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NOTE ON THE ARRANGEMENT OF ABSTRACTS

The Abstracts are classified by subject according to the Universal Decimal Classification, and arranged in order of their U.D.C. numbers. (An abridged version of the U.D.C. accompanies the Annual Index.) An Abstract of interest under more than one head has additional U.D.C. numbers, linked by the colon sign, " : " e.g. "536.21 : 548.0 Conduction of heat in crystals." The Abstract is printed once only, under the main number, e.g. in the section "HEAT 536," but Cross-references are inserted under the other numbers, e.g. "548.0 : 536.21 *see Abstr.* 1234" in the section "CRYSTALLOGRAPHY 548." These Cross-references should be investigated, therefore, when a particular section is being searched, as they contain additional matter relevant to that section. A Cross-reference does *not* refer to the Abstract which appears immediately above it.

Abstracts signed with the following initials have been supplied by the courtesy of the organizations named: "E. R. A." = British Electrical and Allied Industries Research Association. "M. A." = Metallurgical Abstracts. "M.-V." = Metropolitan-Vickers Electrical Co., Ltd. "P. O." = Post Office Engineering Research Department.

389.6 : 535.242 *see Abstr.* 1277
389.6 : 621.3.011.2 : 537.311.081.6 *see Abstr.* 1316
389.6 : 621.383.5 : 535.247.4 *see Abstr.* 1280

MATHEMATICS 51

512.831 : 537.314 : 621.392.22 = 4 1191

On the equations of propagation on an arbitrary line. RAYMOND, F. *C.R. Acad. Sci., Paris*, **220**, 497–500 (*April* 4, 1945) *In French.*—A new approach to the theory of transmission lines is presented. The lines need not be uniform and transient as well as steady state problems are included. If P denotes the column vector $\begin{pmatrix} V \\ I \end{pmatrix}$, where V and I are the Laplace transforms of the voltage and current, the equations of propagation are taken in the form $dP/dx = -MP$, where $M = \begin{pmatrix} 0 & \alpha \\ \beta & 0 \end{pmatrix}$, α and β, the line constants, being generally functions of the distance x along the line. The value of P at the output end is expressed in terms of P_0, the value at the input end, by means of the equation $P = TP_0$ where T is a matrix to be calculated. Write $\Gamma = (\alpha\beta)^{\frac{1}{2}}$ (the propagation constant), $Z = (\alpha/\beta)^{\frac{1}{2}}$ (the impedance), $C = 2^{-\frac{1}{2}}\begin{pmatrix} Z & -Z \\ 1 & 1 \end{pmatrix}$ and $N_0 = \begin{pmatrix} e^{-\gamma} & 0 \\ 0 & e^{\gamma} \end{pmatrix}$ where $\gamma = \int_0^x \Gamma dx$. Further write $M = N_0^{-1} N_1 N_0$, where $N_1 = C^{-1} dC/dx$, and let E denote the unit matrix. It is shown that $T = C_x N_0 \{E + \sum_{n=1} (-)^n I_n\} C_0^{-1}$, where

$$I_0 = E, \quad I_{n+1} = \int_0^x M I_n(x) dx$$

and C_x and C_0 denote the values of C at the points x and $x = 0$ respectively. The first term in T is

$$\begin{pmatrix} ZZ_0^{-1}\cosh\gamma, & -\sinh\gamma \\ -Z_0^{-1}\sinh\gamma, & \cosh\gamma \end{pmatrix}$$

and if $Z \sim Z_0$ this gives the usual result for a uniform line. L. S. G.

512.831 : 537.314 : 621.392.22 = 4 1192

Propagation on an arbitrary symmetric polyphase line. PARODI, M., AND RAYMOND, F. *C.R. Acad. Sci., Paris*, **220**, 522–3 (*April* 9, 1945) *In French.*—A further application of the matrix calculus to propagation on transmission lines. The line now considered consists of any number of conductors and it is shown that the usual quadripole theory may be extended to such a symmetric line. L. S. G.

513.813 : 530.12 1193

On distant affine connection. SCHRÖDINGER, E. *Proc. R. Irish Acad.*, **50 A** (*No.* 9) 143–54 (*March*, 1945).—The recent discovery, by Einstein and Bergmann, of a new form of geometrical connection of a continuum, the distant affine connection, is studied, particular attention being paid to the reciprocal case. Necessary and sufficient conditions for symmetrization and skew-symmetrization in an arbitrary frame are deduced. The symmetric and skew-symmetric cases are not mutually exclusive. The meaning of the symmetry property is discussed. L. S. G.

513.813 : 530.12 1194

Infinitesimal affine connections with twofold Einstein–Bergmann symmetry. MAUTNER, F., AND SCHRÖDINGER, E. *Proc. R. Irish Acad.*, **50 A** (*No.* 13) 223–31 (*July*, 1945).—A continuation of previous work [Abstr. 1193 (1946)]. Two methods are given for transferring the Einstein–Bergmann symmetry conditions for a distant connection to an infinitesimal connection. A general expression is found for an affinity which carries both a non-singular symmetric tensor field and a skew tensor field into themselves. The curvature tensor of this affinity is computed, and a tentative generalization of the cosmological field equations is given. L. S. G.

517.512.2 : 612.813 = 393 *see Abstr.* 1429

517.63 : 621.396.64 : 621.3.01 = 4 1195

The application of the Laplace transformation to electric circuits. CLAVIER, A. G. *Rev. Gén. Élect.*, **51**, 447–55 (*Oct.*, 1942) *In French.*—[Abstr. 1014 B (1946)].

517.942.932 1196

Computation of the solution of Mathieu's equation. MCLACHLAN, N. W. *Phil. Mag.*, **36**, 403–14 (*June*, 1945).—A method is given for solving the equation

$$d^2y/dz^2 + (a - 2q\cos 2z)y = 0$$

where a and q are real parameters capable of any value. Some examples are given. L. S. G.

518.5 1197

A new type of differential analyser. BUSH, V., AND CALDWELL, S. H. *J. Franklin Inst.*, **240**, 255–326 (*Oct.*, 1945). *Errata*, 241 (*March*, 1946).—The new differential analyser is of greater precision, scope and flexibility than earlier machines. It contains 18 integrators, but provision is made for expansion to 30 integrators if necessary. All information is given to the machine by means of punched paper tapes, and a similar tape automatically sets the various gear ratios required, while another puts in the initial conditions. Graphical results are available from curve-plotting output units, but generally the prime data are numerical tabulations of the required functions. These tabulations are prepared on automatic typewriters controlled from special counter units. The over-all machine operation accuracy is 1 part in 10 000. The mechanical and circuit details of the new machine are fully discussed and illustrated. L. S. G.

518.5 1198

A slide rule for the addition of squares. MORRELL, W. E. *Science*, **103**, 113–14 (*Jan.* 25, 1946).

519.21 : 519.52 1199

The probable number of aggregates in random distributions of points. SILBERSTEIN, L. *Phil. Mag.*, **36**, 319–36 (*May*, 1945).—A situation is considered in which n points are placed haphazardly upon a linear segment, all positions of a point on the segment being equally likely. A k-aggregate consists of k points all contained within a subinterval λ of the segment. The problem of determining the probability of any given number of aggregates is not tractable for large n, but the calculation of the probable number $Q_k(n)$ of k-aggregates among any number n of points may be carried out. This is done both for points on a segment (one dimension) and for points in a plane (two dimensions). $Q_k(n)$ satisfies the difference equation

$$Q_k(n+1) = (1-\pi_k)Q_k(n) + \pi_{k-1}Q_{k-1}(n)$$

where the π_k are certain probability coefficients and this equation is solved for $Q_k(n)$. The case of dense or congested distributions ($\lambda_n \simeq 1$) is considered separately. Some numerical examples are given. [See Abstr. 1202 (1946)]. L. S. G.

519.214 1200

The accumulation of chance effects and the Gaussian frequency distribution. GODDARD, L. S. *Phil. Mag.*, **36**, 428–33 (*June*, 1945).—The integral, $\int_0^\infty \left(\frac{\sin x}{x}\right)^n dx$, which appears in a previous paper [Abstr. 75 (1945)], is evaluated by contour integration and an asymptotic formula for it, for large n, is also obtained. This is used to examine the first few terms of another asymptotic formula appearing in the previous paper. L. S. G.

519.283 : 620.113 1201

Statistical methods in quality control. VIII. Control charts for action on variables. IX. Acceptance sampling. *Elect. Engng, N.Y.*, **65**, 23–4 (*Jan.*); 81–3 (*Feb.*, 1946).

519.52 : 519.21 *see Abstr.* 1199

519.52 : 772.1 1202

Aggregates in one- and two-dimensional random distributions. (Developability of silver specks of known dimensions and the size of photographic sensitivity specks). BERG, W. F. *Phil. Mag.*, **36**, 337–46 (*May*, 1945).—A "burst" of k random events in a time series of events is defined and the frequency of the bursts and the frequency of k aggregates [see Abstr. 1199 (1946)] are calculated. The formulae are applied to previous work on the developability of small specks of silver. The photographic application is the main purpose of the paper. L. S. G.

ASTRONOMY. GEODESY 52

521.042 : 539.155.2 *see Abstr.* 1354

521.8 : 523.841.9 1203

An outline of the theory of atmospheric eclipses. KOPAL, Z. *Proc. Amer. Phil. Soc.*, **89**, 590–600 (*Dec.*, 1945).—In close binary systems where one component (or both) may have an atmosphere, a gradual loss of light will precede totality during an atmospheric eclipse, and if a relation is established between loss of light and geometrical and physical properties of the obscuring atmosphere, it would be possible to deduce the latter properties from observations of luminosity during an eclipse if the geometry of the system is known. Assuming spherical symmetry, exponential attenuation and constant extinction coefficient, the optical depth is shown to depend on modified Bessel functions of the second kind, for which approximations are given. An integral expressing the instantaneous luminosity of the secondary is given, but the evaluation is difficult except in special cases; the rate of change of luminosity with distance between the centres of the stars is given by an integral to which close approximations are found. Assuming a depth of the atmospheric eclipse not exceeding 1 or 2 tenths of a magnitude, the luminosity integral is evaluated approximately. The procedure of determining the properties of the obscuring atmosphere from observations of luminosity changes during an eclipse is described, assuming that the eclipsed component may be considered as a luminous point. When this assumption is not warranted, a method of trial and error seems to be the only feasible one. J. A. W.

522.2 1204

The Warner and Swasey Observatory of the Case School of Applied Science. NASSAU, J. J. *Publ. Astr. Soc. Pacif.*, **57**, 281–6 (*Dec.*, 1945).—A description of a 24 in Schmidt telescope completed in 1941. The main mirror is 36 in. in diameter, focal length 7 ft, made of pyrex, coated with chromium–aluminium. The correcting lens has a clear aperture of 24 in and in combination with the main mirror gives a field of 5° on a circular curved plate 7½ in. in diameter. Visual observation by the insertion of a 7 in flat is also possible. An objective prism of 4° angle and 24 in. in diameter permits the photography of spectra. A 10 min exposure using Eastman high-speed plates gives a limiting magnitude of 18·5, while a 20 min exposure through a filter reaches 16·8 for red magnitudes. For spectra, a 15 min exposure with widened images reaches about 12·5. The telescope is at present photographing ten regions in the Milky Way between galactic longitudes 0°–200° in blue and red light and with the objective prism, enabling the absorption and the space densities of each region to be determined. E. G. M.

522.21 : 535.313 *see Abstr.* 1282

523.165 : 621.396.821 1205

Cosmic radiations at 5 metres wavelength. HEY, J. S., PHILLIPS, J. W., AND PARSONS, S. J. *Nature, Lond.*, **157**, 296–7 (*March* 9, 1946).—Periodic observations were made over 9 days with a receiving aerial having a beam width of ±6° in elevation and ±15° in bearing. The intensity between declinations −30° and +60° is shown on a contour chart; the main source appears to be close to the direction of the galactic centre with a secondary source in Cygnus. The intensity in the region of the peak was deduced to be $13{\cdot}2 \times 10^{-21} \Delta\nu\Delta\omega W/m^2$ ($\Delta\nu$ = band width in c/s, $\Delta\omega$ = solid angle subtended in steradians).

523.38 1206

Eclipse predictions. CAMPBELL, J. W., AND JOHNS, H. E. *J.R. Astr. Soc. Can.*, **39**, 347–54 (*Nov.*, 1945).—This paper explains a graphical method of finding the circumstances of an eclipse for any locality, devised by Prof. Dupuis nearly 60 years ago. The long Bessellian method is necessary for high accuracy, but this method is sufficient if the greatest accuracy is not required. The form has been made more convenient for use on present-day standards. The errors of the method are calculated and a comparison with the correct values is made. E. G. M.

523.5 : 551.594.6 *see Abstr.* 1417

523.7 = 4 1207

Researches on solar problems. GRENAT, H. *Bull. Astr., Paris*, **12** (*No.* 3) 99–145 (1940) *In French.*—A modification in electrostatic laws at large distances is proposed. An electrostatic theory of the corona, prominences, cosmic rays, aurorae, stellar heat, nebular red-shift, etc., is then developed. Stars are supposed heated from without, not from within. T. G. C.

523.746 : 550.384 *see Abstr.* 1400

523.755 = 3 1208

The behaviour of hydrogen in the corona of the sun. WALDMEIER, M. *Experientia*, **1**, 118–19 (*July* 15, 1945) *In German.*

523.82 1209

The absolute magnitudes of the stars of type K0. MARTIN, E. G. *Observatory*, 66, 82–7 (*June*, 1945).—This article collects observational evidence of the frequency distribution of stars of type K0, showing the limit to which the work is complete. The probable errors in the deduction of the absolute magnitudes by two methods are quoted and the difficulties due to selection effect are stressed. At present material to determine the frequency distribution is insufficient especially in the centre of the curve where, in theory, a minimum exists between giant and dwarf stars. A list of 35 stars with well-determined absolute magnitudes is given to demonstrate that stars can be found in the region of the minimum. An appeal is made for the observation of suitable stars. E. G. M.

523.821.3 1210

Red magnitudes of the north polar sequence stars. NASSAU, J. J., AND BURGER, V. *Astrophys. J.*, **103**, 25–34 (*Jan.*, 1946).—To establish standard sequences of red magnitudes the values for 51 NPS stars have been determined on photographs taken with the Burrell Schmidt telescope [see Abstr. 1204 (1946)]. A combination of neutral filter and colour filter with an effective wavelength of $\lambda 6200$ was used. The average probable error $\pm \cdot 03$ to $\pm \cdot 07$ mag. varies according to the brightness of the stars. A comparison with Harvard shows no over-all scale differences while the zero-point difference is $\cdot 06$ mag. The magnitude range is from magnitude 6 to 15. E. G. M.

523.841.1 1211

A recurrent nova. STRATTON, F. J. M., AND BUTLER, H. E. *Nature, Lond.*, **157**, 270 (*March* 2, 1946).

523.841.2 : 523.87 *see Abstr.* 1218, 1219

523.841.9 1212

The spectroscopic orbit of the eclipsing variable BD + 55° 616. DEUTSCH, A. J. *Astrophys. J.*, **102**, 496–9 (*Nov.*, 1945).—Radial velocities for H, He I and Ca II(K) from 49 spectrograms taken at McDonald and Yerkes observatories are listed. A systematic difference, apparently real, is found between velocity curves from H and He I, except near the ascending node, and rotational disturbance is indicated during the principal eclipse. Orbital elements are given for both curves, the period in each case being 2·7278 days. The K line appears to be of interstellar origin. D. L. E.

523.841.9 : 521.8 *see Abstr.* 1203

523.841.9 : 523.87 1213

Gaseous rings in close binary systems. STRUVE, O. *Observatory*, 66, 208–15 (*Feb.*, 1946).—The existence of tenuous gaseous rings surrounding the smaller, hotter components of some eclipsing binaries is shown by the appearance and changes of bright hydrogen lines near time of eclipse. The sizes of the rings are similar to those of the larger (eclipsing) stars, and their rotational velocities are high. Eleven known systems of this kind are discussed and compared with Be stars which, though similarly surrounded, show considerable differences in their spectra. Theoretical difficulties of interpretation are briefly discussed. D. L. E.

523.842.3 1214

The Wolf-Rayet spectroscopic binary HD 168206. HILTNER, W. A. *Astrophys. J.*, **102**, 492–5 (*Nov.*, 1945).—This star is of importance since its binary nature offers an opportunity for a complete investigation of a Wolf-Rayet star. The Wolf-Rayet component is of class WC7+; the period, 29·675 days. Three emission bands, He II 4 686, C III–IV 4 652, C IV 4 441 and Hg in absorption were measured for radial velocity. The emission gives a semi-amplitude of 165 km/sec. Hydrogen absorption varies oppositely with a semi-amplitude of 55 km/sec, suggesting attribution to the early type companion. Minimum masses are $M_{WR} \sin^2 i = 8 \cdot 2 \odot$ and $M_B \sin^2 i = 24 \cdot 8 \odot$. D. S. E.

