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55 Selected Abstracts of German Articles on Modern Physics (Solid State, Electronics, and Electrodynamics)

Source: Annalen der Physik, 6. Folge

Band 4 (1949), Nos 5,6,7
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"55 Selected Abstracts of Modern-Physics Articles (Solid State, Electronics, Electrodynamics, etc) From the German Periodical 'Annalen der Physik'* (1949 - 1951)"

Note: This report represents 55 abstracts of German Modern-Physics articles that appeared in 'Annalen der Physik (1949 - 1941). They break down as follows:

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| Solid State Physics: | 24 abstracts |
| Electrodynamics: | 13 " |
| Electronics: | 11 " |
| Relativity | 3 " |
| Electromagnetism: | 2 " |
| Wave Mechanics: | 2 " |

*

"Annalen der Physik" 6.Folge

-Band 4 (1949) No 5, p.248; No 6, pp. 331, 336, 367; No 7, p. 389
-Band 5 (1949) No 1-2, pp.1, 55, 71, 89, 99; No 5-6, pp. 181, 190, 1[illegible], 2[illegible],
-Band 5 (1949) pp. 2, 16, 44, 69, 89, 93, 110, 117, 129, 146, 163, 177, 195, 215, 229, 292, 306, 378.
-Band 6 (1950) No 6-8, pp. 280, 285, 287
-Band 7 (1950) No 1-2, p.97; No 3-4, pp.157, 160, 173; No 6, pp.289, 312.
-Band 8 (1950) No 1-2, pp. 30, 41, 46, [illegible], pp.[illegible], 164, 176, 187, 201, 211
-Band 8 (1951) No 1, pp. [illegible], No [illegible], pp.246, 291, 322.

"55 Selected Abstracts of Modern-Physics Articles (Solid State, Electronics, Electrodynamics, etc) From the German Periodical 'Annalen der Physik' (1949 - 1951)"

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'Annalen der Physik' 6.Folge

-Band 4 (1949) No 5, p.248; No 6, pp. 331, 336, 357; No 7, p. 359
-Band 5 (1949) No 1-2, pp.1, 63, 71, 89, 99; No 3-5, pp. [illegible]
-Band [illegible] (1 49) pp. 2, 18, 44, 69, [illegible], 110, 117, 129, 146, 163, [illegible]
193, 219, 229, 282, 305, 375.
-Band 8 (1 50) No 5-6, pp. 283, 286, 287
-Band 7, (1950) No 1-2, p.97; No 3-4, pp.157, 169, 173; No 6, pp.299, 312.
-Band 8 (1950) No 1-2, pp. 30, 41, 46, 56, 87; No 3-4, pp.[illegible], 124, [illegible]
-Band 9 (1951) No 1, pp. 89, 13,[illegible]40, 481No 2-4, [illegible] No 5-6, pp.246, 291, 328.

# EINDRINGTIEFE MAGNETISCHER FELDER IN SUPRALEITER UND METALLABSORPTION

(Permeability Depth of Magnetic Fields in Superconductors, and Metal Absorption)

F. Möglich and R. Rompe, Berlin
Berlin-Buch, Institut für Festkörperforschung
der Deutschen Akademie der Wissenschaften.
(Berlin-Buch, Institute for Research of Solids
of the German Academy of Sciences)

Berlin, Institut für theoretische Physik der
Universität.
(Institute of Theoretical Physics, Univ.)

Berlin. II. Physikalisches Institut der Universität.
(University Physical Institute)

ABSTRACT.

Connection between the permeability depth of magnetic fields in superconductors and the wave-length boundary of the absorption band of the specified metal in the visual short wave part is presented. Further it is shown that the absorption strength within this band strongly depends on the linear expansion of the metal; it increases with decreasing expansion. It is proved on experimental material, silver, mercury and other metals, that such absorption band really exists and has the property of depending on thickness of layer etc. By means of most recent measurements of the permeability depth of magnetic fields in superconductors it is proved that this absorption band is situated in the spot where, according to theory, plasma oscillations are expected.

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Annalen der Physik" 6. Folge, Band 4, Heft 6 (1 Mar 1949) p 335-351.

Solid State Physics - Superconductivity

# UBER DEN ZASAMMENHANG ZWISCHEN DER SUPRALEITUNG UND DER GEMISCHTEN LEITUNG

(Connection between Superconductivity and Mixed Conductivity)

H. Welker
Vaucresson, S. et O.
Rue Allouard

ABSTRACT.

On the basis of theoretical representations of band models and available experimental data, it is shown that only mixed conductors can become superconductors, while the magnitude of the transitional null-point energy of conducting electrons and electron deficits serves as a measure for the height of the jump points.

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"Annalen der Physik" 6. Folge, Band 5, Heft 1-2 (15 Jun 1949) pp 1-13

ZUR IONENLEITUNG UND FEHLORDNUNG VON SILBERBROMID MIT ZUSATZEN ZWEIWERTIGER KATIONEN

(Ionic Conductivity and Disorder of Silver Bromide with Admixtures of Bivalent Cations. I)

LEITFAHIGKEITSMESSUNGEN UND ZUSTANDSDIAGRAMME

(Conductivity Measurements and Phase Diagrams)

J. Teltow, Dresden,

Institut fur Festkörperforschung der Deutschen Akademie der Wissenschaften zu Berlin, Zweigstelle Dresden

(Institute for Research of Solids of the German Academy of Sciences, Berlin, Dresden Affiliate)

ABSTRACT.

The electrical conductivity of solid silver bromide with admixtures of $CdBr_2$, as well as $PbBr_2$, $CaBr_2$, and $ZnBr_2$, is measured at various temperatures in a mixed crystal phase produced by special research. Here the individual effect of admixture ions is far less in comparison with their double charge effect.

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QUANTITATIVE DEUTUNG DER LEITFAHIGKEITSISOTHERMEN. II

(Quantitative Meaning of Conductivity Isotherms)

[Ibidem]

Concentration and mobility of disorder positions (cations in interlattice positions and in cation holes) is derived from measured isotherms of electrical conductivity. The resistance effect of disorder positions, which never should be neglected, is discussed on basis of two simple hypotheses (association or ion cloud). A preponderance of the interlattice ion-wandering is observed in studies of a model of wandering mechanism.

In this work an attempt is made to evaluate quantitatively the results of the previous publication [see previous abstract - Trans] on the basis of the disorder theory of Frenkel, Schottky and Wagner; namely, under Frenkel's assumption of the simple boundary case (disorder only in the cation part of the lattice). The effect of eventual anion holes is discussed at the end. The effect of admixed cations on the charge displacement is here neglected. Although the experimental proof of this assumption is not available, we may nevertheless assume in advance that the mobility of these divalent ions is small relative to silver ions, because they require double activation energy for their motion.

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"Annalen der Physik", 6. Folge, Band 5, Heft 1-2 (15 Jun 1949) pp 63-70 and 71-88.

Solid State Physics - Conductivity

# MAGNETISCHE WIDERSTANDSÄNDERUNG UND LEITFÄHIGKEITSTYPEN

## (Variation in Magnetic Reluctance and Conductivity Types)

Max Kohler, Horb/Neckar, Schillerstr. 22

ABSTRACT.

Part I.

On the basis of concepts in the general electron theory it is shown that the behavior of divalent metals in a strong magnetic transverse field is uniform. Without any special assumptions as to the interaction mechanism of electrons with the lattice, or with the eigenvalue distribution of electrons or with the crystal structure, it is concluded that electric resistance in the boundary case of a very strong magnetic field increases proportionally to the square of the magnetic field. Accordingly these metals become insulators in the case of extrapolation $H = \infty$. The following assumptions are essential for the derivation of the general results: (1) The number of holes in the first energy band is exactly equal to the number of electrons in the second band; (2) a not too strong overlapping of both energy bands; (3) complete degeneration of the electron gas.

According to the derivation this result is the most general in the modern conductivity theory of metals. An admirable success in the electron theory of metals should be found in the agreement of one of the two Justi conductivity types with experimental results. Probably the behavior of these metals in a magnetic field is caused by the smallness of the Hall field strength and therefore by its failure to increase conductivity.

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Part II.

The electrical resistance and the Hall coefficient of univalent metals of cubic-crystal symmetry in an extreme strong field is studied from electron theory viewpoint, without requiring specialization in the eigenvalue distribution and the collision mechanism of electrons with lattice. The electrical resistance and the Hall coefficient exhibit saturation with respect to dependance on the magnetic field. The Hall coefficient is in general isotropic. Simple relations appear if the boundary energy surface does not reach the surf

surface of the Brillouin zone. In this case the variation in transverse resistance is isotropic and the variation in longitudinal resistance equals at most the transverse. The Hall coefficient is equal to the quantity valid for free electrons. We should conclude from the empirical anisotropy of the resistance variation in most univalent metals that the boundary energy surface at least closely approaches the surface of the Brillouin zone, which is not likely to happen in the case of free electrons. An exception seems to occur in the case of K. From new measurements of the Hall constant of alkalis by Justi a binding effect in these metals, stronger than recently assumed, is derived.

