22873
S/089/61/010/005/001/015
B102/B214

decrease of 2-1.1 %; the rough regulator allows a reactivity change of 2.4 %, the manual regulator 0.1 %, and the automatic regulator 0.036 %. The reactor possesses also a reactivity booster for the production of one intensive pulse. The control and shield system is an automatically functioning electronic arrangement with BF_3 counters and ionization chambers. The whole reactor is placed in a room of size 10·10·7 m whose concrete walls allow complete protection from radiation. The most important experimental arrangement consists of a 1000 m long neutron conductor, a metal tube, 400 mm in diameter in the first part and 800 mm in the second part in which a pressure of 0.1 mm Hg is maintained. This conductor connects a chain of socalled "intermediate pavilions" (at distances of 70, 250, 500, 750, and 1000 m from the reactor) in which experiments can be carried out. There is also an additional neutron conductor of 100 m length. The reactor chamber is joined to an experimental chamber in which four neutron beams of up to 800 mm diameter are available. There us such an experimental chamber also above the reactor chamber. Various experiments were carried out with the reactor and they are described in the present paper. These are experiments with stand

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A pulsed fast reactor

assemblies and slowly moving main block for the determination of the most important parameters of the reactor; experiments with a core assembly (unmoved), experiments with rotating (5000 rpm) main block and a Ra-α-Be source in the core for the investigation of the effect of the multiplication factor, etc. The most important results are represented graphically. For example, Fig. 8 shows the dependence of the half width Θ of a pulse on the reactivity; the dashed line holds for the quasistationary case, the dot-dash line for the case of $\Theta = K(\tau/\alpha)^{1/3} v^{-2/3}$, where v is the velocity of motion of the (rotating) main block; in the quasistationary case $\Theta = 2\sqrt{\varepsilon_m/\alpha v^2}$, where ε_m is the reactivity at the maximal multiplication factor; $\varepsilon = \varepsilon_m - \alpha x^2$, where x is the displacement of the main block. The reactor has been actually used for the measurement of the total, scattering, capture, and fission cross sections by the time-of-flight method. Further experiments will be carried out with a view to obtaining increase of power and decrease of the pulse duration. There are 15 figures and 3 references: 2 Soviet-bloc and 1 non-Soviet-bloc. The reference to the English-language publication reads as follows: J. Orndorf, Nucl. Sci. and Engng, 2, No. 4, 450 (1957).

Card 4/7

POSPELOV, P.N., akademik; MINTS, A.L., akademik; ALEKSANDROV, A.P., akademik; FEDOSEYEV, P.N., akademik; LAVRENT'YEV, M.A., akademik; BERG, A.I., akademik; PETROVSKIY, I.G., akademik; SIDORENKO, A.V.; SKRYABIN, G.K., kand.biolog.nauk; KONSTANTINOV, B.P., akademik; GOLUNSKIY, S.A.; SHUBNIKOV, A.V., akademik; BLOKHINTSEV, D.I.; DORODNITSYN, A.A., akademik; KEDROV, B.M.; SISAKYAN, N.M., akademik

Discussing the reports. Vest. AN SSSR 31 no.12:49-66 D '61. (MIRA 14:12)

1. Chleny-korrespondenty AN SSSR (for Sidorenko, Golunskiy, Blokhintsev, Kedrov).

(Research)

BLOKHINTSEV, D. I.

"Non-Linear Scalar Field Theory"

report presented at the Intl. Conference on High Energy Physics, Geneva, 4-11 July 1962

Joint Inst. for Nuclear Research, Dubna, 1962

BLOKHINTSEV, D.I.; KULIKOVA, L.V.[translator]; SARANTSEVA, V.R., tekhn. red.

On backward scattering of high energy particles. Dubna, Ob"edinennyi in-t iadernykh issledovanii, 1962. 5 p.
(No subject heading)

BLOKHINTSEV, D.I.; SMIRNOVA, L.A.[translator]

Non-linear scalar field theory. Dubna, Ob"edinennyi in-t iadernykh issledovanii, 1962. 7 p.
(No subject heading)

BLOKHINTSEV, D.I.

Present state of the teaching of elementary particles. Fiz mat spisanie BAN 5 no.2:86-104 '62.

BLOKHINTSEV, D., laureat Leninskoy premii, Geroy Sotsialisticheskogo Truda (Moskva)

Lenin and physics. Nauka i zhyttia 12 no.4:1 Ap '62. (MIRA 15:8)

1. Chlen-korrespondent AN SSSR i AN UkrSSR.
(Lenin, Vladimir Il'ich, 1870-1924)
(Particles (Nuclear physics))

S/056/62/042/001/034/048
B125/B102

AUTHORS: Barashenkov, V. S., Blokhintsev, D. I., Wang Jung, Mikhul, E. K., Huang Tsu-chan, Hu Shih-k'o

TITLE: Inelastic high-energy pion nucleon interactions

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, v. 42, no. 1, 1962, 217-223

TEXT: The calculations of peripheral inelastic πN interactions (two types of interactions) at $E > 1$ Bev recently made in Dubna in the single-meson approximation were compared with experimental results. If the number of pions produced (Diagram A of Fig. 1) is even, then the pion production is the main process in the peripheral collision which with odd number (diagram B) is accompanied by the production of a single pion in the scattering of a virtual meson from a nucleon. It is sufficient to study processes A and B whose interaction cross sections are

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$$\sigma_{2n}(E) = g^2 \frac{1}{8\pi^3 v} \int_0^{q_{max\,n}} \frac{q^2 dq}{q_0 p_0 \omega} \sigma_{\pi\pi}^{(2n)}(Q) K(Q) \times$$

$$\times \left\{ \frac{1}{4pq} \ln\left(1 + \frac{4pq}{2p_0q_0 - 2pq - 2M^2 + \mu^2}\right) - \frac{\mu^2}{(2p_0q_0 - 2M^2 + \mu^2)^2 - 4p^2q^2} \right\}, \quad (1)$$

and

$$\sigma_{2n+1}(E) = \frac{1}{4\pi^3 v} \int_0^{P_{max\,n}} \frac{P^2 dP}{p_0 \omega} \int_{\sqrt{P^2+(M+\mu)^2}}^{E-\sqrt{P^2+m_n^2}} K(S)\, \sigma_{\pi\pi}^{(2n)}(S)\, dP_0 \times$$

$$\times \frac{\sigma_{\pi N}(p) \sqrt{(R^2 - M^2 - \mu^2)^2 - 4M^2\mu^2}}{(2P_0p_0 - M^2 - R^2 + \mu^2)^2 - 4P^2p^2}. \quad (2).$$

When calculating the single-meson approximation the authors combined all $\pi\pi$-interactions in the upper nodes of the diagrams A and B. The ratios of the cross sections for even and odd numbers of mesons at the same energies E_0 of the primary meson are given in Table 1. The core of the nucleon can be determined from the type of the production of an odd number of mesons at high primary-particle energies. When using the N-collision cross section of 23 mb calculated with a πN-interaction ...

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constant $g^2 = 14.5$ one obtains ~40 mb for the cross sections of the processes A and B. The calculated values of the multiplicity of the particles produced and the angular and energy distributions of the recoil nucleons are compared with the experimental data. The peripheral -interaction with single-meson exchange proves to be the decisive mechanism. The experimental data are not reliable and the contribution of multi-meson processes to the transfer of large momenta which might be of importance, has hitherto not been studied. The authors thank N. N. Govorun, Kim Ze Pkhen, and P. Libl, collaborators of the Vychislitel'nyy tsentr (Computer Center) of the Joint Institute of Nuclear Research for their help in the numerical computations and Hsien Ting-ch'ang for discussions of the methods of calculating the charge distribution in the statistical theory. There are 7 figures, 2 tables, and 11 references: 7 Soviet-bloc and 4 non-Soviet bloc. The three references to English-language publications read as follows: D. I. Blokhintsev. CERN Symposium II, 155, 1956; Proc. of the 1960 Ann. Int. Conf. on High Energy Phys. at Rochester, Univ. of Rochester, 1960; L. Rodberg. Phys. Rev. Lett, 3, 58, 1959.

Inelastic high-energy pion nucleon ... S/056/62/042/001/034/048
B125/B102

ASSOCIATION: Ob"yedinennyy institut yadernykh issledovaniy (United Institute of Nuclear Research)

SUBMITTED: July 24, 1961

Fig. 1: The most important types of the diagrams A and B in inelastic N-scattering and the less important diagrams A' and B'.

E_0, BcV	σ_3/σ_2	σ_5/σ_4
2	0,1	
7	0,15	
100	1	0,25
1000	2	0,5

TABLE 1

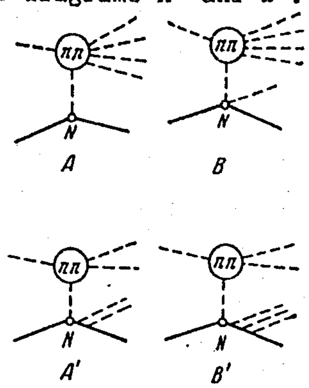

FIG. 1

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35577
S/056/62/042/003/038/049
B108/B102

AUTHOR: Blokhintsev, D. I.

TITLE: Elastic scattering of high-energy pions and nucleons

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, v. 42, no. 3, 1962, 880-881

TEXT: The author shows that the cross section of elastic back scattering in the laboratory system decreases with the energy E_0 of the interacting particles as $\sim 1/E_0$. This result was obtained on the assumption that spin effects are negligible, that the wavelength is small as compared with the dimensions of the interacting particles, and that absorption is high. The results expressed in the form of the differential cross section of back scattering, $(d\sigma/d\Omega)_\pi = \frac{\lambda^2}{4}\frac{9}{4}|(1 - \beta_0)|^2$, agree well with the results of experiments with high-energy pions and nucleons. ($\beta_1 = \exp(2i\eta_1)$; η_1 - complex phase). V. G. Grishin is thanked for discussions. There are

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Elastic scattering of high- ...

S/056/62/042/003/038/049
B108/B102

2 references: 1 Soviet and 1 non-Soviet. The reference to the English-language publication reads as follows: K. W. Lai, L. W. Jones, M. L. Perl, Phys. Rev. Lett., 7, 125, 1961.

ASSOCIATION: Ob"yedinennyy institut yadernykh issledovaniy (Joint Institute of Nuclear Research)

SUBMITTED: October 20, 1961

Card 2/2

BLOKHINTSEV, Dmitriy Ivanovich; TAL'SKIY, D.A., red.; MURASHOVA, V.A., tekhn. red.

[Fundamentals of quantum mechanics] Osnovy kvantovoi mekhaniki. Izd.4. Moskva, Vysshaia shkola, 1963. 619 p. (MIRA 16:12)

(Quantum theory)

BARASHKOV, V.S.; BLOKHINTSEV, D.I.; MIKHUL, E.K.; PATERA, I.;
SEMASHKO, G.L.; SARANTSEVA, V.R., tekhn. red.

