., 31, 759, 1959; Wu C. S. idem, 783.

ASSOCIATION: Kafedra statisticheskoy fiziki i mekhaniki (Department of Statistical Physics and Mechanics)

SUBMITTED: October 7, 1960




Legend to Fig. 1: Dependence of the degree of longitudinal polarization $P_1(\theta_+)$ of the pairs with $s_+ = s_-$ on positron energy at $l = 1$, $\varepsilon_\phi = 4m_0c^2$, $\theta_+ = 10^o, 30^o, 60^o$.

Card 9/11

S/056/61/040/002/028/047
B102/B201

26.2357

AUTHORS: Kerimov, B. K., Sadykhov, F. S.

TITLE: Bremsstrahlung of a longitudinal-polarized electron, taking account of finite nuclear dimensions

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, v. 40, no. 2, 1961, 553-560

TEXT: The correlation between electron polarization and that of a bremsstrahlung emitted in the nuclear field has been repeatedly studied in the past for the case of a point nucleus. The effect of the finite nuclear size has been taken into account in only one study of electron polarization with double scattering (B. K. Kerimov, V. M. Arutyunyan, ZhETF, 38, 1798, 1960). Olsen and Maximon (Phys. Rev. 110, 589, 1958; 114, 887, 1959) have shown that for a polarized high-energy electron the circular polarization of bremsstrahlung quanta is practically not dependent upon the screening of the nuclear field and the Coulomb corrections. A calculation is made of the angular dependence of the outer circular-polarized bremsstrahlung of a relativistic longitudinal-



APPROVED FOR RELEASE: 06/13/2000 CIA-RDP86-00513R000721530002-1"

polarized high-energy electron, taking account of the finite size of the nucleus and the polarization states of primary electrons and of the emitted gamma quantum in Born's approximation. Formulas are obtained which indicate the ratio of the bremsstrahlung cross section in a finite-size nucleus to that obtained for a point nucleus as a function of the scattering angle of the gamma quantum and of the mean square nuclear radius for a given energy of the longitudinal-polarized electron. It should be possible to establish the form factor and the mean square radius of the nuclear charge distribution from an experimental determination of the bremsstrahlung cross section at high energies and large angles. The effect of the finite nuclear size is taken account of by the form factor of the charge distribution

$$F(q) = \int_0^\infty \rho(r) \frac{\sin qr}{qr} 4\pi r^2 dr \approx 1 - \frac{1}{6} q^2 \langle r^2 \rangle. \qquad (1)$$

where $\rho(r)$ denotes the density, $\langle r^2 \rangle$ the mean square radius of the nuclear charge distribution, $\hbar\vec{q}$ the transferred momentum, $\vec{q} = \vec{k} - \vec{k} - \vec{\varkappa}$, $\vec{\varkappa}$ the

S/056/61/040/002/028/047
B102/B201



photon wave vector; $\vec{p} = \hbar\vec{k}$ is the electron momentum. The circular polarization of the bremsstrahlung is characterized by the polarization vector of the photon field:

$$a = \frac{1}{\sqrt{2}} \sum_{l=\pm 1} (\beta + il[\varkappa^0 \beta]).$$

$$\beta = [\varkappa^0 j] / \sqrt{1 - (\varkappa^0 j)^2},$$

where $\vec{\varkappa}^0 = \vec{\varkappa}/\varkappa$ is a unit vector in the direction of departure of the bremsstrahlung photon, $\vec{j}$ is a unit vector in any direction. Using the formulas from Ref. 1 (Kerimov, I. M. Nadzhafov, Izv. AN SSSR, ser. fiz. 22, 886, 1958), the following are obtained in Born's approximation for the differential bremsstrahlung cross sections:

$$d\sigma_{lss'}(\theta,\theta')\,d\Omega\,d\Omega' = |F(q)|^2\Big\{\frac{1}{4}\,d\sigma_{\text{Б-Г}}(\theta,\theta') + $$
$$+ \frac{a_T}{8q^4}\left[ss'f_1(\theta,\theta') + lsf_2(\theta,\theta') + ls'f_3(\theta,\theta')\right]\Big\}\,d\Omega\,d\Omega'. \qquad (2)$$

(2)