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"Annalen der Physik" 6. Folge, Band 5, Heft 1-2 (15 Jun 1949), pp 89-98 and 99-107.

Solid State Physics - Conductivity, Reluctance

# ZUR LEITAHIGKEITSANDERUNG VON CADMIUMSULFIDEINKRYSTALLEN BEI BESTRAHLUNG MIT RONTGENSTRAHLEN

(Variation in the Conductivity of Cadmium Sulphide Monocrystals during Irradiation with X-rays)

J. Fassbender and O. Hachenberg, Berlin-Buch

Institut für Festkörperforschung der
Deutschen Akademie der Wissenschaften.

(Inst. for Research of Solids of
the German Acad Sci)

ABSTRACT.

The variation in the photoelectric resistance of a cadmium sulphide monocrystal drawn in vapor phase is investigated and compared with the already familiar and corresponding photoelectric properties of these crystals. If irradiated by X-rays within a 20 to 65 kV range, similarly as in the case of light, the energy absorbed by the crystal is found to be proportional to the photon beam.

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"Annalen der Physik" 6. Folge, Band 6 (19 Sep 1949), pp 229-231.

# ZUR THEORIE DER SUPRALEITUNG

(Theory of Superconductivity)

F. Möglich and R. Rompe, Berlin-Buch

Institut für Festkörperforschung der Deutschen Akademie der Wissenschaften

Berlin, Institut für theoretische Physik und II. Physikalisches Institut der Humbolt-Universität.

(Inst. for Research of Solids of the German Acad. Sci.)

(Berlin, Inst. for theoretical Physics and II. Physical Inst. of the Humbolt-University)

ABSTRACT

It is shown that the theory of superconductivity, as presented by writers, leads to an expression of energy density in agreement with assumptions of the phenomenological theory by von Laue and London. It is shown further that the transverse states of the plasma, which are the carriers of the superconducting phenomena, are characterized by their vanishing interaction with the metal lattice.

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"Annalen der Physik" 6. Folge, Band 6, (19 Sep 1949) pp 177-192.

**Solid State Physics - Superconductivity**

# DAS HERKUNFTS- UND STOSSZEITPROBLEM IN DER ELEKTRONENTHEORIE DER FESTLEITER

(The Problem of Origin and Collision Time in the Electron Theory of the Solid Conductor)

Walter Schottky, Pretzfeld/Oberfranken.

ABSTRACT.

The topic of the following discussion is why in the case of a correct treatment of electron collision processes in solid conductors the concept of collision time-interval or free path seems incongruent. It is first established (No 2) that this concept is not misinterpreted if we consider the "origin rates" of electrons as specified; the further fate of each electron group newly generated by collision in a volume element is indeed defined by the law of motion and by exactly determinable collision intervals (or free path). It is then possible to determine the perturbed distribution from the original rates, the law of forces and similar collision intervals, by means of a general origin synthesis, related to Riecke-Drude considerations, as well as by Lorentz-Boltzmann equation (No 3); the equations defining origin synthesis appear to be space or time integrals over space-time particular solutions of the LB-equations.

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"Annalen der Physik" 6. Folge, Band 6, (19 Sep 1949) pp 193-214.

Solid State Physics - Electron Collision

# BERECHNUNG VON ELEKTRONENBEWEGLICHKEITEN IN CADMIUMSULFID-EINKRISTALLEN AUS WECHSELLICHTMESSUNGEN

(Computation of Electron Mobility In Cadmium Sulphide Monocrystals from Measurements by Alternating Light)

J. Fassbender and H. Lehmann, Berlin-Buch

Institut für Festkörperforschung der Deutschen Akademie der Wissenschaften.

(Inst. for Research of Solids of the German Acad Sci.)

ABSTRACT.

The photoconductivity of synthetically grown CdS-monocrystals was measured with respect to modulation frequency, intensity and wave length of incident light. The conductivity and the modulation degree are approximately computed on the basis of an energy-band model. The results of measurements are satisfactorily confirmed by the derived relations. The quantitative evaluation enables one to determine the order of magnitude of mobility and concentration of conducting electrons, as well as the recombination coefficients.

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"Annalen der Physik" 6. Folge, Band 6 (19 Sep 1949) pp 215-228.

# THEORIE DER MAGNETISCHEN WIDERSTANDSEFFECTE IN METALLEN

## (Theory of the Reluctance Effect in Metals)

Max Kohler, Horb/Neckar
Schillerstr. 22

ABSTRACT.

Reluctance effects (rise of electric and thermal resistance) of the simplest two-band models are discussed in a general way, without particular consideration of the collision mechanism. The basic statistical equation is solved in a general case according to the procedure employed for the first time by Engskog in the gas theory. Approximative expressions are derived for the electric and thermal resistance in the transverse magnetic field, agreeing with the interpolation formulas derived by Sondheimer and Wilson. The same formulas would be obtained if we took into account the collision time intervals of the electrons, where of course the collision time intervals in processes of purely electric nature at low temperatures differ essentially of those of purely thermal nature. Therefore a computation using the average collision time intervals, including also those at low temperatures, is justified to a certain extent. Thanks to the derived formula, the approximative character of similarity formulas for relative resistance variation (electric or thermal) depending on the magnetic field, and the magnitude of the resistance independent of the magnetic field are revealed in a way similar to the case of Mathiessen's rule or the law of the isothermal straight line. The approximative validity of the similarity rule for relative heat resistance variation

$$\frac{\Delta w}{w_o} = G(H/T \cdot w_o \cdot TL_{S_o})$$

is confirmed by the measurements by de Haas and de Nobel on pure W and by Grüneisen and Erfling on very pure Be-crystals.

The Grüneisen's method for determination of the lattice conductivity as in the case of metals theoretically based on the first conductivity type in a strong transverse magnetic field. The so-obtained small absolute values of lattice conductivity at low temperatures agree with the general interpretations of the theory, stating that the lattice conductivity of metals strongly decreases in comparison with that of insulators, because of the strong interaction of lattice vibrations with electrons.

It is shown by the reduced diagram of the studied metals of the periodic system that the number of valence electrons does not exclusively depend on the conductivity type, but also on the crystalline structure.

In general it is established: Because of its complex mathematical apparatus only few relatively general statements can be made in the theory of reluctance effects. But these statements are well confirmed by experiments. This fact supports the assumption that the modern electron theory of metals may extensively explain by logical formulation the aggregate of phenomena, creating many theoretical difficulties. The previously met rough contradictions to experience were always revealed as theoretical incongruities.

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"Annalen der Physik" 6. Folge, Band 6 (19 Sep 1949) pp 18-38.

# UBER DIE BEDEUTUNG DER ELEKTRONENSTOSSANREGUNG FUR DIE DYNAMIK DER MOLEKULFELDER ORGANISCHER VERBINDUNGEN

(Significance of Electron Impact Excitation in the Dynamics of Molecular Fields of Organic Compounds)

H. Schüler, L. Reinbeck and A. Woeldike,
Hechingen, Kaiser Wilhelm Institut für Physik.
(Kaiser Wilhelm Institute for Physics)

ABSTRACT.

The study of emission spectra of organic compounds excited by electron impact of a glow discharge supplies us with an insight of the disintegration possibility of the excited molecule. Proof of short-lived free radicals is seen. These free radicals seem to be important for the explanation of phosphorescence of organic molecules.

Further, a "blocking effect" is observed, the significance of which is sought in the mass distribution within the molecule and which has a parallel in fluorescence phenomena.

Finally we obtain new viewpoints on whether the excitation of a molecule should be considered as localized or general excitation.

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"Annalen der Physik" 6. Folge, Band 6, (19 Sep 1949) pp 110-116.

Solid State Physics - Electron Excitation

# ZUR INNEREN FELD-THEORIE UND UNTERSUCHUNGSMETHODIK DER DIELEKTRISCHEN RELAXATION IN DIPOLFLUSSIGKEITEN

(Internal-Field Theory and Investigative Procedure of Dielectric Relaxation in Dipole Fluids)

Erich Fischer, Hechingen

Kaiser-Wilhelm Institut für Physik
(Kaiser-Wilhelm Institute for Physics)

ABSTRACT.

The Onsager-Kirkwood internal-field theory of electric polarization is extended to relaxation by derivation of practical useful formulas for the evaluation of the relaxation time using quantities measured at high frequencies $\varepsilon'$ and $\varepsilon''$ ( $\varepsilon = \varepsilon' - i\varepsilon''$ ). The results may be correlated by means of Debye formulas, derived in agreement with Clausius-Mosotti field, and by estimation of reduction factors and may be compared with the theory of rotation impedance. The possibility of an experimental check of the theoretical assumptions on the internal field in connection with relaxation investigations (expecting a later experimental work) and its significance in the treatment of the association problem in dipole fluids are discussed.

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"Annalen der Physik" 6. Folge, Band 6 (19 Sep 1949) pp 117-128.