[Polar theory of Λ-hyperon production in π N-interactions at high energies] Poliusnaia teoriia rozhdeniia Λ-giperonov v πN -vzaimodeistviiakh pri bol'shikh energiiakh. Dubna, Ob"edinennyi in-t iadernykh issledovanii, 1963. 16 p. (MIRA 16:6)

1. Institut atomnoy fiziki v Bukhareste (for Mikhul).
(Hyperons) (Mesons)

BLOHINCEV, D. [Blokhintsev, D.]

On the eve of new discoveries in physics. Term tud kozl 7 no.6:253-254 Je '63.

1. Szovjetunio Tudomanyos akademiaja levelezo tagja; Dubnai Egyesitett Atomkutato Intezet igazgatoja.

S/089/63/014/001/011/013
B102/B186

AUTHOR: Blokhintsev, D. I.

TITLE: Causality in the modern field theory

PERIODICAL: Atomnaya energiya, v. 14, no. 1, 1963, 105-109

TEXT: A detailed discussion is given of the significance attaching to the causality principle in classical and quantum physics (cf. also Blokhintsev, Sb. Filosofiskiye voprosy sovremennoy fiziki - Philosophical problems of modern physics- M.Izd-vo AN SSSR, 1952 and Preprint OIYaI, Dubna, 1962) and of the conclusions following from it. An attempt is made to avoid the divergencies that result when the causality principle in the space time continuum is applied on the microscopic scale. A discussion is given of the theoretical possibility of preserving macroscopic causality and of so modifying microscopic causality that no singularities appear. In this connection the possibilities for a suitable generalization of the causality principle are discussed. Such possibilities may arise from the nonlinear theory of field propagation (Born), the change of the metric of the physical vacuum and the space - time quantization.

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Causality in the modern field theory S/089/63/014/001/011/013
B102/B186

It is uncertain which of the possibilities mentioned will approximate the truth.

SUBMITTED: August 30, 1962

Card 2/2

L 17214-63 EWT(m)/BDS AFFTC/ASD

ACCESSION NR: AP3005297 S/0056/63/045/002/0381/0383

AUTHORS: Barashenkov, V. S.; Blokhintsev, D. I.; Mikhul, E. K.; Patera, I.; Semashko, G. L.

TITLE: Momentum spectrum of baryons in inelastic collisions between fast pions and nucleons

SOURCE: Zhur. eksper. i teoret. fiz., v. 45, no. 2, 1963, 381-383

TOPIC TAGS: baryon, momentum spectrum, pion-nucleon collision, pion-pion collision, SIGMA hyperon, LAMBDA hyperon

ABSTRACT: It is shown that the reason for the double peak observed in the Λ and Σ hyperon momentum spectrum in inelastic collisions between fast pions and nucleons at energies close to 10 BeV is a direct consequence of the resonant interaction between the primary negative pion and the intermediate particle that transmits the bulk of the interaction in peripheral pion-nucleon collisions. Similar double

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L 17214-63
ACCESSION NR: AP3005297

maxima in the spectrum of the recoil nucleons can be attributed to resonance pion-pion interaction. Orig. art. has two figures.

ASSOCIATION: Ob"yedinenny*y institut yaderny*kh issledovaniy (Joint Institute of Nuclear Research)

SUBMITTED: 25Apr63 DATE ACQ: 06Sep63 ENCL: 00

SUB CODE: PH NO REF SOV: 003 OTHER: 006

Card 2/2

KELER, V.R., otv. red.; MILLIONSHCHIKOV, M.D., akademik, red.; BLOKHIN, N.N., red.; BLOKHINTSEV, D.I., red.; GNEDENKO, B.V., akademik, red.; ZAYCHIKOV, V.N., red.; KELDYSH, M.V., akademik, red.; KIRILLIN, V.A., akademik, red.; KORTUNOV, V.V., red.; MONIN, Andrey Sergeyevich, prof., doktor fiz.-matem. nauk, red. (1921); NESMEYANOV, A.N., akademik, red.; PARIN, V.V., red.; REBINDER, P.A., akademik, red.; SEMENOV, N.N., akademik, red.; FOK, V.A., akademik, red.; FRANTSOV, G.P., akademik, red.; ENGEL'GARDT, V.A., akademik, red.; KREMNEVA, G., red.; BALASHOVA, A., red.; BERG,A.I.,akademik,red.

[Science and mankind, 1964; simple and precise information about the principal developments in world science] Nauka i chelovechestvo, 1964.; dostupno i tochno o glavnom v mirovoi nauke. Moskva, Izd-vo "Znanie," 1964. 424 p. (MIRA 18:1)

1. Deystvitel'nyy chlen AMN SSSR (for Blokhin, Parin). 2. Chlen-korrespondent AN SSSR (for Blokhintsev). 3. Akademiya nauk SSSR Ukr.SSR (for Gnedenko).

BLOKHINTSEV

BLOHINCEV, D. [Blokhintsev, D.]

Quantum aggregates. Magy fiz folyoir 12 no.1:1-8 '64.

1. Moscow State University.

ACCESSION NR: AP4042567 S/0056/64/046/006/2049/2051

AUTHOR: Blokhintsev, D.

TITLE: Geometrical optics of elementary particles

SOURCE: Zh. eksper. i teor. fiz., v. 46, no. 6, 1964, 2049-2051

TOPIC TAGS: wave equation, wave function, high energy particle, elementary particle, particle scattering, mathematical method

ABSTRACT: By starting from the equation for the single-time wave function for two particles

$$L\psi(x) = \int V(x, x', W)\,\psi(x')\,d^3x'.$$

and by using two limiting cases, those of long and short waves, it is shown that the nonlocal potential which is obtained from quantum field theory can be replaced in the case of large wave numbers by a local complex refractive index. This gives theoretical grounds for

ACCESSION NR: AP4042567

the application of geometrical optics to the description of the scattering of high-energy particles, as was done by the author and by others elsewhere (D. I. Blokhintsev et al., Uspekhi Fizicheskikh nauk v. 68, 417, 1959; Nuovo cimento 9, 249, 1958. R. Serber, Phys. Rev. Letters v. 10, 357, 1963). However, such a description of the scattering particles is approximate and will not be valid for very large scattering angles such as backward scattering. Orig. art. has: 14 formulas.

ASSOCIATION: Ob"yedinenny*y institut yaderny*kh issledovaniy (Joint Institute of Nuclear Research)

SUBMITTED: 18Jun63 DATE ACQ: ENCL: 00

SUB CODE: NP NR REF SOV: 004 OTHER: 003

Card 2/2

BLOHINCEV, D.I. [Blokhintsev, D.I.]

High-energy physics in 1964. Fiz szemle 15 no.2:48-50 F '65.

1. Joint Institute of Nuclear Research, Dubna.

BLOKHINTSEV, D.I.

On the threshold of the deepest scientific revolution. Priroda 54 no.1:53-56 Ja '65. (MIRA 18:2)

1. Ob"yedinennyy institut yadernykh issledovaniy, Dubna; chlen-korrespondent AN SSSR.

BLOKHINTSEV, D.

Conference on the Theoretical Aspects of the Physics of Elementary Particles. Usp. fiz. nauk 85 no.4:737-754 Ap '65. (MIRA 18:5)

BLOKHINTSEV, D.I.

High-energy physics and the fundamental principles of modern theory. Usp. fiz. nauk 86 no.4:723-724 Ag '65.

(MIRA 18:8)

BLOKHINTSEV, D.I.

Propagation of high-frequency signals in a medium with random characteristics. Dokl. AN SSSR 166 no.3:574-576 Ja '66. (MIRA 19:1)

1. Ob"yedinennyy institut yadernykh issledovaniy; chlen-korrespondent AN SSSR. Submitted October 20, 1965.

L 25732-66 EWT(1)

ACC NR: AP6016662 SOURCE CODE: UR/0053/65/086/004/0721/0724

AUTHOR: Blokhintsev, D. I.

ORG: none

TITLE: High energy physics and basic principles of modern theory

SOURCE: Uspekhi fizicheskikh nauk, v. 86, no. 4, 1965, 721-724

TOPIC TAGS: wave mechanics, elementary particle, particle interaction

ABSTRACT: This article is a brief summary of the state-of-the-art in high energy physics. A brief review of the historical steps leading to the development of wave mechanics is followed by suggested experiments which might lead to further revolutionary discoveries in the area of high energy physics. These suggested experiments have to do with the structure of free time-space and internal events in elementary particles during their most intimate interactions. The overall impression is one of laudatory comment rather than scientific reporting. [JPRS]

SUB CODE: 20 / SUBM DATE: none / ORIG REF: 010 / OTH REF: 006

Card 1/1 UDC: 539.12.01

L 09089-67 EWT(m) JR

ACC NR: AP7002344 SOURCE CODE: UR/0089/66/020/004/0293/0310

AUTHOR: Blokhintsev, D. I.

ORG: none

TITLE: Tenth anniversary of scientific work at the joint institute of nuclear studies

SOURCE: Atomnaya energiya, v. 20, no. 5, 1966, 293-310.

TOPIC TAGS: nuclear reactor technology, nuclear physics

ABSTRACT: A review of some research carried out at the Joint Institute for Nuclear Studies in high-energy physics and reactor technology is presented. The author thanks his co-workers at the Institute who helped him compile this work. Special thanks go to R. A. Asanov, U. S. Barashenkov, V. P. Dzhelopov, I. V. Chuvilo, I. M. Franks and G. N. Flerov. Further thanks goes to P. I. Zol-nikov and Yu. A. Tumanov who took the photographs for this article. [NA]

SUB CODE: 20,18 / SUBM DATE: none / ORIG REF: 071 / OTH REF: 012

Card 1/1

0925 0635

L 10241-67 EWT(1) IJP(c)
ACC NR: AR6028551

SOURCE CODE: UR/0053/66/089/002/0185/0199

AUTHOR: Blokhintsev, D. I.

ORG: Joint Institute of Nuclear Research (Ob"yedinennyy institut yadernykh issledovaniy)

TITLE: Basis for special relativity theory provided by experiments in high energy physics

SOURCE: Uspekhi fizicheskikh nauk, v. 89, no. 2, 1966, 185-199

TOPIC TAGS: special relativity theory, high energy interaction, mass energy relation, parity principle, space time, dispersion equation, elementary particle

ABSTRACT: The author reviews a large number of experiments in high-energy physics for the purpose of checking the degree of support that they can provide for the special theory of relativity. The theoretical foundations for testing the special theory of relativity in the domain of high energies and small dimensions are reviewed from the point of view of numerous elementary premisis of elementary-particle theory such as microcausality, conservation laws, and the various parities. The principles that might be verified on the basis of recent experimental data are microcausality, the disperion relations, the asymptotic relations between various cross sections, and homogeneity and isotropy of space-time. Other possible checks on the theory of relativity in light of present experimental results are also mentioned. It is concluded that the presently known set of facts in dimensions close to 10^{-15} cm (lab.) or 10^{-14} cm

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UDC: 530.12: 531.18

L 10243-67

ACC NR: AP6028551

(c.m.s.) do not contradict relativistic kinematics, which hold on the average with an accuracy of ~1%. The dependence of mass on velocity has been verified with higher accuracy, up to 0.01%. Possible large deviations from relativistic kinematics are conceivable, but these have low probability and have not been investigated. The only troublesome aspect is the situation with local field theory, which is closely related to the assumed form of geometry and to causality. Asymptotic cross sections in the region of 20 Gev do not approach one another as expected, and a comparison of presently known data on the forward scattering of high-energy pions does not agree with the results of calculations by means of dispersion relations. This calls for an increase in the measurement accuracy. If this disagreement between theory and experiment is confirmed, this would serve as a serious basis for a radical reevaluation of the basic postulates of modern special relativity theory. Orig. art. has: 1 figure and 18 formulas.