Здесь

$$f_1(\theta,\theta') = \frac{1}{2kk'}\Big\{\left[2(k_0^2 + KK')(4K'^2 - q^2) - 4k_0^2(3K'^2 + K^2)\right]\frac{k^2\sin^2\theta}{\Delta^2} +$$
$$+ \left[2(k_0^2 + KK')(4K^2 - q^2) - 4k_0^2(3K^2 + K'^2)\right]\frac{k'^2\sin^2\theta'}{\Delta'^2} -$$
$$-2\left[2(k_0^2 + KK')(4KK' + 2\varkappa^2 - q^2) - 4k_0^2(K + K')^2\right]\frac{kk'\sin\theta\sin\theta'\cos(\varphi'-\varphi)}{\Delta\Delta'} +$$
$$+ 16k_0^2\varkappa^2\frac{KK'}{\Delta\Delta'} + 4\varkappa^2KK'\,\frac{k^2\sin^2\theta + k'^2\sin^2\theta'}{\Delta\Delta'} +$$
$$+ 4\varkappa k_0^2(K + K')\left(\frac{1}{\Delta^2} - \frac{1}{\Delta'^2}\right)kk'\sin\theta\sin\theta'\cos(\varphi' - \varphi) +$$
$$+ 4\varkappa k_0^2\,\frac{K + K'}{\Delta\Delta'}(k^2\sin^2\theta - k'^2\sin^2\theta') - 4\varkappa^2k_0^2\left(\frac{K'}{\Delta'} + \frac{K}{\Delta}\right) -$$
$$- 4\varkappa^2k_0^2\left[\frac{K'(K' + k'\cos\theta')}{\Delta^2} + \frac{K(K + k\cos\theta)}{\Delta'^2}\right]\Big\}.$$

$$f_2(\theta,\theta') = \frac{2}{k}\Big\{[\varkappa K(k\cos\theta + k'\cos\theta') - \varkappa^2 K + \varkappa k_0^2]\frac{k^2\sin^2\theta}{\Delta^2} +$$

$$+ [\varkappa K(k\cos\theta + k'\cos\theta') + \varkappa^2 K - \varkappa k_0^2]\frac{k'^2\sin^2\theta'}{\Delta'^2} -$$

$$- 2\varkappa K(k\cos\theta + k'\cos\theta')\frac{kk'\sin\theta\sin\theta'\cos(\varphi'-\varphi)}{\Delta\Delta'} +$$

$$+ \varkappa(\varkappa K - k_0^2)\frac{k^2\sin^2\theta - k'^2\sin^2\theta'}{\Delta\Delta'} - \varkappa^2 k_0^2\frac{k^2\sin^2\theta - k'^2\sin^2\theta'}{\Delta^2\Delta'} -$$

$$- \varkappa k_0^2\left(\frac{1}{\Delta^2} - \frac{1}{\Delta'^2}\right)kk'\sin\theta\sin\theta'\cos(\varphi'-\varphi)\Big\},$$

$$f_3(\theta,\theta') = \frac{2}{k'}\Big\{[\varkappa K'(k'\cos\theta' + k\cos\theta) - \varkappa^2 K' - \varkappa k_0^2]\frac{k^2\sin^2\theta}{\Delta^2} +$$

$$+ [\varkappa K'(k'\cos\theta' + k\cos\theta) + \varkappa^2 K' + \varkappa k_0^2]\frac{k'^2\sin^2\theta'}{\Delta'^2} -$$

$$- 2\varkappa K'\frac{(k\cos\theta + k'\cos\theta')}{\Delta\Delta'}kk'\sin\theta\sin\theta'\cos(\varphi'-\varphi) +$$

$$+ \varkappa k_0^2\left(\frac{1}{\Delta^2} - \frac{1}{\Delta'^2}\right)kk'\sin\theta\sin\theta'\cos(\varphi'-\varphi) +$$



APPROVED FOR RELEASE: 06/13/2000 CIA-RDP86-00513R000721530002-1"

Bremsstrahlung of a longitudinal- ...

$$+\varkappa(\varkappa K'+k_0^2)\frac{k^2\sin^2\vartheta-k'^2\sin^2\vartheta'}{\Delta\Delta'}-\varkappa^2k_0^2\frac{k^2\sin^2\vartheta-k'^2\sin^2\vartheta'}{\Delta\Delta'^2}\Big\}; \quad (3)$$

$$\Delta=K-k\cos\vartheta,\qquad \Delta'=K'-k'\cos\vartheta',$$

$$K=\sqrt{k^2+k_0^2},\qquad K'=\sqrt{k'^2+k_0^2},$$

$$q^2=k^2+k'^2+\varkappa^2-2k\varkappa\cos\vartheta+2k'\varkappa\cos\vartheta'-2kk'(\cos\vartheta\cos\vartheta'+$$
$$+\sin\vartheta\sin\vartheta'\cos(\varphi'-\varphi)),$$

$$\cos\vartheta=\frac{\vec{k}\vec{\varkappa}}{k\varkappa},\qquad \cos\vartheta'=\frac{\vec{k}'\vec{\varkappa}}{k'\varkappa},\qquad a_T=Z^2\alpha^3\frac{k'd\varkappa}{2\pi^3k\varkappa}. \quad (4)$$

$E = c\hbar K$, $E' = c\hbar K'$, $\vec{p}' = \hbar\vec{k}'$ ($E$ - total electron energy; the primed quantities refer to states after quantum emission); $\epsilon_\gamma = c\hbar\varkappa = c\hbar(K-K')$, $\vec{p}_\gamma = \hbar\vec{\varkappa}$ (energy and momentum of emitted quantum); $k_0$ electron rest mass, $\alpha$ - fine structure constant, $d\Omega$ and $d\Omega'$ solid angles of electron pulse, $s' = \pm 1$ are the eigenvalues of the projecting operator $\vec{\sigma}\vec{p}'/p'$.

