HELVETICA PHYSICA ACTA

Thermoelectric Power of Palladium Based Dilute Alloys

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(17. III. 70)

Abstract. The thermoelectric power, S, of palladium alloyed with 1 at.% of Ti, V, Cr, Mn, Fe, Co, Ru, Re, Os or Te has been measured between 1,5 °K and 273 °K. A change in the slope of $S(T)$ near the Curie temperature is observed for the ferromagnetic alloys. The PdCr alloy shows a large positive value of S at low temperature, presumably associated with an effect similar to that observed in alloys based on the noble metals (Kondo effect). For the other alloys, S is generally positive and greater than when the same dilute elements are dissolved in noble metals, but is not anomalously dependant with temperature.

Magnetic Field Effect on the Thermoelectric Power of a Dilute AuFe Alloy

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(17. III. 70)

Abstract. Low temperature measurements are presented on the Seebeck coefficient of an alloy Au + 0,03 at.% Fe in presence of a longitudinal or transversal magnetic field. The effect observed is explained by a theory using the first Born approximation. The s-d exchange integral is estimated: $J \approx -0,35$ eV.

The Unitarity Constraints for Multiple Resonances

by HANS ROSDOLSKY

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(23. III. 70)

Abstract. The unitarity constraints for any number of overlapping resonances are derived. These are the necessary and sufficient conditions on the resonance masses, widths, and couplings for the S-matrix to satisfy unitarity. The unitarity constraints for an isolated resonance, two overlapping resonances, and the dipole are studied in greater detail. The eigenphase behavior for an isolated resonance and a degenerate dipole is also discussed.

Bestimmung der Niveaudichteparameter von Germanium, Holmium und Tantal

von H. SOBOTTKA, ST. GRIMES, P. HUBER, E. MANGOLD, J. SCHACHER und R. WAGNER

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(26. III. 70)

Abstract. Germanium, Holmium and Tantalum samples were bombarded with 14-MeV-neutrons and the resulting neutron spectra measured with a time-of-flight spectrometer. Use of a Monte Carlo computer program permitted the calculation of multiple-scattering effects.

Application of the assumptions of the statistical and superfluid model led to a level density formula which was used to calculate the (n, n')- and $(n, 2n)$-spectra. These calculations for various values of the level density parameter a were fitted to the experimental data.

As a second independent method to determine the level density parameter the Lang and Le Couteur relation was used to obtain a value for the nuclear temperature, which can be related to the density parameter a'_p of the Fermi-gas model.

The resulting values were compared with the magnitudes calculated from the shell model.

	a MeV^{-1}	a'_p MeV^{-1}
Ge	$12,5 \pm 0,7$	$12,3 + 1,6$ $- 1,1$
Ho	$23,0 \pm 1,7$	$17,4 + 1,7$ $- 1,5$
Ta	$27,0 \pm 2,0$	$22,9 + 1,6$ $- 1,5$

Electron Spin Resonance of Cr^{3+} in ZnAl$_2$O$_4$ Spinel: Parameters and Linewidths

by P. Schindler and P. Gerber

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(31. III. 70)

Abstract. The ESR. spectra of Cr^{3+} in synthetic ZnAl$_2$O$_4$ spinel have been measured at 35 and 9 GHz. The parameters of the spin Hamiltonian are at 300 °K: $g_{\shortparallel} = 1.9840 \pm 0.0003$, $g_{\perp} = 1.9798 \pm 0.0005$, $|D| = (0.9304 \pm 0.0003)$ cm^{-1}. The strongly varying linewidths are interpreted quantitatively by a simple model which is consistent with small disorder effects.

Spontane Kernspaltung von ^{238}U und ^{241}Am

von D. Galliker und E. Hugentobler

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und B. Hahn

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(3. IV. 70)

Abstract. With the spinner method, which is based on the principle of cavitation of liquids induced by energy deposition by particles, we have measured the spontaneous fission half lives of ^{238}U and ^{241}Am. We found $(8.19 \pm 0.06)\ 10^{15}$ years for ^{238}U and $(9.5 \pm 0.4)\ 10^{13}$ years for ^{241}Am. In order to search for possible systematic errors, the measurements were done under different experimental conditions.

