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HELVETICA PHYSICA ACTA

Zusammenfassungen der letzten eingegangenen Arbeiten
Résumés des derniers articles reçus

Resonanzabsorption magnetoakustischer Wellen in einem dichten Argonplasma¹⁾

VON B. HOEGGER, K. APPERT, K. FÄSSLER, L. KRLIN²⁾, H. SCHNEIDER

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(29. X. 70)

Abstract. In a cylindrical argon plasma, the heating and the energy dissipation of magnetoacoustic waves were calculated and studied experimentally. Optical spectroscopy, laser interferometry, magnetic probes and diamagnetic loop techniques were used as diagnostics. The maximal temperature increase and energy dissipation were observed under resonant conditions. It turned out that 45% of the available electromagnetic energy was absorbed in the plasma.

¹⁾ Diese Arbeit wurde durch die finanzielle Unterstützung des Schweizerischen Nationalfonds ermöglicht.

²⁾ Permanente Adresse: Czechoslovak Academy of Science, Institute of Plasma Physics, Prague.

Magnetische Supraleiter

VON M. PETER, P. DONZÉ, O. FISCHER, A. JUNOD, J. ORTELLI, A. TREYVAUD, E. WALKER

Institut de Physique de la Matière Condensée
Université de Genève, Suisse

M. WILLHELM und B. HILLENBRAND

Forschungslaboratorium Erlangen der Siemens AG, Erlangen, Bundesrepublik Deutschland

(30. X. 70)

Abstract. The theory of magnetic superconductors is critically reviewed and it is shown that the restrictions such as Ion-electron-exchange scattering, exchange fields, weakening of the RKY coupling and orbital fields will, in certain cases at least, not prevent the coexistence of magnetism and superconductivity. The thermodynamical potential for magnetic superconductors is established and partially evaluated in the appendix. Then recent magnetisation – dilatation – and specific heat measurements on $Ce_{(1-x)}Gd_xRu_2$ are presented and it is concluded that this system is at low temperatures a homogenous magnetic superconductor. The magnetic properties of this system are also unusual since the Gd-Gd exchange interaction is strongly proportional to the temperature in the region investigated.

Effect of Nonlinear Processes on the Plasma Heating in Magnetoacoustic Resonance¹⁾

by J. VACLAVIK

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(31. X. 70)

Abstract. In magnetoacoustic resonance, the effect of nonlinear processes on the temperature increase of a dense collision-dominated plasma is investigated. It is shown that the nonlinear processes diminish the theoretical value of the temperature increase even for very small amplitudes of the excited waves.

¹⁾ Supported by the Swiss National Foundation for Scientific Research.

Die Reaktion $^{13}\text{C}(^3\text{He}, \alpha)^{12}\text{C}$ im Energiebereich $E_{^3\text{He}} = 1,8$ bis $5,4$ MeV

von K. BOEHLE, V. MEYER und H. H. MÜLLER

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(17. XI. 70)

Zusammenfassung. Anregungskurven wurden im Energiebereich $E_\tau = 1,2$ bis $5,4$ MeV in Schritten von 75 keV bei $\vartheta_{\text{Lab}} = 23^\circ$ bzw. 40° und $\vartheta_{\text{Lab}} = 150^\circ$ bzw. 157° gemessen¹⁾. Im Energiebereich $E = 2$ – 5 MeV sind Winkelverteilungen der Reaktion $^{13}\text{C}(\tau, \alpha)^{12}\text{C}$ gemessen worden in Schritten von 140 keV für die Teilchen α_0 ; α_1 und α_2 , die dem Grundzustand, dem ersten und zweiten angeregten Zustand von ^{12}C entsprechen. Absolute Wirkungsquerschnitte werden angegeben und verglichen mit Resultaten anderer Autoren. Zwischenkernbildung ist der wesentliche Reaktionsmechanismus, der zu sich überlappenden Niveaus im ^{16}O -Kern führt mit Anregungsenergien von 24 bis 26 MeV. Andeutungen für isolierte Niveaus liegen vor für $E_x = 25,3$; $25,6$ und 26 MeV. Es wurde versucht, die Winkelverteilungen durch eine Hauser-Feshbach-Rechnung sowie durch Interferenz der Mechanismen für Zwischenkernbildung und Direktreaktion zu beschreiben.