Solid State Physics - Dielectric Relaxation

# MESSUNGEN DER DIFFUSEN STREUUNG VON RONTGENSTRAHLEN AN KRISTALLEN UND IHRE BEEINFLUSSUNG DURCH EINE PLASTISCHE VERFORMUNG MIT DEM INTERFERENZZAHLROHR*

(Diffuse Scattering of X-Rays by Crystals and Their Dependence on Plastic Deformation, Measured by an Interference Counter Tube*)

*[Except from the dissertation by G. Wagner at the Tech. Univ. Stuttgart (1948). Previous publication in Z. Naturforschg. 3a, 364,(1948)]

Gustav Wagner and Albert Kochendörfer, Stuttgart.

Institut für theoretische und angewandte Physik der Technischen Hochschule und Max-Planck-Institut für Metallforschung.

(Institute for theoretical and applied physics of the Technical Univ. and Max-Planck-Institute for Research on Metals)

ABSTRACT.

The diffuse scattering of x-rays is measured by a sensitive array of counter tubes by single-pulse counting of zinc monocrystals and aluminum polycrystals. The effect of plastic deformation on scattering is investigated. For purposes of comparison the total intensity of normal interferences of silver polycrystals is measured and repeated with plastic deformation. In both cases no noticeable variations in intensity were found. Recent research and various derived results are discussed.

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"Annalen der Physik" 6. Folge, Band 6 (19 Sep 1949) pp 129-145.

Solid State Physics - X-ray Scattering

# ZUR VERSTARKUNG VON ELEKTRONENSTROMEN IN BESTRAHLTEN KRISTALLEN

(Intensification of Electron Beams in Irradiated Crystals)

R. W. Pohl and F. Stockmann, Göttingen,

I. Physikalisches Institut der Universität
(Physical Institute of the University)

ABSTRACT

The intensification of electron beams which is observed during irradiation of semiconductors is defined, independently of all concepts of the conducting mechanism, by the life-time tau of the state enabling the electrons to wander (eq-1). The irradiations of semiconductors by high-energy corpuscular rays and gamma-quanta confirm fortunately the observations known for many years from irradiations by visual and ultraviolet light.

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"Annalen der Physik" 6. Folge, Band 6 (19 Sep 1949), pp 89-92.

Solid State Physics - Electron Beam, Semiconductors

# ZUR THEORIE DER UNVOLLSTANDIGEN SUPRALEITUNG

## (Theory of Imperfect Superconductivity)

Heinz Koppe, Göttingen

Max Planck Institut für Physik
(Max Planck Institute for Physics)

ABSTRACT

The behavior of a material, which in the normal state of conductivity of the basic substance contains small isles in a superconducting phase, is investigated. We thus obtain an ohmic conductor with a conductivity extremely sensitive to the magnetic field.

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"Annalen der Physik" 6. Folge, Band 6 (19 Sep 1949) pp 375-380.

Solid State Physics - Superconductivity

# ABKÜHLEN UND EINSCHALTVORGANGE AN SUPRALEITERN NACH DER VON LAUESCHEN THEORIE

(Cooling and Connecting Processes in Superconductors according to Von Laue's Theory)

Gerhard U. Schubert, München.
Laboratorium für technische Physik
der Technischen Hochschule.

(Laboratory for Applied Physics
of the Technical University)

ABSTRACT.

The basic equations of Von Laue's electrodynamics of superconductors are solved for permeability depth variable with time. It provides a phenomenological description of the Meissner effect. The application of an external homogeneous magnetic field to a superconducting half-space with constant temperature is studied, while a solution of Maxwell's equations in an external space and of Von Laue's equations in superconductors, satisfying the stability conditions on the boundary surface, are derived and lead, for $t \to \infty$ in the external space, to a homogeneous magnetic field. It also enables one to study the expansion of the electromagnetic wave front in superconductors.

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"Annalen der Physik" 6. Folge, Band 5, Heft 3-5 (26 Nov 1949), pp 213-236.

Solid State Physics - Superconductivity, Von Laue's theory of

# EINE NICHT-LINEARE PHANOMENOLOGISCHE THEORIE DER SUPRALEITUNG

(A Nonlinear Phenomenological Theory of Superconductivity)

M. Von Laue, Göttingen
Max-Planck Institute für Physik
(Max-Planck Physics Institute)

ABSTRACT

The here-presented new form of superconductivity inherits from the older forms the separation of the conductivity mechanism into ohmic and superconducting parts. It further accepts London's equations for the latter part, but it substitutes for the until recently linear relation between superimpulse and super-current density a nonlinear and still widely undetermined relation. Nevertheless this theory is able to deal with all essential statements of the older theory, as far as they concern stationary cases, either completely, or - as in the case of the Meissner effect - in their essential lines while remaining in agreement with experience. Essential discrepancies should occur in the case of electrical alternating fields, if the amplitudes of oscillations rise too high to fit into the linear approximations, which are correct for weak fields.

The new form is convenient to conceive the idea of maximum current density and therefore to facilitate the quantum theory of superconductivity.

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"Annalen der Physik" 6. Folge, Band 5, Heft 3-5 (26 Nov 1949) pp 197-207.

Solid State Physics - Superconductivity, Nonlinear Theory of

# WARMELEITUNG DER METALLE IM STARKEN MAGNETFELD

## (Thermal Conductivity of Metals in a Strong Magnetic Field)

Max Kohler, Horb/Neckar
Schillerstr 22.

ABSTRACT.

The thermal conductivity lambda $\lambda_H$ behaves in an extremely strong transverse magnetic field much like electrical conductivity sigma $\sigma_H$. Bivalent metals show an electron conductivity proportional to $1/H^2$, while univalent metals show in a strong magnetic field a saturation value of thermal conductivity independent of the magnetic field H.

The relation between $\lambda_H$ and $\sigma_H$, used by Grüneisen and de Haas for the extrapolational determination of lattice conductivity is derived for bivalent metals (in a more general form for two band models, in which the number of electrons in one band equals exactly the number of "holes" in the other band) theoretically as a limiting law in the case of a strong magnetic field.

The measurements by Grüneisen and co-workers on Be result in the first exact definition of a metallic lattice conductivity at about 23° absolute.

While the Grüneisen-de Haas method requires for the determination of lattice conductivity measurements of both conductivities (electric and thermal) at the same temperature in various magnetic fields, we present a method, based on formula (15b), which requires only the measurement of thermal conductivity for various strengths of the magnetic field. In the case of Be $\parallel$ and Be $\perp$ crystals, the measurements by Grüneisen and Adenstedt and by Gruneisen and Erfling confirm the applicability of this method. In the case of $Be_2$ crystal this method gives the same value of lattice conductivity as the Grüneisen-de Haas method.

The absolute thermal force shows in all cases saturation in an extreme magnetic field. A simple relation is derived between the Hall coefficient and the Righi-Leduc coefficient in a strong magnetic field.

The presented investigations do not require special assumptions on the interaction mechanism of electrons with the lattice or of the eigenvalue distribution.

"Annalen der Physik" 6. Folge, Band 5, Heft 3-5 (26 Nov 1949) pp 181-189.

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# UBER FERROMAGNETISCHE PLATIN-MANGAN-LEGIERUNGEN

## (Ferromagnetic Platinum-Manganese-Alloys)

M. Auwärter and A. Kussmann, Weida/Thüringen

Deutsches Amt für Mass und Gewicht
(German Office for Weights and Measures)

ABSTRACT.

Pt-Mn alloys exhibit, at 6 to 16% by weight (18 to 32 at .%) of manganese, ferromagnetic properties with a saturation maximum at $4\pi J \approx 8000$ gauss. The ordered atom pattern $Pt_3Mn$ within the mixed crystal rich in platimum is the carrier of ferro-magnetism. Magnetic susceptibility, thermal expansion, lattice constants and transition temperatures of the alloys are established.

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"Annalen der Physik" 6. Folge, Band 7, Heft 3-4 (1 Apr 1940) pp 169-172.

Solid State Physics - Ferromagnetism in Pt-Mn Alloys.

# UBER MAGNETISCHE EIGENSCHAFTEN VON PLATIN-EISEN-LEGIERUNGEN. II

## (Magnetic Properties of Platinum-Iron Alloys. II)

A. Kussmann and G. Countess von Rittberg, Weida/Thüringen

Deutsches Amt für Mass und Gewicht
(German Office of Weights and Measures)

ABSTRACT.

A remade study of the magnetic behavior of platinum-iron alloys yielded the following results.

1. Variation of saturation and doubling of Curie lines of alloys with platinum content of 50 and 63% by weight could be phenomenologically clarified and explained by the formation of the super-structure phase of $Fe_3Pt$.

2. Within this range the highest yet observed magnetostriction of ferromagnetics was found, namely a length effect of $di/\lambda = 180 \cdot 10^{-6}$ and an extension over the saturation point of round $40 \cdot 10^{-6}$ for each 1000-oersted rise in field strength.

3. The optimal permanent magnetization behavior occurs in the compound with 70% by weight of Pt, while coercive forces of 1900 oersted (for $J = 0$) appear with residual magnetization of 6000 gauss. Magnetostriction of these alloys is very weak.

4. Beyond the until recently assumed limit of ferromagnetic behavior, platinum with small iron content (94 to 98% by weight of Pt) still has a narrow range of ferromagnetism at low temperatures.

