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HELVETICA PHYSICA ACTA

Zusammenfassungen der letzten eingegangenen Arbeiten
Résumés des derniers articles reçus

EPR of Fe in Superparamagnetic Alloys

by C. R. BURR, W. ZINGG and M. PETER
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(21. V. 70)

Abstract. EPR measurements were carried out for Fe_xV_{1-x} and $Fe_{.50}Ti_{.50}$ alloys. Their paramagnetic behavior is compared with NMR, magnetic susceptibility and specific heat data and explained in terms of superparamagnetism.

Dynamic Nuclear Polarization in Ruby [1])

by H. H. NIEBUHR, E. E. HUNDT and E. BRUN
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(21. V. 70)

Abstract. The solid-state effect has been investigated in synthetic ruby ($Al_2O_3:Cr^{3+}$) at both liquid helium and liquid nitrogen temperatures. At 1.55 °K an ^{27}Al nuclear polarization of 17% has been reached in a magnetic field of 11 kilogauss. Experiments have been performed which prove the existence of a spin temperature for the ^{27}Al spin system also under dynamic polarization conditions. At the lowest obtained spin temperature of 0.004 °K the sign of the quadrupole coupling constant $e^2 q Q$ for ^{27}Al has been determined to be positive. The sign has been derived from the intensity ratios of polarized and thermal equilibrium NMR signals. Unusual NMR line shapes have been found when microwave power is supplied to the sample at the center of an ESR line. This new polarization effect is related to the line broadening mechanisms in ruby. The ordinary polarization curves are compared with results from the slightly modified spin temperature theory of dynamic nuclear polarization as developed by Borghini.

Mössbauereffekt an der Mischkristallreihe $ZnAl_{2\,(1-x)}\,Fe_{2x}O_4$

von P. RÜEGSEGGER, F. WALDNER und E. BRUN
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(28. V. 70)

Zusammenfassung. In den untersuchten Spinellen besetzt das Eisen als Fe^{3+} ausschliesslich B-Plätze. Die Quadrupolaufspaltung wird in Abhängigkeit von der Eisenkonzentration x angegeben. Der Wert für $x \to 0$ wird mit demjenigen aus NMR.-Messungen und den Resultaten aus Ionenmodellrechnungen verglichen. Für kleine x tritt ein Relaxationseffekt auf, der die Bestimmung des Vorzeichens von V_{zz} erlaubt. Dieses ist negativ und für die ganze Mischkristallreihe gleich.

Abstract. In the spinels under consideration iron occupies B-sites as Fe^{3+} only. The quadrupol-splitting is given in function of the iron concentration x. The value of the coupling constant for $x \to 0$ is compared with results of NMR measurements and calculations based on the ionic model. A relaxation effect can be seen for small x-values which allows to determine the sign of V_{zz}. For all the samples this sign is negative.

On a Quantum Mechanical Maser Model

by G. SCHARF

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(4. VI. 70)

Summary. A system of N two-level molecules interacting with one mode of the radiation field is treated quantum mechanically with exact methods. The interaction is taken from electric and magnetic dipole coupling where antiresonant terms are neglected. The eigenvalue spectrum of the Hamiltonian is discussed in detail and asymptotic expressions for the eigenvalues (for large N) are derived. The eigenvalues are approximately equidistant with a distance between successive eigenvalues proportional to $N^{1/2}$. This leads to oscillations of the number of photons in time with a period proportional to $N^{1/2}$, as it is observed in the pulsation of laser output.

Solid State Reactions and Defects in Verneuil Laser Rubies II

by P. BALLMER, H. BLUM, W. J. BORER, K. EIGENMANN and Hs. H. GÜNTHARD

Swiss Federal Institute of Technology, Laboratory of Physical Chemistry, Universitätsstrasse 22, 8006 Zürich, Switzerland

(10. VI. 70)

Abstract. Results of new computations of crystal field spectra of Cr^{+3} in the interstitial site of the α-Al_2O_3 structure are presented. The results are used to support an assignment of the absorption band at 315 nm ascribed to a typical defect in Verneuil grown laser rubies.

Methoden zur Untersuchung der Oberfläeche einer Ge(Li)-Diode

von E. BALDINGER und E. HALLER

Institut für angewandte Physik der Universität Basel

(24. VI. 70)

Summary. Channel formation on the intrinsic surface of Ge(Li)-planar detectors has been investigated. With a simple model we can understand the influence of a channel on the capacity of a detector, on the shape of conversion electron lines and on the full energy peak efficiency below 200 keV. With three different methods we can quickly determine length and sign of the channel. Both, chemical preparation of the detector and absorption of gases on a cooled detector at 10^{-8} Torr can lead to a channel formation. The channel simulates an entrance window.

Die Abhängigkeit des Neutrino/Kern-Wirkungsquerschnittes von der Nukleonenzahl des Target-Kernes

von P.-G. SEILER, K. BORER, B. HAHN, H. HOFER und F. KRIENEN

Bern-CERN-Fribourg Kollaboration

(26. VI. 70)

Abstract. The dependence of total cross sections on the mass number A for high energy neutrino nucleus interactions has been investigated. A spark chamber setup containing targets of C, Al, Fe and Pb was exposed to the CERN neutrino beam. For $\theta_{\nu\mu} \leq 29°$ and $q^2 \simeq 0.3$ (GeV/C)^2 the cross sections are proportional to A. A restricted sample of events with $\theta_{\nu\mu} < 5°$ and $q^2 \lesssim 0.1$ (GeV/C)^2 leads to an A-dependence which lies between A- and $A^{2/3}$-proportionality, but due to the small number of events in this sample neither pure A-proportionality nor 65% $A^{2/3}$ contribution can be excluded.

