

Zeitschrift: Helvetica Physica Acta

Band: 44 (1971)

Heft: 4

Rubrik: Zusammenfassungen der letzten eingegangenen Arbeiten = Résumés des derniers articles reçus

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HELVETICA PHYSICA ACTA
Zusammenfassungen der letzten eingegangenen Arbeiten
Résumés des derniers articles reçus

Field Theory and Unstable Particles

by O. STEINMANN

Schweizerisches Institut für Nuklearforschung, Hochstrasse 60, 8044 Zürich
(2. II. 71)

Abstract. The purpose of this paper is to give a field theoretical description of scattering processes involving long-lived unstable particles. A model with one kind of unstable particles, the B , and their stable decay products, the A , is discussed. The B are described by poles on the second sheet in the otherwise smooth Green's functions of a relativistic quantum field corresponding to the A . The decay is assumed to be due to a weak interaction, and the quantities of the theory are considered only in the two lowest non-vanishing orders in its coupling constant. Strong interactions of the B among themselves and the A among themselves are admitted and are rigorously taken into account. The consequences of unitarity are studied. It is shown that a pole with a factorizing residue on the second sheet of the 4-point function enforces the existence of such poles in the higher functions. The spatio-temporal development of scatterings involving B -particles, as seen in experiments, is analysed with the help of a formalism developed in an earlier work. A natural definition of incoming and outgoing scattering states and of the S -matrix is given.

Multi-Particle Quantum Systems below the Four-Particle Threshold

by ALEX SCHATLHEIM

Seminar für theoretische Physik, ETH, Zürich, Switzerland
(3. II. 71)

Abstract. In the time independent approach to the scattering theory of a quantum mechanical system of N nonrelativistic particles, the wave operators are expressed in terms of amplitudes satisfying the Faddeev-Yakubovsky equations. We study these equations for energies below the four particle threshold s_4 . A graphical method is introduced to classify and analyze the singular integrals occurring in the iterated Yakubovsky kernels. Under a certain spectral assumption, we establish and control the Fredholm alternative. Partial asymptotic completeness of the scattering states below s_4 follows.

Die $T(\vec{d}, n)^4\text{He}$ -Reaktion mit polarisierten Deuteronen bei Energien oberhalb der 107-keV-Resonanz

VON H. GRUNDER, R. GLEYVOD, G. LIETZ, G. MORGAN, H. RUDIN, F. SEILER and A. STRICKER
Physikalisches Institut der Universität Basel
(20. II. 71)

Abstract. A source of polarized deuterons, producing a $0.2 \mu\text{A}$ beam characterized by $P_{33} = .60$ and located on the high potential terminal of a 1 MeV cascade generator is described. The analyzing power of the $T(d, n)^4\text{He}$ reaction for deuteron tensor and vector polarization at energies of 0.2, 0.6, 0.8 and 1 MeV has been measured. Fits to the data using Legendre polynomials were employed in conjunction with an analysis in terms of the reaction-matrix in order to obtain information about the elements contributing to the reaction. At energies above the 107 keV $3/2^+$ -resonance the s -wave element with $J^* = 1/2^+$ as well as p -wave elements become significant.

An Exact Solution of the Γ Equation

by MARIO NOVELLO

Centro Brasileiro de Pesquisas Físicas, Rio de Janeiro, Brazil
Université de Genève, Genève
(9. III. 71)

Abstract. We try to evaluate a solution of the Γ equation [1] with spherical symmetry and statical condition. We arrive at Schwarzschild's solution, as it would be expected. Some comments about the possibility of obtaining other solutions are set up.

Untersuchung der ${}^6\text{Li}(\vec{d}, \alpha){}^4\text{He}$ -Reaktion mit polarisierten Deuteronen

VON R. NEFF, P. HUBER, H. P. NÄGELE, H. RUDIN und F. SEILER

Physikalisches Institut der Universität Basel

(20. II. 71)

Abstract. The vector and tensor analysing power of the ${}^6\text{Li}(\vec{d}, \alpha){}^4\text{He}$ -reaction for polarized incident deuterons have been measured at 400, 600, 800 and 960 keV mean deuteron energies. The four independent components $A_y(\vartheta)$, $A_{zz}(\vartheta)$, $A_{xx}(\vartheta) - A_{yy}(\vartheta)$ and $A_{xz}(\vartheta)$ are fitted by the appropriate associated Legendre functions. It is shown that the results can be explained by the assumption of three states with $J^\pi = 2^+$, 4^+ and 0^+ .