SUB CODE: 20/ SUBM DATE: 00/ ORIG REF: 021/ OTH REF: 024

Card 2/2

ACC NR: AP7007073

SOURCE CODE: UR/0020/66/168/004/0774/0776

AUTHOR: Blokhintsev, D. I. (Corresponding Member AN SSSR)
ORG: Joint Institute for Nuclear Research (Ob"yedinennyy institut yadernykh issledovaniy)

TITLE: Space-time metrics and non-linear fields

SOURCE: AN SSSR. Doklady, v. 168, no. 4, 1966, 774-776
TOPIC TAGS: special relativity theory, physics
SUB CODE: 20

ABSTRACT: Certain requirements for signal linearity implicitly contained in the special theory of relativity are usually ignored. Eistein has noted many times that we must deal with the sum "geometry plus physics," not with each component individually. This article analyzes this "sum" in the example of an abstract world in which there is only one form of matter: the scalar field (X) distributed in space R (X) ($X = X_1, X_2, X_3, X_4$). In this case the directions in space R_4 (X) are divided into time directions (within the zone of influence) and space directions (without it). In order to differentiate between space and time, it is necessary to employ a signal which has a cone of influence including all other possible cones of influence. The authors note that the Klein equation, as usually applied, leads to particle motion with speeds higher than the velocity of light. From the point of view of the definition of time given in this article (area attainable by a signal), the author considers that there is one space coordinate and three time coordinates: X_1, X_2, X_3. With this definition of time, particle velocities described

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UDC: 530.18+530.16

ACC NR: AP7007073

by the Klein equation will be less than the velocity of light. Orig. art. has: 4 figures and 10 formulas. [JPRS: 38,417]

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BLOKHINTSEV,. Eng. I.

DAIRY PLANTS

From the experience of master Nikulenkov
Mol. prom. 13, no. 9, 1952

12163

ON THE INTERACTION BETWEEN μ-MESONS AND NUCLEONS. I. S. Shapiro, E. I. Dolinsky, and L. D. Blokhintsev (Moscow State Univ., U.S.S.R.). Nuclear Phys. 4, 273-81(1957) Aug.

The angular distribution and longitudinal polarization of neutrons produced in the capture of μ^- mesons by μ-mesohydrogen are computed.

Blokhintsev, L.D.

AUTHORS: Shapiro, I. S., Dolinskiy, E. I., Blokhintsev, L.D., 20-6-14/42

TITLE: Problem of Interaction of Muon With Nucleons (K voprosu o vzaimodeystvii μ-mezonov s nuklonami).

PERIODICAL: Doklady AN SSSR, 1957, Vol. 116, Nr 6, pp. 946 - 948 (USSR)

ABSTRACT: The present report investigates the angular distribution of neutrons which were obtained at the capture of a negative muon by a proton in μ-mesohydrogen. The negative muon is assumed to be polarized. In this case the angular distribution of the neutrons in a general case will be generally anisotropic because of the non-conservation of the parity with weak interactions, in which case both the sign and the size of anisotropy depend on the form of interaction. The energy of interaction of a nuon with a nucleon taking account of the nonconservation of parity can be written down conjugated complex in the form $H=\sum_k(\overline{\Psi}_n O_k \Psi_p)(\overline{\Psi}_\nu[g_k-g_k'\gamma_5]O_k\Psi_\mu)$ +

In this case O_k means the operators known from the theory of the β-decay which are composed of the Dirac matrices. It further holds k = s,p,v,a,t, in which case s,p,v,a,t signifies the scalar, pseudoscalar, vectorial, pseudovectorial, and tensorial variant of interaction. With $g_k = -g_k$ the variant proposed by L.D.Landau (reference 1) of the theory with a longitudinal polarized neutrino is obtained. The formula $W(\theta)=1+\alpha\cos\theta$, holds for the angular distribution of the neutrons, in which case θ denotes the angle between the

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Problem of Interaction of Muon With Nucleons. 20-6-14/42

direction of emission of the neutron and the negative direction of polarization of the negative muon. The terms valid in the case of the presence of all variants of interaction is given for α The values of α for the different variants of interaction (on the assumption of longitudinal neutrino)are summarized in a table.Such formulae can also be obtained for the capture of negative muons by protons which are bound to nuclei.In this case α depends on the matrix elements of the nuclei which renders the interpretation of the experimental data difficult.Besides the anisotropy of angular distribution of the neutrons, also the fact can be utilized for the determination of the form of interaction that the neutrons formed during the process $\mu^- + p \rightarrow n + \nu$ are generally polarized. This polarization takes place both transversally and longitudinally. A table contains the amounts of longitudinal polarization of the P-neutrons obtained at the capture of unpolarized negative muons by free protons in the case of a longitudinal neutrino.These data hold also approximately for the capture of muons by nuclei.There are 1 figure,1 table and 4 references,2 of which are Slavic.

ASSOCIATION: **Moscow State University im. M. V. Lomonosov** (Moskovskiy gosudarstvennyy universitet im.M.V.Lomonosova)
PRESENTED: May 27, 1957, by D. V. Skobel'tsyn,Academician
SUBMITTED: May 18,1957
AVAILABLE: Library of Congress
Card 2/2

SOV/56-34-3-41/55

AUTHORS: Dolinskiy, E. I., Blokhintsev, ~~L. D.~~

TITLE: The Absorption of Polarized Negative Myons by Nuclei (Pogloshcheniye polyarizovannykh μ^--mezonov yadrami)

PERIODICAL: Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, 1958, Vol. 34, Nr 3, pp. 759 - 761 (USSR)

ABSTRACT: According to I. S. Shapiro and others (Reference 1) the distribution of the neutrons formed in the capture of polariz-ed negative myons by free protons, can be represented in the form $1 + \alpha\cos\theta$. The present report gives the results of calculation of the coefficient α for the case of absorption of negative myons by protons which are bound in nuclei, for the scalar (s), vectorial (v), tensorial (t) and pseudovec-torial (a) variant of the 4-fermion-interaction of myons with nucleons. The nucleus is described by the shell model and the recoil of the nucleus is neglected. The calculation is carried out in non-relativistic approximation with re-spect to the nucleons. The interaction of the neutron being emitted with the nucleus was taken into account by means of

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The Absorption of Polarized Negative Myons by Nuclei

a complex potential which allows the application of a certain probability of absorption of the neutron in the nucleus. The value obtained for α can be still reduced due to various causes which are briefly summarized here. First, terms for the wave functions of the proton and of the neutron are written down. The wave function of the neutron is written down here also by taking account of the spin orbit interaction. The wave function of the neutrino was applied in form of a plane wave. Subsequently, formulae for the emission of a neutron with the energy $E_N = \hbar^2 k_N^2/2m$ under a given angle Θ in the absorption of a negative myon are written down in the subshell characterizable by the quantum numbers n, j, l. These formulae hold for the superposition of the s, v, t and a-variants. The total effect of all closed subshells is obtained by summarizing the corresponding formulae by way of n, j, l. The formulae given here, also describe the absorption of a negative myon by 1 proton which is located above the closed shells. The formulae given here might form a good approximation for the double magic nuclei. The details of the calculation and the numerical estimations for

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The Absorption of Polarized Negative Myons by Nuclei

concrete nuclei will be given in a separate report. There are 4 references, 3 of which are Soviet.

ASSOCIATION: Moskovskiy gosudarstvennyy universitet (Moscow State University)

SUBMITTED: December 9, 1957

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24(5), 21(7) SOV/56-35-6-26/44

AUTHORS: Dolinskiy, E. I., ~~Blokhintsev, L. D.~~

TITLE: Absorption of Polarized μ^--Mesons by Nuclei (Pogloshcheniye polyarizovannykh μ^--mezonov yadrami) The Angular Distribution of Neutrons (Uglovoye raspredeleniye neytronov)

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1958, Vol 35, Nr 6, pp 1488-1498 (USSR)

ABSTRACT: The investigation of the nuclear absorption of negative muons makes it possible to determine the non-electromagnetic interaction between muons and nucleons. The process of the nuclear absorption of muons develops via an intermediate stage with formation of a mesic atom according to (1): $\mu^- + P \rightarrow N + \nu + Q$, (P - proton, N - neutron, ν - neutrino). In the introduction, several earlier publications dealing with this subject are discussed. Most of the theoretical papers, (as e.g. references 1 - 3), operate with the nuclear shell model with j-j coupling. In reference 4 measurements of the ratio between muon decay probabilities are compared with the theoretical results obtained by Tolhoek and Luyten (Tolkhuk, Luyten) (Ref 3) (Gamow-Teller interaction type). In a number of papers (Refs 5-9) the asymmetry of neutron

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Absorption of Polarized μ^--Mesons by Nuclei. The Angular Distribution of Neutrons

angular distribution from (1), (absorption of polarized muons) was investigated. Several authors (Refs 5, 9, 10) found that the nuclei themselves show polarization after the capture of polarized muons. In reference 8 the circular polarization and the angular distribution of γ-quanta in μ^--radiation capture was investigated, references 11 and 12 deal with the investigation of the total depolarization of μ^--mesons in hydrogen. In the present paper the authors investigate neutron angular distribution from (1) when using μ^--mesons, which are produced as a decay product of π^--mesons polarized along the direction of their flight. (1) may be considered to be a direct process for the neutron angular distribution of which $1 + P_\mu \alpha \cos \Theta$ holds (P_μ is the degree of polarization of the μ^--mesons at the instant of capture, α - the asymmetry coefficient, and Θ - the angle between the direction of polarization and the direction in which the neutron is emitted). By taking the non-conservation of parity into account, the Hamiltonian for four-fermion interaction between muon and nucleon is set up. As the binding energy of the μ^--meson in the K-orbit in the mesic atom is considerably lower than its rest energy, the wave function for

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the muon can be used in non-relativistic approximation. For the nucleus the shell model with j-j coupling is used. The recoil energy of the nucleus is neglected. The potential of the shell model and the interaction potential between neutron and nucleus is assumed to be spherically symmetric. The spin-orbit interaction of the emitted neutron with the nucleus is not taken into consideration because this case has already been dealt with by reference 13. The results obtained by theoretical considerations are numerically evaluated for the neutron emission probability $dW(E_N,\Theta)$ and for the asymmetry $\alpha(E_N)$ for the O^{16} and the Ca^{40} nucleus. Calculations are carried out with a coupling constant $g_k = c_k(10^{-49}\ \mathrm{erg.cm}^3)$. The numerical results obtained are shonw by 2 tables and 4 figures. They can be summarized as follows: The energy spectrum has a maximum at $E_N \approx 5$ Mev. The major part of μ^--mesons is absorbed by protons of the external shells of the nucleus. For the angular distribution of neutrons it holds that

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$q(\Theta) = 1 + P_\mu \widetilde{\beta}\alpha_H \cos\Theta$, α_H is the asymmetry coefficient for

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μ^--capture in hydrogen (without consideration of hyperfine structure), $\tilde{\beta}$ for O^{16} and $Ca^{40} \approx +0.5$. Degree of polarization of μ^--mesons in the K-shell of the mesic atom: $\underset{\sim}{P} \sim 0.15 - 0.20$ (Refs 14, 22), α_H is between -1 and +1/3, for $\tilde{\beta} \overset{\mu}{\approx} 0.5$ the asymmetry of neutron angular distribution is of the order 3 - 10%. The authors in conclusion thank I. S. Shapiro for his interest and his discussions, and they also thank M. K. Akimov, who carried out numerical computations on the electronic computer "Strela" of the MGU. There are 4 figures, 2 tables, and 25 references, 10 of which are Soviet.

