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HELVETICA PHYSICA ACTA

Zusammenfassungen der letzten eingegangenen Arbeiten
Résumés des derniers articles reçus

Perturbation Expansion of the Wave Function of Boson Systems

by Edgar Rhodes and Paul Erdös
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(10. II. 68)

Abstract. For applications, the Rayleigh-Schrödinger non degenerate second order perturbation expansion of a many-particle wave-function is explicitely presented. The wave-function represents an assembly of bosons in a perturbing potential. The potential, expressed in second-quantized form is linear and bilinear in the boson operators and contains arbitrary operators which couple the bosons to other systems of particles.

Die Neutronenspektroskopie als Methode zur Untersuchung der Dynamik adsorbierter Moleküle

von G. Verdan
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(17. II. 68)

Abstract. The slow neutron scattering method has been used to study the dynamical behaviour of physically adsorbed H_2, CH_4, C_2H_2 and C_2H_4 molecules. According to the mobility of the adsorbed molecules, three different types of spectra have been observed: Adsorbed C_2H_2 at room temperature behaves like a two-dimensional gas. Its spectrum is similar to the corresponding free gas spectrum. Adsorbed H_2 and CH_4 at about 85 °K behave like two-dimensional liquids, their spectra show the typical broadening of the elastic line. The estimated values of the diffusion coefficient D are: $D = 1{,}3 \times 10^{-5}$ cm²/sec for CH_4 on Merck-charcoal at 89 °K, $D = 1{,}1 \times 10^{-5}$ cm²/sec for CH_4 on Saran-charcoal at 82 °K, $D = 1{,}1 \times 10^{-5}$ cm²/sec for H_2 on Merck-charcoal at 85 °K and $D = 0{,}7 \times 10^{-5}$ cm²/sec for H_2 on Saran-charcoal at 82 °K. Adsorbed C_2H_4 at 85 °K shows still a slight broadening with a corresponding $D = 0{,}3 \times 10^{-5}$ cm²/sec of the elastic peak. On the other hand C_2H_2 at 82 °K is adsorbed in a pseudolocalized film.

Surface heterogeneity causes a decrease of the relative elastic scattering intensity with increasing surface coverage.

No distinct inelastic peaks, corresponding to vibrational modes of the adsorbed molecules relative to the adsorbent surface have been observed.

Some proposals for further neutron scattering experiments are given.

Internal Manifolds, a Description of Exact and Broken Symmetries, Incorporating Rotational Excitations as Implied by the Hypothesis of Regge-Recurrences

by P. Minkowski
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(20. II. 68)

Abstract. An attempt is made to introduce the concept of an internal manifold in elementary particle physics, and to realize the simultaneous action of the Poincaré group and of an internal

SU 3 symmetry group on this manifold. A restricted class of manifolds is investigated, Riemannian globally symmetric spaces of type II, on which the internal symmetry group acts through the adjoint representation.

The interplay of the two groups supplemented by several auxiliary assumptions determines the manifold uniquely. The abstract manifold and the two Lie transformation groups acting on it are reexamined considering a linear boundary value problem on the manifold, stripped partly of its structure as homogeneous space, to allow the symmetry substitutions of the solutions determine the actions of the two transformation groups. The boundary value problem gives rise to a spectrum of masses depending on spin and internal quantum numbers. Meson and baryon masses are calculated defining special models, in which a continuation to complex angular momenta is carried out.

The situation for space like momenta is investigated and the restrictions imposed on the potentials defining the aforementioned models, by demanding that no solutions exist for space like momenta, are studied. The differential equation on the manifold is separable and is reduced to a second order linear differential equation in one dimension. The location of the bound solutions is determined from an associated Jost function. The differential equation is studied by mapping it on an analog potential scattering equation. The analog energy and potential strenth appear as algebraic functions of mass, spin and internal quantum numbers.

The breaking of symmetry is treated as a perturbation. Mass splittings within meson and baryon SU 3 multiplets are obtained in first approximation with respect to the strength of the breaking.

Messung des differentiellen Wirkungsquerschnitts der Reaktion $^{16}O(n, \alpha)\,^{13}C$ im Energiegebiet von 14,8 – 18,8 MeV

von I. Sick, E. Baumgartner, P. Huber und Th. Stammbach
Physikalisches Institut der Universität Basel

(21. II. 68)

Abstract. The differential cross-section of $^{16}O(n, \alpha_0)^{13}C$ and $^{16}O(n, \alpha_{123})^{13}C^*$ has been measured at 28 neutron-energies between 14.8 and 18.8 MeV with 60 keV energy spread at angles between 0 and 156 degrees. Above 16.2 MeV, where the reaction proceeds via a direct mechanism, the α_0-cross-section agree with angular distributions calculated with Butler-theory.

