Zusammenfassungen der letzten eingegangenen Arbeiten = Résumés des derniers articles reçus

HELVETICA PHYSICA ACTA

Zusammenfassungen der letzten eingegangenen Arbeiten
Résumés des derniers articles reçus

Unitary Sum Rule and the Time Evolution of Neutral K-Mesons

by L. P. HORWITZ and J.-P. MARCHAND
Departments of Physics and Mathematics University of Denver
Denver, Colorado 80210

(3. IV. 69)

Abstract. The consequences of the unitary sum rule for the decay of neutral K-mesons are investigated without assuming the usual semigroup property (Wigner-Weisskopf equation with constant complex Hamiltonian). A much wider class of motions in the K-meson subspace then becomes possible. In particular, there may exist evolutions which do not admit any states with pure exponential decay laws. In a CP-invariant theory, however, the unitary sum rule alone implies exponential decay for the CP-eigenstates.

Singular Domains of Space

by PETR HÁJÍČEK
Institute of Theoretical Physics, Sidlerstrasse 5, 3012 Berne, Switzerland

(14. IV. 69)

Abstract. A generalization of a definition of cosmological singularity is proposed, which allows to formulate singularity theorems so that they refer only to a finite domain of space-time. In this way, two theorems due to Hawking are sharpened, by means of what it can be shown that our Universe cannot be singularity free, unless the causal loops violating the strong causality required by Hawking entirely lie in an explicitly indicated compact region of our past.

Elastische und inelastische Streuung von 14,1-MeV-Neutronen an ^{16}O und ^{18}O

von D. MEIER, M. BRÜLLMANN, H. JUNG und P. MARMIER
Laboratorium für Kernphysik ETH, Zürich

(14. IV. 69)

Summary. Angular distributions for elastic and inelastic scattering of 14.1 MeV neutrons by ^{16}O and ^{18}O have been measured in the angular range $7.5° \leqslant \theta \leqslant 155°$ using a fast time-of-flight spectrometer and targets of $H_2{}^{16}O$, $D_2{}^{16}O$ and $D_2{}^{18}O$. Absolute differential cross sections were determined for the states or groups of states at O, 6.1, 7 MeV in ^{16}O and at O, 1.98, 3.7, 5.3 MeV in ^{18}O as well as the integrated cross sections for these levels and the levels at 6.3, 7.12, 7.62 MeV in ^{18}O. The results are compared with optical model predictions and direct interaction theories. In the case of ^{16}O, the experimental data are in good agreement with previous work. The angular distribution for neutrons inelastically scattered to the 6.1 MeV state differs from the corresponding proton data and is not well reproduced by theoretical curves. For ^{18}O appreciably larger scattering cross sections were observed for $Q = 0$ and -1.98 MeV than in comparable proton measurements. It may be concluded, that the averaging over the level structure in these light nuclei is not suffi-

cient. In a supplementary measurement the total cross section for ^{18}O has been determined by a transmission experiment to 1610 ± 70 mb, which is considerably higher than the previously reported value.

On the Structure of Quantal Proposition Systems

by J. M. Jauch and C. Piron
Institut de Physique Théorique, University of Geneva, Geneva, Switzerland

(23. IV. 69)

Abstract. It is shown that the axiom of atomicity and the covering law can be justified on the basis of a new and more satisfactory notion of state and the existence of ideal measurements of the first kind. These two axioms are thereby given a satisfactory justification in terms of empirical facts known about micro-systems. Furthermore the new notion of state introduced here does not involve any probability statements and there is therefore no difficulty attributing it to individual systems, which was not possible with the notion heretoforth used in quantum mechanics.

Le saut de diffusion lacunaire

par J.-J. Paltenghi
Laboratoire de Génie Atomique, EPF Lausanne

(30 IV 69)

Abstract. A phenomenological theory of the vacancy jump is presented. It is shown on one hand that diffusion of crystalline structure defects may be described only as evolution of statistical distributions. On the other hand, a strong conceptual relation is noted between the states of a diffusive particle and of a particle in a fluid.

The crystal energy is then taken as a sum of interactions between pairs of atoms. Jaynes' generalization of Gibbs' statistical method is used. A self consistent field approximation gives a simple analytical expression for the jump rate, the migration energy and the migration volume of a vacancy. Numerical results agree clearly well with experimental data.