S/056/61/040/002/028/047
B102/B201

Bremsstrahlung of a longitudinal- ...

$d\sigma_{B-H}(\theta,\theta')$ is the known cross section of the unpolarized bremsstrahlung (Heitler), ls and ls' determine the longitudinal spin correlation between quantum and electron, ss' that of the longitudinal electron spin prior to and after emission. Summing (2) over the final spin state of the electron one obtains

$$d\sigma_{ls}(0, 0')\, d\Omega\, d\Omega' = |F(q)|^2 \left\{\frac{1}{2}\, d\sigma_{B-H}(0, 0') + ls\, \frac{a_T}{4q^4} f_3(0, 0')\right\} d\Omega\, d\Omega'. \quad (5)$$

and after integration with respect to $d\Omega'$ one has

$$d\sigma_{ls}(0, \langle r^2\rangle)\, d\Omega = d\sigma_{ls}^T(0)\, d\Omega - 2\pi a_T \{\langle r^2\rangle [\Phi_2(0) + ls\, \Phi_3(0)] - \langle r^2\rangle^2 [\Phi_1(0) + ls\, \Phi_5(0)]\}\, d\Omega. \quad (6)$$

where

Card 7/14

$$-\frac{2k_0^2(2\varkappa K^3+k^2K)\varkappa}{k^2\Delta}+\frac{\varkappa^2K(K^2+k_0^2)}{k^2}\Big]+\frac{\varepsilon\varkappa}{k'}\Big[\frac{K}{\Delta}(K+K')-K\Big]\Big\}, \qquad (7)$$

$$\Phi_4(0)=\frac{1}{36}\Big\{k_0^2\Big[\frac{1}{2}(T^2+k'^2)-2K'^2\Big]\frac{1}{\Delta^2}+[KK'(K+2K')-\varkappa k'^2-$$

$$-T^2(\varkappa+K'\sin^2\theta)]\frac{1}{\Delta}+(K+K')\Delta-(k_0^2+2(2K^2+K'^2))+$$

$$+\frac{\varepsilon}{k'}[k_0^2(2KK'-K^2-K'^2+T^2\sin^2\theta)\frac{1}{\Delta}-\frac{1}{2}(K^2+K'^2+k_0^2)\Delta+$$

$$+K(K^2+K'^2)+\frac{3}{2}k_0^2K']\Big\},$$

$$\Phi_5(0)=\frac{1}{72k}\Big\{-\varkappa k_0^2(4k_0^2+k'^2+T^2)\frac{1}{\Delta^2}+2\varkappa K[4k_0^2+K'(K+K')]\frac{1}{\Delta}+$$

$$+6\varkappa\Delta K-2\varkappa(2KK'+6K^2-k_0^2)+\frac{\varepsilon}{k'}\Big[-\frac{2k_0^2\varkappa^2K}{\Delta}-$$

$$-\varkappa(k^2+KK')\Delta+\varkappa(2K^3+K'(2k^2-k_0^2))\Big]\Big\};$$

and

$$d\sigma_{ls}^{T}(0) = \frac{1}{2}\, d\sigma_{\text{Б-Г}}(0) + ls \cdot 2\pi a_T \Phi_1(0), \qquad d\sigma_{\text{Б-Г}}(0) = 4\pi a_T \Phi_0(0); \quad (8)$$

$$T = |\mathrm{k} - \varkappa|, \quad \varepsilon = \ln\frac{K' + k'}{K' - k'}, \quad \varepsilon^T = \ln\frac{T + k'}{T - k'},$$

$$L_0 = \ln\frac{KK' + kk' - k_0^2}{KK' - kk' - k_0^2}.$$

(8)

S/056/61/040/002/028/047
B102/B201

Bremsstrahlung of a longitudinal- ...

hold. After summing over the polarizations of electron and quantum,

$$d\sigma(\theta, \langle r^2\rangle)\, d\Omega = d\sigma_{Б-Г}(\theta)\, d\Omega - 4\pi a_T \{\langle r^2\rangle \Phi_2(\theta) - \langle r^2\rangle^2 \Phi_4(\theta)\}\, d\Omega. \quad (9)$$

can be obtained. With

$$d\sigma_{ls}(\theta, \langle r^2\rangle) = d\sigma^T_{ls}(\theta)\left\{1 - \langle r^2\rangle \frac{\Phi_2(\theta) + ls\,\Phi_3(\theta)}{\Phi_0(\theta) + ls\,\Phi_1(\theta)} + \langle r^2\rangle^2 \frac{\Phi_4(\theta) + ls\,\Phi_5(\theta)}{\Phi_0(\theta) + ls\,\Phi_1(\theta)}\right\}. \quad (10)$$