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"Annalen der Physik" 6. Folge, Band 7, Heft 3-4 (1 Apr 1940) pp 173-181.

Solid State Physics - Ferromagnetism in Pt-Fe Alloys.

# ZUR THEORIE DER LUMINESCENZ UND DER ELEKTRISCHEN LEITFAHIGKEIT VON KADMIUMSULFIDKRISTALLEN*

(The Theory of Luminescence and of Electric Conductivity of Cadmium Sulfide Crystals*

*(Report read by R. Warminsky on 28 Feb 1950 at a Colloquium of the Kaiser-Wilhelm Institute for Physical Chemistry and Electrochemistry, Berlin-Dahlem)

Immanuel Broser and Ruth Warminsky, Berlin-Dahlem

Kaiser-Wilhelm Institut für physikalische Chemie und Elektrochemie

(Kaiser-Wilhelm Institute for Physical Chemistry and Electro chemistry)

ABSTRACT.

Processes occurring in CdS while excited to luminescence and electric conductivity are quantitatively discussed on the basis of the Riehl-Schön band model. It is assumed that the charge transfer occurs not only in the free band, but also over the trapping centers. Luminescence and conductivity are reduced to charge concentration in the various groups of terms. Reaction kinetics for computation of charge concentration may be developed into a simple system of differential equations, expressing the properties of the real-crystal (concentration of trapping positions and excitons) and containing explicitly the excitation density as well as the temperature. Because the general solution of the equations involves mathematical difficulties, important particular cases easily checked experimentally are computed. Computational results quantitatively reflect well the electric and optic behavior of crystals, established experimentally, as well as the connection between luminescence and conductivity. Some constants (recombination factor, electron mobility) are computed by making use of measurements.

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"Annalen der Physik" 6. Folge, Band 7, Heft 6 (15 Jun 1950) pp 289-311.

Solid State Physics - Photoconductivity and Luminescence

# ZUR FLUORESZENZANREGUNG ORGANISCHER SUBSTANZEN DURCH ALPHATEILCHEN UND GAMMASTRAHLEN*

(Flourescence Excitation of Organic Substances by Alpha-Particles and Gamma Rays*)

*Supplement to "Die Fluoreszenzanregung von festem und flüssigem Naphthalin, Diphenyl und Phenanthren durch Alpha-Teilchen, schnelle Elektronen und Gammastrahlen", L. Herforth and H. Kallmann, Ann. Physik 4, 231 (1949)

Lieselott Herforth
Berlin-Buch, Institut für Medizin
und Biologie der Deutschen
Akademie der Wissenschaften
(Berlin-Buch, Institute for Medicine
and Biology of the German Academy
of Sciences)

ABSTRACT.

As continuation of previous (2) fluorescence measurements of liquid naphthalene, diphenyl and phenathrene a number of further organic substances are investigated with respect to transparency and output during excitation by alpha and gamma rays. Fluorescence spectra of the studied substances are measured during excitation with alpha particles.

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(2) I. Broser, L. Herforth, H. Kallmann and U. M. Martius, Z. Naturforsch. 3a, 6 (1948); loc. cit. Dissertation, LieselottHerforth (1948) T. U. Berlin.

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"Annalen der Physik" 6. Folge, Band 7, Heft 6 (15 Jul 1950) pp 312-320.

Solid State Physics - Fluorescence in Organic Substances

# FEHLORDNUNGSERSCHEINUNGEN UND PLATZWECHSELVORGANGE IN ELEKTRONENLEITENDEN MISCHPHASEN

(Disorder Phenomena and Site Exchange Processes in Electron Conducting Mixed Phases)

Karl Hauffe, Greifswald

Phys.-chem. Abtl. der Chemischen Institutes der Universität.
(Phys. Chem. Div of the Chemical Institute of the University)

ABSTRACT.

The Wagner-Schottky disorder theory is extended to electron conducting heterotypical mixed phases. It may be shown here, either experimentally or on a model, that an addition of high or low-valency oxides to a carrier-oxide results in a definite variation of conductivity in the meaning of the theory of semiconductivity. The following general rules were found:

1. The electrical conductivity of conductors with electron deficit is increased by the addition of low-valency cations and decreased by the addition of high-valency cations.

2. In the case of conductors with electron excess the phenomena are reversed. In this case the electrical conductivity is decreased by the addition of low-valency cations and increased by the addition of high-valency cations.

3. Superconductors with lattice eigen semiconductivity exhibit as well during addition of low or high-valency cations, an increase of conductivity.

The rules found in electron-conducting mixed systems allow, by means of the Wagner theory of scale processes on metallic alloys, one to predict the effect produced by addition of a foreign metal on the scaling rate of the metal.

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"Annalen der Physik" 6. Folge, Band 8, Heft 3-4 (10 Nov 1950), pp 201-210.

Solid State Physics - Conductivity of metals

# REFLEXIONSEFFEKTE BEI DER NICHTLINEAREN THEORIE DER SUPRALEITUNG

(Reflection Effects in the Case of a Nonlinear Theory of Superconductivity)

Walter Heywang, Würzburg

Physikalisches Institut der Universität.
(Physical Institute of the University)

ABSTRACT.

Effects of harmonic oscillations which, according to Koppe's theory, occur in the case of reflection of an electric wave from a superconductor are investigated. It is shown that these effects are substantially modified by a superposed direct current and may be brought within measurable range.

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"Annalen der Physik" 6. Folge, Band 8, Heft 3-4 (10 Nov 1950), pp 187-200.

# ZUR PHOTELEITFAHIGKEIT VON CADMIUMSULFID EINKRYSTALLEN BEI TIEFEN TEMPERATUREN

## (Photoconductivity of Cadmium Sulfide Monocrystals at Low Temperatures)

E. A. Niekisch, Berlin

II. Phys. Inst. der Humbolt Univ.
(II. Inst. of Physics of the Humbolt Univ.)

ABSTRACT.

Photocurrent (during excitation in the region of ground-lattice and discharge absorption) was measured in synthetic CdS monocrystals, as well as the position and shape of the "selective maximum" of conductivity, in relation to temperature, ranging from room temperature to that of liquid air. Under the assumption of two recombination processes, different in behavior, due to dependence on temperature, one process non-radiative and monomolecular and the other radiative and bimolecular, as was previously suggested for the explanation of luminiscent properties of similar crystal phosphors (ZnS, ZnCdS) within the framework of the Riehl-Schön energy-band model, the experimental state may be evaluated in some respect, without taking into account the function of intermediate terms lying in the forbidden zone.

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"Annalen der Physk" 6. Folge, Band 8, Heft 5-8 (15 Feb 1951) pp 291-300.

# UBER STRENG PUNKTFORMIGE ELEMENTARLADUNGEN. EINE BEMERKUNG ZUR KLASSISCHEN ELEKTRONTHEORIE

(Elementary Strictly Point Charges. A Remark Concerning Classical Electron Theory)

Erich Kretschmann, Halle (Salle)

Institut für Theoretische Physik.
(Institute for Theoretical Physics)

ABSTRACT.

It is shown how the simple assumption of elementary strictly point charges can be set in agreement with the law of conservation of energy and spin moment. The most important consequences derived from the suggested variation of the electron theory, are indicated.

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"Annalen der Physik" 6. Folge, Band 4, Heft 6 (1 Mar 1949) pp 331-334

Electrodynamics - Point Charges

# ÜBER DIE THEORIES DER ELEKTRISCHEN UND MAGNETISCHEN ABLENKUNG VON ELEKTRONENSTRAHLENBUNDELN UND EIN IHR ANGEPASSTES STÖRUNGSVERFAHREN

(The Theory of Electric and Magnetic Deflection of Electron-Ray Bunches and a Suitable Disturbance Method)

Walter Glaser
Wien, Lehrkanzel für angewandte Physik der Technischen Hochschule

(Vienna, Chair for Applied Physics of the Technical Univ)

ABSTRACT.

A disturbance method well suited to the theory of deflection of electron-beam bunches which was used in 1938 to compute deflection errors of electric and magnetic deflection systems, was developed. Results of this work are once more summarized, and it is shown that the results of the treatise: "Beiträge zur Theorie der elektrischen Ablenkung von Elektronenstrahlbündeln" (Contributions to the Theory of Electric Deflection of Electron-Beam Bunches") by Johannes Picht and Josef Himpan I and II (cf: Ann Physik 39, 410 (1941)) which will be quoted in the following text as P-H-I and P-H-II (1941) represents particular cases included in our previous work of 1938 (cf: W. Glaser, Z. Physik 111, 357, (1938), quoted as Z. Ph. (1938)) as cases limited to a purely electric deflection field and to the absence of a lateral diffusion field.

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"Annalen der Physik" 6. Folge, Band 4, Heft 7 (6 May 1949), pp 389-408.

Electrodynamics - Electron Optics

# DER ENERGIE-IMPULSTENSOR IN DER VON LAUE-LONDONSCHEN ELEKTRODYNAMIK DER SUPRALEITERS

(The Energy-Impulse Tensor in the von Laue-London Electrodynamics of Superconductors)

Gerhard U. Schubert, München

Laboratorium für technische Physik der Tech. Hochschule
Laboratory for Applied Physics of the Tech. Univ.)