Halbleitermessungen von Fallout

von P. Winiger, O. Huber und J. Halter
Physikalisches Institut der Universität Fribourg, Schweiz

(23. II. 68)

Abstract. Two γ-ray spectra of recent fission products, measured by a NaI well type crystal and a Ge(Li) drifted diode are compared. The high energy resolution of the small semi-conductor compensates nearly its low detection efficiency and allows a much more reliable analysis of complex spectra within the monitoring of radioactivity. An example of an analysis is given.

Application de la théorie relativiste des phénomènes irréversibles à la phénomènologie de la supraconductivité

par F. Rothen
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(26 II 68)

Summary. The dynamics of a superfluid or superconducting system is described entirely by means of a relativistic theory of irreversible processes using no further hypothesis except the

irrotationality of the movement of the superfluid. In the case of the superconductor, considering irreversible chemical exchanges between normal electrons and Cooper pairs will turn out to be important for the establishment of the equilibrium, especially in the penetration depth; it plays also a role for thermal conduction processes and has to be taken into account in expressing correctly the thermal conductivity.

Submillimeterwellen-Technik

von J.-F. Moser, H. Steffen und F. K. Kneubühl
Laboratorium für Festkörperphysik der Eidgenössischen Technischen Hochschule, Zürich

(29. II. 68)

Summary. The present state of the art of submillimeterwaves is reviewed. Performance and development of sources, detectors and spectrometers are discussed and compared with results obtained at our laboratory.

Optische Aktivierung von Haftstellen in Anthrazeneinkristallen

von M. Schadt
Institut für angewandte Physik, Universität Basel

(2. III. 68)

Abstract. The photoelectric behaviour of the space charge limited hole current in Anthracene single crystals is examined as a function of wavelength. It is shown that the wavelength dependence of the current – below the absorption edge of Anthracene – is correlated to the optical activation of traps.

From the two rises observed in the current at 1.5 μ and 1.1 μ we conclude that there are two types of traps with different energies, energy distributions and cross sections.

In order to explain the measurements, the trap-model proposed by Mark and Helfrich is modified insofar as an energy distribution for the deep lying traps is assumed. This distribution is determined from the measurements.

Résonance paramagnétique du dibutyldithiocarbamate de chrome

par J. Ortelli et R. Lacroix
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(11 III 68)

Résumé. Des cristaux de dibutyldithiocarbamate d'indium dotés de chrome ont été étudiés par la résonance paramagnétique. Les mesures ont permis de déterminer les constantes de l'hamiltonien de spin.

Supraleitung in Alkalimetallen?

von T. Schneider, E. Stoll und W. Bührer
Delegation für Ausbildung und Hochschulforschung am EIR, 5303 Würenlingen

(19. III. 68)

Summary. The contribution of the electron-phonon interaction to the density of states and other parameters of the superconducting state are calculated using the pseudopotential approach. On the basis of these calculations we discuss the occurence of superconductivity in alkali metals.

Normal Solutions of the Linearized Boltzmann Equation

by G. SCHARF
Institut für Theoretische Physik der Universität Zürich

(21. III. 68)

Summary. The problems of initial and boundary conditions in hydrodynamics are discussed on the basis of the linearized Boltzmann equation. Using the hydrodynamic approximation involving the normal solutions, the connection problem of relating the actual initial values of the hydrodynamic quantities to the initial values appropriate to the equations of fluid dynamics is solved. Explicit formulae correcting the initial layer are given in the Navier-Stokes approximation. The normal solutions are then applied to steady state problems of the Boltzmann equation. In this connection a useful method for treating boundary value problems is employed. Finally the nature of the hydrodynamic approximation is investigated. It is found that this approximation is correct in the two limiting cases, either (i) finite mean free path ε as $t \to \infty$, or (ii) finite time as $\varepsilon \to 0$. The approach to equilibrium or to a steady state is also considered.

Effect of Nonlinear Excitation on Magnetoacoustic Resonance in a Cold Plasma

by K. FÄSSLER, J. VACLAVIK and H. SCHNEIDER
University of Fribourg, Department of Physics, Fribourg, Switzerland

(1. IV. 68)

Abstract. In magnetoacoustic resonance, amplification of the exciting magneting field was studied, both theoretically and experimentally, in the region where B_z is not small compared with magnetostatic field B_0. Dependence on the mutual polarity of B_0, B_z and on the exciting energy was found and excitation of higher harmonics was observed.