ASSOCIATION: Moskovskiy gosudarstvennyy universitet (Moscow State University)

SUBMITTED: June 24, 1958

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DOLINSKIY, Ye. I. and BLOKHINTSEV, L. D.

"Absorption of Polarized μ-Mesons by Nuclei; The Neutron Angular Distribution," Nuclear Physics, Vol. 10, No. 5, 1959, pp. 527-540 (No. Holland Publ. Co., Amsterdam)

The angular distribution of neutrons emitted in the absorption of polarized μ^--mesons by nuclei is calculated. Numerical computations are carried out for $_8O^{16}$ and $_{20}Ca^{40}$.

Moscow State Univ.

21(7), 21(8) SOV/56-36-1-36/62

AUTHOR: Blokhintsev, L. D.

TITLE: The Absorption of Polarized μ^--Mesons by Nuclei (Pogloshcheniye polyarizovannykh μ^--mezonov yadrami) The Polarization of Neutrons (Polyarizatsiya neytronov)

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1959, Vol 36, Nr 1, pp 258-263 (USSR)

ABSTRACT: The present paper calculates the polarization of neutrons which occur in the reaction $\mu^- + P \rightarrow N + \gamma$ at the capture of negative muons by a free proton. In the first chapter neutron polarization is calculated. The vector $\vec{P}_N$ of neutron polarization is defined as the mean value of the operator $\vec{\sigma}$ of neutron spin: $\vec{P}_N = Sp(\rho\vec{\sigma})/Sp\,\rho$. Here ρ denotes the density matrix, and the elements in its diagonal determine the probability of the departure of a neutron. On the basis of general considerations it holds that $\vec{P}_N = a\vec{P}_\mu + b\vec{k}_N + c[\vec{k}_N \vec{P}_\mu]$, where $\vec{P}_\mu$ denotes the polarization vector of the negative muon and $\vec{k}_N$ the momentum of the neutron. Further, the Hamiltonian of muon-nucleon interaction used in these calculations in consideration of

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The Absorption of Polarized μ^--Mesons by Nuclei. The Polarization of Neutrons SOV/56-36-1-36/62

the non-conservation of parity is written down. The polarization of neutrons is calculated by basing on the same conditions as in the case of angular distribution in a previous paper by E. I. Dolinskiy and L. D. Blokhintsev (Ref 1). The formulas obtained in this way hold actually only in the case of nuclei with completely filled proton-subshells. Two cases are investigated: The spin-orbit interaction between neutron and nucleus was 1) neglected, and 2) taken into account. The rather voluminous formulas for neutron polarization in disregard of spin-orbit interaction are explicitly written down. The even more complicated formulas taking account of this interaction are not given. The formulas permit the following conclusions to be drawn: 1) In μ^--capture in mesic hydrogen the component P_N^x is different from zero only if the above mentioned Hamiltonian is invariant with respect to an inversion of the spatial- and time-axes. 2) P_N^y is not connected with the degree of non-conservation of spatial parity in the aforementioned Hamiltonian. 3) The longitudinal polarization P_N^z

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of the neutron does not become equal to zero even in the case of unpolarized negative muons. The second chapter of this paper deals with the numerical calculation for the nuclei ${}_{8}O^{16}$ and ${}_{20}Ca^{40}$. The degree of polarization (especially of longitudinal polarization) of a neutron may attain very considerable values. The author thanks I. S. Shapiro for his interest and for discussing the results obtained. There are 7 references, 5 of which are Soviet.

ASSOCIATION: Institut yadernoy fiziki Moskovskogo gosudarstvennogo universiteta (Institute for Nuclear Physics of Moscow State University)

SUBMITTED: July 15, 1958

AUTHORS: Shapiro, I. S., Blokhintsev, L. D. SOV/56-37-3-26/62

TITLE: Circular Polarization of the γ-Quanta Emitted by a Nucleus After a μ^--Capture

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1959, Vol 37, Nr 3(9), pp 760-764 (USSR)

ABSTRACT: In computing the circular polarization mentioned in the title the hyperfine splitting up of the level of the mesic atom was taken into account. The authors made their computations for the case that the nucleus passes to a discontinuously varying level in the μ^--capture (i.e. no neutron departs). The process to be investigated is the following: Nucleus A_Z with spin j_1 captures a polarized negative ion from the K-shell and passes to the excited level A_{Z-1} with spin j_2, which then passes from the multiplicity J to the ground state with spin j_3 under emission of a γ-quantum. The authors wrote down the Hamiltonian of the four-fermion interaction as a superposition of the vectorial (v), axially vectorial (a), and pseudoscalar (p) variant with the coupling constants g_v, g_a and g_p. The degree C_γ of circular

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polarization is defined as follows: $C_\gamma = (W_+ - W_-)/(W_+ - W_-)$. W_+ and W_- denote the probabilities of the emission of γ-quanta with their spin in parallel (right-hand polarization) and anti-parallel position respectively, to the momentum (left-hand polarization). For a longitudinal neutrino the computation furnishes the result: $C_\gamma = P_\mu \alpha \cos\theta$, $\alpha = B/A$. P_μ denotes the degree of polarization of the negative muon at the instant of its incidence on the K-orbit of the mesic atom, θ - the angle between the directions of the polarization vector of the negative muon and of the direction of departure of the γ-quantum. The above-mentioned formulas hold for the case that the neutrino departs with a certain angular momentum $\Lambda = \Lambda_{min}$. This is the least possible angular momentum admitted by selection rules. The correction shown by Gell-Mann (Ref 4) concerning the allowed transitions due to the "weak mechanism" has already been taken into consideration in the above expressions. In order to examine this, the authors investigate the transition

Card 2/4 $\Delta j = j_2 - j_1 = \pm 1$ (no). A formula is written down for the matrix element M_v of the μ transition. The structure of this matrix element M_v is similar to that of the matrix element of the operator for the energy of interaction of the magnetic moment with the magnetic field. Quantity μ (the total magnetic moment of the transition, computed in nuclear magneton units) takes into account the contribution of virtual pions according to Gell-Mann. (Ref 4). For the transitions of the type $\Delta j = \pm 1$ (no), however, neither corrections are made for a "weak mechanism" nor are other relativistic corrections of the same order of magnitude applied to the amount of polarization of the γ-rays although they contribute to the total probability of the process. The problem of such corrections in the μ^--capture was investigated more exactly by B. L. Ioffe (Ref 5). In computing the expression for C_γ the hyperfine splitting up of the mesic-atom level was taken into account, for it plays an important part. In the transitions satisfying Fermi's selection rules the circular polarization of γ-quanta is entirely due to hyperfine interaction. As an example of an allowed transition

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with subsequent dipole radiation ($\Lambda = 0$, $J = 1$) at $j_1 = j_2 = j_3 = 1/2$ is investigated for the Gamov-Teller variant. In most cases, the μ^--capture leads to the departure of a neutron from the nucleus. There are 7 references, 3 of which are Soviet.

SUBMITTED: April 3, 1959

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BLOKHINTSEV, L. D., Cand Phys-Math Sci (diss) -- "Polarization phenomena in the capture of μ-mesons by nuclei". Moscow, 1960. 11 pp (Moscow Order of Lenin and Order of Labor Red Banner State U im M. V. Lomonosov, Sci Res Inst of Nuclear Physics), 130 copies (KL, No 12, 1960, 124)

SHAPIRO, I.S.; BLOKHINTSEV, L.D.

Capture of μ^--mesons by the O^{16} nucleus. Zhur. eksp. i teor. fiz. 39 no.4:1112-1114 O '60. (MIRA 13:11)
(Mesons)

APPROVED FOR RELEASE: 06/09/2000 CIA-RDP86-00513R000205610004-3"

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AUTHORS: Akimova, M. K., Blokhintsev, L. D., Dolinskiy, E. I.

TITLE: Angular Distribution and Polarization of Neutrons Emitted in Muon Capture of Some Light Nuclei

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1960, Vol. 39, No. 6(12), pp. 1806-1817

TEXT: A study of the angular distribution and polarization of neutrons emitted from nuclei as a result of the reaction $\mu^- + P \rightarrow N + \nu$ gives information on the muon-nucleon weak interaction constant. Formulas for angular distribution and polarization (Refs. 1-4) have been obtained in different approximations, and numerical calculations have been made for several concrete cases. The very extensive calculations presented here are based on the theory of universal Fermi interaction, and have been made on the assumption that the interaction of "stripped" fermions can be described by V- and A-type four-fermion coupling. All relativistic terms which are of first order in v_n/c (v_n - nucleon velocity), including weak

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magnetism and effective pseudoscalar interaction, are taken into account. The Hamiltonian H_{eff} describing the muon capture is taken from Ref. 7, and from the universal Fermi interaction with conservation of the vector current it follows that

$$g_V^{(\mu)} = 0.972\, g_V^{(\beta)},\ \mu = 1+\mu_P - \mu_N = 4.71,\ g_A^{(\mu)} = 0.999\, g_A^{(\beta)},\ \text{and}$$

$g_P^{(\mu)} = 8g_A^{(\beta)}$; $g_V^{(\beta)}$ - Fermi coupling constant for β-decay of nucleons; μ_P, μ_N - anomalous magnetic moments of proton and neutron in nuclear magnetons; $g_A^{(\beta)}$ - Gamow-Teller coupling constant for β-decay of nucleons. These assumptions and results of a previous paper (Ref. 3) are used to derive formulas for the emission probability of neutrons with given kinetic energy from a nucleus, for the angular distribution and the polarization for the case of direct neutron emission:

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$$dW(E_N,\theta)=G^{(\mu)2}W_0(E_N)\,[I(E_N)+P_\mu K_1(E_N)\cos\theta]\,dE_N d\Omega_N/4\pi, \quad (4)$$

$$I(E_N)=(1+3\lambda^2)+2\,[1+2\lambda\mu-\lambda^2(\varkappa-1)]\,\gamma_1(E_N)+ + [2\mu^2+\lambda^2(\varkappa-1)^2+1]\,\gamma_2(E_N), \quad (5)$$

$$K_1(E_N)=-\{(-1+\lambda^2)\,\beta_0(E_N)+2\,[-1+2\lambda\mu+ + \lambda^2(\varkappa-1)]\,\beta_1(E_N)\,\gamma_1(E_N)+[2\mu^2-\lambda^2(\varkappa-1)^2-1]\,\beta_2(E_N)\,\gamma_2(E_N)\}, \quad (6)$$