523.851 1215

Regression lines and the functional relation. II. Charlier's formulae for a moving cluster. SEARES, F. H. *Astrophys. J.*, **102**, 366–76 (*Nov.*, 1945).—A continuation of a previous paper. The formulae for the functional coefficient of a linear relation derived in the former paper are extended to the solution of Charlier's equation for the convergence of the motion of a moving star cluster. Application to the Taurus cluster shows that neglect of the regression error leads to a distance about 7% too small. The solution given by Merriman and by Hertzsprung for a linear equation involving constant weights are shown to be a special case of the general solution. [See Abstr. 2107 (1945)]. V. C. A. F.

523.852.3 : 530.12 1216

The spiral form of extra-galactic nebulae. WALKER, A. G. *Observatory*, 66, 215–17 (*Feb.*, 1946).—Since length scales in kinematical relativity are defined in terms of time-scales, the mathematical equation of an orbit may be a spiral if one time-scale is used and a closed curve if another is employed. Observed orbits are closed according to Milne's theory of gravitation.

A nebular arm is a stream of particles moving in closed orbits (on the dynamical time-scale). But stream lines do not transform into stream lines when the time-scale is changed, so that it is not possible to assume that, using the cosmical time-scale, the spiral is both the form taken by a stream of particles and the orbit of each individual particle. G. C. McV.

523.854.12 1217

Nature of absorbing material within the galaxy and its influence on estimates of galactic dimensions. BEALS, C. S. *J.R. Astr. Soc. Can.*, 39, 329–74 (*Nov.*, 1945).—Using absolute magnitudes derived from line spectra and Cepheid variability, and stellar distances derived from studies of open cluster diameters and galactic rotation, an average coefficient of absorption of 0·8 mag. per 1 000 ps is obtained. Counts of extra-galactic nebulae give a smaller value of 0·65 mag. The absorbing layer is about 1 000 ps thick and the corrected linear major diameter of the Galaxy is about 33 000 ps. The absorbing material is irregularly distributed and its absorption must for the most part be due to solid particles of diameter 10^{-5} cm. Interstellar gases also occur, the atoms of Na, K, Ca, Ti, Fe, H, O, N having been identified in various states of ionization. Molecules of CH, CN and CH^+ have also been discovered. Unidentified diffuse lines are possibly due to the solid particles. The density of the material is probably of the order of 6×10^{-24} gr/cm^3 and the main contribution is due to the gases rather than to the solid particles. The total mass of the absorbing material may well be equal to or greater than that of the combined masses of the stars.

G. C. McV.

523.87 : 523.841.2 1218

Measurements in the spectrum of R hydrae. MERRILL, P. W. *Astrophys. J.*, 103, 6–12 (*Jan.*, 1946).

523.87 : 523.841.2 1219

The period of the spectrum variable ι Cassiopeiae. DEUTSCH, A. J. *Astrophys. J.*, 103, 99–101 (*Jan.*, 1946).

523.87 : 523.841.9 *see Abstr.* 1213

523.87 : 539.153 1220

The motion of an electron in the Hartree field of a hydrogen atom. CHANDRASEKHAR, S., AND BREEN, F. H. *Astrophys. J.*, 103, 41–70 (*Jan.*, 1946).—The radial wave functions χ_0 and χ_1 (of unit amplitude at infinity) of an electron moving in the static field of a ground-state hydrogen atom with angular momenta of 0 and 1 Bohr units respectively are tabulated for kinetic energies of astrophysical interest. Auxiliary quantities such as phase shifts are also tabulated.

D. L. E.

523.877 1221

Curve of growth for δ Canis Majoris. STEEL, H. R. *Astrophys. J.*, 102, 429–32 (*Nov.*, 1945).—Intensities of 62 Fe I lines measured by O'Keefe at Yerkes, with Menzel and Goldberg's solar values of $\log X'_0$, are used. The excitation temperature (4 400°) agrees with other F-type supergiants, but the turbulent velocity (5·1 km/sec) is high. Visual intensity estimates of lines originating in normal and metastable levels, compared with values in stars with no appreciable dilution, suggest the probability that no dilution effects are present. D. L. E.

523.877 : 539.172.3 *see Abstr.* 1362

PHYSICS 53

53(43) 1222

War physics in Germany. GOUDSMIT, S. A. *Rev. Sci. Instrum.*, 17, 49–52 (*Jan.*, 1946).

53.081.5 : 537 : 538 = 4 1223

Simplification of the dimensional formulae for electric and magnetic quantities. TARBOURIECH, M. *C.R. Acad. Sci., Paris*, 221, 745–7 (*Dec.* 12, 1945) *In French.*—The usual four basic symbols are L, M, T and P, the permeability. In terms of these the formulae for electric and magnetic quantities have fractional exponents. An improved system is obtained by taking as the four basic symbols, R, I, T and L, where R is resistance and I is current intensity. Then all quantities, including purely mechanical quantities, have formulae which possess integral indices, e.g. mass is $RI^2T^3L^{-2}$ and permeability is RTL^{-1}. The fundamental units in this system are the ohm, the ampère, the second and the metre and it is referred to as the O.A.S.M. system. A list of advantages of the O.A.S.M. system over other systems is given. L. S. G.

FUNDAMENTALS 530.1

530.12 : 513.813 *see Abstr.* 1193, 1194

530.12 : 523.852.3 *see Abstr.* 1216

530.12 : 531.18 1224

A generalization of the relativistic theory of gravitation. EINSTEIN, A. *Ann. Math., Princeton*, 46, 578–84 (*Oct.*, 1945).—An attempt is made to establish a unified field theory, starting with the group of real continuous co-ordinate transformations. The theory is unified in the sense that neither the field equations nor the Hamiltonian function can be expressed as the sum of several invariant parts, but are formally unified entities. An infinitesimal parallel translation is introduced and an expression is found for the curvature tensor. The Hamiltonian density function is constructed and used to derive the field equations. The physical significance of these equations will depend upon the construction of exact solutions. L. S. G.

530.12 : 531.18 : 535.13 1225

Derivation of the Lorentz transformations. IVES, H. E. *Phil. Mag.*, 36, 392–403 (*June*, 1945).—It is shown that the transformations may be derived by imposing the laws of conservation of energy and momentum on radiation processes as developed by Maxwell's methods. A study is made of the impact of radiation upon a reflecting particle initially at rest. The energy and momentum of the radiation are obtained from the wave theory, and these quantities for the particle are obtained by the condition of conservation. An apparent discrepancy arises and this necessitates the introduction of a mass varying with the velocity. The same impact is considered with the system in uniform motion and this demands that the intervals of length and time also vary with the velocity. Exact expressions for these variations are given and these lead to the Lorentz transformations. L. S. G.

530.12 : 531.18 = 4 1226

Covariant definition of force. COSTA DE BEAUREGARD, O. *C.R. Acad. Sci., Paris*, **221**, 743-5 (*Dec.* 12, 1945) *In French.*—The usual dynamical equations,

$$Fdt = d(mv), \quad Fdr = dW$$

of a point mass m whose position vector is r, are replaced by the set

$$(K \times v + \mathfrak{F})dt = d(mv), \quad \mathfrak{F}dr = dW$$

where K is an arbitrary vector depending on r and $\mathfrak{F}$ (the coforce) is defined by

$$K \times v + \mathfrak{F} = F$$

The second set of equations is relativistically covariant but the first set is not. The introduction of the coforce is useful in various problems of relativistic dynamics. An example is given. L. S. G.

530.14 = 4 1227

On the various types of elementary particles. MURARD, R. *C.R. Acad. Sci., Paris*, **221**, 607-9 (*Nov.* 19, 1945) *In French.*—The "fundamental ring" of operators of a particle is discussed, and two postulates regarding these operators are introduced in order to eliminate the non-physical solutions of the wave equation. The theory of the operators involves a study of various representations of the complete Lorentz group and it is concluded that all elementary particles have the spin $\frac{1}{2}$, so that particles of spin 1 (photon, meson) or spin 2 (graviton) cannot be considered as elementary. L. S. G.

530.14 = 4 1228

Spinor and higher representations of the Lorentz group and the theory of particles of multiple mass and spin. KWAL, B. *C.R. Acad. Sci., Paris*, **221**, 658-9 (*Nov.* 26, 1945) *In French.*—Let $D(\frac{1}{2}, k)$ be the representation involving a group of k spinors. When $k = 1$ the representation gives rise to the wave equation of a particle of spin $\frac{1}{2}$ and zero rest-mass. When $k = 2$ (Dirac's case) wave equations are obtained which describe a particle, of spin $\frac{1}{2}$, which admits 2 proper values for its mass. Generally the representation $D(\frac{1}{2}, k)$ permits a definition of a particle, of spin $^1/_2$, with k different mass values, one of which is zero when k is odd. The direct product, $D(\frac{1}{2}, k) \times D(\frac{1}{2}, k) \times \ldots \times D(\frac{1}{2}, k)$, where there are $2j$ factors, describes a particle of spin $2j$, with $2jk$ proper values for its mass; but the irreducible representation $D(j,j, \ldots, j)$ where there are k factors, has just k proper values, e.g. the vector meson, defined by $D(1, 1)$ has two proper mass values. The wave equations for this particle are written down. L. S. G.

530.145 1229

On the method of second quantization. BECKER, R., AND LEIBFRIED, G. *Phys. Rev.*, **69**, 34 (*Jan.* 1 *and* 15, 1946).

530.145 = 4 1230

Properties of some types of particles. Application to the nucleon. MURARD, R. *C.R. Acad. Sci., Paris*, **219**, 577-9 (*Dec.* 4, 1944) *In French.*—The following results are announced, the numbers in brackets denoting the proper values of the operators. (1) Particles of spin $(\frac{1}{2}, \frac{1}{2})$ and mass $(-m, m)$ satisfy the laws of a Dirac particle; (2) there exist no particles of spin $(-\frac{1}{2}, 0, \frac{1}{2})$ and mass $(-m, m)$; (3) for every particle of spin $(-1, 0, 1)$ and mass $(-m, m)$ the operators of the fundamental ring satisfy the same algebraic relations as does a Dirac particle, with the exception of the spin operators; (4) every particle of spin $(-\frac{1}{2}, \frac{1}{2})$ is a Dirac particle with several possible mass states. An example of the latter is the nucleon. The fundamental ring of operators for this particle is discussed. A base for the ring consists of $1, \tau_x, \tau_y, \tau_z$ where τ is the isotopic spin. For a system containing only nucleons the total isotopic spin (or total mass) is conserved. Using this principle an expression is given for the interaction operator of two nucleons. L. S. G.

530.145 = 4 1231

Behaviour of particles in an exterior field: application to the nucleon. MURARD, R. *C.R. Acad. Sci., Paris*, **221**, 547-9 (*Nov.* 5, 1945) *In French.*—The hamiltonian of a particle in an exterior field may be written $H = H_0 + A$ where H_0 is the hamiltonian of the free particle and A is an operator satisfying certain invariance conditions. The external field is defined by given quantities U_0, U_l, U_{lj} . . . behaving like the components of tensors of orders 0, 1, 2, . . . Then the operator A is expressible in the form

$$A = \Omega_0 U_0 + \sum \Omega_l U_l + \sum \Omega_{lj} U_{lj} + \ldots$$

where Ω_0, Ω_l, Ω_{lj}, . . . are operators of the fundamental ring. These are two of the three given sufficient conditions for determining A. The results are applied to the Dirac particle of spin $\frac{1}{2}$ and to the nucleon. In the latter case previous work [Abstr. 1230 (1946)] is continued. L. S. G.

530.145.1 : 537.13 1232

On the production of mesons by proton-proton collisions. II. HEITLER, W. *Proc. R. Irish Acad.*, **50** A (*No.* 10) 155-65 (*May*, 1945).—The calculations of paper I [Abstr. 213 (1944)] were carried out on the basis of the quantum theory of radiation damping [Abstr. 2558 (1942)]. The results, and their applications to cosmic radiation [Abstr. 2834 (1943)], are now modified by using the Weizsäcker-Williams approximate method, greater accuracy in the mathematical analysis being obtained. A graph is given of the energy spectrum of pseudoscalar mesons produced by collisions with a nucleon, having $E = 5M$, where E is the energy of the nucleon and M is its rest energy. [See also Abstr. 809 (1946)]. L. S. G.

530.145.6 : 539.152.1 *see Abstr.* 1349

530.145.63 : 539.185 = 3 1233

On spin-path coupling of two nucleons in meson theory. FIERZ, M. *Helv. Phys. Acta*, **18** (*No.* 2) 158-66 (1945) *In German.*—The elements of the matrix of tensor forces which occur in the symmetrical meson theory with strong coupling are calculated by a method developed in earlier papers [Abstr. 983, 985, 986 (1946)]. Explicit expressions are given in the case of the deuteron ground states and the possibility of an approximate treatment of the associated eigenvalue problem is discussed. The matrix elements necessary in the calculation of the quadrupole moment of the deuteron are also given. L. S. G.

530.162 : 537.312.62 : 536.48 *see Abstr.* 1309

MECHANICS OF SOLIDS 531

531.18 : 530.12 *see Abstr.* 1224, 1226

531.18 : 535.13 : 530.12 *see Abstr.* 1225

531.224.3 1234

The effective width of cylinders, periodically stiffened by circular rings. BIEZENO, C. B., AND KOCH, J. J. *Proc. Ned. Akad. Wet.*, **48**, 147–65 (1945).—Numerical data are given for simplifying the computation of the greatest tangential stress which may occur in a thin-walled cylinder stiffened by rings placed at a constant interval along the axis. The load system of the cylinder is periodic in the axial direction with period equal to that of the rings. For the cylinder without rings there exists an infinity of characteristic load systems which produce only tangential displacements. The mathematical analysis of these loads is carried out. Tables of the effective width are given for various values of the parameters which occur in the problem. L. S. G.

531.259 : 536.41 1235

On thermal stresses in circular cylinders. JAEGER, J. C. *Phil. Mag.*, **36**, 418–28 (*June*, 1945).—Numerical solutions, suitable for practical use, are given of the problem of a solid cylinder, initially at constant temperature, and later with its surface maintained at zero temperature or radiation at its surface into a medium at zero temperature. Formulae for the stresses are given which are of value when the usual expressions (involving Bessel functions) converge very slowly. The problem is also solved when the cylinder is hollow. The case of a periodic surface temperature is examined briefly. L. S. G.

531.261 = 4 1236

On a variational principle of Gauss in potential theory. MONNA, A. F. *Proc. Ned. Akad. Wet.*, 44 (*No.* 1) 50–61 (1941); 49 (*No.* 1) 54–62 (1946) *In French.*—Given a distribution of positive mass of potential V on an open set Ω of bounded frontier Σ, with $F = \Omega + \Sigma$, U the potential of a distribution $\rho(\varepsilon)$ of positive mass on Σ such that $U \leqslant V$ everywhere and $U = V$ on CF, $\mu(\varepsilon)$ the distribution obtained by the sweeping out process, $\bar{\mu}(\varepsilon)$ that obtained by the process of extremization, then $\mathrm{Pot}\mu \geqslant U \geqslant \mathrm{Pot}\bar{\mu}$. The evaluation of $\rho(\varepsilon)$ itself in terms of $\bar{\mu}(\varepsilon)$ and $\mu(\varepsilon)$ by means of Stieltjes' integrals is discussed. The demonstration appears to be incomplete. The second theorem is that the integral $\int(U - 2V)d\rho$ of such distributions $\rho(\varepsilon)$ is a maximum when $\rho(\varepsilon)$ is identical with $\bar{\mu}(\varepsilon)$. An application of this theorem and the generalization of these theorems to non-Newtonian potentials is considered. In the second paper a simpler demonstration of the second theorem is given. V. C. A. F.

531.36 : 534.015 = 4 *see Abstr.* 1251

MECHANICAL MEASUREMENTS 531.7

531.717.7 : 535.313.08 *see Abstr.* 1283

531.787.4 : 532.66 *see Abstr.* 1245

531.787.9 : 621.316.5 1237

Electromagnetic pressure recorder. BAXTER, H. H. *Electrician*, **135**, 691–3 (*Dec.* 21, 1945).—[Abstr. 1095 B (1946)].