В случае неполяризованного тормозного излучения вместо (10) имеем соотношение

$$d\sigma(\theta, \langle r^2\rangle) = d\sigma_{Б-Г}(\theta)\left\{1 - \langle r^2\rangle \frac{\Phi_2(\theta)}{\Phi_0(\theta)} + \langle r^2\rangle^2 \frac{\Phi_4(\theta)}{\Phi_0(\theta)}\right\}. \quad (11)$$

$$P(\theta, \langle r^2\rangle) = ((d\sigma_{ls})_{l=1} - (d\sigma_{ls})_{l=-1}) / ((d\sigma_{ls})_{l=1} + (d\sigma_{ls})_{l=-1}). \quad (12)$$

Card 10/14

Bremsstrahlung of a longitudinal- ...

$$P(0, \langle r^2\rangle) = sP^T(0)\frac{1-\langle r^2\rangle d_3(0)+\langle r^2\rangle^2 d_5(0)}{1-\langle r^2\rangle d_2(0)+\langle r^2\rangle^2 d_4(0)}, \qquad (13)$$

где

$$d_3(0) = \Phi_3(0)/\Phi_1(0), \qquad d_5(0) = \Phi_5(0)/\Phi_1(0),$$
$$d_2(0) = \Phi_2(0)/\Phi_0(0), \qquad d_4(0) = \Phi_4(0)/\Phi_0(0), \qquad (14)$$
$$P^T(0) = \Phi_1(0)/\Phi_0(0).$$

one obtains

$$\Psi_2^{\text{к.р.}}(0) = \frac{1}{6}\Big\{3 + \frac{a^2b^2k_0^2}{T^2} - \Big[4 + a^2b^2(1-a)\frac{k_0^2}{T^2}\Big]\frac{1}{\Delta_0} -$$
$$-\frac{\varepsilon^T a^2b^3k_0^3}{T^3(1-a)}(1-a\cos 0) - \frac{a^2\varepsilon'}{2(1-a)} + \varepsilon\Big(\frac{1}{\Delta_0}-\frac{1}{2}\Big)\frac{2-2a+a^2}{1-a}\Big\}.$$

$$\Phi_3^{\text{к.р.}}(0) = \frac{a}{6}\left\{1 + \frac{ab^2k_0^2}{T^2} - \left[4 + a(1-a)\frac{b^2k_0^2}{T^2}\right]\frac{1}{\Delta_0} - \right.$$

$$\left. - \frac{\varepsilon^T ab^3 k_0^3}{T^3(1-a)}\left(1 - a\cos 0\right) + \frac{a\varepsilon'}{2(1-a)} + \frac{\varepsilon}{1-a}\left[\frac{2-a}{\Delta_0} - \left(1 - \frac{a}{2}\right)\right]\right\},$$

$$\Phi_4^{\text{к.р.}}(0) = \frac{1}{36}\left\{-2k_0^2b^2(3 - 2a + a^2) + b^2k_0^2(2-a)\Delta_0 + \right.$$

$$+ \left[b^2k_0^2(1-a)(3 - 3a + a^2) - T^2(a + (1-a)\sin^2 0)\right]\frac{1}{\Delta_0} -$$

$$- k_0^2\frac{(1-a)^2}{\Delta_0^2} + \frac{\varepsilon}{b^2(1-a)}\left[(T^2\sin^2 0 - a^2b^2k_0^2)\frac{1}{\Delta_0} - \right.$$

$$\left.\left. - k_0^2b^4(2 - 2a + a^2)\left(\frac{\Delta_0}{2} - 1\right)\right]\right\},$$

$$\Phi_5^{\text{к.р.}}(0) = \frac{abk_0}{30}\left\{-2bk_0(4-a) + 3bk_0\Delta_0 + bk_0(2 - 3a + a^2)\frac{1}{\Delta_0} - \right.$$

$$\left. - \frac{k_0(1-a)}{b\Delta_0^2} - \frac{\varepsilon k_0}{2(1-a)}\left[\frac{2a}{b\Delta_0} - (2-a)(1 + \cos 0)\right]\right\};$$

$$a = \frac{\varepsilon_\gamma}{E}, \quad b = \frac{E}{m_0c^2}, \quad \varepsilon^T = \ln\frac{T + (1-a)}{T - (1-a)},$$

$$\varepsilon = 2\ln[2b(1-a)], \quad \varepsilon' = -2\ln a, \quad \Delta_0 = 1 - \cos 0,$$

$$T = k_0 b\sqrt{1 + a^2 - 2a\cos 0}, \quad 1/k_0 = \hbar/m_0c = 3{,}86\cdot 10^{-11}\ \text{см}.$$

Bremsstrahlung of a longitudinal- ...