Particle-Vibration Coupling and the Giant Dipole Resonance in C^{12}

by G. BAUR and K. ALDER

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(15. III. 71)

Abstract. The cross sections for the reactions ${}^{12}\text{C}(\gamma, p)$ and ${}^{12}\text{C}(\gamma, n)$ in the giant resonance region have been calculated in a collective correlation model where the final nucleus may be in different excited states. The agreement with the rather incomplete experimental data is good.

Some Potential Perturbation of the Laplacian

by P. A. REJTO

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School of Mathematics, University of Minnesota, Minneapolis, Minnesota 55455

(20. III. 71)

Study of Waves at a Plasma Vacuum Boundary

by P. BOULANGER and N. ASHBY

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(31. III. 71)

Summary. We consider in this work the behaviour of waves at a plasma-vacuum interface. Under the specular reflection condition for electrons at the boundary, the dispersion relation for surface waves is calculated. The disappearance of the so-called surface plasmon effect is shown when proper boundary conditions are taken. The generation of transverse waves by longitudinal waves striking the plasma-vacuum transition is obtained as well as the longitudinal waves created by an impinging electromagnetic wave.

Elastic Scattering of Protons from Chromium

by W. R. WYLIE, F. ZAMBONI and W. ZYCH

Physikinstitut der Universität Zürich

(7. IV. 71)

Summary. Elastic scattering of protons from chromium has been measured in the energy range 2.4–4.1 MeV. Only one of many strong resonances is attributed to an analogue state to an excited level with $J^\pi = 3/2^-$ at $E_x = 2.321$ MeV in ${}^{53}\text{Cr}$. The Coulomb energy displacement is given as $\Delta E_c = (8.354 \pm 0.005)$ MeV.

The Inverse Problem of Potential Scattering According to the Klein-Gordon Equation

by R. WEISS and G. SCHARF

Institut für Theoretische Physik der Universität Zürich, Switzerland

(6. V. 71)

Abstract. The inverse problem of constructing a spherically symmetric potential from its scattering data is solved for the Klein-Gordon equation, following the approach of Marchenko for the Schrödinger equation. This theory is well suited for the application to actual scattering processes. The interaction potential can be calculated uniquely from the scattering phase shift and the bound state data.

Magnetostriction in Superconducting Indium Lead Alloys

by G. BRÄNDLI, F. D. ENCK and R. GRIESEN

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Swiss Federal Institute of Technology, 8006 Zürich, Switzerland

(3. III. 71)

Abstract. The magnetostriction and the magnetization have been measured in a series of indium alloys having a lead content ranging from 0 to 25 at.%. From the measured curves – of which some typical are presented – the critical temperature, T_c , the critical field at absolute zero, H_0 , the coefficient of the electronic specific heat, γ , the Ginzburg-Landau parameter, K , and, in particular, their volume dependences are deduced. These parameters are related to variations in the crystal structure, the Fermi surface, and the mass enhancement constant λ .

Variation angulaire du pouvoir de polarisation de la diffusion n -D à 2,6 MeV

par J. PIFFARETTI

Institut de Physique, Université de Neuchâtel

(7 IV 71)

Summary. The polarisation of 2,6 MeV neutrons elastically scattered on deuterium has been determined by measuring the left-right asymmetry of polarized neutrons from the $^{12}\text{C}(d, n_0)^{13}\text{N}$ reaction (initial deuterons energy 3 MeV, emission angle 20° lab) by the time of flight method.

An extensive study of the possible instrumental asymmetries is made and it is shown how most of them can be eliminated by a suitable choice of the measurement method.

A new polarimeter using a single photomultiplier connected to two scintillation detectors is described. The main advantage of this device is to greatly reduce the asymmetry resulting from gain variations of the photomultiplier.

The results after multiple scattering correction are:

θ_{CM}	60°	88°	146°
$P_1 P_2$	$(-0.39 \pm 0.5) \%$	$(-1.64 \pm 0.37) \%$	$(-0.48 \pm 0.75) \%$
P_2	$(+1.0 \pm 1.2) \%$	$(+4.1 \pm 1.0) \%$	$(+1.2 \pm 1.8) \%$

(taking the polarisation P_1 of the incident neutrons to be $(-40 \pm 2) \%$).

These results agree with predictions based on a recent 'effective range' fit by Viennet [13].

On the Uniqueness of the Hamiltonian and of the Representation of the CCR for the Quartic Boson Interaction in Three Dimensions

JEAN-PIERRE ECKMANN

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and KONRAD OSTERWALDER

Courant Institute of Mathematical Sciences, New York University, New York

(4. V. 71)

Abstract. Glimm has constructed a Hamiltonian for the $(:\Phi^4:)_2+1$ interaction with space cutoff, using a truncated version of the formal wave operator in order to define a domain for this Hamiltonian. For a wide class of such truncations we obtain equivalent representations of the canonical commutation relations in the sense of Fabry. We establish unitary equivalence of the closures of the Hamiltonians obtained for many different truncations.