MECHANICS OF LIQUIDS 532

532.5 1238

The Kármán-Tsien pressure-volume relation in the two-dimensional supersonic flow of compressible fluids. COBURN, N. *Quart. Appl. Math.*, **3**, 106–16 (*July*, 1945).—Kármán and Tsien treated the subsonic flow by replacing the pressure-volume curve by the tangent line drawn at an arbitrary point of the curve. It is shown that this method may be used in the supersonic range when the flow is fairly uniform, and then the characteristics form a Tschebyscheff net. If the diagonal curves of the net of characteristics are drawn so as to correspond to equidistant values of the arc length parameter along the characteristics, then these diagonal curves will be the families of equipotentials and stream lines. The general representation of the stream lines depends upon two real arbitrary functions which are equal if one stream line coincides with the x-axis. The velocity and density depend only upon the angle between the characteristics and the Mach number of the flow. L. S. G.

532.517.3 1239

On the stability of two-dimensional parallel flows. I. General theory. LIN, C. C. *Quart. Appl. Math.*, **3**, 117–42 (*July*, 1945).—A historical survey is made of the existing theories of the transition from steady to turbulent flow and a valuable bibliography is given. The problem of stability is formulated mathematically and the stability equation of Orr and Sommerfeld is solved by means of (1) convergent series, (2) asymptotic series. Analytical properties of the solutions are obtained. Boundary value problems discussed include (*a*) flow between solid walls in relative motion, (*b*) symmetrical flow between solid walls at rest, and (*c*) flow of the boundary-layer type. L. S. G.

532.517.3 1240

On the stability of two-dimensional parallel flows. II. Stability in an inviscid fluid. LIN, C. C. *Quart. Appl. Math.*, **3**, 218–34 (*Oct.*, 1945).—[See Abstr. 865 (1945)]. A critical survey of the work of Rayleigh and Tollmien is made and their necessary and sufficient conditions for the existence of a disturbance are summarized. Tollmien's result for the existence of unstable modes of oscillation is proved rigorously and extended. Instability in an inviscid fluid is interpreted physically by considering the distribution of vorticity. The motion is stable when the gradient of the vorticity does not vanish. An explicit formula is derived, in two different ways, for the acceleration of vortices in a non-uniform field of vorticity. The first is a kinematical method, using vorticity theorems. In the second, pressure forces correlated with vorticity fluctuations are considered. L. S. G.

532.517.3 1241

On the stability of two-dimensional parallel flows. III. Stability in a viscous fluid. LIN, C. C. *Quart. Appl. Math.*, **3**, 277–301 (*Jan.*, 1946).—The work of the two previous parts is extended to a viscous fluid. Heisenberg's criterion for instability is given in a slightly improved form and a study is made of the general characteristics of the curve of neutral stability. The discussion is then restricted to the two types: (*a*) the Blasius case (a boundary-layer profile), (*b*) the plane Poiseuille motion (symmetrical profile). The stability characteristics are studied and the

numerical results obtained are compared with experimental results. The physical significance is discussed and a few remarks are made concerning the transition to turbulence. L. S. G.

532.583.5 = 3 1242

Gliding [on water] of a flat-[sided] keel-shaped slab. SEDOW, L. I., AND WLADIMIROW, A. N. *C.R. Acad. Sci., URSS*, **33** (*No.* 2) 116–19 (1941) *In German.*—A brief mathematical discussion; the results are illustrated by experimental data. J. S. G. T.

532.612.4 1243

On the volumes of mercury menisci and the surface tension of mercury deduced from them. KISTEMAKER, J. *Comm. K. Onnes Lab., Leiden* (*No.* 268*c*). *Physica, 's Grav.*, **11**, 270–6 (*Dec.*, 1945).—By means of X-ray shadowgraphs determinations of the volumes of mercury were made in a tube of radius 14·738 mm. A formula for the volumes of these menisci is given for radii of 3–15 mm. With the aid of Blaisdell's tables for the volumes of mercury menisci [see Abstr. 978 (1941)] the surface tension is calculated to be 430 ± 5 dynes/cm at approximately 18°C.

532.63 1244

Liquid rise in a capillary tube. BRITTIN, W. E. *J. Appl. Phys.*, **17**, 37–44 (*Jan.*, 1946).—A theory of the dynamics of capillary rise is developed by making certain assumptions as to the nature of the motion of the liquid in the tube. The most important assumptions are that the same forces act on the liquid when it is in an accelerated state of motion as when it is in a steady state, that the surface tension is constant, that the angle of contact between the meniscus of the liquid and the tube wall is constant, and that the wetting of the tube is not a rate-determining factor of the motion. This theory leads to a second-order non-linear differential equation, the solution of which represents the motion of the liquid in the tube. A formal solution of the differential equation is obtained in the form of a double Dirichlet series. Approximations to the series are compared with experimental data, and it is concluded that the agreement between theory and experiment is satisfactory.

532.66 : 531.787.4 1245

The capillary depression of mercury and high precision manometry. KISTEMAKER, J. *Comm. K. Onnes Lab., Leiden* (*No.* 268*d*). *Physica, 's Grav.*, **11**, 277–86 (*Dec.*, 1945).—Determinations of the capillary depression of mercury in cylindrical tubes as a function of the meniscus height have been made by means of X-ray shadowgraphs. The results of two series of measurements clearly confirmed the view, that even with the highest precautions, the capillary constant a of mercury in manometer work, is not always the same. It may easily spread over values from 5 to 10% apart, corresponding with a spread in the depression of 40%. Graphical determination of the curvature along a meridian curve showed, in the case of two menisci, that a does not change over the surface within the limit of accuracy (5%). A simple method is given for determining each time the value of a in a manometer.

MECHANICS OF GASES 533

533.15 : 534.833 *see Abstr.* 1266

533.275 : 621.317.39 = 3 1246

Electrical humidity meter. KOBEL, E. *Schweiz. Arch. angew. Wiss. Tech.*, **11**, 238–41 (*Aug.*, 1945) *In German.*—[Abstr. 1120 B (1946)].

533.5 1247

A metal packless vacuum valve. TOPANELIAN, E., JR., AND COGGESHALL, N. D. *Rev. Sci. Instrum.*, **17**, 38 (*Jan.*, 1946).

533.5 : 542.231.8 1248

An apparatus for stirring under vacuum. ATKINS, B. R. *J. Sci. Instrum.*, **23**, 84 (*April*, 1946).

533.56 1249

Device for automatic protection of a diffusion vacuum pump. WANG, T. J. *Industr. Engng Chem. (Analyt. Edit.)* **17**, 670 (*Oct.*, 1945).

533.69 : 629.13.014.7 = 3 1250

Problem and future of the variable airscrew. ROTH, F. *Schweiz. Bauztg*, **126**, 179–203 (*Nov.* 3); 209–13 (*Nov.* 10); 228–30 (*Nov.* 17, 1945) *In German.*—[Abstr. 957 B (1946)].

ACOUSTICS . VIBRATIONS 534

534.015 : 531.36 = 4 1251

On the damping and maintenance of oscillations with n degrees of freedom. HAAG, J. *C.R. Acad. Sci., Paris*, **221**, 734–6 (*Dec.* 12, 1945) *In French.*—The system studied consists of $n + 1$ solid bodies subject to a driving force, an elastic force and a passive resistance which absorbs the instantaneous power. The Lagrange equations for the system are written down and periodic solutions are discussed. The equations are solved approximately and expressions are obtained for the proper frequencies. A theory of percussion is developed in the case where one body receives an instantaneous impact each time it strikes the neighbouring body, and the damping coefficient is calculated. The results obtained have application in various problems, e.g. the double pendulum or the pendulum with a non-rigid support. L. S. G.

534.015 : 621.396.611.3 1252

Systems with gyroscopic coupling terms. BLOCH, A. *Phil. Mag.*, **36**, 440–1 (*June*, 1945).—A reply to a letter [Abstr. 2835 (1945)] relating to an earlier paper by the author [Abstr. 2399 (1944)]. L. S. G.

534.112 1253

On the non-linear vibration problem of the elastic string. CARRIER, G. F. *Quart. Appl. Math.*, **3**, 157–65 (*July*, 1945).—A perturbation method is used in an analysis of the free vibrations of a string with fixed ends, when the motion is such that the relative changes in the tension of the string are not small. The results are compared with those of the linear theory. A close approximation is made to the periodic motions arising from an initial sinusoidal deformation. The method is applied to motions not restricted to a single plane, and an exact solution is given for the transmission of a localized deformation along the string. L. S. G.

534.213.4 : 534.64 1254

The analysis of plane discontinuities in cylindrical tubes. I and II. MILES, J. W. *J. Acoust. Soc. Amer.*, **17**, 259–84 (*Jan.*, 1946).—[See Abstr. 535 (1945)]. The effect of a plane discontinuity on a plane wave

propagated in a cylindrical tube of arbitrary cross section is calculated by considering the higher order modes excited at the discontinuity. In carrying out the calculations, a transmission line analogy is used and the effect of the discontinuity at a distance is represented by a capacitance placed at the discontinuity. In I, the equations of motion for the propagation of a small disturbance in a cylindrical tube are assumed at the outset and are shown to yield the two-dimensional wave equation, the solutions to this equation constituting an infinite set of modes, in addition to the plane wave usually treated in the literature. The analogy between propagation of sound and an electrical transmission line is established, and it is shown that each mode requires a separate transmission line. The effect of the higher modes excited by a plane discontinuity may be represented by a lumped capacitance, and this capacitance is given by a variational expression which gives a systematic method of calculation yielding an upper limit to the true answer. For the case of a window, a variational principle is produced which gives a lower limit to the true answer. In II, this method is applied to windows and changes of cross section in circular and rectangular tubes and to the calculation of resonance in certain types of cavities. The ordinary reflection and transmission coefficients are correlated with the theory of I. Finally, the experimental determination of equivalent circuit impedances is discussed.

534.22 : 536.48 1255

Two velocities of sound in helium–II. LIFSHITS, E. M., AND PESHKOV, V. P. *Vestn. Akad. Nauk* (*No.* 4) 117 (1945). *Summary in Nature, Lond.*, **157**, 200 (*Feb.* 16, 1946).—The phenomenon predicted by Landau's theory [see Abstr. 2985 (1945)] has been demonstrated as follows: A method of exciting the "abnormal" sound waves by temperature fluctuations was adopted, as analysis showed that the amplitude of pressure oscillation in these waves is low, and all the usual methods of sound excitation only produce the normal sound waves. Stationary waves were set up in a closed tube 25 cm long with a steel piston at one end whose temperature was varied rhythmically by heating with alternating current. For detector, a resistance thermometer of very fine phosphor-bronze wire, which could be moved up and down the tube, was used with a $10^6\times$ amplifier. The velocity of the "abnormal" sound waves was found to be 19·5 mm/sec at 1·35°K, rising to 20·4 m/sec at 1·65°K and then rapidly falling to zero at the λ-point (2·19°K). No "dispersion" was found over the frequency range 100–10 000 c/s. The speed of normal sound at these temperatures is 250 m/sec.

534.23 1256

Acoustic transmission through a fluid lamina. RUDNICK, I. *J. Acoust. Soc. Amer.*, **17**, 245–53 (*Jan.*, 1946).—The acoustic wave equation is derived for a moving fluid medium in which all changes follow an adiabatic law, and it is shown that it may be written in a form which is very similar to the usual wave equation. The transmission and reflection coefficients for a fluid lamina in uniform motion are derived; it is only the component of motion in the direction of incidence which affects these coefficients. Measurements are reported on the transmission coefficients of a non-turbulent thermal lamina whose motion has no component in the plane of incidence, from 2–14 kc/s and angle of incidence 0°–89°. These measurements are compared with those calculated for a theoretically approximated lamina, and are in reasonable agreement. It is shown that there is considerable transmission for angles greater than the critical angles and that for very thin lamina the transmission coefficient is a uniformly decreasing function of frequency.

534.231 1257

Generalized plane wave horn theory. SALMON, V. *J. Acoust. Soc. Amer.*, **17**, 199–211 (*Jan.*, 1946).—By the use of dimensionless variables and simplifying transformations, Webster's plane wave horn equation [Abstr. 1329 B (1940)] is recast into a form permitting separation of the effects of horn contour and frequency. A generalized expression for the admittance also displays this separation. Further interrelations among the variables are developed which permit the formal synthesis of a horn from a given conductance or susceptance function. The conditions for realizability of the horn thus synthesized are discussed. Several applications of the results are presented, including a comparison with Freehafer's exact theory for the hyperbolic horn.

534.231 1258

A new family of horns. SALMON, V. *J. Acoust. Soc. Amer.*, **17**, 212–18 (*Jan.*, 1946).—A new family of horns is synthesized in which the exponential forms a central member. This permits the effect of perturbations from the exponential contour to be estimated. From other members of the family unique impedance characteristics are obtained, and are discussed with possible applications in mind.

534.232 1259

Acoustic intensity distribution from a "piston" source. II. The concave piston. WILLIAMS, A. O., JR. *J. Acoust. Soc. Amer.*, **17**, 219–27 (*Jan.*, 1946).—An approximate method for computing the theoretical supersonic acoustic field from a plane piston [see Abstr. 1344, 2205 (1945)] is extended to cover a larger region and is applied to concave pistons as well. The resulting equations are given for a certain range of frequencies, piston sizes, and distances from the source. The excess acoustic pressure can be evaluated from them, along the beam axis and for a narrow region around it. It is shown that the assumed nature of vibration of the piston does not matter very much unless the source is sharply curved. The locus of maximum excess pressure is not, in general, near the centre of curvature. Labaw's data on the acoustic fields of curved crystals are analysed in the light of the present equations. The agreement in general is satisfactory, but it seems that his plane crystal was faulty or else that curved crystals must produce several times the acoustic intensity of plane ones with the same applied voltage.

534.24 : 550.834.5 1260

Rayleigh waves and free surface reflections. DIX, C. H., FU, C. Y., AND MCLEMORE, E. W. *Quart. Appl. Math.*, 3, 151–6 (*July*, 1945).—Numerical and graphical results are given relating to the reflection of a plane compressional wave at a free surface. The

results are of value in the seismic method of oil exploration, where Rayleigh waves are important.

L. S. G.

534.3 1261

Dependence of tuning of wind instruments on temperature. YOUNG, R. W. *J. Acoust. Soc. Amer.*, **17**, 187–91 (*Jan.*, 1946).—Observations on the change of tuning of musical wind instruments with ambient temperature are summarized by a single coefficient representing each instrument tested. The largest effect was observed on the *BB*♭ sousaphone where the increase with ambient temperature occurred at the rate of 2·6 cents/°c. This is equivalent to a fractional frequency coefficient of $1{\cdot}6 \times 10^{-3}$/°c. The cent is a logarithmic unit of frequency ratio such that 1 200 cents equals one octave. A theory is developed by which the average temperature (and thus the velocity of sound) of the air within a wind instrument may be inferred from the empirically determined dependence of equilibrium tuning on ambient temperature. The theory also provides a qualitative estimate of the change in tuning which occurs while the instrument is first being warmed by the player's breath.

534.321.9 1262

A new aspect of ultrasonics. SAHAY, B. K. *J. Acoust. Soc. Amer.*, **17**, 285–6 (*Jan.*, 1946).—With present generators, it has been possible for ultrasonics to reach up to the wavelength of visible light, but there is a wide divergence between the order of their frequencies. The improvement of ultrasonic wave generators is suggested to reach still higher frequencies which might exhibit some of the dormant properties of ultrasonics. The investigation of interaction of such high energy ultrasonics with matter is interesting, and it may decide whether the sound wave also has a corpuscular aspect.

534.321.9 : 534.614 *see Abstr.* 1264

534.321.9 = 4 1263

Diffusion of ultrasonic waves by thermal waves. BAUER, E. H., AND WEIGLE, J. *C.R. Soc. Phys. Hist. Nat. Genève*, **61**, 175–8 (*April–July*, 1944) *In French.*—A brief discussion of a general nature. The damping of an incident wave by internal friction and the transformation of kinetic into thermal energy are explained by regarding the incident wave as being diffracted by the thermal waves. The ideas developed are useful in explaining certain crystal phenomena, e.g. thermal conductivity.

L. S. G.

534.614 : 534.321.9 1264

A variable path ultrasonic interferometer for the four megacycle region with some measurements on air, CO_2, and H_2. STEWART, J. L. *Rev. Sci. Instrum.*, **17**, 59–65 (*Feb.*, 1946).—Alignment of the piston and crystal to the order of one light fringe was attained and maintained by employing Newton and Haidinger optical fringe systems. Velocities were measured to an accuracy of 0·1%, and absorption and reflection coefficients to 50% in air and CO_2. The limit of accuracy in both cases was determined by the measurements of length, as measured to one micron with a micrometer screw. Preliminary measurements on H_2 gave evidence of molecular dispersion between 4 and 8 Mc/s. [See Abstr. 772 (1939), 5154 (1934), 5122 (1932)].