where $E = cp$ denotes the kinetic energy of the superrelativistic electron, $\varepsilon_\gamma$ the quantum energy. The cross section ratios

$$I_1 = d\sigma_{||}(0, \langle r^2\rangle)/d\sigma_{||}^T(0), \quad I_2 = d\sigma(0, \langle r^2\rangle)/d\sigma_{B-T}(0) \qquad (15)$$

may be represented, as shown in Fig. 1, by $\langle r^2 \rangle = 19.594 \cdot 10^{-26}$ cm$^2$ ($Ag^{108}$); ($E = 50$ Mev, $\varepsilon_\gamma = 25$ Mev, $s = 1$, $l = 1$). Fig. 2 shows the angular dependence of the polarization degree, $P(\theta)$ for an extended nucleus (1) and a point nucleus (2) likewise for $Ag^{108}$ and otherwise equal conditions as per Fig. 1. Professor A. A. Sokolov is thanked for interest displayed. There are 2 figures and 16 references: 6 Soviet-bloc and 10 non-Soviet-bloc.

ASSOCIATION: Moskovskiy gosudarstvennyy universitet (Moscow State University)

SUBMITTED: July 20, 1960

S/056/61/040/002/028/047
B102/B201

Bremsstrahlung of a longitudinal- ...

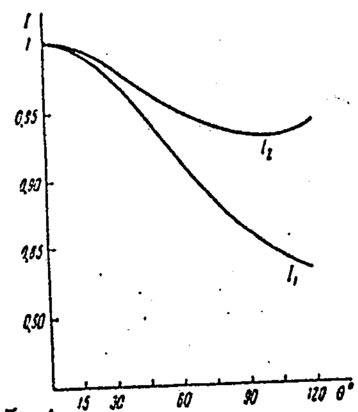



Fig.1

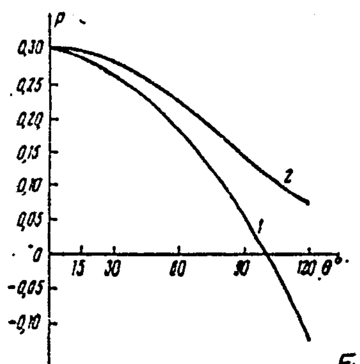



Fig.2

Card 14/14

KERIMOV, B.K.; SADYKHOV, F.S.

Polarization phenomena arising in pair formation, taking the final dimensions of the nucleus into account. Izv.vys.ucheb.zav.; fiz. no.3:14-19 '61. (MIRA 14:8)

1. Moskovskiy gosuniversitet im. M.V.Lomonosova.
(Electron pairs) (Nuclear reactions)

KERIMOV, B.K.; NADZHAFOV, I.M.

Polarization correlations in the formation of an electron-po-sitron pair by a gamma-quantum. Vest. Mosk. un. Ser. 3 Fiz., astron 16 no.2:41-53 Mr-Ap '61. (MIRA 14:6)

1. Kafedra statisticheskoy fiziki i mekhaniki Moskovskogo gosudarstvennogo universiteta.
(Electrons) (Quantum theory)

S/188/62/000/002/004/013
B125/B102

AUTHORS: Kerimov, B. K., Popov, Yu. A., Loskutov, Yu. M., Galkina, L. P.

TITLE: Polarization properties of $\mu^{\mp}$-meson decay electrons

PERIODICAL: Moscow. Universitet. Vestnik. Seriya III. Fizika, astronomiya, no. 2, 1962, 29-35

TEXT: The polarization properties of electrons from the $\mu^{\mp} \rightarrow e^{\mp} + \nu + \nu'$ decay of a longitudinally polarized charged muon at rest were investigated with two variants of weak four-fermion V-A interactions. In the Lee-Yang version of the interaction Hamiltonian, the transverse polarization of electrons polarized in the plane perpendicular to that of decay is sensitive to a possible non-conservation of time parity; in the Feynman-Gell-Mann version, however, there is no polarization. If the state of polarization of decay electrons is described by $\psi_e = \sum_{s_e} g_{s_e} \psi_{s_e}$, the probability of electron production is given by

Card 1/6

APPROVED FOR RELEASE: 06/13/2000 CIA-RDP86-00513R000721530002-1"

S/188/62/000/002/004/013
B125/B102

Polarization properties of ...

$$dW = \frac{d\vec{k}_e}{(2\pi)^4 c\hbar^2 24}\,\xi\left\{\sum_{s_e} g^+_{s_e} g_{s_e} W_{s_e} + (g^+_1 g_{-1} + g_1 g^+_{-1})\,\frac{1}{2} W_2 + i\,(g_1 g^+_{-1} - g_{-1} g^+_1)\,\frac{1}{2} W_3\right\}, \qquad (8)$$

with

$$W_{s_e} = \frac{1}{2}(1-\eta)(1 \mp s_e\beta_e)\{(q^2 - 3k_e^2 \pm 2s_e q k_e)(3 - s_e\cos\theta) + 8k_e(k_e \mp s_e q)\}, \quad \text{(см. [5])},$$
$$W_2 = \pm(1-\eta)(q^2 - k_e^2)\frac{k_{0e}}{K_e}\sin\theta,$$
$$W_3 = 0. \qquad (9),$$