где

$$G^{(\mu)}=g_V^{(\mu)}\cdot 10^{49}\ \text{эрг}^{-1}\cdot\text{см}^{-3},\quad \lambda=-g_A^{(\mu)}/g_V^{(\mu)},\quad \varkappa=g_P^{(\mu)}/g_A^{(\mu)},$$

$$q(E_N,\theta)=1+P_\mu\alpha_1(E_N)\cos\theta, \quad (7)$$

$$\alpha_1(E_N)=K_1(E_N)/I(E_N). \quad (8)$$

$$P_N^{\parallel}(E_N)=L_1(E_N)/I(E_N), \quad (9)$$

$$L_1(E_N)=-2\,\{\lambda(\lambda+1)\,\beta_0(E_N)+ + \lambda\,[2(\mu+1)-\varkappa]\,\beta_1(E_N)\,\gamma_1(E_N)+[\mu^2-\lambda(\varkappa-1)]\,\beta_2(E_N)\,\gamma_2(E_N)\}. \quad (10)$$

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The angle, θ, of neutron emission is measured with respect to the direction of polarization of the μ^- mesons; their degree of polarization on the K-orbit of the mesic atom at the instant of capture is denoted by P_μ. The neutron kinetic energy lies in the interval (E_N, E_N+dE_N). The coefficients W_o, β_k, and γ_k have been calculated by the computer "Strela" of MGU (Moscow State University) for the nuclei of C^{12}, Ne^{20}, Si^{28}, and S^{32} on the following assumptions: The state of the protons in the nucleus may be described by the nuclear shell model with jj-coupling; spin-orbit splitting of proton levels is neglected. A square-well potential for the shell model is assumed with $R = r_o A^{1/3}$. The interaction between neutron and nucleus is described by a complex square well:

$$V_N(r) = \begin{cases} -U_N(1+i\zeta), & r < R \\ 0 & r > R \end{cases}$$

with the same R; computations are performed for $\zeta = 0$, -0.10, and -0.15; the coordinate dependence of the wave function ψ_μ of the muon on the

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K-orbit is taken into account. Numerical results are summarized in Tables 1 and 2. Fig. 1 shows $W_o(E_N)$ for the three values of $\int$ (curves 1-3). The values of α in Table 1 are defined by $\psi_\mu = \sqrt{\alpha^3/\pi}\, e^{-\alpha r}$, $\alpha = Zm_\mu e^2/\hbar^2$. Fig.2 shows $\beta_o(E_N)$ again for the three values of $\int$. In the final section, the results obtained are compared with experimental data and discussed in detail. Professor I. S. Shapiro is thanked for discussions. A. Ye. Ignatenko is mentioned. There are 7 figures, 3 tables, and 20 references: 8 Soviet, 10 US, 1 Italian, and 1 Japanese.

ASSOCIATION: Institut yadernoy fiziki Moskovskogo gosudarstvennogo universiteta (Institute of Nuclear Physics of Moscow State University)

SUBMITTED: July 29, 1960

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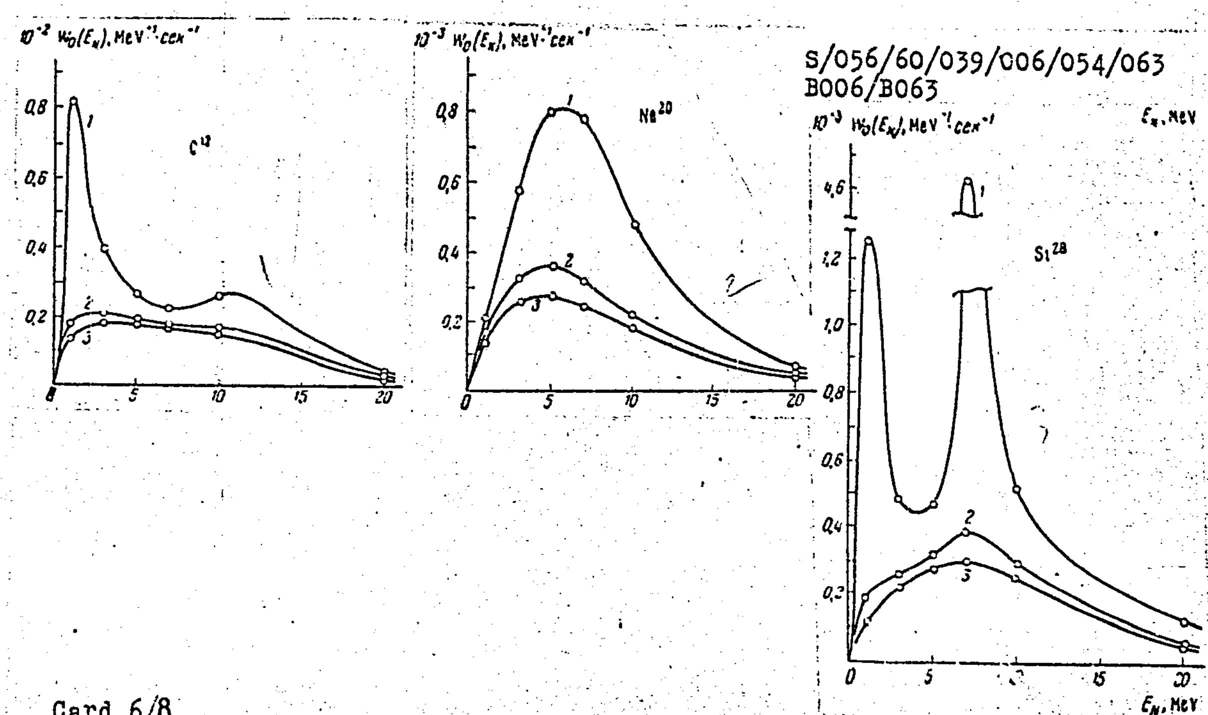

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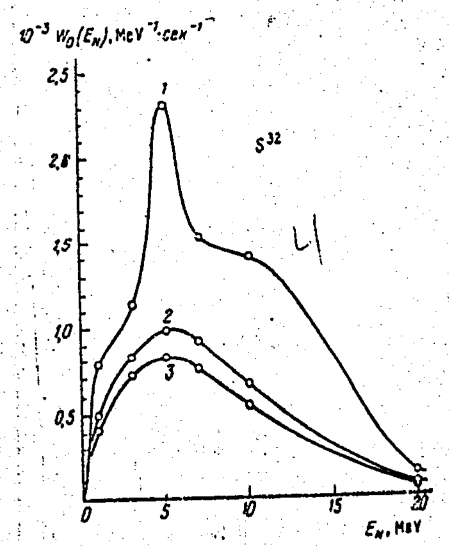

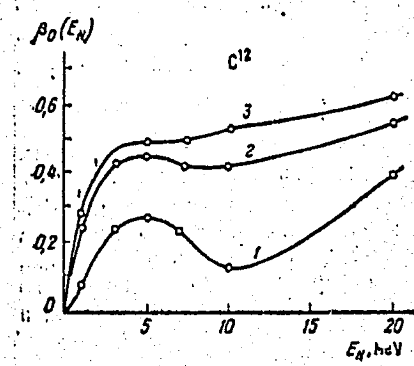

Fig. 4

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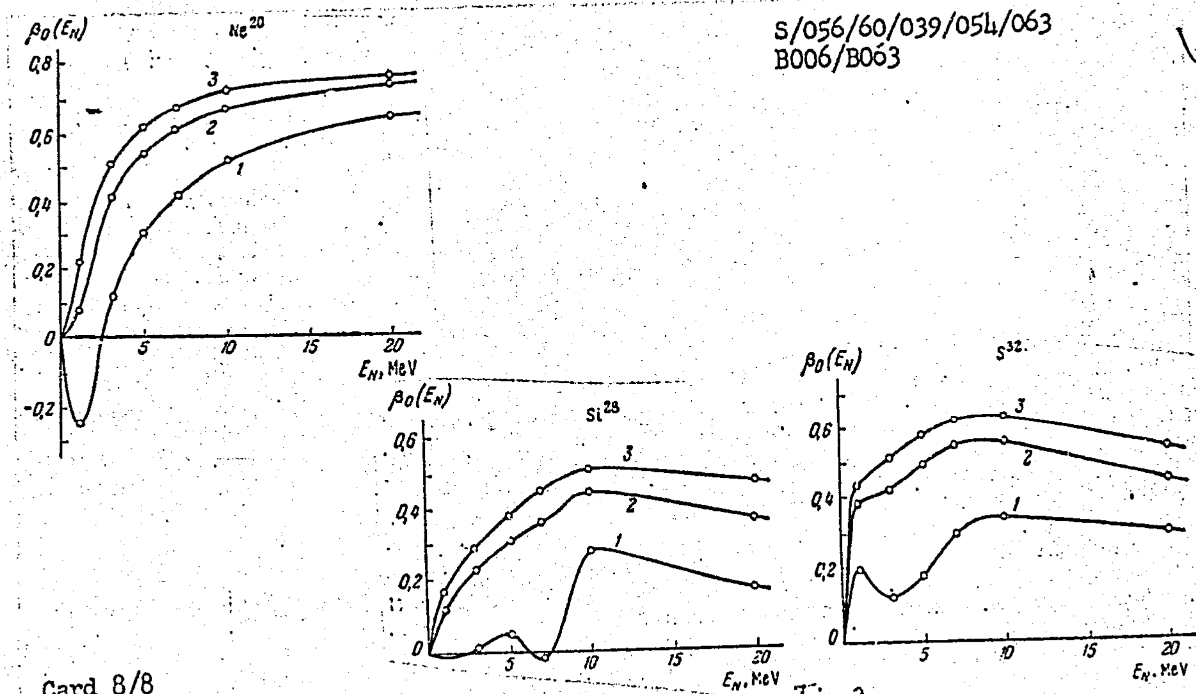

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Fig 2

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AUTHORS: Blokhintsev, L. D., Dolinskiy, E. I.

TITLE: Coupling constants in μ-capture

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, v. 41, no. 6(12), 1961, 1986-1995

TEXT: It is shown that within the universal Fermi interaction theory the best agreement with experimental data is obtained in the theory in which the vector current is conserved. The four coupling constants indicated in Table 1 are determined by experimental studies of the probability of muon capture on the one hand, and of the angular distribution of neutrons on the other. The experiments proved that in the case of negative $\lambda (\lambda = -g_A^{(\mu)}/g_V^{(\mu)})$ for $\mu = 4.7$ and $\mu = 1$, $(\mu = 1 + g_M^{(\mu)}/g_V^{(\mu)})$, and in the case of positive λ for $\mu = 1$ no λ and $\varkappa$ $(\varkappa = g_P^{(\mu)}/g_A^{(\mu)})$ exist that would simultaneously satisfy the three experiments considered: determination of capture probability in C^{12} and P^{31} and of neutron angular distribution.