534.64 : 534.213.4 *see Abstr.* 1254

534.756 : 612.85 = 3 *see Abstr.* 1436

534.773.2 1265

The testing of deaf aids. TURNEY, T. H. *J. Sci. Instrum.*, **23**, 58–9 (*March*, 1946).—The two-voltmeter method [Abstr. 2205 (1940)] using piezo earphones, in which the sound output is proportional to the voltage between the terminals at any given frequency, has been used to measure the amplification of a given deaf aid. The results are compared with those obtained by another method using an artificial ear. It is shown that there is substantial agreement between the results obtained by the two methods. A third method, suggested by Hartridge, if two artificial ears are available, is also described.

534.833 : 533.15 1266

Simplified flow resistance measurements. LEONARD, R. W. *J. Acoust. Soc. Amer.*, **17**, 240–1 (*Jan.*, 1946).—An apparatus for the measurement of the absolute flow resistance of porous acoustical materials is described. The pressure is measured by weighing on a chemical balance to one arm of which a piston is attached, and the rate of flow by timing the movement of the balance pointer.

534.833.1 1267

Demountable soundproof rooms. GORTON, W. S. *J. Acoust. Soc. Amer.*, **17**, 236–9 (*Jan.*, 1946). *Communications*, **26**, 30 *and* 33 (*March*, 1946).—Soundproof rooms of plaster on hollow tile are effective acoustically, but have pronounced disadvantages pertaining to their construction and demolition, and have practically no salvage value. This paper describes soundproof rooms composed of panels of two sheets of steel cemented to two sheets of composition board, with a rockwool blanket between, supported on industrial type rubber mountings for the reduction of building vibration. For the most effective attenuation of sound a second room is constructed which completely encloses the first room. Noise meter measurements show an attenuation of 43 db for the single rooms and more than 57 db for the double rooms.

534.845 1268

The absorption of sound in a homogeneous porous medium. SCOTT, R. A. *Proc. Phys. Soc., Lond.*, **58**, 165–82 (*March*, 1946).—Recent theories relating to the wave-propagation of acoustic disturbances in homogeneous, isotropic porous media are discussed, and expressions are given for the wave-equation and for the oscillatory pressure in the material in terms of a "velocity potential of average flow." In their most general form these expressions are closely analogous to those which correspond to the propagation of sound in free air. The general theory is expressed in terms of two complex parameters which respectively take the place of the wavelength constant and the mean density of the air. Expressions for the complex parameters are also given in terms of the "effective" inertia, compressibility and flow-resistance of the material. The complex parameters can be evaluated experimentally at a given frequency by measurement of the attenuation constant and of the velocity of propagation of sound in the medium, together with measurement of the normal acoustic impedance at the surface of a sample of effectively unlimited depth.

Experimental methods are described and results given for a typical sample. Validity of the general theory is suggested by the good experimental agreement obtained on applying the theory to measurements of the normal acoustic impedance of specimens of various finite depths. From the measured values of the complex parameters, calculation of effective inertia, compressibility and porous resistance are made for the material used in the experimental work and the variation of these quantities with frequency is deduced. The results throw interesting light on the mechanism of the propagation of sound in the material.

534.845.2 1269

The effect of position on the acoustical absorption by a patch of material in a room. HARRIS, C. M. *J. Acoust. Soc. Amer.*, **17**, 242–4 (*Jan.*, 1946).

534.86 : 621.395.61 1270

Gradient microphones. OLSON, H. F. *J. Acoust. Soc. Amer.*, **17**, 192–8 (*Jan.*, 1946).—The response-frequency and directional characteristics of gradient microphones from zero to *n*th order have been obtained. Higher order unidirectional microphones have also been developed. The directivity increases with the order which means a corresponding discrimination against random sound. The accentuation of the low frequency response, when the distance from a small source is less than a wavelength, increases with the order and the wavelength. This feature may be used to obtain high discrimination against distant sounds in a close talking microphone. The amount of discrimination increases with the order of the microphone.

OPTICS . RADIATION . SPECTRA 535

535.13 : 531.18 : 530.12 *see Abstr.* 1225

535.131 1271

Total reflexion in absorbing media. PINCHERLE, L. *Nature, Lond.*, **157**, 226–7 (*Feb.* 23, 1946).

535.14 = 4 1272

On the relation of Uhlenbeck and Laporte for the photon. BLOCH, L. *C.R. Acad. Sci., Paris*, **219**, 674–5 (*Dec.* 27, 1944) *In French.*—The relation was originally derived for the Dirac electron. It is now shown that a similar relation may be set up for the photon, using the 32 operators, *F*, which occur in de Broglie's theory of the photon. L. S. G.

535.215.1 : 621.383 1273

The influence of illumination on the fatigue of photo-electric cells. SOMMER, A. *Electronic Engng*, **17**, 504 (*May*, 1945).—[Abstr. 1153 B (1946)].

535.23.08 : 621.317.794 1274

Production and properties of nickel bolometers. BROCKMAN, F. G. *J. Opt. Soc. Amer.*, **36**, 32–5 (*Jan.*, 1946).—As a part of the development of an a.c. bolometer, very thin Ni ribbons and foil as thin as 0·1 micron, have been prepared by plating Ni on to Cu foil, and dissolving the Cu after mounting. These filaments appear to possess the properties of bulk Ni. The method is not restricted to Ni, since Bi ribbons have been prepared by the same procedure. Values are given of the temperature coeff. of resistance, and an equation for the conductance of a ribbon in terms of current and ambient temperature. The time constant is calculated to be 5 msec.

535.231 : 621.396.612.7 : 538.563 *see Abstr.* 1341

535.24 : 535.653 = 4 1275

Homochromatic photometer. BLOTTIAU, F., AND FRANÇON, M. *Rev. Opt. (Théor. Instrum.)* **21**, 121–7 (1942) *In French.*—A photometer is described in which the light from the source under examination is matched against white light to which is added monochromatic radiation of any desired wavelength. Two beams are taken from the comparison lamp and these are ultimately combined. One beam remains as white light whose intensity is controlled by a pair of Nicols, the other passes into a monochromator, and the intensity of the resulting monochromatic beam is controlled similarly. Thus both the wavelength of the monochromatic radiation and the relative intensities of the monochromatic and white radiation can be varied. The use of the apparatus in colorimetry is also considered. A. H.

535.241.41 1276

The ratio of the new international lumen to the lightwatt. CALDIN, E. F. *Proc. Phys. Soc., Lond.*, **58**, 207–10 (*March*, 1946).—The ratio is expressed as a function of the radiation constants alone, to a close approximation. Its value is calculated for various recommended values of these constants. The corresponding values of the ratio of the present, or "old," international lumen to the lightwatt are also given.

535.242 : 389.6 1277

B.S. specification for visual type portable photometers. *Brit. Stand.* (*No.* 230) 10 *pp.* (1945).—Comprises those photometers intended for the measurement of illumination by visual comparison under conditions where portability and convenience in use are more important than great accuracy. Three types are specified: very low illumination (0·0005–0·5 f.c.), low illumination (0·01–10 f.c.) and medium and high illumination (0·2–200 f.c.). Definitions, constructional requirements and an appendix referring to measurements involving large colour differences are included. [See Abstr. 1280 (1946)].

535.242.43 = 4 1278

Rotating variable aperture sector for the control of luminous flux. PÉRILHOU, P. *Rev. Opt. (Théor. Instrum.)* **21**, 235–7 (1942) *In French.*—Details are given of a rotating sector by means of which the intensity of a beam of light may be reduced to 1/10 000 of its original value, the fraction passing being known with great exactness. The sector is made of two discs (suitably cut), one of the two rotating at half the speed of the other, whilst the two discs can be set at any angle to one another. A. H.

535.247.4 : 615.831 : 551.521.63 1279

The measurement of ultraviolet radiation useful in heliotherapy. COBLENTZ, W. W. *J. Opt. Soc. Amer.*, **36**, 72–6 (*Feb.*, 1946).—A survey article dealing with the evaluation of the biologically effective component of ultraviolet in solar and sky radiation. Details are given of the type of photoelectric cell employed, of the methods of standardization in absolute units and of the methods of making the measurements. A. H.

535.247.4 : 621.383.5 : 389.6 1280

B.S. specification for photo-electric type portable photometers. *Brit. Stand.* (*No.* 667) 9 *pp.* (1945).—

The specification applies to photo-voltaic cell instruments for illumination measurements between 0·01 and over 200 f.c. and covers maximum permissible errors, variation with temperature and angle of light incidence, and diameter of light sensitive surface. [See Abstr. 1277 (1946)]. H. K. H.

535.312 : 654.91 1281

Heliographic signaling mirrors. HUNTER, R. S. *J. Opt. Soc. Amer.*, **36**, 110–15 (*Feb.*, 1946).—Describes several types of mirror developed during the war for use by survivors as signalling devices. The materials used are described, and the question of size and flatness limits discussed. Methods of sighting (using foresight, rearsight, and retro-reflector types of mirrors) are described and the results obtained from tests under actual service conditions are given. A. H.

535.313 : 522.21 1282

An improved type of Schmidt camera. HAWKINS, D. G., AND LINFOOT, E. H. *Nature, Lond.*, **157**, 445–6 (*April* 6, 1946).—Describes a combination of aspheric Schmidt plate and a meniscus lens in front of a spherical mirror [see Abstr. 2413 (1944)] which is superior to either alone.

535.313.08 : 531.717.7 1283

Measurement of the radius of curvature of concave spheres. RANK, D. H. *J. Opt. Soc. Amer.*, **36**, 108–10 (*Feb.*, 1946).—In the method of measuring the radius of curvature of a sphere with an autocollimating microscope it is claimed that the substitution of an Abbe for a Gauss eyepiece leads to an improvement in ease of manipulation and accuracy. Abbe eyepieces manufactured by Gaertner are described and their method of use detailed. The sensitivity of the method is also discussed. A. H.

535.315 : 535.322.2 1284

Calibration of a set of master wedges. RANK, D. H. *J. Opt. Soc. Amer.*, **36**, 116–19 (*Feb.*, 1946).

535.317.2 1285

The paraxial differential transfer coefficients of a lens system. CRUICKSHANK, F. D. *J. Opt. Soc. Amer.*, **36**, 13–19 (*Jan.*, 1946).—Certain fundamental differential coefficients are developed which specify the rate of change of quantities defining the path of a paraxial ray in the final image space with the constructional parameters of the system, i.e. the surface curvatures, axial separations, and refractive indices. From these, other differential transfer coefficients are derived which specify the rate of change of the paraxial magnification, the focal length, and the positions of the paraxial image plane and the image principal plane with the constructional parameters of the system. The calculation of these coefficients is based on the results of a paraxial ray trace and lends itself to systematic arrangement for machine computation.

535.317.3 1286

On the primary chromatic coefficients of a lens system. CRUICKSHANK, F. D. *J. Opt. Soc. Amer.*, **36**, 103–7 (*Feb.*, 1946).—Expressions are derived for the primary longitudinal and transverse chromatic aberrations of a lens system as summations of terms over all the singlet components of the system. Each term in these summations is the product of the partial dispersion of the glass of the lens with a certain coefficient which is easily calculated from the data of a paraxial trace, and specifies the contribution made by the lens to the corresponding primary chromatic aberration of the final image. The coefficients are called the primary chromatic coefficients of the system. In addition, the coefficients provide a rapid means of analysing the complete secondary spectrum of the system, and afford a clear guide to the adjustment of the primary chromatic aberrations in so far as it is desired to do this by the selection of different glass types.

535.32 : 548.73 : 548.19 *see Abstr.* 1389

535.322.2 : 535.315 *see Abstr.* 1284

535.322.4 1287

A photo-electric refractometer. KARRER, E., AND ORR, R. S. *J. Opt. Soc. Amer.*, **36**, 42–6 (*Jan.*, 1946).—Utilizes the rapid variation of reflecting power with refractive index in the region of the critical angle. By immersing a suitably shaped prism in the liquid to be measured, and measuring photo-electrically the light reflected internally at the surface of the prism, a calibration curve may be produced, connecting light intensity with refractive index of liquid, so long as the latter is lower than that of the prism. The range of the instrument may be extended by using prisms of different materials and special sensitivity may be obtained in particular regions by suitable shapes of prism. The instrument is direct reading and a sensitivity of 2 in the seventh decimal place is claimed under the best conditions. N. C.

535.33 : 537.523 = 82 *see Abstr.* 1319

535.33.03 : 545.828 *see Abstr.* 1387

535.33.072 1288

Two bilateral spectrograph slits. ROEMER, H., AND OETJEN, R. A. *J. Opt. Soc. Amer.*, **36**, 47–51 (*Jan.*, 1946).

535.33.072–15 : 778.344 *see Abstr.* 1457

535.333–15 : 548 : 535.375.5 *see Abstr.* 1295

535.338.4 1289

Perturbations in the $^1\Sigma$–$^1\Sigma$ system of the band spectrum of beryllium oxide. LAGERQVIST, A., AND WESTÖÖ, R. *Ark. Mat. Astr. Fys.*, **32 A** (*No.* 3) *Paper* 10, 24 *pp.* (1945).—The visible $^1\Sigma$–$^1\Sigma$ system of BeO is analysed in detail, the rotational structure of 9 vibrational levels in the excited state and 7 in the ground state being determined, 25 bands in all being analysed. The various constants are evaluated and Morse curves drawn for the two states, existing data enabling the curve for the $^1\Pi$ state to be added. Many perturbations are observed in the excited (Σ^*) state. Term diagrams are constructed for the Σ^* and Π states and it is found (in accordance with theory) that perturbations occur at every intersection between the Σ^* and Π graphs, save for the lowest Σ^* state ($v = 0$). This exception is attributed to the fact that the magnitude of the perturbation increases with v, and for $v = 0$ the effect is so small as to be masked. Other perturbations are accounted for in terms of $\Sigma\Sigma^*$ interaction. Some perturbations cannot be accounted for in terms of known electronic states and it is suggested that they indicate the existence of other electronic states so far unidentified. A. H.

535.338.4 1290

Methyl iodide flame bands. BLAKE, R. C., AND IREDALE, T. *Nature, Lond.*, **157**, 229 (*Feb.* 23, 1946).—[See Abstr. 4983 (1937)].

535.338.4 : 539.13 1291

A new band system in the green excited in a mixture of xenon and oxygen and the energy of dissociation of CO. KENTY, C., AICHER, J. O., NOEL, E. B., PORITSKY, A., AND PAOLINO, V. *Phys. Rev.*, 69, 36 (*Jan.* 1 *and* 15, 1946).

535.338.4 : 539.132 1292

The asymmetric rotor. III. Punched-card methods of constructing band spectra. KING, G. W., CROSS, P. C., AND THOMAS, G. B. *J. Chem. Phys.*, **14**, 35–42 (*Jan.*, 1946).—[See Abstr. 2061 (1944), 1145 (1943).] The stochastic method of analysis of band spectra of asymmetric rotors involves the calculation of line strengths and positions for successive estimates of six molecular constants, until the calculated intensities at all wavelengths agree satisfactorily with the observed. This paper shows that these extensive calculations, as based on tables previously published, are well adapted to standard punched-card equipment. In addition to the above calculations, it is possible to construct the appearance of the rotational structure for various values of slit width. The procedure is carried through for H_2S with some approximate constants. Very satisfactory representations of observed spectra are obtained for completely resolved spectra, as in the photographic region; for slit width 1 and 2 cm^{-1}, as in the near infra-red; for slit width 10 cm^{-1}, as in poorly resolved infra-red spectra.

535.338.42 : 539.132 *see Abstr.* 1348

535.339 1293

A simple monochromatic source. BARNES, R. B., RICHARDSON, D., AND BERRY, J. W. *J. Opt. Soc. Amer.*, **36**, 52 (*Jan.*, 1946).

535.371 1294

Quenching of fluorescence by van der Waal's forces. SAMBURSKY, S., AND WOLFSOHN, G. *Nature, Lond.*, **157**, 228–9 (*Feb.* 23, 1946).

535.375.5 : 535.333–15 : 548 1295

Motions of molecules in condensed systems: I. Selection rules, relative intensities, and orientation effects for Raman and infra-red spectra. HALFORD, R. S. *J. Chem. Phys.*, **14**, 8–15 (*Jan.*, 1946).—A method is described for deducing selection rules for Raman and infra-red spectra of crystals from a knowledge of the space group designation and the population of the unit cell. When used with an appendix, showing the distribution of point symmetries within space groups, the method can be applied by a user familiar with point group manipulation but having no special knowledge of space groups. There are no selection rules operating in the liquid state. Tentative qualitative conclusions are drawn concerning the relative intensities of certain kinds of components appearing in spectra of condensed systems. Sharpened selection rules are expected, and have been observed by others, to operate for single crystals containing non-rotating molecules when these are given special orientations in the light path. These orientations and the appropriate selection rules can be predicted from the information mentioned, and inspection of the external form of a crystal.