in the Feynman-Gell-Mann version, and with

Card 2/6

$$W_{s_e} = [(1 \pm s_e\beta_e\eta)[(q^2 - 3k_e^2)(3 - s_e\cos\theta) + 8k_e^2] +$$
$$+ 2(1 + s_e\cos\theta)qk_e(\beta_e \pm s_e\eta) + \eta_1\frac{k_{0e}}{K_e}(k_e^2 - q^2)(3 - s_e\cos\theta)\}, \quad (10),$$
$$W_2 = \pm 2\sin\theta\left[\frac{k_{0e}}{K_e}(q^2 - k_e^2) - \eta_1(2\beta_e k_e q + k_e^2 + q^2)\right],$$
$$W_3 = 2\sin\theta(\eta_2\beta_e)(k_{0\mu}^2 - k_{0e}^2),$$

in the Lee-Yang version.

$$\xi = G_A^+ G_A + G_V^+ G_V, \quad \eta = \frac{1}{\xi}(G_A^+ G_V + G_V^+ G_A),$$
$$\eta_1 = \frac{1}{\xi}(G_V^+ G_V - G_A^+ G_A), \quad \eta_2 = \frac{i}{\xi}(G_V^+ G_A - G_A^+ G_V), \quad (11).$$
$$q = k_{0\mu} - K_e, \; \beta_e = \frac{k_e}{K_e} = \frac{v_e}{c}, \; \cos\theta = (\vec{s}_\mu \vec{k}_e^0), \quad \frac{k_{0e}}{K_e} = \frac{m_0 c^2}{E_e},$$

The square of the modulus of the constant $g_{s_e}$ yields the probability of the electron being in the $\psi_{s_e}$ state ($s_e = \pm 1$). $\vec{s}_\mu = s_\mu \vec{k}_\mu^0$ is the spin vector

S/188/62/000/002/004/013
B125/B102



of a muon at rest. The transverse polarizations $P_3$ and $P_2$ of electrons polarized in the decay plane ($\varphi=0$) and perpendicularly thereto ($\varphi=\pi/2$), respectively, are given by $P_{3,2} = W_{3,2}/(W_1+W_{-1})$. $W_0 = W_1+W_{-1}$ is the total electron-decay probability, and $P_1 = (W_1-W_{-1})/W_0$ is the longitudinal electron polarization. The relation $\sqrt{P_1^2+P_2^2+P_3^2} = 1$ is valid for a completely polarized electron beam. If the beam is partly formed by unpolarized electrons, the fraction $P_0$ of the unpolarized state is given by $P_0 = 1-\sqrt{P_1^2+P_2^2+P_3^2}$. The polarization of the decay electrons is closely related to the ratio between the constants $G_A$ and $G_V$. As a phase shift ($G_A = G_V e^{-i\delta}$) exists between constants with equal modulus, $\eta = \cos\vartheta$, $\eta_1 = 0$, and $\eta_2 = \sin\vartheta$. If $\delta = \pi$ ($G_A = -G_V$) (V-A interaction), the Feynman-Gell-Mann and the Lee-Yang versions are equivalent. If $\delta \neq \pi$, the following is found: In the Lee-Yang version, part of the high-energy

S/188/62/000/002/004/013
B125/B102

respectively. If $\delta = \pi$, $\tau$ is the same in both versions. $P_2$ is very sensitive to phase shifts. It is noted that the investigation of transverse polarization is an appropriate means for choosing the interaction Hamiltonian. A. A. Sokolov is thanked for discussions and advice. The English-language reference is: Sokolov A. A. Nucl. Phys., 9, 420, 1959.

ASSOCIATION: Kafedra statisticheskoy fiziki i mekhaniki (Department of Statistical Physics and Mechanics)

SUBMITTED: May 5, 1961

S/058/63/000/001/039/120
A062/A101

AUTHORS: Kerimov, B. K., Sadykhov, F. S.

TITLE: Note on the production of an electron-positron pair by a $\gamma$-quantum, taking into account the spin effects and the finite dimensions of the nucleus

PERIODICAL: Referativnyy zhurnal, Fizika, no. 1, 1963, 16, abstract 1B127 (In collection: "Elektron. uskoriteli". Tomsk, Tomskiy un-t, 1961, 400 - 404)

TEXT: In the Born approximation an expression is found for the differential cross-section of the production process of longitudinally polarized electron-positron pairs by circularly polarized $\gamma$-quanta, taking into account the finite dimensions of the nucleus. The cross-section is presented in the form $d\sigma = d\sigma_0 + d\sigma_1$ wherein $d\sigma_0$ is the pair production cross-section on a point nucleus, taking into account the longitudinal spin states of a pair and the impinging $\gamma$-quantum, $d\sigma_1$-portion of the cross section taking into account the effect of the root-mean-square radius of the nuclear electric charge distribu-

Card 1/2

S/058/63/000/001/039/120
A062/A101

Note on the production of an...

tion on the angular and longitudinal spin correlations between electron, positron and $\gamma$-quantum.