ABSTRACT.

The conservation laws of momentum and energy of von Laue's electrodynamics of superconductors at rest may be expressed in a relation among Lorentz invariant quantities. An assumption as to the force density in superconductors allows one to derive the energy-impulse tensor.

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"Annalen der Physik" 6. Folge, Band 6, (19 Sep 1949) pp 163-168.

Electrodynamics - Superconductivity

# DIE KANTENBLEDINGUNG IN DER THEORIE DER BEUGUNG ELEKTROMAGNETISCHER WELLEN AN VOLKOMMEN LEITENDEN EBENEN SCHIRMEN

(The Boundary Condition in the Diffraction Theory of Electromagnetic Waves by Perfectly Conducting Flat Screens)

J. Meixner, Aachen,
Institut für theoretische Physik
der Technischen Hochschule

(Institute for Theoretical Physics
of the Technical University)

ABSTRACT.

The behavior of electromagnetic fields in the vicinity of boundaries of perfectly conducting surfaces is studied. Usually the electromagnetic field strength rises infinitely high on the boundary. In order to definitely define the electromagnetic boundary value problems, particularly diffraction problems, the order of tending to infinite should be limited in an appropriate manner. This is realized by the boundary condition. It consists in the physically plausible requirement that the electromagnetic energy density in the vicinity of the boundaries be integrable; i.e., that the field energy be finite in every finite volume. A particularly simple mathematical expression of the boundary condition is supplied by the Debye potentials of the electromagnetic field. The necessity of the boundary condition arises, because solutions of Maxwell's equations do not satisfy the boundary conditions and exhibit a behavior contradictory to physical conditions. A simple example in this matter is presented.

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"Annalen der Physik" 6. Folge, Band 6, (19 Sep 1949) pp 2-9.

Electrodynamics - Diffraction of Waves

# DIE DIFFUSIONSTHEORIE DER POSITIVEN SAULE IN ELEKTRONEGATIVEN GASEN

## (The Diffusion Theory of the Positive Column in Electronegative Gases)

R. Seelinger, Greifswald,
Physikalisches Institut.

(Physical Institute)

ABSTRACT.

The diffusion theory of the positive column is extended to electronegative gases, in which negative ions also play a role of charge carriers. One is not permitted here simply to add complementary terms to the relation between $D_a$ and q, defining the electron temperature in the initial theory, but must bo backwards to formulas of cross currents. The resulting simultanous differential equations may be solved under some simplifying assumptions to yield final formulas easy to evaluate.

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"Annalen der Physik" 6. Folge, Band 6 (19 Sep 1949), pp 93-96.

Electrodynamics - Diffusion theory, Electronegative Gases

# ZUR DEFINITION DES MAGNETISCHEN MOMENTES

(Definition of Magnetic Moment)

W. Döring, Braunschweig

Lehrstul für Theor. Physik der Techn Hochschule
(Chair of Theoretical Physics of the Tech. Univ.)

ABSTRACT.

If we define the magnetic moment $M_H$ of a body magnetized while immersed in a liquid medium of permeability $\mu$, by the equation: mechanical torque $D_{mech} = [M_H \cdot H]$ and accordingly the magnetization $T_H$ by the equation $B = \mu_0 H + I_H$, then $M_H$ equals the volume integral over the magnetization of the body itself and over the magnetization induced by the eigen-field of the magnet in its surrounding. Because of convergence it is necessary to pay attention to the integrating order of the infinite volume integrals encountered during computation. However, if we define the magnetic moment in such a way that induction B plays instead of H the role of "magnetic field strength", then the corresponding relation is lost. In the case of a current circuit a similar definition leads to an expression of magnetic moment, in which besides current strength the permeability of the surrounding medium arises as factor. It is shown that this factor accounts for the fact that the eigen-field of the current loop induces magnetization in the surrounding medium, in a such way that the total magnetic moment of the current loop and of the surrounding medium is proportional to $\mu$. The preference of some manuals to define magnetic moment as ratio of torque and induction B leads to a number of unpleasant aspects in physical relations and besides destroys in many cases the analogy to corresponding relations in electrostatics.

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"Annalen der Physik" 6. Folge, Band 6 (19 Sep 1949) pp 69-88.

Electrodynamics - Magnetic Moment

# EINIGE EINFACHE ÜBERLEGUNGEN ZUR RUCKDIFFUSION SCHNELLER ELEKTRONEN

## (Some Simple Discussions of the Back-Diffusion of Fast Electrons)

W. Bothe, Heidelberg

Physikalisches Institut der Universität und
Institut für Physik am Kaiser-Wilhelm-Institut
für med. Forschung

Physical Institute of the University and
Institute for Physics of the Kaiser-Wilhelm
Institute for med. Research

ABSTRACT.

In part 1 the back-diffusion of fast electrons from a thick wall is treated as an albedo problem. This method is valid for the low-energy part of back-diffused electrons. In part 3 a strict diffusion theory is discussed in order to comprehend more exactly at least a part of the back-diffusion process. The maximum of the energy distribution curve is well defined. In part 4 the effect of separate scattering on back-diffusion is briefly discussed.

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"Annalen der Physik" 6. Folge, Band 6 (19 Sep 1949) pp 44-52.

Electrodynamics - Back-diffusion of electrons

# ZUR THEORIE DER RADIALSCHWINGUNGEN DER ELECTRONEN IN EINER ELEKTRONEN-SCHLEUDER

(Radial Oscillations of Electrons in an Electron Accelerator)

Helmut Jahn and Hans Kopfermann, Gottingen.

Zweites Physikalisches Institut der Universität
(Second Physical Institute of the University)

ABSTRACT.

From the equations of electron motion in the electromagnetic field of an electron accelerator approximative formulas are derived for the electron oscillations around their instantaneous circle with finite amplitude; in particular the damping of these amplitudes is given and applied to the field of the 6-MeV electron accelerator of the Siemens-Reiniger Works.

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"Annalen der Physik" 6. Folge, Band 6 (19 Sep 1949), pp 305-320.

Electrodynamics - Induction Accelerator, Design

# DIE ELEKTRISCHEN UND MAGNETISCHEN FLÄCHENWIRBEL BEI BEWEGTEN KÖRPERN

(Electric and Magnetic Surface Vortices in the Case of Moving Bodies)

Theodor Schlomka, Hannover
Wilhelm Busch Str. 7.

ABSTRACT.

If an electrically and magnetically polarized body is moved, abrupt jumplike variations of D and B appear to the observer at rest along the space drawn in a straight line by the boundary surface of the moving body. These local instantenous field-jumps of D and B along the moving boundary surface of the body mean surface vortices of H and E to observers at rest. Formulas for these surface vortices of H and E and for the surface vortex of the "driving electric field strength" $E^* = E + v \cdot B$ are given. An appendix contains a derivation of a general formula for the local instantenous field-jump $\frac{-\Delta F}{\partial t}$ on the boundary surface of any moving body, which is the carrier of an arbitrary vector field F.

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"Annalen der Physik" 6. Folge, Band 5, Heft 3-5 (26 Nov 1949) pp 190-196.

Electrodynamics - Moving Charges

# "NATURLICHE MASSEINHEITEN" UND ELEKTRODYNAMIK

## ("Natural Units of Measurement" and Electrodynamics)

U. Stille, Braunschweig,
Physikalisch-Technische Anstalt
des Vereinigten Wirtschaftsgebiets.

(Physical-Technical Institute of the Bizone)

ABSTRACT.

By means of a specially selected law of "natural units of measurement" which, besides three mechanical and one thermal units, contain in each case an electric and a magnetic elementary basic unit, it is shown how the discriminating quantity definition of electric and magnetic quantities, based on 3, 4 and 5 basic quantities, is affected in the domain of atomic physics. Here a simple representation and significance of the quantity gamma of atomic physics, characteristic for the 5-basic-quantity interpretation of electrodynamics, are obtained.

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"Annalen der Physik" 6. Folge, Band 5, Heft 3-5 (26 Nov 1949), pp 208-212.

# STRENGE THEORIES DER BEUGUNG EBENER ELEKTROMAGNETISCHER WELLEN AN DER VOLKOMMEN LEITENDEN KREISSCHEIBE UND AN DER KREISFORMIGEN OFFNUNG IM VOLLKOMMEN LEITENDEN EBENEN SCHIRM

(Precise Theory of the Deflection of Plane Electromagnetic Waves by a Perfectly Conducting Circular Disk and by a Circular Aperture in a Perfectly Conducting Flat Screen)

J. Meixner and W. Andrejewski, Aachen

Institut der theoretischen Physik der Techn. Hochschule.
(Institute of Theoretical Physics of the Tech. Univ.)

ABSTRACT.

The problem of the deflection of electromagnetic waves by a perfectly conducting flat circular disk is exactly solved by the Hertz's potential vector and its expansion into spheroidal functions. The solution satisfies besides boundary and emission conditions, also edge condition and therefore has a unique value.