535.39 1296

Anti-reflexion films evaporated on glass. BANNON, J. *Nature, Lond.*, **157**, 446 (*April* 6, 1946).—Reports experience in processing MgF_2 and CaF_2 films.

535.415 : 535.87 1297

High-reflexion films. GREENLAND, K. M. *J. Sci. Instrum.*, **23**, 48–50 (*March*, 1946).—The high-vacuum evaporation process has found a new application in the coating of glass with interference films which increase the reflectivity of the coated surface. This new type of semi-reflector is used for neutral or coloured filters and beam-splitters. The chief advantage over metallic reflectors or absorption colour filters lies in a very high optical efficiency, the colours of the reflected and transmitted beams of a colour filter being complementary. Curves of the transmissivity and reflectivity of some high-reflexion films illustrate the range of reflectivities attainable.

535.417 1298

Interferometers and the group index. CANDLER, A. C. *Nature, Lond.*, **157**, 444 (*April* 6, 1946).—The group index $G = N + \nu\delta N/\delta\nu$ where N is the refractive index and ν the wave number. Its use simplifies determination of effective range and limit of resolution for all interferometers [see Abstr. 1373 (1945)].

535.434 : 541.18 *see Abstr.* 1381, 1382

535.435 : 541.24 1299

Light scattering of high polymer solutions. WASER, J., BADGER, R. M., AND SCHOMAKER, V. *J. Chem. Phys.*, **14**, 43–5 (*Jan.*, 1946).

535.436 : 551.521.3 *see Abstr.* 1409

535.64 1300

Modified chromatic value colour space. SAUNDERSON, J. L., AND MILNER, B. I. *J. Opt. Soc. Amer.*, **36**, 36–42 (*Jan.*, 1946).—Describes an analytical transformation from the I.C.I. colour notation to a uniform colour space, based on the revised Munsell notation [see Abstr. 2788 (1943)]. Convenient methods of carrying it out are given. J. W. T. W.

535.64 = 3 1301

Principles of colour measurement applied to the properties of mixed colours. POKROWSKI, G. I. *C.R. Acad. Sci., URSS*, 32 (*No.* 9) 627–9 (1941) *In German.*—Gives the equations representing the colours of mixed pigments when these are (*a*) opaque, (*b*) transparent and shows that a colour metric for pigment mixtures can be constructed, using this method of treatment as its basis. J. W. T. W.

535.653 : 535.24 = 4 *see Abstr.* 1275

535.736 : 628.9 1302

The relation between illumination and vision. CROUCH, C. L. *Illum. Engng, N.Y.*, **40**, 747–84 (*Nov.*, 1945).—[Abstr. 942 B (1946)].

535.767 1303

Theory of the space-eikonometer. OGLE, K. N. *J. Opt. Soc. Amer.*, **36**, 20–32 (*Jan.*, 1946).—If the sizes of the images formed by the two eyes are different, binocular vision will give an incorrect space localization. This can be corrected by the insertion of appropriate lenses. The space-eikonometer is used

for determining the amount and type of correction needed. The present paper gives the theory of the instrument and describes the way in which it should be used in order to obtain reliable results. J. W. T. W.

535.81 1304

The ageing of glass surfaces. PFUND, A. H. *J. Opt. Soc. Amer.*, **36**, 95–9 (*Feb.*, 1946).—Ageing, both normal and accelerated, is described and details are given of apparatus for producing this acceleration. The identification of surface films by means of infra-red reflection is described. The effect of surface films on the performance of optical instruments is discussed, also the optical properties of silica skeleton films formed when glass is attacked with HF. A. H.

535.87 : 535.415 *see Abstr.* 1297

HEAT . THERMODYNAMICS 536

536.2.01 = 4 1305

Establishment of thermal equilibrium: internal friction of solids. BAUER, E. H., AND WEIGLE, J. *C.R. Soc. Phys. Hist. Nat. Genève*, **61**, 178–80 (*April–July*, 1944) *In French.*—The results of a previous note [Abstr. 1263 (1946)] are used to calculate the damping coefficient of longitudinal waves in a hypothetical medium, having a simple law of dispersion. A graph shows the variation with temperature. L. S. G.

536.21 = 4 1306

Propagation of heat in a heterogeneous medium. PARODI, M. *C.R. Acad. Sci., Paris*, **219**, 177–9 (*Aug.* 7, 1944) *In French.*—A medium is considered in which the thermal conductivity K and the thermal capacity γ are functions of the distance x in the medium. The heat flux $P(x, t)$ and the temperature $\theta(x, t)$ satisfy $P = K\partial\theta/\partial x$ and $\partial P/\partial x = \gamma\partial\theta/\partial t$. Solutions of these equations are found of the form

$$P(x, t) = \sum_{i=1}^{\infty} P_i(x, t), \qquad \theta(x, t) = \sum_{i=1}^{\infty} \theta_i(x, t).$$

L. S. G.

536.41 : 531.259 *see Abstr.* 1235

536.413 : 537 : 548.7 *see Abstr.* 1391

536.423.15 1307

Device for determining vapour pressure of one drop of pure liquid. NATELSON, S., AND ZUCKERMAN, J. L. *Industr. Engng Chem.* (*Analyt. Edit.*) **17**, 739–41 (*Nov.*, 1945).—A drop of liquid is placed at the bottom of a capillary by dipping it into the liquid. The pressure is reduced at the top and bottom by suspending the capillary from a thermometer, and inserting this combination into a large test tube connected with a vacuum pump and suitable gauge. When the pressure is reduced the meniscus in the capillary will descend rapidly as soon as its vapour pressure is reached—a point registered on the gauge. Reproducibility within 0·5 mm of mercury can be obtained easily, and the device is useful for the determination of the vapour pressure of pure liquids or of pure low-melting solids. Vapour pressures are given for acetone, benzene, ethyl alcohol, toluene, water, acetic acid, and carbon tetrachloride, and compared with known data. H. H. HO.

536.423.45 : 551.576.11 1308

Second note on condensation in the form of clouds and dew. ARCHBOLD, J. W. *Phil. Mag.*, **36**, 414–18 (*June*, 1945).—A continuation of previous work [Abstr. 2803 (1943)], where the interaction effect of the remaining drops on the potential energy of any one drop was neglected. This effect is now considered. L. S. G.

536.48 : 534.22 *see Abstr.* 1255

536.48 : 537.312.62 : 530.162 1309

Transfer phenomena and indeterminacy. DAUNT, J. G., AND MENDELSSOHN, K. *Phys. Rev.*, **69**, 126 (*Feb.* 1 *and* 15, 1946).—The analogy between superconductivity and the λ-phenomenon in liquid He [Abstr. 3016 (1945)] is further discussed with reference to a recent paper by London [Abstr. 776 (1946)].

536.513.088.6 1310

A nomograph for emergent stem correction of thermometers. SOMERVILLE, W. T. *Industr. Engng Chem.* (*Analyt. Edit.*) **17**, 675 (*Oct.*, 1945).

536.521 1311

The design and performance of some commercial optical pyrometers of the disappearing-filament type. BARBER, C. R. *J. Iron Steel Inst.*, 18 *pp.* (*Advance copy, Feb.*, 1946).—A critical examination was made of five models with reference to the design of the lamp, the optical system, the monochromatic and neutral filters, and the measuring system. It was shown that in many cases the lamp filaments are too short to be free from end-effect, and the advantages of the use of a flat filament are discussed. The size and position of the diaphragms of the optical system were in some examples not in accordance with those necessary for obtaining perfect disappearance of the filament. The transmission curves of the monochromatic and neutral filters are given, and the requirements of the combination of the two filters are examined. A current or voltage calibration of the lamp may be employed and the advantage of the latter for short filaments is pointed out. The potentiometer method used in one pyrometer has considerable merit.

536.53 : 621.438 1312

The measurement of gas temperatures in turbine engines. PROBERT, R. P., AND SINGHAM, J. R. *J. Sci. Instrum.*, **23**, 72–7 (*April*, 1946).—The high temperatures and high gas velocities demand instruments which are free from radiation and conduction errors and insensitive to frictional heat effects in the gas flow. Errors due to these causes are discussed theoretically and an account is given of experimental work on the reduction of these errors to an acceptable order of magnitude. The thermocouple is the most suitable temperature-sensitive device as a basis of these instruments, and suitable radiation screening around the thermocouple elements with regulation of the gas velocity is required. The amount of screening and the gas velocity used in the instrument depend largely upon the local conditions of gas density, radiation, etc. Suitable instruments are described for use in combustion chambers, compressors, jet pipes, etc.

536.8 : 629.135 : 621.438.01 = 3 1313

Jet propulsion for aircraft. SCHMIDT, D. *Schweiz. Arch. angew. Wiss. Tech.*, **11**, 298–302 (*Oct.*, 1945) *In German.*—[Abstr. 1230 B (1946)].

ELECTRICITY . MAGNETISM . X-RAYS CHARGED PARTICLES 537/538

537 : 536.413 : 548.7 *see Abstr.* 1391

537 : 538 : 53.081.5 = 4 *see Abstr.* 1223

537.122 : 538.3 1314

The size of an electron and the nature of its mass. HOWE, G. W. O. *Wireless Engr*, **23**, 33–42 (*Feb.*, 1946).—The size of a moving electron is calculated on the assumption that its apparent mass is due entirely to the inertia of the associated magnetic field. The result is $1{\cdot}88 \times 10^{-13}$ cm if the electric charge is assumed to be confined to the surface of the electron, and $2{\cdot}256 \times 10^{-13}$ if it is assumed to be uniformly distributed throughout its volume.

537.13 : 530.145.1 *see Abstr.* 1232

537.133 : 539.153.4 = 3 *see Abstr.* 1352

537.226.1 : 621.317.79 1315

Dielectric-constant meter. ALEXANDER, F. C., JR. *Electronics*, **18**, 116–19 (*April*, 1945).—[Abstr. 1130 B (1945)].

537.311.081.6 : 389.6 : 621.3.011.2 1316

Stability of double-walled manganin resistors. THOMAS, J. L. *J. Res. Nat. Bur. Stand., Wash.*, **36**, 107–11 (*Jan.*, 1946).—[Abstr. 1017 B (1946)].

537.311.33 : 537.722 *see Abstr.* 1338

537.311.62 : 621.3.011.2.029.5 1317

The electrical resistance of iron wires and permalloy strips at radiofrequencies. SMITH, A. W., GREGORY, J. H., AND LYNN, J. T. *J. Appl. Phys.*, **17**, 33–6 (*Jan.*, 1946).—The ratio of a.c. to d.c. resistances has been measured in the frequency range 1·5–6·0 mc/s. Empirical equations obtained are compared with existing theoretical equations derived on the assumption of constant permeability, and from them values of the permeability are calculated.

537.312.62 1318

The occurrence of superconductivity in a collective electron assembly. BAND, W. *Phys. Rev.*, **69**, 41 (*Jan.* 1 *and* 15, 1946).

537.312.62 : 530.162 : 536.48 *see Abstr.* 1309

537.314 : 621.392.22 : 512.831 = 4 *see Abstr.* 1191, 1192

537.523 : 535.33 = 82 1319

Spectroscopy of power discharges. BABUSHKIN, A. *Bull. Acad. Sci. USSR, Phys. Ser.*, **9** (*No.* 3) 247–9 (1945) *In Russian.*—The light emission and spectral characteristics of a capacitor discharge through a narrow glass or quartz tube were studied. The characteristic behaviour of the vapour can be divided into two stages: at the moment of breakdown, when a rupturing wave and pressure impulse are produced, and in the arc stage, when a quasi-stationary gas efflux is observed. From the rates of diffusion it is possible to determine the pressure, temperature and degree of ionization of the vapours in the discharge canal. E. R. A.

537.523.2 1320

Electrical properties of tungsten oxide films. JONES, F. L. *Nature, Lond.*, **157**, 371–2 (*March* 23, 1946).—The electron emission of tungsten wires in various conditions was measured by observation of the time-lag of sparking under an impulsive e.m.f. [see Abstr. 2232 B (1943)] and the thickness of oxide films determined for maximum emission.

537.525.5 1321

Current density at the cathode spot of the mercury arc. FROOME, K. D. *Nature, Lond.*, **157**, 446 (*April* 6, 1946).

537.526.6 : 621.314.65 : 621.385.18 = 4 1322

Measuring arrangement for direct determination of probe characteristics (voltage as function of current) for ionized vapour of a mercury rectifier. LEROY, L. *Rev. Gén. Élect.*, **52**, 329–35 (*Nov.*, 1943) *In French.*—[Abstr. 1162 B (1946)].

537.531 1323

Auger transitions. HIRSH, F. R., JR. *Phys. Rev.*, **69**, 32 (*Jan.* 1 *and* 15, 1946).—[See Abstr. 1620 (1945)].

537.531 : 535.341 : 615.849.1 *see Abstr.* 1443

537.531.08 : 621.386.86 : 613.647 *see Abstr.* 1438

537.531.9 : 539.185.9 : 578.088.5 *see Abstr.* 1422

537.531.9 : 578.088.5 *see Abstr.* 1421

537.533.72 1324

Applications of metallic shadow-casting to microscopy. WILLIAMS, R. C., AND WYCKOFF, R. W. G. *J. Appl. Phys.*, **17**, 23–33 (*Jan.*, 1946).—[See Abstr. 3038 (1945)]. Advantages of the use of shadow-casting are described, and an estimate is made of the lower limit of size of objects which should be observable. Examples are given and illustrations are shown of the applications of this technique to the electron micrography of particles of macromolecular dimensions, of replicas of such particles, and of surface replicas prepared in several ways.

537.533.73 : 621.385.833 1325

Improvement of resolution in electron diffraction cameras. HILLIER, J., AND BAKER, R. F. *J. Appl. Phys.*, **17**, 12–22 (*Jan.*, 1946).—[Abstr. 1171 B (1946)].

537.533.8 : 621.385.4 1326

Space charge and electron deflections in beam tetrode theory. RODDA, S. *Electronic Engng*, **17**, 541–5 (*June*); 589–92 (*July*); 649–50, 652 (*Aug.*, 1945).—[Abstr. 1163 B (1946)].

537.533.9 : 616.5.012.9 *see Abstr.* 1447

537.534.74 : 539.185 = 3 1327

Anistropy of proton-neutron scattering and symmetrical meson theory. WENTZEL, G. *Helv. Phys. Acta*, **18** (*No.* 5) 430–46 (1945) *In German.*—The work outlined in a previous note [Abstr. 1352 (1946)] is developed in detail, a calculation being made of the matrix elements arising in the Hamiltonian function for the two nucleon system. A numerical example is discussed and the various potential curves are drawn. The results are compared with the experimental observations of Amaldi and others [*Naturwiss*, **30**, 582 (1942)]. L. S. G.

537.542 : 539.167.3.08 1328

Counters for use in nuclear spectroscopy. WIEDENBECK, M. L. *Rev. Sci. Instrum.*, **17**, 35–8 (*Jan.*, 1946).—In nuclear spectroscopy conversion electrons have been counted with energies as low as 20 kV arising from an excitation process having a cross section of the order of 10^{-34} cm^2. The special requirements of counters for such purposes are reviewed and a description is given of several self-quenching counters which have proved useful in a

study of nuclear spectra. A simple and rapid method of filling these counters with the active gas is described.

537.543 : 621.385.83 1329

Combination of betatron and synchrotron for electron acceleration. POLLACK, H. C. *Phys. Rev.*, 69, 125 (*Feb.* 1 *and* 15, 1946).—[Abstr. 1167 B (1946)].

537.56.08 : 621.385.5 1330

Use of 6AK5 and 954 tubes in ionization chamber pulse amplifiers. PARSEGIAN, V. L. *Rev. Sci. Instrum.*, 17, 39–40 (*Jan.*, 1946).

537.585 : 621.385.832 1331

Origin of ion burn in cathode-ray tubes. LIEBMANN, G. *Nature, Lond.*, 157, 228 (*Feb.* 23, 1946).—[Abstr. 1169 B (1946)].

537.591 1332

Particular type of cosmic-ray stars observed with a photographic plate. TAMBURINO, S. *Phys. Rev.*, 69, 35–6 (*Jan.* 1 *and* 15, 1946).—Microscopic examination of photographic plates which had been exposed to cosmic rays showed the presence of "stars" due to cosmic ray disintegrations. Some of them showed a dense track which later divided into two less dense tracks. These are supposed to be due to the breaking up of nuclear fragments emitted in the disintegration processes initiated by cosmic rays, protons of small energy being produced. In other cases the original track is less dense than the two tracks into which it splits. The initial track may here be due to a small nuclear fragment of high energy, or a proton, and the branching indicates an elastic collision between the proton and a hydrogen nucleus in the gelatin. Statistical fluctuations in the grain spacing may be the reason for the fact that some of the tracks start at distances of 3 to 6 μ from the centre. A. J. M.