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Coupling constants in μ-capture

$g_A^{(\mu)}$ denotes the axial pseudo vector coupling constant, $g_V^{(\mu)}$ is the vector coupling constant, $g_P^{(\mu)}$ is the effective pseudoscalar coupling constant. In the case of positive λ and for μ = 4.7, κ and λ values may exist within the ranges: $10 \leqslant \kappa \leqslant 25$, $1.6 \leqslant \lambda \leqslant 6$. The experimental data and those expected theoretically are compared and found to be in better agreement if the vector current is conserved. The comparison also shows that the sign of $g_V^{(\mu)}$ is opposite to that of $g_A^{(\mu)}$. Also, $|g_A^{(\mu)}| > |g_V^{(\mu)}|$. The sign of $g_P^{(\mu)}$ is positive in accordance with theory. The remarkable tendency toward relatively high values of the ratios $|g_A^{(\mu)}/g_V^{(\mu)}|$ and $g_P^{(\mu)}/g_A^{(\mu)}$, compared with theoretical calculations, may possibly be explained by experimental inaccuracies, and this point may yet have to be revised. I. S. Shapiro is thanked for discussions, and V. S. Yevseyev and A. Ye. Ignatenko for having submitted their own findings (L. B. Yegorov, G. V. Zhuravlev, A. Ye. Ignatenko, A. V. Kuptsov, Li Hsüang-ming, M. G. Petrashku. Preprint OIYaI, 1961; V. S. Yevseyev,

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B109/B102

Coupling constants in μ-capture

V. I. Komarov, V. Z. Kush, V. S. Roganov, V. A. Chernogorova, M. M. Shimchak. IOYaI, preprint, 1961). There are 3 figures, 2 tables, and 31 references: 6 Soviet and 25 non-Soviet. The four most recent references to English-language publications read as follows: H. Überall. Phys. Rev., 121, 1219, 1961; M. K. Akimova, L. D. Blokhintsev, E. I. Dolinskiy. Nucl. Phys., 23, 369, 1961; E. J. Maier, B. L. Bloch, R. M. Edelstein, R. T. Siegel. Phys. Rev. Lett., 6, 417, 1961; A. Astbury, J. H. Bartley, J. M. Blair, M. A. R. Kemp, H. Mirhead, T. Woodhead. Preprint, Liverpool University, 1961.

ASSOCIATION: Institut yadernoy fiziki Moskovskogo gosudarstvennogo universiteta (Institute of Nuclear Physics of the Moscow State University)

SUBMITTED: July 23, 1961

Legend to Table 1: (1) coupling constant in μ-capture; (2) diagrams considered; (3) expressed in terms of coupling constants in the β-decay of nucleons.

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B104/B108

AUTHORS: Blokhintsev, L. D., Dolinskiy, E. I., Popov, V. S.

TITLE: Analytical properties of nonrelativistic graphs

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, v. 42, no. 6, 1962, 1636 - 1646

TEXT: Some problems of the nonrelativistic graph technique are studied. A nonrelativistic graph with n internal lines and with l independent closed contours can be represented in the form

$$F_{nl} = \lim_{\delta \to +0} \int \prod_{s=1}^{l} d^3 k_s \, d\varepsilon_s \left\{ \prod_{l=1}^{n} (\mathbf{q}_l^2 - 2m_l \mathcal{E}_l - i\delta) \right\}^{-1},$$

With the aid of a Feynman parametric representation, F_{nl} is derived as a function of the kinematic invariants X and Λ:

$$F_{nl} = (i\pi^{3/2})^l \Gamma(n - 5l/2) \lim_{\delta \to +0} \int_0^1 \prod_{l=1}^{n} d\alpha_l \, \delta\left(\sum_{k=1}^{n} \alpha_k - 1\right) \times \times \prod_{s=1}^{l} \delta\left(\sum_{(s)} \omega_\sigma \alpha_\sigma m_\sigma\right) \Lambda^{-3/2} (X/\Lambda - i\delta)^{-(n-5l/2)}, \quad (8).$$

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X and Λ are homogeneous functions of the first order of the Feynman parameters α_i. The characteristic feature of this integral representation is the δ-function $\delta(\sum_{\langle s \rangle} \omega_\sigma \alpha_\sigma m_\sigma)$, which reduces the number of integrations over α_i as compared to the analogous relativistic case. The number of nontrivial integrations in (8) over α_i remains constant when internal lines are added to the initial graph, which pairwise connect the apexes of the graph. Real singularities of single-contour graphs are investigated, and an explicit expression is obtained for the amplitude of a triangular graph. There are 3 figures and 2 tables.

ASSOCIATION: Institut yadernoy fiziki Moskovskogo gosudarstvennogo universiteta (Institute of Nuclear Physics of the Moscow State University). Institut teoreticheskoy i eksperimental'noy fiziki Akademii nauk SSSR (Institute of Theoretical and Experimental Physics of the Academy of Sciences USSR)

SUBMITTED: January 23, 1962

S/056/62/043/005/045/058
B125/B104

AUTHORS: Blokhintsev, L. D., Dolinskiy, E. I., Popov, V. S.

TITLE: On the Feynman amplitudes for nonrelativistic processes

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, v. 43, no. 5(11), 1962, 1914-1926

TEXT: The nonrelativistic limit $F^{(0)}_{nl}$ of the relativistic amplitude F^{r}_{nl} of an arbitrary Feynman graph is ascertained for the case when the kinetic energy transferred in the outer vertexes and the energy liberated at each vertex of the graph is low with respect to the virtual particles. All inner lines of the Feynman graph are to represent scalar particles. l is the number of independent closed contours. Results: For $\beta \ll 1$, F^{r}_{nl} can be written as the sum of the principal term $F^{(0)}_{rl}$ of the expansion of F^{r}_{nl} with respect to the small parameter β, and of the relativistic correction $F^{(1)}_{nl}$. For $n > 5l/2$, $F^{(0)}_{nl}$ coincides with the nonrelativistic amplitude having

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singularities with respect to the nonrelativistic invariants. For $n < 5l/2$, $F^{(0)}_{nl}$ depends only on the mass of the virtual particles, but not on the nonrelativistic kinematic invariants. The entire dependence on the nonrelativistic invariants and all nonrelativistic singularities are contained in the small relativistic correction $F^{(1)}_{nl}$. At $n = 5l/2$, the amplitude $F^{(0)}_{nl}$ depends logarithmically on the nonrelativistic invariants. The order of magnitude of the relativistic corrections to the principal terms in the expansion of the amplitude F^{r}_{nl} with respect to β is given by

$$F^{r}_{nl} = F^{(0)}_{nl}(1 + \delta_{nl}); \qquad (24)$$

$$\delta_{nl} \sim \begin{cases} \beta^2 & \text{при } 2n - 5l = 0 \\ \beta & \text{при } 2n - 5l = \pm 1 \\ \beta^2 \ln \beta & \text{при } 2n - 5l = \pm 2 \\ \beta^2 & \text{при } 2n - 5l = \pm 3, \pm 4, \ldots \end{cases} \qquad (25).$$

On the Feynman amplitudes for... S/056/62/043/005/045/058
B125/B104

The graphs with $n < 51/2$ are not essential in describing nonrelativistic processes. They contribute nothing to the mechanism of the direct nuclear reactions. The multidirectional β graphs are always nonrelativistic. For the triangular graphs for the reactions of the type $A+x \longrightarrow B+y$ (L. D. Blokhintsev et al. ZhETF, 42, 1636, 1962) the nonrelativistic approximation has an accuracy of $\sim 10\%$ in a large range of energies of the incident particles. In convergent β graphs, the relativistic propagators for particles possessing a spin can be replaced by propagators not depending on spin. There are 4 figures and 1 table.

ASSOCIATION: Institut yadernoy fiziki Moskovskogo gosudarstvennogo universiteta (Institute of Nuclear Physics of Moscow State University); Institut teoreticheskoy i eksperimental'noy fiziki Akademii nauk SSSR (Institute of Theoretical and Experimental Physics of the Academy of Sciences USSR)

SUBMITTED: June 18, 1962

Card 3/3

S/056/62/043/006/054/067
B102/B186

AUTHORS: Blokhintsev, L. D., Dolinskiy, E. I., Popov, V. S.

TITLE: The complex singularities of the amplitudes of direct nuclear reactions

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, v. 43, no. 6(12), 1962, 2290-2298

TEXT: The complex amplitude singularities on the physical sheet are investigated for non-relativistic single-loop graphs with arbitrary masses. A classification of the singularities is given and rules for separating them are discussed. On the example of the triangular graphs of direct nuclear interactions of the type $A+x \rightarrow B+y+z$ it is shown that complex singularities with respect to the transferred momentum t_{xy} may arise near the physical region. Therefore investigations of the complex singularities are of importance for the dispersion theory of direct nuclear interactions. From the integral representation of the amplitude

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The complex singularities of the... S/056/62/043/006/054/067
B102/B186

$$F_{n1}(\eta_{ij}) = C_{n1}\int_0^1 \prod_{l=1}^{n} d\alpha_l\,\delta\left(\sum_{k=1}^{n}\alpha_k - 1\right)\delta\left(\sum_{l=1}^{n}\omega_l m_l \alpha_l\right)(X - i\delta)^{-(n-3/2)}, \qquad (1)$$

$$\delta \to +0;$$

a unique analytic expression is derived for F_{31} of a triangle graph with constant vertices:

$$F_{31}(\eta_{ij}) = C_{31}(\eta^0_{23} - \xi_{23})^{-1/2}\varphi(z); \qquad (11)$$

$$C_{31} = i\pi^3\left[\frac{2}{m_2 m_3 (m_1+m_2)(m_1+m_3)}\right]^{1/2}, \quad \varphi(z) = \frac{1}{2\sqrt{z}}\ln\frac{1+\sqrt{z}}{1-\sqrt{z}}, \qquad (12)$$

$$z = \frac{\eta_{23}-\eta^0_{23}}{\xi_{23}-\eta^0_{23}}, \quad \eta^0_{23} = m_1(m_2-m_3)\left[\frac{\eta_{13}}{m_2(m_1+m_3)} - \frac{\eta_{12}}{m_3(m_1+m_2)}\right], \qquad (13)$$

$$\xi_{23} = \begin{cases} \eta^-_{23} = \eta_{12} + \eta_{13} - 2(\eta_{12}\eta_{13})^{1/2} & \text{при } \eta_{12} < 0,\ \eta_{13} < 0 \\ \zeta^+_{23} = \eta_{12} + \eta_{13} + 2i(-\eta_{12}\eta_{13})^{1/2} & \text{при } \eta_{12}\eta_{13} < 0 \\ \eta^+_{23} = \eta_{12} + \eta_{13} + 2(\eta_{12}\eta_{13})^{1/2} & \text{при } \eta_{12} > 0,\ \eta_{13} > 0 \end{cases} \qquad (14)$$