Calculation of the N-N Phase-Shifts Taking into Account Exited States of the Nucleons

by S. WAGNER
II. Institut für theoretische Physik der Universität Hamburg
and P. WINIGER
Physikalisches Institut der Universität Fribourg

(10. IV. 68)

Summary. Elastic N–N phase-shifts are calculated using the stron-coupling potential derived by FIERZ [1] who employed the fixed source PS–PS meason theory of WENTZEL [2]. In the limit of strong coupling, isobaric states of the nucleon appear, and consequently the N–N interaction has to be treated as a multi-channel problem. Using the experimental values of the renormalized pion coupling constant and of the N_{33} resonance energy, we introduce a hardcore of about 0.5 fermi as the only phenomenological parameter. The multi-channel Schrödinger equation is solved for positive energies. As a result of the calculations we obtain the correct energy dependence of the two S-wave phase-shifts at intermediate energies. All D-wave phase-shifts check with the experimental values up to 100 MeV; for higher energies the computed phase-shifts are too large. For high values of angular momentum they tend to OPEC phase-shifts; here all phase-shifts with $J \geqslant 3$ are in agreement with experiment. But for most of the intermediate odd phase-shifts there occurs the same kind of disagreement that is known from perturbation theory, when no vector measons and no spinorbit potential are introduced into the theory.

Etude des centres paramagnétiques du soufre condensé à basse température. Fonctions d'onde d'une chaîne de soufre

par Jean Buttet
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(16 IV 68)

Résumé. Les variétés instables du soufre, formées par condensation de molécules $S2$ sur un support refroidi à 77 °K, ou par condensation simultanée de molécules $S2$ et d'atomes de gaz rare sur un support à 4 °K, ont été étudiées par la technique de résonance paramagnétique électronique. Deux types de centres paramagnétiques ont été observés, l'un est attribué à l'électron non pairé à l'extrémité d'une chaîne de soufre, l'autre est un état ionisé positivement dû à l'interaction de 2 extrémités de chaîne.

Les fonctions d'onde d'une chaîne de soufre ont été calculées par une méthode semi-empirique, les valeurs du facteur de Landé et les coefficients de structure hyperfine calculés sont comparés aux valeurs mesurées. L'accord indique que l'électron non pairé est essentiellement localisé dans une orbitale de type π, antiliante, répartie sur les 2 atomes à l'extrémité d'une chaîne.

Etude des formes instables du soufre piégées à basse température et description d'un équilibre thermodynamique

par André Chatelain
Laboratoire de Physique de l'Ecole Polytechnique de l'Université de Lausanne

(16 IV 68)

Résumé. L'étude du retour à l'équilibre des formes instables du soufre piégées à basse température (irradiation du solide, condensation de la vapeur ou trempe du liquide) à l'aide de la résonance paramagnétique électronique montre qu'il faut distinguer quatre stades de restaurations; les trois premiers sont attribuables à l'évolution du paramagnétisme d'extrémités de chaînes et le quatrième à des impuretés. Dans un premier stade, deux extrémités de chaînes non totalement recombinées durant les processus de piégeage peuvent ou achever cette combinaison ou donner deux extrémités libres. Les deuxième et troisième stades concernent la migration et la recombinaison des extrémités libres de chaînes (polymérisation) de manière corrélée d'abord puis non corrérée (cinétique du second ordre). A température ambiante, la structure est celle du soufre mou (très longues chaînes); ainsi durant ces processus, les chaînes augmentent de longueur en même temps que leur concentration diminue. La cristallisation du soufre mou en soufre orthorhombique se fait ensuite par arrachements successifs, aux extrémités des chaînes, de molécules $S8$ qui se ferment.

L'état d'équilibre à température ambiante (soufre orthorhombique) est caractérisé par l'existence d'un paramagnétisme résiduel (6,5 centres/gramme) attribuable à des extrémités de chaînes $S16$. Il est possible d'expliquer ce phénomène par un calcul thermodynamique de l'équilibre dans un réseau d'anneaux $S8$ (liquide ou solide) en admettant les réactions d'initiation et de polymérisation imaginées par Tobolsky pour le liquide. Ce calcul fait intervenir principalement la variation des fréquences propres de vibration lorsqu'un anneau $S8$ s'ouvre.