537.591 1333

Soft component of cosmic radiation. CLAY, J. *Proc. Ned. Akad. Wet.*, 43 (*No.* 10) 1261–75 (1940).—An arrangement of 5 counter systems was used to determine the energy spectrum of the soft component of cosmic rays, the absorption in Pb, Fe, Al, C, H_2O, and paraffin being measured. The absorption of paraffin is abnormally high in comparison with that of Al, C, and H_2O. C gives an abnormal decrease for thicker layers, which is explained by the production of secondary electrons by mesons. The angular distribution of the soft radiation is the same as for mesons between 0° and 60°, but for larger angles the percentage is greater and at nearly 90° it is 40% of the total number. A. J. M.

537.591.1 = 82 1334

Basic results of the Pamirs expedition on cosmic rays. SKOBELTSIN, D. *Bull. Acad. Sci., USSR, Phys. Ser.*, 9 (*No.* 3) 250–8 (1945) *In Russian.*—Observations were taken at an altitude of 3 860 m. A quantitative evaluation was obtained for the number of heavy ionizing particles, products of the nuclear processes arising from cosmic radiation. In addition to protons, heavy secondary mesons are produced in the form of strongly ionizing particles. As a result of new methods of observation, the first curves at high altitudes were obtained for the distribution, according to magnitude, of ionizing impulses produced by showers. E. R. A.

537.591.1/.2 = 393 1335

Extensive showers of mesons in cosmic radiation. CLAY, J., AND SWIERS, H. *Versl. Ned. Akad. Wet. Afd. Natuurk.*, 53 (*No.* 6) 380–4 (1944) *In Dutch.*—Measurements were made of the decrease in density of extensive electron and penetrating particle showers by means of fourfold coincidence recordings. The ratio of the numbers of these particles is constant for distances of 0·24–27·5 m. The same ratio being found for a 20 cm Pb protective shield it was concluded that the penetrating particles were mesons. For distances >3 m the decrease of density with counter distance fell off according to the exponential law $N_x = N_0 e^{-0{\cdot}04x}$ (N_0 is the density at the shower centre). A special amplifier was used, the circuit being shown, which had a time constant of $2{\cdot}5 \times 10^{-7}$ sec.

537.591.3 1336

Cosmic ray absorption underground. GEORGE, E. P. *Nature, Lond.*, 157, 296 (*March* 9, 1946).

537.722 1337

A modified Kelvin method for measuring contact potential differences. MEYERHOF, W. E., AND MILLER, P. H., JR. *Rev. Sci. Instrum.*, 17, 15–17 (*Jan.*, 1946).—A simple, rugged, and reliable apparatus for the measurement of contact potential differences (CPD) by a modified Kelvin method is described. The null circuit using a 6F5 as electrometer tube has a sensitivity of 0·5 cm deflection/mV of CPD/cm^2 sample area, which permits the CPD to be determined to 0·01 V for samples with surface areas as small as 2 mm^2. The apparatus was developed for the study of surface characteristics of metals.

537.722 : 537.311.33 1338

A method for measuring effective contact e.m.f. between a metal and a semi-conductor. STEPHENS, W. E., SERIN, B., AND MEYERHOF, W. E. *Phys. Rev.*, 69, 42 (*Jan.* 1 *and* 15, 1946).

538 : 537 : 53.081.5 = 4 *see Abstr.* 1223

538.221 : 538.639 *see Abstr.* 1344

538.26 = 4 1339

Note on methods for calculating the flux in a magnetic circuit with air-gap under the action of a given magnetomotive force. MATHIEU, M. *Bull. Soc. Franç. Élect.*, 1, 237–9 (*April*, 1941) *In French.*

538.3 : 537.122 *see Abstr.* 1314

538.32 1340

Reciprocal electric force. WARBURTON, F. W. *Phys. Rev.*, 69, 40 (*Jan.* 1 *and* 15, 1946).—The force of one charge on another is derived from an assumed potential energy expanded in a power series of $1/c$, where c is the speed of light, and the relative velocity of the charges. By a suitable choice of constants, the formula can be made to yield the formulae for the force due to Weber, Riemann, and Ritz. Application is made to the change in magnetization of a rod by the passage of a longitudinal current through it. V. C. A. F.

538.563 : 535.231 : 621.396.612.7 1341

On the method of resonance thermocouples used for the investigation of complete radiation in the ultra-hertz band. GLAGOLEVA-ARKADIEVA, A. A., AND SOKOLOV, N. A. *C.R. Acad. Sci., URSS*, 32 (*No.* 8) 543–5 (1941).—[Abstr. 1207 B (1946)].

538.566 : 621.392.2 = 4 1342

Propagation of a disturbance in a wave guide. COTTE, M. *C.R. Acad. Sci., Paris*, **221**, 538–40 (*Nov.* 5, 1945) *In French.*—[Abstr. 1177 B (1946)].

538.567 : 621.396.611.4 1343

The transverse electric modes in coaxial cavities. KIRKMAN, R. A., AND KLINE, M. *Proc. Inst. Radio Engrs, N.Y.*, **34**, 14–17*P* (*Jan.*, 1946).—[Abstr. 1203 B (1946)].

538.639 : 538.221 1344

The magneto-resistance of high coercivity alloys. BATES, L. F. *Proc. Phys. Soc., Lond.*, **58**, 153–64 (*March*, 1946).—Measurements have been made of the change of resistance of ferromagnetic alloys of high coercivity when exposed to longitudinal and transverse magnetic fields. The changes in the cases of the permanent magnet materials alni, alnico (cast and sintered) and alcomax II are in marked contrast to those of pure ferromagnetic metals. The results are discussed on the basis of the domain concept in ferromagnetism.

538.691 : 621.384.6 = 4 1345

Non-linear resonance of a relativistic particle in the cyclotron. ANDRONOV, A., AND GORÉLIK, G. *C.R. Acad. Sci., Paris*, **221**, 696–8 (*Dec.* 3, 1945) *In French.*—A study is made of the periodic motion that may be set up, at least theoretically, in view of the energy loss by radiation and collision. An analysis is also made of the stability of the motion by a perturbation method and the condition for stability is found. The non-linearity of the motion is similar to that which exists between the flux and the current in a solenoid possessing a ferromagnetic core. L. S. G.

RADIOACTIVITY . ATOMS . MOLECULES 539

539.13 : 535.338.4 *see Abstr.* 1291

539.13 : 541.183.02 *see Abstr.* 1383

539.13 : 541.55 : 621.3.012.8 : 621.316.313 1346

Electric circuit models for the vibration spectrum of polyatomic molecules. KRON, G. *J. Chem. Phys.*, **14**, 19–31 (*Jan.*, 1946).—Electrical circuits are developed to determine the normal frequencies and normal modes of vibration of polyatomic molecules having arbitrary configurations. The networks for each molecule are set up without equations from physical considerations alone and may be solved by an a.c. network analyser, by numerical methods, or by digital (punch card, etc.) calculating machines. The networks enable the resultant secular equations of the molecule to be established by simple inspection. The potential function considered is either a general quadratic form of the displacements, or it may correspond to the customary "valence-force" system employing stretching, bending, and twisting of the valence bonds and angles. [See Abstr. 1347 (1946)].

539.13 : 541.55 : 621.3.012.8 : 621.316.313 1347

Network analyzer tests of equivalent circuits of vibrating polyatomic molecules. CARTER, G. K., AND KRON, G. *J. Chem. Phys.*, **14**, 32–4 (*Jan.*, 1946).—To illustrate the use of the equivalent circuits for vibrating polyatomic molecules [see Abstr. 1346 (1946)], network-analyser tests of circuits are described for three successively more complicated molecules. The first is the symmetrical linear CO_2 molecule; the second is the unsymmetrical linear COS molecule; and the third is the unsymmetrical non-linear CH_3CH_2OH molecule. In each case, starting from given constants of the molecular structure, the normal frequencies and modes are measured by means of the equivalent circuit. It is shown that for these cases the analyser measurements agree satisfactorily with the known normal-frequency characteristics.

539.132 : 535.338.4 *see Abstr.* 1292

539.132 : 535.338.42 1348

The vibration-rotation energies of polyatomic molecules. II. Accidental degeneracies. NIELSEN, H. H. *Phys. Rev.*, **68**, 181–91 (*Sept.* 1 *and* 15, 1945).—The 1st- and 2nd-order corrections to the vibration-rotation energies of polyatomic molecules are dealt with in instances where two or more vibration frequencies are accidentally degenerate. The method of the contact transformation employed in Part I [Abstr. 831, 1851 (1942)] is extended and made applicable to the two types of first-order resonance interactions, i.e. the Fermi–Dennison type and the Coriolis type. The components of the energy matrix are evaluated in general, and examples are considered to demonstrate how the actual energies may be evaluated.

539.152.1 : 530.145.6 1349

The binding energies of the lightest atomic nuclei with an application of the theory of integral equations to the eigenvalue problems. SVARTHOLM, N. *Univ. Lund* (*Thesis Phys. Inst.*) 86 *pp.* (1945).—The nuclear 2-body problem is formulated in momentum space and the resulting integral equation is solved by a variation-iteration method. The ground state of a 2-body system (e.g. deuteron) with an error function potential is studied. The force constant is calculated, and the asymptotic properties of the eigenfunctions are examined. The speed of convergence is compared with that of the variational method. This work is generalized to apply to many-body problems. The ground-states of the nuclei H^3, He^3 and He^4 are examined, the error function potential being again taken. Calculations are made of the force constant for the triton, the Coulomb energy of He^3, the ground state of the α-particle, and the role of exchange forces in 3- and 4-body problems is discussed. The Yukawa potential is next taken and the 2-body problem is first solved. This is a basis for the study of the ground states of H^3 and He^4. The results are discussed and compared with those of earlier investigations. The methods of the thesis are based on the fact that approximate wave functions with simple analytical expressions may be constructed more easily in momentum space than in co-ordinate space. L. S. G.

539.152.1 = 4 1350

The principles of nuclear physics. BLOCH, L. *Rev. Gén. Élect.*, **55**, 31–5 (*Jan.*, 1946) *In French.*—An account of current nuclear theories which, it is argued, tend to develop along lines following closely classical electromagnetism. Whereas the interaction between light corpuscles (electrons) in electrodynamics is transmitted by electromagnetic waves (light photons), in nuclear theories the nuclear interaction between heavy particles (protons, neutrons) is also supposed transmitted by a Maxwellian type of waves consisting of heavy photons (mesons), present in cosmic radiation. It is pointed out that these theories are neces-

sarily provisional and that they involve at present a number of serious difficulties. V. C. A. F.

539.152.2 1351

Resonance absorption by nuclear magnetic moments in a solid. PURCELL, E. M., TORREY, H. C., AND POUND, R. V. *Phys. Rev.*, 69, 37–8 (*Jan.* 1 *and* 15, 1946).—Transitions between energy levels corresponding to different orientations of proton spin in a constant magnetic field have been observed by measuring the absorption of radio-frequency energy in solid paraffin. A resonant cavity with a resonance frequency of approximately 29·8 Mc/s was placed in a strong magnetic field, the inductive part of the cavity being filled with paraffin. Power was introduced into the cavity and the output balanced out so that only changes were recorded on the detecting instrument. On varying the magnetic field a very sharp resonance absorption was observed at a field of 7 100 oersted, giving a value of 2·75 nuclear magnetons for the magnetic moment of the proton, in good agreement with the accepted value. The relaxation time was less than 1 min, thus being several hundred times smaller than would be deduced from the type of spin-lattice coupling suggested by Waller. W. E. D.

539.153 : 523.87 *see Abstr.* 1220

539.153.4 : 537.133 = 3 1352

A problem on the theory of the deuteron. BLEULER, K. *Helv. Phys. Acta*, 17 (*No.* 6) 405–8 (1944) *In German.*—A continuation of previous papers [Abstr. 986 (1946)]. Certain matrix elements are now calculated and used in a discussion of the *S*-potential curves $J = 1$, $K = 0$ (^3S) and $J = 0$, $K = 1$ (^1S), and the ^{3}P-curve, $J = K = 1$ and the ^{1}P-curve, $J = K = 0$. L. S. G.

539.155.2 1353

A mass-spectrographic study of the isotopes of silicon. NEY, E. P., AND MCQUEEN, J. H. *Phys. Rev.*, 69, 41 (*Jan.* 1 *and* 15, 1946).

539.155.2 : 521.042 1354

On the frequency of even and odd atomic nuclei. CHERDYNZEV, V. V. *C.R. Acad. Sci., URSS*, 33 (*No.* 1) 22–3 (1941).—An expression for the logarithms of the relative frequencies of the elements is given, and is applied to the determination of the relative frequencies of even and odd nuclei in the cosmos, on the liquid drop theory of atomic structure. There is satisfactory agreement between calculated and experimental values. A. J. M.

539.16 : 539.185 *see Abstr.* 1365

539.16 : 612.663.53 *see Abstr.* 1428

539.16 : 615.849.7 *see Abstr.* 1444

539.16.08 : 614.72 *see Abstr.* 1440

539.163.2 1355

The γ-rays of radium D. TSIEN, S. T. *Phys. Rev.*, 69, 38 (*Jan.* 1 *and* 15, 1946).

539.163.2 1356

Fine structure of the α-rays from protactinium. TSIEN, S. T., BACHELET, M., AND BOUISSIÈRES, G. *Phys. Rev.*, 69, 39 (*Jan.* 1 *and* 15, 1946).

539.166.75 = 4 1357

On the absorption of the γ-radiation emitted by the UX complex. DA SILVEIRA, M. *Portugaliae Physica*, 1 (*No.* 4) 175–7 (1945) *In French.*—The experiments of an earlier paper [Abstr. 1951 (1945)] on the absorption of γ-rays emitted by uranium and its immediate products have been repeated with a source of UX and its products. Mass absorption coefficients measured in Pb and Al were found to be 0·085 cm²/gm and 0·064 cm²/gm respectively, giving a wavelength of 15 X-units which is in good agreement with the magnetic deflection measurements on the recoil electrons. It is suggested that the discord between the absorption measurements of previous experimenters and their disagreement with electron recoil measurements can be accounted for by the failure to allow for the presence of neutrons in the absorption experiments [see Abstr. 1116 (1946)]. W. E. D.

539.167.3 1358

Radiation from active nitrogen. SIEGBAHN, K., AND SLÄTIS, H. *Ark. Mat. Astr. Fys.*, 32 A (*No.* 3) *Paper* 9, 32 *pp.* (1945).—The half-life (t) of ^{13}N, determined by means of a Geiger–Müller counter and an electrometer, is 10·13 ± 0·10 min. Formulae are given for the determination of t and the resolving power of the counter directly from the disintegration curve, and for the calculation of t from electrometer experiments. A lock device for transferring the sample into the β-spectrograph without allowing air to enter is described. The β-spectrum of $^{13}_{7}$N has been investigated. The maximum limit is 1·24 ± 0·02 eMV. The use of the photo- and Compton-effects to obtain γ-lines by means of β-spectrography is discussed. In the case of ^{13}N no other γ-lines exist apart from the annihilation γ-radiation, the energy of which is 0·515 ± 0·010 eMV. A simple formula is given for the effect of the Coulomb field of the nucleus on the energy distribution. The Fermi diagram is curved, but it is shown that complexity of the β-spectrum is very improbable. A formula which gives a straight line for the Fermi diagram is proposed. It may be used for the analysis of complex spectra. A. J. M.

539.167.3 1359

Activity of N^{16} and He^6. SOMMERS, H. S., JR., AND SHERR, R. *Phys. Rev.*, 69, 21–30 (*Jan.* 1 *and* 15, 1946).—An interrupted flow method of handling short lived gases is described. By use of the method, pure N^{16} and pure He^6 are readily produced. Geiger counter measurements on the N^{16} give a period of 7·3 ± 0·3 sec. Presence of γ-rays having energy greater than 5 eMV is demonstrated with a cloud chamber and absorption measurements. A lower limit to the end point of the N^{16} spectrum is derived from absorption curves, and an upper limit fixed by excitation measurements. By taking into account the barrier of N^{16} against emission of a proton, and excluding the electron self-energy, the maximum electron energy of the decay may be set at 10 ± 0·5 eMV. The electron absorption curves show the β-spectrum to be complex with a softer component having an end point at approximately 4 eMV corresponding to decay to an excited state of O^{16} in the region of 6 eMV. The He^6 period found is 0·85 ± 0·05 sec, and its end point 3·5 ± 0·6 eMV, in agreement with Bjerge and Bröstrum.