¹⁾ τ steht für ^3He .

Untersuchung des Zusammenhangs zwischen Grenzschichtzuständen und Charge-Pumping-Effekt bei MOS-Transistoren

von J. GOLDBERGER und E. BALDINGER †

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(18. XI. 70)

Summary. As reported by Brugler and Jespers [1], periodical variations of the gate potential of enhancement-mode MOS-transistors cause a charge pumping effect correlated with the altering occupancy of states in the band gap. This paper extends the rather phenomenological analysis of Ref. [1] and describes the effect more precisely. To this end, Shockley-Read-Hall statistics are, as usual, applied to the interface states. In contrast to the linear models treated by different authors, nonlinearities have to be considered in the analysis of the charge pumping. The theoretical result obtained for small periodical variations of the gate potential explains the experimental data well within the error limits. Thus it may be concluded, that under these conditions the interface states in p -type MOS-transistors are predominantly filled with electrons by the n -substrate and emptied by the p -regions (drain and source). This unidirectional electron transfer leads to the nonvanishing DC component in the substrate current observed in the charge pumping experiment. In principle, the energy distribution of the interface states might be determined by means of the charge pumping effect; but as a consequence of the nonlinear relations involved, this procedure becomes quite unpractical.

Electron Spin Resonance of $\text{Fe}^{3\pm}$ in ZnAl_2O_4 Spinel and Anisotropy Energies in Ferrites¹⁾

by P. GERBER²⁾

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and F. WALDNER³⁾

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(20. XI. 70)

Abstract. The ESR spectra of iron doped ZnAl_2O_4 spinel have been measured at 35 GHz at room temperature. The Fe^{3+} ions occupy only the trigonally distorted B sites in the center of oxygen octahedrons. The g tensor shows a slight asymmetry with $g_x = 2,0001 \pm 0,0004$ and $g_y = 2,0019 \pm 0,0008$. The evaluated electric interaction parameters are in cm^{-1} : $D = (-)$

0.34017 ± 0.00015 , $a - F = (+) 0.04707 \pm 0.00021$, $a = (+) 0.0575 \pm 0.0004$. The sign of a relative to $a - F$ and D could be determined by the asymmetry of the spectra around $\theta = 90^\circ$. The large value of a shows that the 'single-ion' anisotropy energy of Fe^{3+} ions is a main source of the magnetic anisotropy energies in ferrites. The differences to the ESR results of Fe^{3+} ions in MgAl_2O_4 , for which almost equal structure constants have been observed, demonstrate that D , a , and F might be very sensitive to changes in covalent bonding in these fairly ionic crystals.

- 1) Research supported in part by the Swiss National Science Foundation and the U.S. Atomic Energy Commission.
- 2) Present address: Physikalisch-Chemisches Institut, Universität Zürich.
- 3) On leave of absence from University of Zürich.

Zur magnetischen Diffusion in Zylindergeometrie

VON FRITZ HERLACH

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(13. XI. 70)

Abstract. The diffusion of magnetic flux in conductors is discussed with a view to cylindrically imploding megagauss generators. Simple analytical expressions are developed which are adequate for a precise analysis of most experiments. It is shown that in many cases a suitable plane approximation can be used instead of the exact cylindrical solution. For the field at the surface of the conductor, an exponential field rise is assumed. Deviations from this in actual experiments are treated by a superposition of the basic exponential solutions. The change of the resistivity due to Joule heating is discussed in terms of Bryant's solution of the nonlinear diffusion equation. The concept of the flux diffusion speed is developed, and it is shown that the diffusion of magnetic flux into the conductor depends essentially on the resistivity at the surface. The partition of the energy flow into magnetic and Joule energy is analyzed, and a differential equation is derived which governs field distributions with equipartition between these energies. Applications are discussed and practical examples are given.