In the limiting case of long waves particular attention is paid to the field behavior and distribution of the current induced in the deflecting circular disk.

Owing to the validity of the generalized Babinet principle, the additional problem of deflection produced by a circular disk aperture in a perfectly conducting plane extended to infinity is already solved.

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"Annalen der Physik", 6. Folge, Band 7, Heft 3-4 (1 Apr 1950), pp 157-168.

# ZUM PROBLEM DER MAXWELLSCHEN SPANNUNGEN

(Problem of Maxwell's Potentials)

A. Sommerfeld and F. Bopp, München

Institut für theoretische Physik
(Institute for Theoretical Physics)

ABSTRACT.

In order to check the various recently-suggested expressions for magnetostatic force density f , we add to Maxwell's equations the postulate that it should be possible to calculate f as the divergence of a symmetrical potential tensor, not only outside the magnet, but also inside it. The classical Maxwell tensor in symmetrisized form does not lead either to f = div H.B or to f = μ div. H.H, but to the complicated equations (11). Along with the Maxwell tensor, we present a "modified potential tensor", referring to the recently published demonstration by L. Kneissler. The force density corresponding to this tensor is outlined by the concept of an Ampère molecular beam. The ratio of the here derived torque to that derived from the Maxwell tensor is $\mu : \mu_0$ ( $\mu$ = permeability of the external space). Hence the two tensors and their corresponding force densities may be distinguished by means of the measured torque. But we notice that from our purely phenomenological viewpoint the potential tensor does not possess a unique form, and that the measurement of the torque does not give a definite interpretation of the basic force density.

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"Annalen der Physik" 6. Folge, Band 8, Heft 1-2 (31 Jul 1950) pp 41-45.

Electrodynamics - Field Equations, Potentials

# ANNÄHERUNG VON RATIONSSYMMETRISCHEN POTENTIALFELDERN MIT ZYLINDRISCHEN ÄQUIPOTENTIALFLÄCHEN DURCH EINE ANALYTISCHE FUNKTION

(Approximation of Rotationally-Symmetrical Potential Fields with Cylindrical Equipotential Surfaces by an Analytic Function)

Friedrich Lenz, Düsseldorf

Rheinisch-Westfalisches Inst. für Übermikroskopie

(Rhine-Westfalia Inst. for Super-Microscopy.)

ABSTRACT.

It is shown that rotationally-symmetrical potential fields with cylindrical equipotential surfaces, as they occur e.g. in electron lenses, are extinguished exponentially at great distance from the middle of the lens. A function is given, which accounts for this phenomenon and expresses in good approximation the field distribution in magnetic fields by an analytic dependence on the dimensions of the pole pieces. The quality of the approximation is analyzed for symmetric as well as asymmetric fields by comparison with diagrams of numerically-computed field distributions.

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"Annalen der Physik" 6. Folge, Band 8, Heft 3-4, (10 Nov 1950) pp 124-128.

Electrodynamics - Electron microscope (Field Equations)

# UNTERSUCHUNGEN ÜBER DIE BEWEGUNG DES BRENNFLECKS AUF DER KATHODE EINES QUECKSILBERDAMPF-NIEDERDRUCKBOGENS

(Investigations into the Motion of Hot-Spots on the Cathode of a Mercury Vapor Low-Pressure Arc)

Erwin Schmidt, Berlin-Siemensstadt
Siemens-Schuckertwerke A. G.
Gerätewerk (Equipment Plant)

ABSTRACT.

1. By means of time-exposure pictures of a $H_g$ low-pressure arc, the separation of the cathode discharge into individual hot-spots for strong currents was found. Here the statistically fluctuating current strength of a separate spot averages about 6.7 amperes (Chapter IIa)

2. The random motion of an individual spot corresponds purely formally to the Brownian motion of a small particle in a homogeneous gas. The law valid for molecular motion, that the mean square displacement of the particle has to be proportional to the time of observation, may be applied to the random wandering of the hot-spot. Because the displacement law still correctly reflects the behavior, even in the case of short observation-intervals, of the order of $4.10^{-4}$, we should assume that the time lapse pushing the hot-spot at random is at least one exponent of ten shorter than this shortest observation time. (Chapter IIb)

3. Further in the case of an appropriate shape of the discharge space a directional force is applied to the hot-spot, driving it in a direction tending to shorten the arc curve. (Chapter IIc)

4. It is assumed that this directional force is initially related to the Steenbeck minimum principle and that the frequency distribution of the hot-spot on the cathode's cross-section may be determined by the Boltzmann formula, whose exponent is given by the ratio of a function continuously increasing with cathode potential to the thermal disorder energy. (Chapter IIIa)

5. Statistical measurements of the frequency distribution on a plane cathode, related to the cathode potential distribution, did not support this assumption (4). (Chapter III b, c)

6. The connection between the local frequency distribution of the hot-spot and the corresponding values of cathode potential, measured on a linear (expanding in only one direction) cathode, may be very exactly expressed by a Boltzmann formula (Chapter III d, e)

7. Connections between the exponents of the Boltzmann formula of the diffusion constants of the hot-spot and its drift variation according to the theory of statistical fluctuation phenomena prove to be satisfactory in the case of a linear cathode. (Chapter IV)

8. Without further auxiliary assumptions it is not possible to explain the results of measurements by the minimum principle. (Chapter V)

9. A field effect of the discharge current is derived from investigation of the effect of transverse magnetic fields on the drift variation of the hot-spot. If we take into account an effect found by J. Stark, that the hot spot is deflected by the transverse magnetic field in an electrodynamically false sense, then the results of measurements could be explained by the effect of the magnetic eigenfield of discharge. (Chapter VI)

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Annalen der Physik, 6. Folge, Band 4, Heft 5 (2 Feb 1949) pp 246-270.

Electronics - Mercury Cathode

# ÜBER DIE DRUCKABHANGIGKEIT DES KONTINUUMS IM QUECKSILBER* HOCHDRUCKBOGEN.

(The Pressure Dependence of the Continuum in the Mercury High-Pressure Arc)

G. Busz and P. Schulz, Bonn.

ABSTRACT.

The intensity of continuous radiation of the mercury high-pressure arc for current intensities of 6 and 10 amp in the pressure range of 16 to 36 atm is measured. The pressure dependence may be expressed by $S_K = c_1 p^{0,7} + c_2 p^{1,75}$, where $c_1$ and $c_2$ are constants and p is the pressure. Theoretically the term $p^{0,7}$ corresponds to recombination radiation, and $p^{1,75}$ corresponds to the radiation of molecular collisions. Accordingly the test results are evaluated so as to make the continuum be composed of recombination and molecule-collision radiation. In the case of small-current-densities and high pressures the molecule-collision radiation predominates; but in the case of high current-densities and low pressures, the recombination radiation predominates.

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"Annalen der Physik" 6. Folge, Band 6 (19 Sep 1949), pp 232-240.

Electronics - Mercury Arc

# DIE BESTIMMUNG DER DIELEKTRISCHEN UND MAGNETISCHEN EIGENSCHAFTEN INHOMOGENER DIELEKTRIKEN, INSBESONDERE BIOLOGISCHER KÖRPER, IM DEZIMETERWELLENBEREICH*

(Determination of Dielectric and Magnetic Properties of Inhomogeneous Dielectrics, Particularly Biological Bodies, in the Decimeter Wave Range)

*Abbreviated excerpt from Frankfurt Dissertation 1946)

H. Schwan, Frankfurt a.M.
Kaiser-Wilhelm Institut für Biophysik
(Kaiser-Wilhelm Institute for Biophysics

## PART 1. THEORETISCHE BEHANDLUNG DER RESONANZVERFAHREN ZUR BESTIMMUNG KOMPLEXER WIDERSTÄNDE UND MATERIALEN BEI DEZIMETERWELLEN

(Theoretical Treatment of Resonance Methods for Determining Complex Resistances and Materials With Decimeter Wave)

ABSTRACT.

In the present work non-quasistationary resonance methods are discussed. We should mention in advance that quasistationary methods of measurement may be applied not below the 70-cm wave limit, provided that only cases of loss-free resistance are treated and that some corrections, conditioned by the beginning of the non-quasistationary behavior, will be taken into account. Due to these specified limitations in the decimeter wave range, only non-quasistationary methods are of practical value. Therefore we attempt to find the most interesting resonance arrangements and discuss procedures dealing with inductive excitation. In this case five different arrangements are possible. A detailed discussion is presented of three cases of most importance in practice.

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## PART II. DER EINFLUSS VON HALTERUNGEN AM ENDE VON LECHERLEITUNGEN

(Effect of Short-Circuiting Bridges at the End of Lecher-Wires)

ABSTRACT.

The work presents a study of the short-circuiting bridge at the end of the measuring line and its significance in the determination of reactance. The results are outlined.

If substitution of the short-circuiting bridge by a loss-free capacitor $C_o$, practically independent of the coupling, can be made, we obtain without consideration of the short-circuiting bridge, the value of the relative error equal to $\tan (2\pi/\lambda)\, \beta_o \cdot \tan (2\pi/\lambda)\, (\beta + \beta_o)$, where $\beta$ and $\beta_o$ are voltage division shifts, resulting from coupling and the movable bridge. Hence the relative error is high at the terminals which require a wide shift. It is concluded from quantitative data that, in cases of not well balanced short-circuiting bridges, this error necessarily should be taken into account.