Messung des differentiellen Wirkungsquerschnitts der Reaktionen $^{14}\text{N}(n, \alpha)^{11}\text{B}$ und $^{12}\text{C}(n, \alpha)^9\text{Be}$ im Energiegebiet von 14,8 bis 18,8 MeV

VON W. SALATHE, E. BAUMGARTNER und P. HUBER

Physikalisches Institut der Universität Basel

(6. V. 71)

Abstract. The differential cross-section of $^{14}\text{N}(n, \alpha_0)^{11}\text{B}$, $^{14}\text{N}(n, \alpha_1)^{11}\text{B}^*$ and $^{12}\text{C}(n, \alpha_0)^9\text{Be}$ has been measured at 30 neutron energies between 14.8 and 18.8 MeV with 60 keV energy spread at angles between 0 and 156 degrees. Indications are given that the reaction $^{14}\text{N}(n, \alpha_0)^{11}\text{B}$ proceeds partly by formation of a compound nucleus.

A Study of the $^{11}\text{B}(\vec{d},n)^{12}\text{C}$ Reaction with Polarized Deuterons at $\bar{E}_d = 900$ keV

by S.M. RIZVI, P. HUBER, F. SEILER and H.R. STRIEBEL

Physikalisches Institut der Universität Basel

(6. V. 71)

Abstract. The analysing power of the $^{11}\text{B}(\vec{d},n)^{12}\text{C}$ reaction for the neutron group leaving the ^{12}C nucleus in the ground state has been measured at a mean deuteron energy of $\bar{E}_d = 900$ keV. An analysis of the results shows that the major contribution to the reaction at this energy comes from a $5/2^-$ state of the compound nucleus ^{13}C with s-waves in the entrance channel. It is shown that this is possibly the 19.7-MeV level in ^{13}C .

Die Tensorpolarisation von elastisch an ^{12}C gestreuten Deuteronen zwischen 1,6 und 2,7 MeV

von H.O. MEYER, P. HUBER und E. BAUMGARTNER

Physikalisches Institut der Universität Basel

(6. V. 71)

Abstract. The spin tensor moments t_{20} , t_{21} and t_{22} of initially unpolarized deuterons elastically scattered from ^{12}C have been measured with the $^3\text{He}(d,p)^4\text{He}$ reaction as an analyzer of deuteron polarization. The three deuteron polarization parameters are presented as functions of incident deuteron energy between 1.6 and 2.7 MeV at 30° , 51° , 75° and 105° scattering lab angles. A phase-shift analysis of the differential cross-section and the polarization near the 2.50 MeV resonance confirmed the level parameters of the 12.41 MeV level in ^{14}N as assigned by McEllistrem et al. [5]. No reasonable set of parameters could be found to reproduce the data near the anomaly at 1.79 MeV.

Das Analysatorvermögen der $^3\vec{\text{He}}(d,p)^4\text{He}$ -Reaktion für Targetpolarisation im Energiegebiet von 300 keV und 2,5 MeV

von U. ROHRER, P. HUBER, Ch. LEEMANN, H. MEINER und F. SEILER

Physikalisches Institut der Universität Basel

(6. V. 71)

Abstract. The analysing power of the $^3\vec{\text{He}}(d,p)^4\text{He}$ -reaction for polarized target and unpolarized beam has been measured at 7 energies between 300 keV and 2.5 MeV and at angles between 30° and 150° . The angular distributions show that a small part of the reaction proceeds via incoming p - and d - wave channels. In particular, d -wave contributions are considerably enhanced at 430 keV, the energy of the $3/2^+$ -resonance. The incoming p -waves apparently proceed through a direct reaction mechanism, while the d -wave contributions are mainly produced by one d -wave matrix element, otherwise identical to the resonant s -wave matrix element.

An optical method, capable of measuring the targetpolarisation continuously during nuclear physics experiments, is also described.

Perturbations and non-Normalizable Eigenvectors

by WILLIAM G. FARIS

Battelle Institute, Advanced Studies Center, Geneva, Switzerland

(10. V. 71)

Abstract. A spectral representation of a self-adjoint operator acting in a Hilbert space is given by eigenvectors of an extension of the operator to a suitable space containing the original Hilbert space. A perturbation argument shows the extended operator has no eigenvalues that do not belong to the spectrum of the original operator. The abstract result is applied to Schrödinger operators $-\Delta + V$.