B. Kerimov

[Abstracter's note: Complete translation]

Card 2/2

KERIMOV, B.K.; POPOV, Yu.A.; LOSKUTOV, Yu.M.; GALKINA, L.P.

Problem of polarizational characteristics of electrons from the $\mu^{\mp}$-meson decay. Vest.Mosk.un.Ser.3.Fiz., astron. 17 no.2:29-35 Mr-Ap '62. (MIRA 16:2)

1. Kafedra statisticheskoy fiziki i mekhaniki Moskovskogo universiteta.

(Electrons) (Mesons)
(Angular momentum (Nuclear physics))

S/188/63/000/001/010/014
B164/B102

AUTHORS: Kerimov, B. K., Popov, Yu. A., Loskutov, Yu. M.

TITLE: Electron polarization on $\mu^{\mp}$ meson decay (II)

PERIODICAL: Moscow. Universitet. Vestnik. Seriya III. Fizika, astronomiya, no. 1, 1963, 62-65

TEXT: In continuation of their study of the decay probability of resting longitudinally polarized $\mu^{\mp}$ mesons ($\mu^{\pm} \rightarrow e^{\pm} + \nu + \tilde{\nu}$) (VMF no. 2, 29, 1962) the authors calculate the decay probability of moved longitudinally polarized $\mu^{\pm}$ mesons and the degree of longitudinal ($P_1$) and transverse ($P_2$ and $P_3$) polarization of the electrons produced. The calculations were made on the basis of the Hamilton operator for V-A interaction given by Yang and Lee (Phys. Rev. 105, 1671, 1957) and by Feynman and Gell-Mann (Phys. Rev. 109, 193, 1958). The proportion of the non-polarized electrons in the beam is calculated from

$$P_0 = 1 - \sqrt{P_1^2 + P_2^2 + P_3^2}$$

Card 1/2

Electron polarization on ...

S/188/63/000/001/010/014
B164/B102

The expressions obtained are equivalent for the coupling constants $G_A = -G_V$ (V-A interaction). In this case (Feynman-Gell-Mann) $P_0 = 0$. For $G_A = G_V e^{-i\delta}$, $\delta \neq \pi$, different expressions are obtained. It is shown that the measurement of the transverse polarization $P_2$ and $P_3$ of the electrons and of $P_0$ gives indications of the interrelation between the coupling constants and, therefore, of the time reversal invariance of the weak interaction.

ASSOCIATION: Kafedra statisticheskoy fiziki i mekhaniki (Department of Statistical Physics and Mechanics)

SUBMITTED: June 23, 1962

Card 2/2

KERIMOV, B. K.; ALISHEV, S. I.

"The Beta Decay of Moving Neutrons with Longitudinal Polarization."

report submitted for All-Union Conf on Nuclear Spectroscopy, Tbilisi, 14-22 Feb 64.

MGU (Moscow State Univ)

KERIMOV, B. K.; ROMANOV, Yu. I.

"Scattering of the Neutrino and Anti-neutrino on the Electron with the Calculation of Spin Correlations."

report submitted for All-Union Conf on Nuclear Spectroscopy, Tbilisi, 14-22 Feb 64.

MGU (Moscow State Univ)

KERIMOV, B. K.; ABUTALYBOV, I. M.

"Bremsstrahlung Radiation of Polarized Electrons on Nuclei Possessing a Magnetic Moment."

report submitted for All-Union Conf on Nuclear Spectroscopy, Tbilisi, 14-22 Feb 64.

MGU (Moscow State Univ)

KERIMOV, B.K.; RAM TAKVALE

Polarization effects in high-energy electron scattering by protons. Izv. vys. ucheb. zav.; fiz. 7 no.6:172-180 '64.

(MIRA 18:2)

1. Universitet Puny [India] (for Ram Takvale). 2. Moskovskiy gosudarstvennyy universitet imeni M.V. Lomonosova.

ACCESSION NR: AP4037613 S/0056/64/046/005/1912/1914

AUTHORS: Kerimov, B. K.; Romanov, Yu. I.