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PART III. AUSWERTEVERFAHREN ZUR BESTIMMUNG DER ELEKTRISCHEN UND MAGNETISCHEN STOFFKONSTANTEN IN DEZIMETERWELLENGEBIET

(Evaluation Procedures for Determining the Electric and Magnetic Constants of Materials in Decimeter Wave Range).

ABSTRACT.

The present work discusses the problem of appropriate determination of four electric and magnetic constants of materials $\varepsilon$, $\mu$, $\tan \vartheta_\varepsilon$ and $\tan \vartheta_\mu$. It is assumed that the sample of material will fill out, or surround, the end of the Lecher-wires without modifying the line dimensions and that the familiar method of voltage scanning between transmitter and sample may be applied. This method is used for measuring the wave ratio U(min) : U(max) and the position of voltage minima, while the sample at the deflected line terminal is once short- and once open-circuited. The computational methods known until recently used for determination of the specified constants of materials obtained from measured data are rather cumbersome. The procedure outlined in the beginning of this work and only slightly improved as compared to procedures of other writers requires 58 computational operations (equations 8c, 8d, 10b, 10c, 13a, 13b, 13e, and 13f). Only a small part of this work can be facilitated by graphic representation. The application of series for evaluation involves a disturbingly long time. Hence the problem of more appropriate evaluation procedures yielding quicker results is created. Such procedures are presented in this work.

"Annalen der Physik" 6. Folge, Band 5, Heft 6-8 (16 Jan 1950) pp 253-267, 287-310.

Electronics - Dielectrics

# "UBER DIE BESCHNEIDUNG DES RAUSCHSPEKTRUMS BEI SCHWINGUNGSKREISEN

## (The Cut-off of Noise Spectrum in Oscillatory Circuits)

Wolfgang Boer, Berlin

II Physikalisches Institut der Univ.
(II Inst. of Physics of the Univ.)

ABSTRACT.

As a supplement to the work by R. Feldtkeller (Geb.d.Nachr. tech. 6, 2 Folge (1936)) the noise of an oscillating circuit was computed in connection with the width of the transmission band of the next amplifier. It was found that the magnitude of noise voltage depends on the amount of circuit attenuation; i.e. drops with increasing attenuation. In addition the noise voltage rises with increasing relative band width. As follows from subsequent discussion, the operation of input circuits subjected to attenuation as low as possible is by no means always advantageous. In special cases laws governing favorable capacity to inductivity ratios can be derived.

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"Annalen der Physik" 6. Folge, Band 8, Heft 1-2 (31 Jul 1950), pp 87-92.

Electronics - Noise Spectrum Cut-Off

# UNTERSUCHUNGEN ÜBER DIE BEEINFLUSSUNG DER SPEKTRALEN EMPFINDLICHKEIT VON SELEN-PHOTOELEMENTEN DURCH PHOTOSTROM UND AUSSENWIDERSTAND

(Investigations of the Influence of Photo-Current and External Field on the Sensitivity of Selenium Photo-elements)

Irmgard Wolf, Potsdam

Astrophysikalisches Institut
(Astrophysical Institute)

ABSTRACT.

I. Two methods for measuring the spectral sensitivity of selenium photoelements are described:

1. Reading of spectral sensitivity by use of an equi-energetical spectrum.

2. Reading of spectral sensitivity while keeping the photocurrent constant.

II. Dependence of spectral sensitivity in case 1 on the magnitude of the incident radiation intensity; in case 2 on the magnitude of the photo-current; and in both cases on the coupled external field.

III. The nonproportional increase of photocurrent with intensity of the incident light, different for various wave lengths, is considered to be the cause.

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"Annalen der Physik" 6. Folge, Band 8, Heft 1-2 (31 Jul 1950), pp 30-40.

Electronics - Selenium photocells

# ZUR THEORIE DES SCHROT- UND JOHNSON-EFFEKTES

## (The Theory of the Shot and Johnson Effect)

H. Dänzer, Mainz a. Rh.

Physikalisches Institut der Universität
(Physical Institute of the University)

ABSTRACT.

The amplification power of low and high-frequency amplifiers is limited by two familiar effects, known as shot effect and Johnson effect. Experimental and theoretical treatises of both effects are available. A uniform, mathematical analysis of both oscillatory phenomena is presented in the following text and, as the writer hopes, it will eliminate certain formal deficiencies of the initial theory and should therefore be of interest.

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"Annalen der Physik" 6. Folge, Band 8, Heft 3-4 (10 Nov 1950), pp 176-186.

Electronics - Amplifiers, Shot Effect

# RAUMLADUNGSEFFEKTE IN HF-GESTEUERTEN ELEKTRONENSTROMUNGEN

## (Space Charge Effects in HF-controlled Electron Beams)

J. Labus, Karlsruhe (Baden)

Siemens and Halske A. G.
Röhren-Labor. 2

(Tube Laboratory 2)

ABSTRACT.

In the study of transit-time phenomena along a controlled electron beam we presume, according to W. C. Hahn, the existence of plasma, consisting in unexcited state of balanced electron and ionic charges. Because of the larger mass of ions, only electrons execute rapid oscillations. Such shift of balance produces dynamic space charge effects, resulting in formation of electron concentration (phase focusing). In this respect electron space charges, invariable with time (static), are useful in prolonging the transit-time. One of the respective quantities (e.g. velocity) may lead to a differential equation with coefficients independent of positions in the case of vanishing static space charges. We take this undisturbed state (corresponding to plasma) as a starting point and develop the solution in terms of a distortion parameter, defined by the ratio of space charge to electron charge. The more we approach the state of a pure electron beam, the more the defocusing effect of the dynamic space charge will decrease as compared to the static.

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"Annalen der Physik" 6. Folge, Band 9, Heft 1 (15 Mar 1951) pp 6-18.

# BERECHNUNG DER ELEKTRONENOPTISCHEN ABBILDUNG DURCH DREI TYPESCHE, STARKE MAGNETLINSEN UND IHR ZUSAMMENHANG MIT DER GEWOHNLICHEN LINSENGLEICHUNG

(Calculation of the Electron-Optical Image by means of Three Typical, Strong Magnetic Lenses and its Connection with the Ordinary Lens Equation)

Walter Glaser and Friedrich Lenz

Wien, Inst. f. angew. Phys. der Tech. Hochschule
(Vienna, Inst. for Applied Phys. of the Tech Univ)

Berlin, Abt. f. Elektronenoptik der Siemens-Halske AG
(Berlin, Div. for Electron Optics of Siemens-Halske Inc

Düsseldorf, Rhein-Westf Inst f. Übermikroskopie.
(Dusseldorf, Rhine-Westfalia Inst. for Supermicroscopy)

ABSTRACT.

For three typical magnetic image fields $B_z = B_0/(1 + (z/a)^2)^{\nu}$, for $\nu = 1$ and $\nu = 2$ and $B_z = B_0 e^{-(z/a)^2}$, the relation between object and image positions, as well as the magnification from numerically computed electron paths for various values of the parameter $J^2/U_*$ are exactly computed. The connection with the ordinary lens equation is derived from the computation of the osculating Newton cardinal elements of the specified fields.

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"Annalen der Physik" 6. Folge, Band 9, Heft 1 (15 Mar 1951) pp 19-28.

Electronics - Electron Optics

# SEKUNDARELEKTRONENEMISSION VON Ni, Mo, MgO UND VON GLASS

(Secondary Electron Emission from Ni, Mo, MgO and from Glass)

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(Institute for Research on Solids, German Acad Sci)

ABSTRACT.

Temperature dependence of secondary electron emission of Ni, Mo, MgO and of glass for various primary energies is investigated. The emissivity of secondary electrons by Ni and Mo is independent of temperature and by glass nearly so. Magnesium oxide exhibits a decrease of emissivity with rising temperature.

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"Annalen der Physik" 6. Folge, Band 9, Heft 1, (15 Mar 1951) pp 48-56.

Electronics - Secondary Emission in Ni, Mo, MgO, Glass

# HOCHFREQUENZWIDERSTAND UND VERZERRUNG EINES SCHWACHEN WECHSELSTROMES IM SUPRALEITER BEI ÜBERLAGERUNG EINES STARKEN GLEICHSTROMES

(High-Frequency Resistance and Distortion of a Weak Alternating Current in a Superconductor by Superposition of a Strong Direct Current)

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Max Blanck Institut für Physik
(Max Planck Institute for Physics)

ABSTRACT.

According to the extended phenomenological theory of superconductivity, under the assumption of the existence of a maximum current density, the behavior of a superconducting wire subjected simultaneously to the flow of a strong direct current and a weak alternating current is computed. The approximative results show that the alternating current follows distortion-free the frequency of the input voltage, while the high-frequency resistance depends on the strength of the superposed direct current in contradiction to the results of the linear theory. This discrepancy is so strong, according to the attempted evaluation, that an experimental proof should be possible.