This theory may be considered as a connection between fluid and solid diffusion.

Die Kompressionswelle mit endlicher Amplitude in einem magnetisierten Plasma

von D. W. Zickert and H. Schneider
Physikalisches Institut der Universität Freiburg i. Ue.

(23. V. 69)

Zusammenfassung. In einem homogenen Argonplasma zylindrischer Geometrie wird eine hydromagnetische Kompressionswelle endlicher Amplitude angeregt. Das Anregungsverhältnis erreicht Werte bis $B_s/B_0 = 0{,}35$. Untersucht wird die Ausbreitung dieser Welle längs des quasistationären axialen Magnetfeldes und die dadurch bedingte Veränderung des Plasmawiderstandes. Der in der nichtlinearen Theorie von L. C. Woods behandelte Einfluss der durch die starke Anregung erzeugten höheren Harmonischen wird experimentell nachgewiesen.

Abstract. A hydromagnetic compressional wave with finite amplitude is excited in a homogeneous argon plasma of cylindrical geometry. We study the propagation of this wave along a quasistatic axial magnetic field and the increase of plasma conductivity, when the perturbation ratio is increased up to $B_s/B_0 = 0.35$. The experiment verifies the influence of higher harmonics as postulated by the nonlinear theory of L. C. Woods.

Size Effect and Diffusion in Sandwich Structures Made from Pure and Impur Indium

by G. Brändli, M. Montanarini, and J. L. Olsen
Laboratorium für Festkörperphysik, Eidgenössische Technische Hochschule, Zürich, Switzerland

(10. VI. 69)

Abstract. Foils of indium and of an indium-lead alloy were rolled together to form sandwich structures with a total thickness of 0.2 mm having from 2 to 8000 alternating layers of pure and alloyed material. In these samples, in which the layer thickness varied over several orders of magnitude, the size effect in d.c. electrical conduction was compared with Fuchs' calculation and with calculations based on his model. The diffusion rate of lead in these specimens was investigated experimentally and theoretically.

Metallic Hydrogen

by T. Schneider
Delegation für Ausbildung und Hochschulforschung am E.I.R., 5303 Würenlingen, Schweiz

(11. VI. 69)

Summary. In this report we consider metallic hydrogen as an array of protons embedded in a sea of electrons. This system will be described in terms of the adiabatic approximation. The electronic contribution to the potential energy of the lattice will be calculated by use of a modified Hartree-Fock method. Starting from free electrons the electron-proton interaction will be introduced as a perturbation in a self-consistent manner. On this basis we shall discuss the following properties: Lattice energy, lattice dynamics, lattice stability, effective proton-proton interaction, electron band structure and superconductivity. In addition, we shall discuss the phase transition between molecular and metallic modifications. Results will enable us to make quantitative statements about the relation between electronic structure, crystal stability and phonon zero point energy. They suggest that increasing pressure leads to a phase transition from the metallic solid state into the liquid state due to the phonon zero point energy. The results furthermore imply interesting astrophysical consequences and indicate that metallic hydrogen may be a high temperature superconductor.

Messung von Konversionskoeffizienten mit einer Ge-(Li) Diode

von E. Baldinger und E. Haller
Institut für angewandte Physik der Universität Basel

(25. VI. 69)

Summary. High resolution Ge(Li)-detectors, produced in our laboratory, were used to register simultaneously gammas and conversion electrons of nuclear transitions. Registration with arbitrarily narrow window can be achieved by direct irradiation of the intrinsic volume of the diode. Good agreement of the internal conversion coefficients α_K of 570 keV-^{207}Pb, 1064 keV-^{207}Pb and 662 keV-^{137}Ba transitions with previous measurements has been found. The corresponding relative coefficients α_K/α_L and α_K/α_{M+N} do not appear to be published as yet and consequently only the values obtained at this laboratory are presented. The accuracy of the method is limited by the error in the full energy peak efficiency of the Ge(Li) detector and is in our experiments about 10% for α_K and $< 10\%$ for the α_K/α_L and α_K/α_{M+N}. The simple experimental arrangement and the rapidity with which results can be obtained give this method considerable preference. On the other hand irradiation into the intrinsic zone may imply difficulties concerning the surface treatment.