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$$(\eta_{23}^0 - \xi_{23})^{1/2} = (\omega_{23}|\eta_{12}|)^{1/2} + (\omega_{23}^{-1}|\eta_{13}|)^{1/2} \text{ при } \eta_{12} < 0,\ \eta_{13} < 0,$$

$$\omega_{23} = m_2(m_1 + m_3) / m_3(m_1 + m_2). \qquad (15)$$

$$(\eta_{23}^0 - \xi_{23})^{1/2} = \begin{cases} (\omega_{23}|\eta_{12}|)^{1/2} + (\omega_{23}^{-1}|\eta_{13}|)^{1/2} & \text{при } \eta_{12}<0,\ \eta_{13}<0 \\ (\omega_{23}|\eta_{12}|)^{1/2} - i(\omega_{23}^{-1}\eta_{13})^{1/2} & \text{при } \eta_{12}<0,\ \eta_{13}>0 \\ -i(\omega_{23}\eta_{12})^{1/2} + (\omega_{23}^{-1}|\eta_{13}|)^{1/2} & \text{при } \eta_{12}>0,\ \eta_{13}<0 \\ -i[(\omega_{23}\eta_{12})^{1/2} + (\omega_{23}^{-1}\eta_{13})^{1/2}] & \text{при } \eta_{12}>0,\ \eta_{13}>0 \end{cases} \qquad (16)$$

The η_{ij} are external kinematic invariants (cf. Blokhintsev et al. Nucl. Phys. in print), $\omega_i = \pm 1$ indicates the direction of the i-th inner line of the graph. The analytical properties and the asymptotic behavior of F_{31} are investigated.

$$F_{31}(\eta_{ij}) \approx \begin{cases} \frac{1}{2}\pi C_{31}|\eta_{23}|^{-1/2} & \text{при } \eta_{23} \gg |\eta_{12}|,\ |\eta_{13}| \\ h(\omega_{23})C_{31}|\eta_{12}|^{-1/2} & \text{при } -\eta_{12} \gg |\eta_{13}|,\ |\eta_{23}|. \\ h(\omega_{23}^{-1})C_{31}|\eta_{13}|^{-1/2} & \text{при } -\eta_{13} \gg |\eta_{12}|,\ |\eta_{23}| \end{cases} \qquad (17)$$

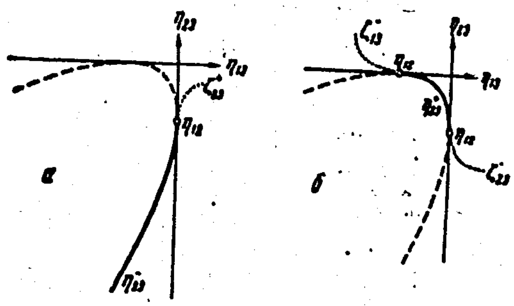
is obtained where $h(\omega)$ for $0\leqslant\omega<\infty$ is given by

$$h(\omega)=\begin{cases}\frac{1}{2}\left(\frac{\omega}{1-\omega}\right)^{1/2}\ln\frac{1+\sqrt{1-\omega}}{1-\sqrt{1-\omega}} & \text{при } 0<\omega<1\\ 1 & \text{при } \omega=1\\ \left(\frac{\omega}{\omega-1}\right)^{1/2}\operatorname{arctg}\sqrt{\omega-1} & \text{при } \omega>1\end{cases}\qquad(18)$$

There are 6 figures.

ASSOCIATION: Institut yadernoy fiziki Moskovskogo gosudarstvennogo universiteta (Institute of Nuclear Physics of Moscow State University); Institut teoreticheskoy i eksperimental'noy fiziki (Institute of Theoretical and Experimental Physics)

SUBMITTED: July 24, 1962



$$\eta_{23} = \bar{\zeta}_{23} = \eta_{12} + \eta_{13} - 2i(-\eta_{12}\eta_{13})^{1/2} \text{ при } \eta_{12} < 0,\ \eta_{13} > 0,$$
$$\eta_{13} = \bar{\zeta}_{13} = \eta_{12} + \eta_{23} - 2i(-\eta_{12}\eta_{23})^{1/2} \text{ при } \eta_{12} < 0,\ \eta_{23} > 0.$$

Fig. 2. Curves of the real and complex singularities of the amplitude F_{31}. a) for $\eta_{12} < 0$; b) for $\eta_{12} < \eta_{13} < 0$; solid lines: real singularities of F_{31} on the physical sheet; dashed lines: real singularities, not on the physical sheet; dotted lines: complex singularities on the physical sheet.

BLOKHINTSEV, L.D.; DOLINSKIY, E.I.; POPOV, V.S.

Analytic properties of nonrelativistic diagrams. Zhur. eksp. i teor. fiz. 42 no.6:1636-1646 Je '62. (MIRA 15:9)

1. Institut yadernoy fiziki Moskovskogo gosudarstvennogo universiteta i Institut teoreticheskoy i eksperimental'noy fiziki AN SSSR.
(Nuclear reactions) (Graphic methods)

BLOKHINTSEV, L.D.; DOLINSKIY, E.I.; POPOV, V.S.

Feynman amplitudes for nonrelativistic processes.
Zhur. eksp. i teor. fiz. 43 no.5:1914-1926 N '62.(MIRA 15:12)

1. Institut yadernoy fiziki Moskovskogo gosudarstvennogo universiteta i Institut teoreticheskoy i eksperimental'noy fiziki AN SSSR.
(Graphic methods) (Nuclear reactions)

BLOKHINTSEV, L.D.; DOLINSKIY, E.I.; POPOV, V.S.

Complex characteristics of direct nuclear reaction amplitudes.
Zhur.eksp.i teor.fiz. 43 no.6:2290-2298 D '62. (MIRA 16:1)

1. Institut yadernoy fiziki Moskovskogo gosudarstvennogo universiteta i Institut teoreticheskoy i eksperimental'noy fiziki.

(Nuclear reactions)

DOLINSKIY, E.I.; BLOKHINTSEV, L.D.; MUKHAMEDZHANOV, A.M.

Use of the diagram summation method in making allowance for interaction in the initial and final states of direct nuclear reactions. IAd. fiz. 1 no.3:426-435 Mr '65. (MIRA 18:5)

1. Nauchno-issledovatel'skiy institut yadernoy fiziki Moskovskogo gosudarstvennogo universiteta.

ACC NR: AP7012410 SOURCE CODE: UR/0367/67/005/001/0115/0122

AUTHOR: Blokhintsev, L. D.; Dolinskiy, E. I. -- Dolinsky, E. I.

ORG: Institute of Nuclear Physics of Moscow State University (Institut yadernoy fiziki Moskovskogo gosudarstvennogo universiteta)

TITLE: Existence effects in quasi-elastic scattering

SOURCE: Yadernaya fizika, v. 5, no. 1, 1967, 115-122

TOPIC TAGS: elastic scattering, graph theory, nuclear reaction

SUB CODE: 20

ABSTRACT: Effects due to the existence of intermediate particles in quasi-elastic scattering reactions are studied using the graph theory of direct nuclear reactions. It is demonstrated in the example of the (N, N'd) reaction that the neglect of such effects leads to large errors. It is noted that the effects considered are not taken into account in the usual calculations of direct reaction amplitudes, using the wave function formalism. Orig. art. has: 4 figures and 22 formulas. [Based on authors' Eng. Abst] [JPRS: 40,393]

Card 1/1 0932 1342

1ST AND 2ND ORDERS

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3RD AND 4TH ORDERS

CA

11D

The distribution of rubber in the root system of kok-saghyz. A. A. Prokof'ev, L. L. Blokhintseva and M. A. Obolenskaya. *Biokhim. i Fiziol. Kauchukonosnykh Rastenii* 1939, No. 2, 30–43; *Khim. Referat. Zhur.* 1940, No. 2, 40.—The content of rubber is comparatively low in the upper part of the root. It increases to its max. in the 18–25-cm. zone, after which it decreases slowly. No definite correlation was observed between the wt. of the root and the content of rubber in the 1-year plant.

W. R. Henn

ASM-SLA METALLURGICAL LITERATURE CLASSIFICATION

COMMON ELEMENTS

OPEN

MATERIALS INDEX

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AUTHOR INDEX

1ST AND 2ND LETTERS

3RD AND 4TH ORDERS

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1ST AND 2ND ORDERS

PROCESSES AND PROPERTIES INDEX

The anatomy and microchemistry of kok-saghyz. I. I. Blokhintseva. *Biokhim. i Fiziol. Kauchukonosnykh Rastenii* 1939, No. 2, 60-70; *Khim. Referat. Zhur.* 1940, No. 2, 40; cf. *C. A.* 33, 2930[9].—Rubber appears in the roots of kok-saghyz on the 1st day after germination. During vegetation the content of rubber in the roots increases and the content of resins decreases. Accumulation of sugar and inulin in the roots begins during the bud-formation period and reaches its max. during the fruit-bearing period. During the initial period rubber is distributed among the whole bark of the roots, but is later localized around and between the latex vessels. Rubber is a product of secondary synthesis taking place in the roots. This synthesis is not connected directly with photosynthesis.

W. R. Henn

ASB-SLA METALLURGICAL LITERATURE CLASSIFICATION

1ST AND 2ND ORDERS

PROCESSES AND PROPERTIES INDEX

CA

11D

Formation of rubber in kok-saghyz. I. I. Bokhuntseva. *Khim. Referat. Zhur.*
Botan. Zhur. 24, No. 4, 265-72; —Microchem. in-
1940, No. 2, 40; cf. *C. A.* 35, 2930[9]. kok-saghyz leaves showed that during
vestigations of kok-saghyz leaves showed that during
vegetation there is accumulated in the assimilating cells
a secretion consisting mainly of resinous substances sol. in
acetone. The *n* increases and the vol. of the secretion
drops decreases on treating them with water vapor or base.
A slight darkening is observed on treatment with osmic
acid. Phenols and complex ethers and no reducing sub-
stances are present in the secretions. Bromination expts.
indicate that the secretion does not contain any rubber
during the early stages of growth and contains only traces
during the blossoming and fruit-bearing stages. Rubber
is formed not in the leaves, but in the latex vessels of kok-
saghyz. W. R. Henn

ASM-SLA METALLURGICAL LITERATURE CLASSIFICATION

1ST AND 2ND ORDERS

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Ca

110

Formatio w rubber in kok-saghyz as a function of the latex vessels. I. I. Blokhintseva. *Bull. acad. sci. U. R. S. S., Ser. biol.* 1940, No. 4, 608-13.—In kok-saghyz (*Taraxacum kok-saghyz* Rod.) rubber is formed in latex vessels. This process has no direct connection with photosynthesis. The formation of rubber particles takes place with the participation of plastids and is confirmed by the protein membrane on the rubber particles. The greater portion of the rubber is formed and accumulated in the roots in the latex vessels of the secondary cork. During the vegetative period, the particles increase in size and the ratio of rubber to resins becomes greater. When the latex vessels cease to function, a solid rubber thread is formed in the cavity of these vessels.

B. Z. Kamich

ASM-SLA METALLURGICAL LITERATURE CLASSIFICATION

S.C.6.