Coulomb Corrections to Low Energy Elastic and Charge Exchange πN Scattering

by G. C. Oades and G. Rasche

Institut für Theoretische Physik der Universität Zürich

(24. VI. 70)

Summary. We consider the problem of πN scattering in the simultaneous presence of the short range nuclear potential and the long range Coulomb potential. The existing treatment of $\pi^+ p$ scattering is outlined and similar methods are then used to derive the corresponding results for the coupled channel processes $\pi^- p \to \pi^- p$ and $\pi^- p \to \pi^0 n$. Finally we show how the Coulomb corrections so obtained can be calculated to first order in the Coulomb parameter.

Spectromètre pour l'Etude des Réactions (n, α) à 14 MeV

par J. F. Loude, J. P. Perroud et Ch. Sellem

Institut de physique nucléaire de l'Université de Lausanne

(16 VII 70)

Abstract. A spectrometer has been constructed for the study of (n, α) reactions at 14 MeV. By detecting the ^{4}He particle associated with neutron production, it is possible to measure the α time-of-flight in addition to the residual energy and energy loss, as measured by a telescope comprising a semiconductor detector and two proportional counters. The differential cross-section for the reaction $^{12}C(n, \alpha_0)^9Be^{gs}$ has been measured for several angles.

Coupled Channel Equations and the Giant Dipole Resonance

by G. Baur and K. Alder

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(20. VII. 70)

Abstract. The cross section for the (γ, nucleon) reaction on nuclei in the giant resonance region is calculated in a coupled-channel model. 1 particle–1 hole excitations and collective surface vibrations, which are coupled to the particle degrees of freedom, are considered. It is shown that the coupled channel equations may be simplified by using the 'external mixing' approximation. Furthermore, the interference of E1- and E2-radiation and its influence on the angular distribution are calculated. Numerical calculations are done for the giant dipole resonance in C^{12} and O^{16} and compared with the experimental data. Contrary to the usual bound state calculations this model makes explicit predictions for the various observable quantities, such as total cross sections for photodisintegration and their angular distributions.

Quasi-Elastic Electron Scattering and Nuclear Shell Structure

by Raoul D. Viollier and Kurt Alder

Institute for Theoretical Physics, University of Basel

(20. VII. 70)

Abstract. Quasi-elastic electron scattering, knocking out a proton from the target nucleus, is treated in a distorted wave Born approximation. The coincidence cross section for the $N(e, e' p)N'$ reaction is calculated in the impulse approximation. Since the energy of the emitted proton depends upon the shell and its binding energy, the nuclear shell structure can be studied directly if the angular correlation of the emerging particles is measured. The angular distribution of the outgoing proton is calculated and compared with plane wave Born approximation values for ^{40}Ca, ^{32}S and ^{28}Si.

Bemerkungen über quantenmechanische Entropie-Ungleichungen

von Fritz Baumann
Seminar für theoretische Physik, ETH Zürich
(24. VII. 70)

Abstract. In a first part we check the validity of a conjecture of D. Robinson and D. Ruelle, concerning the quantum mechanical entropy. The partial results obtained tend to confirm it.

The second part deals with a generalization of an expression for the skew information defined by E. Wigner and M. Yanase; it is shown, that for Quaternions an important convexity property holds.

On Nonrelativistic Positive-α Landau Surfaces

by Colston Chandler
Seminar für theoretische Physik der Eidgenössischen Technischen Hochschule, Zürich
(30. VII. 70)

Abstract. Results previously proved for relativistic positive-α Landau surfaces are extended to the nonrelativistic case. It is proved that in the physical region, at points where no two initial and no two final particle momenta are parallel, leading surfaces are real analytic submanifolds of codimension 1. The normal to a leading surface at a manifold point is proved to determine, in an essentially unique way, the Coleman-Norton space-time picture of the corresponding multiple scattering process.

On the Logarithmic Power of Kernel Integrals

by J.-P. Eckmann
Institut de Physique Théorique, Université de Genève
(30. VII. 70)

Abstract. Sufficient conditions are given under which the asymptotic behaviour of integrals is described by pure power counting, excluding therefore logarithmic powers.

Explicit Solutions for Quadratic Interactions

by Ph. Ch. Zabey and M. Ducommun
Institute for Theoretical Physics, Geneva, Switzerland
(31. VII. 70)

Abstract. Explicit operator solutions are given for quadratic interactions, both for scalar and spinor fields. Their existence is rigorously established.

Das Verhältnis von Neutralen zu geladenen Hadronen der kosmischen Strahlung in einer atmosphärischen Tiefe von 976 g cm^{-2}

von Pierre Le Coultre
Physikalisches Institut der Universität Bern
(15. VIII. 70)

Abstract. The ratio of neutral to charged hadrons in the cosmic rays at an atmospheric depth of 976 gcm^{-2} is measured with a spark chamber set-up. A value of 0.73 ± 0.03 has been found for incoming particles with a weighted average energy larger than or equal to 12 GeV. At a minimum value of 15 GeV approximately the ratio is 0.64 ± 0.04. Provided that the neutron to proton ratio equals unity at the atmospheric depth of 976 gcm^{-2}, the π-meson to nucleon ratios for energies larger or equal to 12 GeV and 15 GeV are 0.18 ± 0.03 and 0.28 ± 0.05 respectively.