539.167.3 : 615.849.7 = 3 *see Abstr.* 1445

539.167.3 : 620.179 1360

Autoradiographic detection of aluminium. STEPHENS, W. E., AND LEWIS, M. N. *Phys. Rev.*, **69**, 43 (*Jan.* 1 *and* 15, 1946).—The distribution of Al in silicon slabs prepared for the manufacture of crystal detectors can be observed by exposing to fast neutrons, and placing on an X-ray film for several hours. The active isotope is Na^{24}. Freshly ground Si slabs affect the film by a chemical action producing H_2O_2; this effect [see Abstr. 908 (1898)] was observed with Mg, Cd, Zn, Ni and Al.

539.167.3.08 : 537.542 *see Abstr.* 1328

539.172 1361

Discovery of elements 95 and 96 and the chemical properties of the transuranic elements. SEABORG, G. T. *Industr. Engng Chem.* (*News Edit.*) 2085, 2190 (1945). *Nature, Lond.*, **157**, 307–8 (*March* 9, 1946).—The elements were prepared by bombarding U238 and Pu239 with 40 eMV α particles, and chemical studies made by tracer technique. The elements from actinium (89) upwards have "rare-earth" similarity, and it is suggested that, beginning with Th, the 5*f* shells are being filled rather than the 6*d*. Pu239 has been studied (half-life 24 000 years) and an α-emitting Np237 also (half-life 2·25 million years, produced by a side reaction in carbon piles). The presence of small quantities of Pu (1 in 10^{14}) in pitch-blende has been demonstrated.

539.172.3 : 523.877 1362

On the nuclear photo-effect. WATAGHIN, G. *Phys. Rev.*, **69**, 33–4 (*Jan.* 1 *and* 15, 1946).—The nuclear photo-effect assumes a great importance at temperatures of 10^{10}–10^{11} degrees producing a high neutron density, which in turn produces a large number of $\pm\beta$ disintegrations. On the basis of Planck's formula and known photo-effect thresholds, the mean life of a nucleus is estimated at 3–30 $\times$ 10^{-5} sec at $2{\cdot}4 \times 10^{10}$ degrees. The consequences of this are briefly discussed.

539.172.3 = 3 1363

A new activity induced in cerium and neodymium by the nuclear photo effect. HUBER, O., LIENHARD, O., AND WÄFFLER, H. *Helv. Phys. Acta*, **17** (*No.* 4) 251 (1944) *In German.*—Upon exposure to Li γ-radiation of 17 eMV, Ce and Nd showed activities of half-lives $1{\cdot}1 \pm 0{\cdot}1$ min and $1{\cdot}6 \pm 0{\cdot}3$ hours respectively. The nuclear processes involved are discussed briefly.

L. S. G.

539.18 1364

A theory of the low mass neutral mesotron. KIKUCHI, C. *Phys. Rev.*, **69**, 125 (*Feb.* 1 *and* 15, 1946).—[See Abstr. 206 (1943), 1848, 1966 (1945)].

539.185 : 530.145.63 = 3 *see Abstr.* 1233

539.185 : 537.534.74 = 3 *see Abstr.* 1327

539.185 : 539.16 1365

The beta-activity of the neutron. SUNDARACHAR, C. K. *Nature, Lond.*, **157**, 268 (*March* 2, 1946).—In experiments on the scattering of neutrons in deuterium [Abstr. 854 (1942)] about 1 in 20 of the observed recoils appeared to have energy much in excess of the incident-neutron energy. These may have been associated with the radio-activity of the neutron [see Abstr. 3072 (1946)].

539.185.9 : 537.531.9 : 578.088.5 *see Abstr.* 1422

STRUCTURE OF SOLIDS 539.2

539.214 1366

A definition of plasticity. BOSWORTH, R. C. L. *Nature, Lond.*, **157**, 447 (*April* 6, 1946).

539.214 : 551.578.4 = 3 *see Abstr.* 1414

539.26 : 539.4.016.2 : 548.73 *see Abstr.* 1396

ELASTICITY . STRENGTH . RHEOLOGY 539.3/.8

539.31 1367

On the proportion of crystalline and amorphous components in stretched vulcanized rubber. WILDSCHUT, A. J. *J. Appl. Phys.*, **17**, 51–60 (*Jan.*, 1946).—Determinations of the tension-temperature relation of stretched vulcanized rubber can provide us with data about the proportion of crystalline and amorphous components. The amount of crystalline material appears to be 30–32% at 600% elongation and at 20°c. An expression is derived relating percentage crystalline material and temperature. The results are in close agreement to those of X-ray measurements carried out by Goppel but diverge largely from those obtained by Field. The cause of this difference is not yet quite clear. Stretched vulcanized rubber consists of a predominating amorphous phase with crystallites embedded in it. On stretching orientation occurs and a systematical addition of secondary valency forces is possible. This is the main cause of the existence of a certain tensile strength. Crystallization, though important as an indication on orientation, is more or less an incidental phenomenon. The distance function of the secondary forces may be of equal importance with the orientation.

539.312 1368

Elastic limit for dynamic loading. BARGMANN, V., AND LUDLOFF, H. F. *J. Appl. Phys.*, **17**, 63 (*Jan.*, 1946).—In the case of transversal impact of a mass, striking upon the centre of a simply supported beam, there are definite theoretical indications that the elastic limit is determined by a critical impulse, $\int_0^t F(t_1)dt_1$, where $F(t)$ is the contact force between striking mass and beam. $F(t)$ itself as well as local stresses may for short instants rise far beyond values that are permissible in static loading. A rigorous method is here worked out for the experimental determination of $F(t)$-curves from time records of the centre deflection of a beam under impact loading.

539.32 : 621.315.1.056 = 4 1369

Coefficient of elasticity of conductors used for overhead transmission lines. CARPENTIER, H. *Rev. Gén. Élect.*, **50**, 405–10 (*Dec.*, 1941) *In French.*—[Abstr. 1065 B (1946)].

539.32 : 674 : 620.175.22 : 620.172.225 = 3 1370

Elasticity and shear moduli of plywood. BRUNNER, H. *Schweiz. Arch. angew. Wiss. Tech.*, **11**, 344–52 (*Nov.*, 1945) *In German.*—[Abstr. 997 B (1946)].

539.37 1371

Problems in non-elastic deformation of metals. ZENER, C., AND HOLLOMON, J. H. *J. Appl. Phys.*, **17**, 69–82 (*Feb.*, 1946).—An understanding of non-elastic deformation would be enhanced by research upon the following topics: (1) The anelasticity associated with the viscous behaviour of grain

boundaries and the temporary viscous behaviour of slip bands. (2) The mechanics of the initiation and growth of twin bands. (3) The mechanics of the initiation and growth of slip bands, including the drop in resistance to deformation which accompanies the initial slip bands. (4) The mechanics of the segregation of solute atoms in solid solution, such as of C and N in Fe. (5) The conditions under which strain hardening is not removed by recovery or by recrystallization, and hence under which a mechanical equation of state exists, i.e. under which a relation exists between strain rate, strain, stress, and temperature. (6) Variation of the heat of activation for plastic strain rate upon stress and upon the microstructure. (7) Anisotropy introduced by deformation.

539.374 1372

Methods of representing the properties of visco-elastic materials. ALFREY, T. *Quart. Appl. Math.*, **3**, 143–50 (*July*, 1945).—A differential equation, E, is given which describes the mechanical behaviour of a visco-elastic material in pure shear. This behaviour is also expressed in terms of a mechanical analogue or model consisting of springs and dashpots. Two typical models are shown, consisting respectively of Voigt elements in series and Maxwell elements in parallel. Methods are given for changing readily from one method of description to the other; namely, given the constants in E the constants of the equivalent Voigt or Maxwell model are found, and conversely.

L. S. G.

539.4.013.3 : 539.56 1373

Notch brittleness and the strength of metals. OROWAN, E. *Trans. Instn Engrs Shipb. Scot.*, **89**, 165–204 (*Jan.*); 205–15 (*Feb.*, 1946).—Metals fail in four ways: brittle fracture, ductile fracture (fibrous), ductile fracture (shear), and treacle-type rupture. The first two are those upon which most work has been done. Simple derivations are given of the relations that (1) the theoretical strength of a material is $\simeq \sqrt{(E\alpha/a)}$ (2) on the Griffiths' crack theory the actual strength is $\simeq \sqrt{(E\alpha/c)}$, where E is Young's modulus, α is the surface energy, a is the interatomic distance, and c is the length of the most dangerous crack. These relations give an adequate picture of brittle fracture, and of the increase in strength when tension in the surface layers is avoided. Ductile materials yield by plastic deformation before the brittle strength is reached, and at least two conditions have to be satisfied: the shear strain energy must exceed a critical value, and a crack must start. If extensive plastic deformation is avoided, e.g. by the use of a test piece with a fine circumferential saw cut, the tension in the core can be raised to about three times that possible in an unnotched test piece, and brittle fracture may occur in ordinarily ductile materials ("notch brittleness"). The condition for notch brittleness is therefore that the brittle strength should be between one and three times the plastic yield stress. In general notch-brittle substances are also low-temperature brittle. Other phenomena of fracture are discussed in a less quantitative way.

A. J. C. W.

539.4.016.2 : 539.26 : 548.73 *see Abstr.* 1396

539.42 1374

Problems in fracture of metals. HOLLOMON, J. H., AND ZENER, C. *J. Appl. Phys.*, **17**, 82–90 (*Feb.*, 1946).—An understanding of fracture would be enhanced by research upon the following topics: (1) The effects of the following variables on the virtual fracture stress: (*a*) Strain; (*b*) strain rate; (*c*) temperature; (*d*) stress distribution; (*e*) structure; (*f*) mechanical history (i.e. fatigue). (2) A comparison of the fracture characteristics of metallic crystals with those of non-metallic crystals, such as rocksalt. (3) The hindrances of plastic deformation by sharp stress gradients. (4) The introduction of stress concentration by: (*a*) Non-metallic inclusions; (*b*) precipitates; (*c*) slip bands; (*d*) twin bands; (*e*) grain boundary deformation. (5) The effect of reversal of stresses upon the properties of slip bands.

539.431.4 : 620.178.322.4 1375

Damping capacity and the fatigue of metals. HANSTOCK, R. F., AND MURRAY, A. *J. Inst. Met.*, **72**, 97–132 (*Feb.*, 1946). *Engineering*, **161**, 358–60 (*April* 12); 381–3 (*April* 19, 1946).—[Abstr. 1000 B (1946)].

539.56 : 539.4.013.3 *see Abstr.* 1373

539.62 1376

Radioactive tracers in the study of friction and lubrication. GREGORY, J. N. *Nature, Lond.*, **157**, 443–4 (*April* 6, 1946).—A lead slider containing radioactive isotope transfers metal to a lubricated or unlubricated metal plate, and the amount and distribution can be determined from "auto-radiographs" of the plate obtained by placing it in contact with a photographic plate [see Abstr. 2262 (1944)].

PHYSICAL CHEMISTRY 541

ELECTROCHEMISTRY 541.13

541.13 1377

The polarography of uranium. I. Reduction in moderately acid solutions. Polarographic determination of uranium. HARRIS, W. E., AND KOLTHOFF, I. M. *J. Amer. Chem. Soc.*, **67**, 1484–90 (*Sept.*, 1945).—A polarogram of uranyl chloride in 0·01–0·2M HCl shows two distinct reduction waves, the first corresponding with the reduction of U^{6+} to U^{5+} and the second with U^{5+} to U^{3+}. The equation of the first polarographic wave corresponds with an electron transfer of one and the second with an irreversible reduction. The first half-wave potential in 0·01–0·1N HCl is $-0{\cdot}18$ V; this value is independent of $[UO_2^{\cdot\cdot}]$ and is scarcely affected by the acidity of the solution or the [KCl]. The half-wave potential of the second wave is $-0{\cdot}92$ V and it is independent of the [U] and [HCl] in the solution. This independence of acidity of both half-wave potentials indicates that hydrogen ions are not involved in the electrode reactions, and an explanation of this fact has been advanced. The diffusion coefficient of the $UO_2^{\cdot\cdot}$ ion at 25°c is calculated to be $0{\cdot}62 \times 10^{-5}$ cm^2 sec^{-1} corresponding with a mobility of the $UO_2^{\cdot\cdot}$ ion of 46·5 ohm^{-1} sec^2. Uranous uranium in 0·1N HCl gives one wave corresponding with the reduction of $U^{\cdot\cdot\cdot\cdot}$ to $U^{\cdot\cdot\cdot}$ and the half-wave potential is equal to that for the second

uranyl wave. The diffusion current is proportional to the uranyl ion concentration in a range between 5×10^{-4} and 4×10^{-3} M when the first diffusion current is measured at −0·5 V in 0·01–0·1 N HCl. Use is made of the catalytic effect of uranium on the polarographic reduction of nitrate. An empirical procedure has been developed for polarographic determination in a concentration range between 2×10^{-7} and 3×10^{-5} M. W. R. A.

541.13 1378

Electrochemistry of uranium. HEAL, H. G. *Nature, Lond.*, **157**, 225 (*Feb.* 23, 1946).—Results confirming in general those of Abstr. 1377 (1946).

541.132.3 : 620.197.3 1379

Application of equilibrium *p*H to recirculating cooling water systems. EMERSON, A. G. D. *J. Soc. Chem. Ind.*, **64**, 335–9 (*Dec.*, 1945).—[Abstr. 1004 B (1946)].

541.138.2 : 620.193.7 1380

Hydrogen overvoltage as a factor in the corrosion of metallic couples. HOAR, T. P. *Nature, Lond.*, **157**, 408–9 (*March* 30, 1946).—[See Abstr. 202 (1946)].

541.14 : 612.843.5 *see Abstr.* 1431

541.14 : 612.843.6 *see Abstr.* 1433

COLLOIDS . ADSORPTION 541.18

541.18 : 535.434 1381

Opalescence of silicic acid gels. COPISAROW, A. C., AND COPISAROW, M. *J. Amer. Chem. Soc.*, **67**, 1915–16 (*Nov.*, 1945).—The simpler basic silicic acid gels, differing in intensity of opalescence and in *p*H value between 8·0 and 11·0, are automatically reproduced as a rhythmic series under the conditions of the Liesegang phenomenon. The synthesis of the opalescent, opaque, and clear polysilicic acid gels is significant as a possible basis for the formation of opalite and hyalite. W. R. A.

541.18 : 535.434 1382

Observations on the angular scattering of light by sulphur sols. LA MER, V. K., AND JOHNSON, I. *J. Amer. Chem. Soc.*, **67**, 2055–6 (*Nov.*, 1945).—The colours shown by S sols prepared from very dilute solutions (approx. 0·001M) of $Na_2S_2O_3$ and H_2SO_4 are sharper in definition and purer than those obtained previously by Ray [Abstr. 1122 (1922)]. This indicates more uniform particle size. Although many bands of colour are exhibited sols are characterized most easily by the bands of reddish hue and the angular position and number of such bands, called "orders," are related theoretically to the size of the S particles. W. R. A.

541.183.02 : 539.13 1383

Insoluble monolayers at the air–water and oil–water interfaces. ALEXANDER, A. E. *Rep. Phys. Soc. Progr. Phys.*, **9**, 158–76 (1942–3).—The experimental technique in investigating monolayers is outlined and the determination of molecular structure from monolayer measurements is discussed. Applications are described of insoluble monolayers to certain problems of adsorbed films—the "surface ageing" phenomenon, the Gibbs adsorption equation, and the structure of surfaces of solutions. An extensive bibliography is given of work published during the past ten years. L. S. G.

541.24 : 535.435 *see Abstr.* 1299

541.54 : 548.3 *see Abstr.* 1390

541.55 : 621.3.012.8 : 621.316.313 : 539.13 *see Abstr.* 1346, 1347

CHEMICAL PROCESSES . APPARATUS 542

542 : 66.01/.09 1384

Unit operations review. *Industr. Engng Chem.*, **38**, 4–28 (*Jan.* 16, 1946).—A set of papers giving résumés of recent progress [see Abstr. 1231 B (1946)].

542.231.8 : 533.5 *see Abstr.* 1248

542.7 1385

A constant-volume pump for circulating gases. PUDDINGTON, I. E. *Industr. Engng Chem.* (*Analyt. Edit.*) **17**, 529 (*Sept.*, 1945).

CHEMICAL ANALYSIS 543/545

545.828 1386

Spectrochemical analysis of lead base metals. DULL, B. B., AND HIBBERT, L. J. *J. Opt. Soc. Amer.*, **36**, 53–6 (*Jan.*, 1946).—Using a flat surface sparking technique, working curves have been drawn to cover Sn from 4–10% and Sb from 10–20%. The reliability of this method is sufficient for routine control.