// Planting

Changes in the rubber particles in the latex of krim-saghiz and kok-saghiz during growth. I. I. [illegible] (Izvestia Akad. Nauk U.S.S.R. (Biol. Ser.), 1944, No. 4, 193-204; Hort. Abs., 1945, 15, 2511. The rubber particles in krim-saghiz are at first spherical and small, but become rod-shaped and larger as the plant grows older, those of kok-saghiz remain spherical, but grow somewhat bigger as the plant matures. The quality of the rubber seems to be connected with these changes, the rod-shaped particles producing a better rubber than the spherical particles. The presence of small spherical particles in large numbers indicates the active formation of such particles and of new latex vessels. Towards the end of the season, new particles cease to be formed and the latex begins to coagulate in the latex vessels, which gradually die, the latex in them forming into strands of rubber. 1225.33

1944

BLOKHINTSEVA, T.D.; VASILENKO, A.T.; GREBINNIK, V.G.; ZHUKOV, V.A.; LIBMAN, G.; NEMENOV, L.L.; SELIVANOV, G.I.; YUAN' ZHUN-FAN [Yuan Jung-fang]

[Eight-liter hydrogen-deuterium dubble chamber in a magnetic field] Vos'militrovaia vodorodno-deiterievaia puzyr'kovaia kamera v magnitnom ple. Dubna, Ob"edinennyi in-t iadernykh issl., 1961. 20 p. (MIRA 15:1)
(Bubble chamber) (Magnetic fields)

(5)

BLOKHINTSEVA, T.D., GREBINNIK, V. T., LIBMAN, G., NEMENOV, L. L., SELIVANOV, G. I. YUNG-FANG, Yuan, ZHUKOV, V. A.

"π-Meson Interaction with Hydrogen at 340 Mev"

report presented at the Intl. Conference on High Energy Physics, Geneva, 4-11 July 1962

Joint Inst. for Nuclear Research
Lab. of Nuclear Problems

BLOKHINTSEVA, T.D.; GREBINNIK, V.G.; ZHUKOV, V.A.; LIBMAN, G.; NEMENOV, L.; SELIVANOV, G.I.; YUAN' ZHUN-FAN [Yuan Jung-fang]; SARANTSEVA, V.R., tekhn. red.

[Interaction between π^--mesons and hydrogen at an energy of 340 Mev] Vzaimodeistvie π^--mezonov s vodorodom pri energii 340 Mev. Dubna, Ob"edinennyi in-t iadernykh issl., 1962. 27 p. (MIRA 15:10)

(Nuclear reactions) (Mesons) (Hydrogen)

41436

S/120/62/000/005/009/036
E039/E420

21.6000

AUTHORS: Blokhintseva, T.D., Vasilenko, A.T., Grebinnik, V.G., Zhukov, V.A., Libman, G., Nemenov, L.L., Selivanov, G.I., Yuan Jung-Fang

TITLE: An eight litre hydrogen-deuterium bubble chamber in a magnetic field

PERIODICAL: Pribory i tekhnika eksperimenta, no.5, 1962, 51-59

TEXT: A detailed description of the apparatus is given. Essentially it consists of two coaxial cylinders, the inner space being the working volume and the outer space for temperature control. The inner cylinder is of copper to improve heat transfer and the outer cylinder, together with most of the casing, is constructed from 1X18H9T (1Kh18N9T) stainless steel. Observation ports at the ends of the inner cylinder consist of discs of ЛК-5 (LK-5) glass 40 mm thick and with an aperture of 280 mm. Detailed drawings are given of the expansion apparatus and the associated two stage double acting electromagnetic valve. The normal gas pressure for operating the expansion apparatus is 7 atm and the degree of expansion can be altered by changing the

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An eight litre hydrogen- ... S/120/62/000/005/009/036
E039/E420

quantity of liquid in the hydraulic system. A detailed schematic layout of the gas system is shown and constructional details of the stereo-camera are given. The liquid nitrogen supply system for the radiation shield and a 24 litre Dewar flask for liquid hydrogen are also described. The magnetic field in the working volume is 12 kilo oersteds and is supplied by a standard MC-4 (MS-4) electromagnet. Preliminary cooling with liquid nitrogen must be gradual and consumes about 100 litres. Cracks were observed on the walls of the chamber when the cooling time was less than 8 hours. The time to fill the working volume with liquid hydrogen is about 3 hours and requires about 20 litres. During operation 2.5 to 3 litres/hour of liquid hydrogen are consumed. A photograph of a typical track showing the elastic collision of a π^- meson with hydrogen is shown. The chamber has been used satisfactorily for 6 months during which time 30000 stereo photographs were obtained. The expansion apparatus has performed about 70000 cycles without changing the bellows. The dead time of the chamber does not exceed 2 sec. There are 13 figures.

ASSOCIATION: Ob"yedinennyy institut yadernykh issledovaniy (Joint Institute for Nuclear Research)

SUBMITTED: December 9, 1961

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35504

S/056/62/042/003/046/049
B108/B102

24.6700

AUTHORS: Blokhintseva, T. D., Grebinnik, V. G., Zhukov, V. A., Libman, G., Nemenov, L. L., Selivanov, G. I., Yüan Jung-fang

TITLE: Measurement of the total cross section of the (π^-p) reaction with 340-Mev π^--mesons

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, v. 42, no. 3, 1962, 912-913

TEXT: The reactions

$$\pi^- + p \to \pi^- + \pi^+ + n, \quad (1),$$

$$\pi^- + p \to \pi^- + \pi^0 + p, \quad (2),$$

$$\pi^- + p \to \pi^- + \gamma + p. \quad (3)$$

have been studied at energies of the primary π^- mesons of 340 ± 15 Mev with the aid of a 25-cm liquid-hydrogen chamber in a magnetic field of 12,000 oe. The respective total cross sections were determined as $\sigma_1 = 1.24 \pm 0.14$ mb, $\sigma_2 = 0.13^{+0.06}_{-0.04}$ mb, $\sigma_3 = 0.09^{+0.03}_{-0.06}$ mb. In the

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determination of the cross section of reaction (3) only cases where the energy of the emitted gamma quantum was higher than 100 Mev were considered. In order to obtain a representation of the contribution of the different isotopic states in the cross sections of the reactions (1) and (2), the latter are written down in the form

$$\sigma_1 = \frac{1}{9}\left[\frac{1}{5}\left|A_2^{3/2}\right|^2 - 2\sqrt{\frac{2}{5}}\,\mathrm{Re}\,(A_2^{3/2*}A_0^{3/2}) + 2|A_0^{3/2}|^2\right] + \frac{1}{9}\,[|A_1^{1/2}|^2 - 2\,\mathrm{Re}\,(A_1^{1/2*}A_1^{3/2}) + |A_1^{3/2}|^2],$$

$$\sigma_2 = \frac{1}{10}\left|A_2^{3/2}\right|^2 + \frac{1}{9}\left[\frac{1}{2}|A_1^{3/2}|^2 + 2\mathrm{Re}(A_1^{3/2*}A_1^{1/2}) + 2|A_1^{1/2}|^2\right],$$

where A_K^i denotes the invariant isotopic amplitudes (superscript refers to total isotopic spin of entire system, subscript denotes total isotopic spin of the system of two pions). The cross sections of the reactions (1) and (2) permit with some assumptions to infer the following about the magnitudes and phases of the isotopic amplitudes: (a) if the amplitudes

APPROVED FOR RELEASE: 06/09/2000 CIA-RDP86-00513R000205610004-3"

$A_1^{1/2}$ and $A_1^{3/2}$ are zero, then the $A_2^{3/2}$ will be considerably smaller than $A_0^{1/2}$: $3.1|A_2^{3/2}|^2 \leqslant |A_0^{1/2}|^2 \leqslant 5.7|A_2^{3/2}|^2$; (b) if it is considered that σ_1 and σ_2 are determined mainly by $A_1^{1/2}$ and $A_1^{3/2}$, then the phase shift of these amplitudes is about 180°C, and their moduli are connected by the relation $|A_1^{3/2}| \approx 2|A_1^{1/2}|$. For incident pion energies of 340 Mev the maximum total energy (c.m.s.) of two pions is 400 Mev. If the case (a) applies, one may state that the pions in the energy range 280-400 Mev will interact mainly in states with total isotopic spin T = 0 and not with T = 2. Professor B. M. Pontekorvo and P. F. Yermolov are thanked for advice and discussions. There are 5 references: 2 Soviet and 3 non-Soviet. The references to English-language publications read as follows: J. Deahl et al. Proc. of the 1960 Ann. Int. Conf. on High Energy Phys. at Rochester, 1960, p. 185; H. J. Schnitzer. Preprint, 1961; B. C. Barish et al. Bull. Amer. Phys. Soc., II, 6, 523, 1961.

ASSOCIATION: Ob"yedinennyy institut yadernykh issledovaniy (Joint Institute of Nuclear Research)

Measurement of the total cross ...

S/056/62/042/003/046/049
B108/B102

SUBMITTED: January 24, 1962

Card 4/4

S/056/63/044/001/022/067
B104/B144

AUTHORS: Blokhintseva, T. D., Grebinnik, V. G., Zhukov, V. A., Libman, G., Nemenov, L. L., Selivanov, G. I., Yuan Jung-fan

TITLE: Interaction of π^- mesons with hydrogen at 340 Mev

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, v. 44, no. 1, 1963, 116-126

TEXT: The reactions $\pi^- + p \rightarrow \pi^- + \pi^+ + n$, $\pi^- + p \rightarrow \pi^- + \pi^0 + p$, and $\pi^- + p \rightarrow \pi^- + \gamma + p$ were studied with a 25 cm liquid hydrogen bubble chamber in a 12,000-oe magnetic field. The π^- meson beam was generated in the synchrocyclotron of the Laboratoriya yadernykh problem OIYaI (Laboratory of Nuclear Problems OIYaI), the meson energy was 340 ± 15 Mev. 1400 two-pronged stars were found in 16,000 stereoscopic photographs. Those listed in Table 2 complied with the following conditions: (1) the angle α between the track of the incident particle and the central plane of the chamber must not exceed $\pm 4^o$; (2) the π^- meson track must not be shorter than 10 mm; (3) the distance between the point of interaction and the boundary of the visible range of the working volume of the chamber must not be smaller than 20 mm; (4) the azimuthal angle of a negative particle must not exceed 70°; (5) the noncomplanarity of elastic interactions must not exceed 3°. The angular distributions and the energy distributions of the secondary particles suggest an effect due to resonance of the spin with the isospin 3/2. A steep increase of the $\pi\pi$ interaction cross section with a total isospin T = 0 was found by analyzing the energy distribution in the $(\pi^+\pi^-)$ c.m.s. There are 10 figures and 2 tables.

ASSOCIATION: Ob"yedinennyy institut yadernykh issledovaniy (Joint Institute of Nuclear Research)

SUBMITTED: August 4, 1962

	(1)	(2)	(3)
$\pi^- + p \to \pi^- + \pi^+ + n$	108	$1,24 \pm 0,14$	1,60
$\pi^- + p \to \pi^- + \pi^0 + p$	11	$0,13^{+0,06}_{-0,04}$	0,19
$\pi^- + p \to \pi^- + \gamma + p$	6	$0,08^{+0,05}_{-0,05}$	—
$\pi^- + p \to \pi^0 + n$, $\pi^0 \to \gamma\ e^+, e^-$	8	—	—
Упругое $\pi^- p$-рассеяние	764	$7,52 \pm 0,55$	—

Table 2. Interaction cross sections.
Legend: (1) Number of events; (2) σ_{total}, millibarn, experimental; (3) σ_{total}, theoretical.