TITLE: Spin correlations in neutrino and antineutrino scattering by electrons

SOURCE: Zh. eksper. i teor. fiz., v. 46, no. 5, 1964, 1912-1914

TOPIC TAGS: spin correlation, neutrino, antineutrino, cross section, polarization, fermion, particle interaction

ABSTRACT: Continuing earlier investigations (Izv. AN SSSR, seriya fiz. v. 25, 157, 1961 and Ann. der Phys. v. 7, 46, 1958), the authors calculated the cross sections for $\nu e$ and $\bar{\nu} e$ scattering in the V-A variant of the weak four-fermion interaction, with allowance for the polarization of the target electron and the recoil electron. The total scattering cross sections of the processes

$$\nu + e \rightarrow \nu' + e' \text{ and } \bar{\nu} + e \rightarrow \bar{\nu}' + e'$$

ACCESSION NR: AP4037613

with allowance for the longitudinal polarization of the recoil electron, are calculated. It is shown that at the high limit of the neutrino energy the recoil electrons produced by $\nu e$ scattering has the same helicity as the incident neutrino, whereas the recoil electrons from $\bar{\nu} e$ scattering will have an helicity which is opposite that of the incident antineutrinos. When left-polarized neutrinos (or right-polarized antineutrinos) of high energy are scattered by electrons, the resultant recoil electrons will be completely left-polarized, while scattering of right-polarized neutrinos (left-polarized antineutrinos) of high energy will result in completely right-polarized recoil electrons. When the target electron is polarized in the same direction as the incident neutrino beam, the scattering cross section of the right-polarized neutrinos vanishes, whereas the scattering cross section of the left-polarized neutrinos differs from zero and assumes a maximum value. On the other hand, when an antineutrino of high energy is scattered by an electron polarized in the direction of the incident antineutrino beam, the scattering cross sec-

ACCESSION NR: AP4037613

tion of the left-polarized antineutrinos vanishes, whereas the cross section for the scattering of right-polarized antineutrinos differs from zero and has a maximum. If the target electron is polarized in a direction opposite that of the incident neutrino (antineutrino) beam, the situation is reversed. The results show that a study of the spin correlations in neutrino (antineutrino) electron scatterings would make it possible, on the one hand, to resolve the problem of the existence of direct neutrino-electron interaction and, on the other hand, to check the predictions of the theory of the four-component neutrino, relative to the helicities of the two neutrinos and two antineutrinos. "We are grateful to Professor A. A. Sokolov and D. D. Ivanenko for continuous interest in the work." Orig. art. has: 1 figure and 4 formulas.

ASSOCIATION: Moskovskiy gosudarstvenny*y universitet (Moscow State University)

SUBMITTED: 15Oct63 DATE ACQ: 09Jun64 ENCL: 01

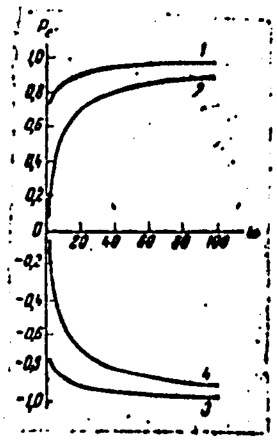
SUB CODE: NP NR REF SOV: 003 OTHER: 007



APPROVED FOR RELEASE: 06/13/2000 CIA-RDP86-00513R000721530002-1"

ACCESSION NR: AP4037613

ENCLOSURE: 01




Dependence of the degree of polarization on the energy of the initial neutrino and antineutrino: 1 - for right-hand polarized incident neutrinos, 2 - for left polarized antineutrinos, 3 - for left polarized neutrinos, 4 - for right polarized antineutrinos.

Card 4/4

ACCESSION NR: AP4043835 S/0020/64/157/005/1096/1099

AUTHORS: Sokolov, A. A.; Ivanov, Yu. P.; Pavlenko, Yu. G.; Kerimov, B. K.

TITLE: Account of damping in weak interactions

SOURCE: AN SSSR. Doklady*, v. 157, no. 5, 1964, 1096-1099

TOPIC TAGS: weak interaction regime, elementary particle, scattering amplitude perturbation theory, polarization, neutrino, mu meson, electron

ABSTRACT: The scattering of an electronic neutrino by an electron or the scattering of a muonic neutrino by a muon are considered in the four-component theory with damping taken into account. The use of damping theory eliminates the difficulty arising at high neutrino energies ($\sim 10^3$ BeV in the center of mass system), when the lower order of perturbation theory yields diverging series. Since the

ACCESSION NR: AP4043835

solution of the equations of damping theory for the scattering amplitudes is equivalent to summation of a series of chain diagrams, this series can be summed in the region of convergence and the resultant scattering amplitude can be regarded as an analytic continuation of the series in the region of divergence. The summation is facilitated by using Wigner d-functions (M. Jacob and G. C. Wick, Ann. Phys., v. 7, 404, 1959) making the resultant amplitude differ from the perturbation-theory amplitude by the presence of a denominator such that the partial cross sections never exceed unity. In the case of antineutrino scattering by an electron, account must also be taken of the S and P waves. The polarization properties of scattering of neutrinos by polarized electrons is examined and it is shown that the recoil electrons will be fully polarized in a longitudinal direction only in the ultrarelativistic case. This report presented by N. N. Bogolyubov. Orig. art. has: 3 figures and 13 formulas.

APPROVED FOR RELEASE: 06/13/2000 CIA-RDP86-00513R000721530002-1"