On the Infinitude or Finiteness of the Number of Bound States of an N-Body Quantum System

by Barry Simon

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(15. IV. 70)

Abstract. We present a general discussion of when an N-body quantum system with two-body forces will have infinitely many bound states. A physically-motivated criterion for infinitude is presented and proved sufficient. In a restricted class of cases, it is proven to be necessary. Two applications are made: first, we recover the Zhislin and Zhislin-Sigalov results on the number of bound states of atoms; secondly, we discuss the coupling constant dependence of the number of bound states and find it very different from the two-body situation. Finally, we present examples of N-body systems with infinitely many bound states even though the two-body forces are too weak to bind any states.

Spectral Concentration for the Helium Schroedinger Operator

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(23. IV. 70)

Differentialraum-Quantentheorie

von W. Ochs

Sektion Physik der Universität München

(11. V. 70)

Summary. Differential-Space Quantum Theory reformulates quantum mechanics as a theory with *hidden variables*. In this new theory all observables of a physical system have well-defined values which change in a deterministic way. In analogy to statistical mechanics a quantum mechanical state (here regarded as a *macro-state*) is represented by an ensemble of *micro-states* with an appropriate probability distribution.

The following paper contains a simplified presentation of *Differential-Space Quantum Theory* and the underlying mathematics.

Eine Analyse der Differentialraum-Quantentheorie

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Sektion Physik der Universität München

(11. V. 70)

Summary. An analysis of *Differential-Space Quantum Theory (DSQ)* is given, continuing a former presentation of this theory. Our investigation reveals (1) contradictions between the mathematical formalism of *DSQ* and the properties of an ensemble-theory, and (2) quantitative differences between quantum mechanics and *DSQ* in the description of the measuring process.

Etude des atomes π-mésoniques au moyen des longueurs de diffusion

par E. Lambert

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(11 V 70)

Summary. From pionic atoms measurements the π-nucleus experimental scattering lengths are determined. These s and p scattering lengths are then connected to those of the π–N elementary process through a multiple scattering theory. The binding of the nucleons is neglected and the nuclear structure introduced in a simple way using the independent particle model. The absorption is treated phenomenologically by taking complex values for the π–N scattering parameters. A set of these parameters is then adjusted to the experimental results and discussed.

Rechenmethode zur Analyse hochaufgelöster γ-Spektren und ihre Anwendung auf Spaltfragmentgemische

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(15. V. 70)

Abstract. γ-spectroscopic methods offer considerable advantages compared to other proceedings in the analysis of unknown mixtures of radionuclides. There exists especially the possibility of computer programs to achieve a complete analysis of highly resolved spectra even with rather small installations. The principles of a peak location, the approximation of the peaks with Gaussian distributions and the energy calibration and determination, which allow an identification of the peaks with a suitable catalogue of γ-ray energies, are outlined. Besides the calculation of the activity of the identified nuclides and the necessary time corrections a comparison with normal mixtures of fission fragments is executed. To do this, we assume a special fission mode and calculate to every measured nuclide the corresponding number of fissions; its expected value for normal mixtures is a constant Q, if the chosen fission mode is correct. The accuracy of this procedure has been tested experimentally with a normal mixture of fission fragments of U-235, irradiated with thermal neutrons. The mean deviation of the Q-values was about $\pm 10\%$, using the most recent data. The analysis of three airfilter samples with fission fragments and neutron induced nuclides (Np-239, U-237) from nuclear explosions allowed their attribution to two different types of bombs.

EPR of Fe in Superparamagnetic Alloys

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(21. V. 70)

Abstract. EPR measurements were carried out for $Fe_x V_{1-x}$ 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]

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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 $ZnAl_{2(1-x)}\,Fe_{2x}O_4$

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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 quadrupolsplitting 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 [1]

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
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(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
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(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 Abhäengigkeit des Neutrino/Kern-Wirkungsquerschnittes von der Nukleonenzahl des Target-Kernes

von P.-G. Seiler, K. Borer, B. Hahn, H. Hofer und F. Krienen
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(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
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(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

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(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.