Stationary State Scattering Theory¹⁾

by W. O. AMREIN, V. GEORGESCU and J. M. JAUCH

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(9. XII. 70)

Abstract. We give a rigorous mathematical derivation of the stationary state scattering theory from the time-dependent theory. The basic tool used is the spectral integral for operator valued functions with an operator valued measure. The chief result is the correct interpretation and validation of the formal expressions often used in stationary state scattering theory.

- 1) Basel a diploma thesis by V. Georgescu.

Wirkungsquerschnitte in Ortho-Para-Wasserstoffgemischen

VON M. CAMANI

Laboratorium für Festkörperphysik, ETH, Zürich

(16. XII. 70)

Summary. The dependence of the viscosity of ortho-para-hydrogen mixtures on temperature (15–120°K) has been measured in the range from 10 to 100% $p\text{-H}_2$. From these data the relative differences of the interaction cross sections for $o\text{-}o$ -, $o\text{-}p$ - and $p\text{-}p$ -collisions can be derived. The results differing slightly from earlier measurements show that quantum statistical symmetry effects are not sufficient to explain the observations. Furthermore, methods are described to produce large quantities of pure ortho hydrogen.

**Polarisation des neutrons émis par la réaction $^{12}\text{C}(d, n)^{13}\text{N}$ sous 20° Lab.
pour $E. = 2,75$ MeV et 3 MeV**

par S. JACCARD, J.-F. GERMOND, J. PIFFARETTI et J. WEBER
Institut de Physique, Université de Neuchâtel, Neuchâtel, Suisse

(18 XII 70)

Summary. As a check of results published earlier and as a test of our liquid He polarimeter we have performed two measurements of the polarisation of the neutrons from the $^{12}\text{C}(d, n)^{13}\text{N}$ reaction at $E. = 2,71$ and $2,96$ MeV. Monte Carlo techniques have been used for multiple scattering corrections. The results are $P_1 = (-36.5 \pm 2.2)\%$ and $P_1 = (-37.0 \pm 1.8)\%$ respectively in good agreement with the results of Walter et al.

**On the Geometry Dependence of Nonlinear Electrical Conduction
in Intrinsic Semiconductors**

by W. A. SCHLUP

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(23. XII. 70)

Abstract. It is shown that for a cylindrical-shaped specimen the current-voltage characteristic depends in its nonlinear part on the shape and dimensions of the cross-section. It saturates for a large electric field and constant mobility for any nonlinear recombination rate of electrons and holes, whereas for a linear recombination rate it exhibits a superohmic behavior. Neglecting magneto-resistance effects the result can be generalized to field-dependent mobilities. It again yields a saturation of the current for large fields if a linear recombination law and a saturating drift velocity are assumed. The result agrees with experimental data essentially for large dimensions.

Influence of the Chemical Environment on β -Decays

by K. ALDER, G. BAUR and U. RAFF

Institute for Theoretical Physics, University of Basel, Switzerland

(26. XII. 70)

Abstract. The influence of a change of the electron screening on β^- -decay is discussed. The results are used to calculate the change of the half-life of various β -decays in different chemical environments.

Die Diffusion von Zink und Gallium in Galliumarsenid bei 1100°C

VON H. R. WINTELER

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(29. XII. 70)

Summary. The regular chemical diffusion of Zn in n -type GaAs at 1100°C is analysed. The Zn-concentration profiles obtained under different, well defined, Zn and As partial pressure were measured electrically. Hence the concentration-dependence of the chemical diffusion coefficient D_{Zu}^{chem} was determined by the Boltzmann-Matano-analysis for all boundary conditions. It is found that the value of D_{Zu}^{chem} depends on the local as well as on the surface concentration of Zn.