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"Annalen der Physik" 6. Folge, Band 9, Heft 1 (15 Mar 1951) pp 40-47.

Electronics - Supreconductivity

# ZUR FRAGE DER WIDERSTANDSSCHICHTUNG IN KUPFEROXDUL-GLEICHRICHTERN. II. UNTERSUCHUNGEN AN GLEICHRICHTERSCHEIBEN

(The Problem of Resistance Layers in Copper Oxide Rectifiers. II Investigations of Rectifying Discs)

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Siemens Schuckert Werke

(Siemens Schuckert Works)

ABSTRACT.

Impedance measurements of $Cu_2O$-rectifiers up to 100 Kc are reported. The measurements were performed in the temperature range from about 195°K to 303°K and on rectifiers of various basic materials, produced in various cooling conditions. The method of conductivity analysis by K. Lehovac, described in part I, is applied to the measurements.

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"Annalen der Physik" 6. Folge, Band 9, Heft 2-4 (30 Jun 1951) pp 124-140.

Electronics - CuO Rectifier Discs

# "FLÄCHEN"GRÖSSEN UND ELEKTRODYNAMISCHE GRENZBEDINGUNGEN BEI BEWEGTEN "KÖRPERN

(Surface Quantities and Electrodynamic Boundary Conditions in the Case of Moving Bodies)

H. Epheser and T. Schlomka, Hannover
Ferdinand-Wallbrechtstr. 30 and Wilhelm-Busch 7.

ABSTRACT.

Four-dimensional representations of the following quantities are given: simultaneously measured spatial distance between 2 points of a moving body; simultaneously measured surface element of a body, unit vector normal to the surface, surface charge and surface current density, as well as surface conductivity current density. Here a new relativity factor appears: $k_n = \left(1 - \frac{(un)^2}{c^2}\right)^{-1/2}$.

Then it is shown how the electrodynamic boundary conditions of moving bodies are found by application of the general Lorentz transformation to three-dimensional boundary conditions, valid for the rest system of the body, or a more simple four-dimensional formulation of these electrodynamic boundary conditions.

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"Annalen der Physik" 6. Folge, Band 8, Heft 3-4 (10 Nov 1950), pp 211-220.

Relativity - Electrodynamics of Moving Bodies

# ZUR REGULARISIERUNG DER KLASSISCHEN ELEKTRODYNAMIK*

(Regulation of Classical Electrodynamics*)

(*Dissertation, Jena.)

H. Lehmann, Jena

Theor. -Physikalisches Inst der Univ.
(Inst. of Theoretical Physics of the Univ.

ABSTRACT.

The problem of eliminating difficulties in the classical electron theory, within the framework of a linear Lorentz-invariant theory, is treated. Starting with the substitution of Green's functions of Maxwell's wave equation by regular expressions, we obtain a uniform representation of various works in this field. Particular research is devoted to field equations, occurrence of advanced effects, energy-impulse tensor, as well as the radiation of accelerated electrons. Finally it is indicated that the similar results are achieved if, while conserving the Maxwell equations, we change the expression of the Lorentz force.

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"Annalen der Physik" 6. Folge, Band 8 Heft 3-4 (10 Nov 1950), pp 109-123.

Relativity - Electrodynamic Field Equations

# DAS OHMSCHE GESETZ BEI BEWEGTEN KÖRPERN

(Ohm's Law for Moving Bodies)

Teodor Schlomka, Hannover
Wilhelm Busch Str. 7

ABSTRACT.

Two different three-dimensional formulations of Ohm's law for moving bodies are available in literature. The difference consists in a different decomposition of the total current into conducting and convective current. In the old current decomposition the product $\varrho_L u$, formed by the conducting charge density rho $\varrho$ and the velocity of the body u, is considered to be the convective current density, while in the new decomposition the current density $\varrho_L u$ makes up part of the conducting current. The atomic derivation of the conducting current in moving bodies leads necessarily to the old conducting current density $G_L^{old}$; therefore only this value and the here connected three-dimensional concept of Ohm's law are acceptable. From the transformation formula for $G_L^{old}$ a new fourth-order tensor $s_L^{ik}$ of the conducting current is derived; it leads to a new four-dimensional formulation of Ohm's law: $u_k s_L^{ik} = \sigma u_k F^{ik}$.

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"Annalen der Physik" 6. Folge, Band 8, Heft 5-8 (15 Feb 1951) pp 246-252.

# DAS DREHMOMENT EINES PERMANENTEN MAGNETEN IM FELDE EINES PERMEABELN MEDIUMS

(The Torque of a Permanent Magnet in the Field of a Permeable Medium)

A. Sommerfeld and E. Ramberg, München*)

Institut für theoretische Physik
(Institute for Theoretical Physics)

(*) Princeton, N. J. RCA Laboratory.

ABSTRACT.

1. Solution of the boundary problem; the prolate homogeneously-magnetized ellipsoid in a homogeneous external field of arbitrary direction. 2. Computation of torque from a modified potential tensor. 3. Performance of integration. 4. Limiting case of the rod magnet. 5. Ellipsoid of revolution of arbitrary form, in particular the case $\mu = \mu_0$.

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"Annalen der Physik" 6. Folge, Band 8, Heft 1-2 (31 Jul 1950) pp 46-54.

Electromagnetism - Magnetic Torque (Moment)

# ZUR DEFINITION DER MAGNETISCHEN GROSSEN

(Definition of Magnetic Quantities)

Johannes Fischer, Karlsruhe
Schirmestr. 6

ABSTRACT.

Contribution to the question whether the effects of magnetic forces on carriers of magnetism should be expressed by $K = p_H H$, $M = \overline{m_H H}$ or by $K = p_B B'$, $M = \overline{m_B B}$. - The similarity of revealed magnetic effects produced on current conductivity and on magnets should not necessarily depend on the fact that the effects of forces are expressed by the same magnetic force vector B'; the similarity may already be seen from the interchangibility of both effects, magnetically indistinguishable; thus either of the two designations for forces is sufficient. - The pole strength $p_H$ is in principle always measurable by a uniquely defined vector flux outside the magnet; it is an internal property of the magnet, independent of the permeability of the surrounding medium. But the pole strength depends on the latter, and its accurate determination requires the always available exact knowledge of the magnetic field inside the magnet. - If we consider the electric charge as an independent basic quantity for which the conservation law holds, then the electric charge q, magnetic moment $m_B$ and magnetic pole strength $p_B$ are electric quantitative magnitudes, and $m_H$ and $p_H$ are quantities of electric intensity. If we consider m or p as the basic independent quantities for which the conservation law holds, then $m_H$ and $p_H$ may be considered magnetic quantitative, but the electric charge q is then the magnetic intensity. If the electric charge, magnetic moment and magnetic pole strength are magnitudes of the same kind (with respect to either quantity or intensity), then the conservation law holds only for either q, or m and p. If the conservation law holds for the electric charge as well as for magnetic

moment and magnetic field strength, then q, m and p are not magnitudes of the same kind. We have to make up our mind for one of the two suggestions in order to draw a conclusion concerning the question posed in the beginning.

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"Annalen der Physik" 6. Folge, Band 8, Heft 1-2 (31 Jul 1950) pp 55-64.

Electromagnetism - Magnetic Quantities, Definition of

# UBER DIE ZUSTANDSANDERUNG DURCH DEN MESSPROZESS

(the Change in State Due to the Measuring Process)

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(Inst. for Theoretical Physics of the Univ)

ABSTRACT

The statistical theory of transformations not only contains some rules for the computation of probabilities of measurements, but also requires the rounding up of a law governing the changes in state due to measurements. A law in this respect by J. van Neumann is discussed and rejected. A law for the change in state, essentially identical with the "Reduction of the Wave Function" is suggested. It allows a deepening of the concept of admissibility of measurements. Finally, measurements of states satisfying secondary conditions are discussed.

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"Annalen der Physik" 6. Folge, Band 8, Heft 5-8 (15 Feb 1951) pp 322-328.

Wave Mechanics - Measurements, Changes in State

# LAUFENDE ELEKTROMAGNETISCHE MULTIPOLWELLEN UND EINE NEUE METHODE DER FELD-QUANTISIERUNG

(Traveling Electromagnetic Multipole Waves and a New Method of Field Quantization)

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Kaiser-Wilhelm Institut für Physik
(Kaiser-Wilhelm Institute for Physics)

ABSTRACT.

Incident and transmitted electromagnetic multipole waves of arbitrary multipole order are investigated, using a complex method of writing and being in close agreement with Dirac's theory of the electron-positron field. The waves are distinguished, instead of by the usual separation into electric and magnetic multipole waves, by their (circular or longitudinal) polarization state. The investigation leads to the introduction of a polarization variable, analogous to the Dirac rho-matrices. A modified quantization order is suggested, which in the case of an electromagnetic field makes wide use of the polarization variable and leads to finite field energy.

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"Annalen der Physik" 6. Folge, Band 6, (19 Sep 1949) pp 146-162.

Wave Mechanics - Multipole waves, Field-Quantization

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