545.828 : 535.33.03 1387

A combination arc-spark source for magnesium analysis. CALDECOURT, V. J., AND SAUNDERSON, J. L. *J. Opt. Soc. Amer.*, **36**, 99–102 (*Feb.*, 1946).

545.828 : 576.8.093.3 1388

Spectrographic determination of calcium in microbiological culture media. EASTMOND, E. J. *J. Opt. Soc. Amer.*, **36**, 57–60 (*Jan.*, 1946).

CRYSTALLOGRAPHY 548

548 : 535.333–15 : 535.375.5 *see Abstr.* 1295

548.19 : 548.73 : 535.32 1389

Physical methods for the identification of materials. PORTER, M. W., AND SPILLER, R. C.; HENRY, N. F. M.; BANNISTER, F. A.; BUNN, C. W. *J. Sci. Instrum.*, **23**, 34–8 (*Feb.*, 1946). *Nature, Lond.*, **157**, 234–6 (*Feb.* 23, 1946).—A report of a joint meeting of the X-ray Analysis Group and the Midland Branch of the Institute of Physics. Four papers were presented.

(1) *Morphological Methods.* Barker has given rules by which it is possible to choose crystal axes unambiguously from goniometric measurements. The chief criterion is that faces should have simple indices, i.e. those consisting of 1's and 0's only. With the orientation and symmetry fixed a few (in favourable cases one) interfacial angles are sufficient to identify any crystal not of the cubic system. A two-circle goniometer is convenient. An index that will make the method practicable is in course of preparation, and it is intended to include all non-cubic substances in Groth's *Chemische Krystallographie.*

(2) *Optical Methods.* Optical methods are useful for crystals without well-developed faces, or too small to be measured conveniently. Refractive indices are the most frequently useful determinative characters, but extinction angles can also be used.

(3) *X-ray Methods.* Single-crystal photographs are of use in identifying materials that are available only in very small amounts, or would be distorted by powdering, or too complex for easy identification from powder photographs. They have also been used for sorting out grains from a mixture till enough of each component is available for chemical analysis. The powder-photograph method has, however, been developed further, and indexes are available for its systematic use. The largest is that published by the A.S.T.M., containing cards for over 2 500 materials arranged according to the spacings of the three strongest lines.

(4) *Identification Problems of an Industrial Chemical Laboratory.* The relative merits of the methods and certain points of technique are discussed. A subsidiary index, arranged according to the innermost line, is found to be a valuable supplement to the A.S.T.M. index of X-ray powder patterns.

Each paper was followed by a discussion. It was generally agreed that the morphological method is best suited to organic crystals and the X-ray to inorganic, with optical methods supplementing both.

A. J. C. W.

548.3 : 541.54 1390

High-temperature crystal chemistry of A_mBX_n compounds with particular reference to calcium orthosilicate. BREDIG, M. A. *J. Phys. Chem.*, **49**, 537–53 (*Nov.*, 1945).—The high-temperature forms α (stable above about 1 550°c) and α' (stable 1 420°–1 550°c) of Ca_2SiO_4 are probably isomorphous with the α and β forms of K_2SO_4, so that the oxygen co-ordination of the Ca ion is 9–10. In low-temperature (γ) Ca_2SiO_4 the co-ordination is 6. The co-ordination number thus decreases with temperature, and the medium-temperature form β is probably, in the absence of any direct evidence, 8-co-ordinated. The comparative ease of hydration of β-Ca_2SiO_4 may be due to an attempt to decrease the Ca co-ordination, in contrast to the theory of Brandenberger [*Schweiz. Arch. angew. Wiss. Tech.*, **2**, 45–58 (1936)]. Other explanations are considered. There is probably continuous isomorphous replacement of Ca by Mg in the α' form, extending to merwinite (Ca : Mg approximately 3 : 1). A. J. C. W.

548.7 : 537 : 536.413 1391

Recent research work in the Davy Faraday laboratory. LONSDALE, K. *Nature, Lond.*, **157**, 355–7 (*March* 23, 1946).—A short account of (1) thermal vibrations in crystals, their investigation with X-rays, their variation with temperature, and the resulting anisotropy of thermal expansion; (2) sub-crystalline changes of structure at the transition points of Rochelle salt; (3) the study of crystal texture by divergent beam Laue photographs, including precision measurements of variations of lattice spacings.

548.73 1392

X-ray studies on ABO_4 compounds of rutile type and AB_2O_6 compounds of columbite type. BRANDT, K. *Ark. Kemi Min. Geol.*, **17 A** (*No.* 3) *Paper* 15, 8 *pp.* (1943).—The substances $CrTaO_4$, $FeTaO_4$, $RhTaO_4$, $CrNbO_4$, $FeNbO_4$, $RhNbO_4$, $AlSbO_4$, $CrSbO_4$, $FeSbO_4$, $RhSbO_4$, $GaSbO_4$, and $RhVO_4$ have the rutile structure. The metal atoms are distributed statistically over the (*a*) sites in the space group $P4/mnm$. The substances $MgTa_2O_6$, $NiTa_2O_6$, $CoTa_2O_6$, $FeTa_2O_6$, $MgSb_2O_6$, $NiSb_2O_6$, $CoSb_2O_6$, $FeSb_2O_6$ and $ZnSb_2O_6$ have a trirutile structure. The substances $MgNb_2O_6$, $NiNb_2O_6$, $CoNb_2O_6$, $FeNb_2O_6$, $ZnNb_2O_6$, $MnNb_2O_6$, $ZnTa_2O_6$, $MnTa_2O_6$, and $MnSb_2O_6$ have the columbite structure. The cell dimensions of the rutile- and columbite-like substances are given. A. J. C. W.

548.73 1393

Patterson distributions and native protein crystallography. WRINCH, D. *Nature, Lond.*, **157**, 226 (*Feb.* 23, 1946).—A method is given for evaluating the Patterson distribution of a given distribution, or 2 or more distributions superposed. This is of interest in connection with native protein crystals which are essentially protein-water systems.

548.73 1394

Crystal structure of double oxides of the perovskite type. MEGAW, H. D. *Proc. Phys. Soc., Lond.*, **58**, 133–52 (*March*, 1946).

548.73 1395

The accurate determination of cell dimensions from single-crystal X-ray photographs. FARQUHAR, M. C. M., AND LIPSON, H. *Proc. Phys. Soc., Lond.*, **58**, 200–6 (*March*, 1946).—The importance of improving the accuracy of the determination of cell dimensions determined from single-crystal photographs is pointed out and the general principles upon which such improvements can be obtained are outlined. These principles, which are based on those used for powder photographs, are illustrated by application to an orthorhombic crystal, thallium hydrogen tartrate, the cell dimensions being determined to an accuracy of the order of 0·005%. Extensions of the method to monoclinic and triclinic crystals are also discussed.

548.73 : 535.32 : 548.19 *see Abstr.* 1389

548.73 : 539.4.016.2 : 539.26 1396

X-ray examination of self-recovery in metal. VAN REIJEN, L. L. *Nature, Lond.*, **157**, 371 (*March* 23, 1946).

548.734.3 : 620.179 1397

Geiger counter spectrometer for industrial research. FRIEDMAN, H. *Electronics*, **18**, 132–7 (*April*, 1945).—[Abstr. 1002 B (1946)].

548.74 = 3 1398

Electron diffraction by ice. KÖNIG, H. *Nachr. Wiss. Göttingen* (*No.* 1) 1–6 (1942) *In German.*—By cooling a collodion film to liquid-air temperature in an electron diffraction apparatus, a layer is formed which is impenetrable to electrons of ordinary velocities, but using a fine diaphragm, a thin film can be produced, and this gives by irradiation with a parallel electron beam two ring systems, one orthorhombic (due to fats), one of diamond type. The latter can only be eliminated by application of P_2O_5 and is due to a new crystalline type of ice. Using 63 kV electrons, the lattice constant was

determined as $a = 6{\cdot}36 \pm 0{\cdot}01$ Å. The O-atoms form a diamond lattice, surrounded by a regular tetrahedron of H-atoms. This crystal structure can only be formed by freezing at very low temperatures, not by cooling of the β-tridymite type. The structure of ice is thus analogous to the β-tridymite and β-cristobalite structure of quartz. [See Abstr. 53 (1936)]. J. A. W.

GEOPHYSICS 55

550.37/.38 1399

Magnitude of the earth's charge. ARLICK, A. B. *Curr. Sci.*, **14**, 318–19 (*Dec.*, 1945).

550.384 : 523.746 1400

Solar and magnetic data, April to September, 1945, Mount Wilson Observatory. NICHOLSON, S. B., AND MULDERS, E. S. *Terr. Magn. Atmos. Elect.*, **50**, 243–4 (*Sept.*); 313–14 (*Dec.*, 1945).

550.385 1401

Principal magnetic storms April to September, 1945. *Terr. Magn. Atmos. Elect.*, **50**, 245–7 (*Sept.*); 322–4 (*Dec.*, 1945).

550.389 1402

American magnetic character-figure, C_A, three-hour-range indices, K, and mean K-indices, K_A, for April–September, 1945. JOHNSTON, H. F. *Terr. Magn. Atmos. Elect.*, **50**, 237–40 (*Sept.*); 315–18 (*Dec.*, 1945).

550.834 : 621.317.39 1403

Geophysical prospecting equipment. SHEFFET, D. *Electronics*, **18**, 116–23 (*Dec.*, 1945).—An electronic seismograph records reflected waves from geologic layers after an explosive charge has been fired below the surface. 12–96 seismometers (ground-contact microphones) are placed in exactly known spots and their outputs fed into identical amplifiers. Groups of 12 or 24 amplifiers are connected to a recording oscillograph. Input signal range is very great (1 to 10 000), hence the need for efficient AVC systems, some of which are described. Diodes are used as variable resistors in attenuators. High phase fidelity is required (time measurement). Some timing and auxiliary communication gear is discussed, and a complete circuit diagram of explosion controlled transmitter equipment given. A. L.

550.834.5 : 534.24 *see Abstr.* 1260

551.311.123 = 3 1404

Development and problems of snow and glacier investigation in Switzerland. HAEFELI, R. *Experientia*, **2**, 1–7 (*Jan.* 15, 1946) *In German.*—The history of glacier research, leading to the establishment of the Jungfraujoch laboratory (1943), is reviewed. Next, the plastic properties of snow are discussed [see Abstr. 1414 (1946)]. In a horizontal layer, the principal stresses are vertical, remaining constant during setting due to weight, and horizontal, increasing with setting until, for solid ice, it becomes equal to the vertical stress. For a snow cover on a sloping mountain side, the setting is not vertical, the initial movement forming an angle (β) with the sloping surface and following a hyperbola, ultimately becoming parallel to the surface. The first principal stress is inclined at an angle $45° + \beta/2$ to the surface and is always positive. The second principal stress may be negative, decreasing in value during setting and vanishing as the first principal stress passes the vertical. This leads to stabilization, but if slope or thickness of the cover changes, as is generally the case in glaciers, stress variations occur throughout the mass, cracks appear, and the mechanical properties are non-uniform. J. A. W.

METEOROLOGY 551.5

551.508.1 1405

Recent advances in meteorological methods. JOHNSON, N. *Nature, Lond.*, **157**, 247–50 (*March* 2, 1946).—A general survey of new methods of collecting meteorological data, covering the following subjects: Positioning of wireless "atmospherics," measurement of wind velocity by radio and radar balloon observation and observation of smoke-shell bursts at great heights, radio sondes, daily explorations of the atmosphere by aircraft, and the frost-point hygrometer.

551.508.11 : 621.396.933.2 1406

The application of ultra-short-wave direction finding to radio sounding balloons. SMITH-ROSE, R. L., AND HOPKINS, H. G. *Proc. Phys. Soc., Lond.*, **58**, 184–99 (*March*, 1946).—[Abstr. 1227 B (1946)].

551.508.94 1407

Radio-sonde recording of potential gradients. KREIELSHEIMER, K., AND BELIN, R. *Nature, Lond.*, **157**, 227–8 (*Feb.* 23, 1946).

551.510.535 : 551.590.24 1408

Radio-echo observations at Tromsö during the solar eclipse on July 9, 1945. HARANG, L. *Terr. Magn. Atmos. Elect.*, **50**, 307–10 (*Dec.*, 1945).—The critical frequencies of the ionized layers were determined during the partial eclipse at Tromsö. The maximum obscuration was 92%. For the F_1- and E-layers a symmetrical decrease and increase of the critical frequencies and the corresponding maximum electron-densities were observed during the eclipse. The maximum electron-concentration decreased from $3{\cdot}47$ to $1{\cdot}48 \times 10^5$ electrons/cm^3, i.e. by 57%, for the F_1-layer, and from $2{\cdot}04$ to $1{\cdot}04 \times 10^5$ electrons/cm^3, i.e. by 49%, for the E-layer. For the F_2-layer the commencement of the eclipse was followed by a sudden decrease in the ionization-curve, with a minimum at about the time of maximum obscuration. But after the eclipse the previous conditions of the F_2-layer seem not to have been restored. It seems to be evident that the eclipse has an effect on the F_2-layer but that this effect is masked by vertical movements and the slower recombination-processes.

551.510.535 : 551.594.6 *see Abstr.* 1418

551.521.3 : 535.436 1409

The primary and secondary scattering of sunlight in a plane-stratified atmosphere of uniform composition. II. Numerical tables and discussion of the directional distribution of the primary scattered light. HAMMAD, A. *Phil. Mag.*, **36**, 434–40 (*June*, 1945).—A continuation of an earlier paper [Abstr. 3599 (1939)]. The emission and reception of primary scattered sun-

light is discussed and the total primary scattered radiation received at the ground is calculated. L. S. G.

551.521.63 : 615.831 : 535.247.4 *see Abstr.* 1279

551.571.4 1410

Sea breeze cross-sections from psychrometric measurements. CRAIG, R. A., KATZ, I., AND HARNEY, P. J. *Bull. Amer. Met. Soc.*, **26**, 405–10 (*Dec.*, 1945).—The measurements were made on July 5 and 7, 1944, days of sea-breeze, over Massachusetts Bay. At the shore station the instruments (psychrometer and thermometers) were carried up by a balloon which was connected to the ground by a recording cable. The same procedure was adopted from a boat. Soundings by aeroplane were made farther out at sea. The records show a pronounced tongue of moist air extending towards the land for 8 miles seaward between 500 and 800 ft. Lower down the air was dry. Graphs of vapour-pressure distribution and of potential temperature at sea level are given and are contrasted with graphs for a day with no sea breeze (Oct. 19, 1944). G. C. McV.

551.575.1 = 4 1411

Study of the structure of fog by an ionized electric field. PAUTHENIER, M., AND BRUN, E. *Rev. Gén. Élect.*, **51**, 58–67 (*Jan.*, 1942) *In French.*—A critical review is given of some previous methods of determining the distribution of drops, according to their size, in clouds and fog. An electrical precipitation method is described in detail, using a 20 cm long, 0·2 mm dia. wire stretched in a bakelite tube of 4 cm dia. The wire is charged to −15 000 V and another wire charged to −2 000 V acts as "grid," the ionization current passing from the axial wire to the grid. Water drops in fog entering the bakelite tube become charged and deflected by the grid into a vessel containing paraffin oil. The drops suspended in the oil are observed microscopically. A photographic method is described, using two co-axial bakelite tubes 15 cm distant from one another, a sheet of fine-grained photographic paper being wound round the tubes and exposed to the precipitation in the interval between the tubes. A determination of the liquid content in fog is given. J. A. W.

551.575.1 = 4 1412

Additional note on the study of fog structure by an ionized electric field. PAUTHENIER, M., BRUN, E., AND DEMON, L. *Rev. Gén. Élect.*, **52**, 220–1 (*July*, 1943) *In French.*—[See Abstr. 1411 (1946)]. The ratio of drop diameter to size of imprint on the sensitive paper is constant to within 15% and is not sensibly affected by a 10% variation in potential. Apparatus for continuous recording is described, the paper being fixed around the inside of a metal cylinder which is rotated in small steps, thereby exposing each time a fresh area of paper through a window in a fixed co-axial cylinder filled with the fog. J. A. W.

551.576.11 : 536.423.45 *see Abstr.* 1308

551.576.4.08 1413

A method of determining cloud heights. STOMMEL, H. G. *Bull. Amer. Met. Soc.*, **26**, 411–13 (*Dec.*, 1945).—Describes a method of using a clinometer or other sighting apparatus to measure cloud heights. The method is worked out to be used in conjunction with curves giving wind speed against height obtained at pilot balloon stations. Graphical application assists in speeding up results. E. G. M.

551.578.4 : 539.214 = 3 1414

Snow as a crystalline aggregate. DE QUERVAIN, M. *Experientia*, **1**, 207–12 (*Oct.* 15, 1945) *In German.*—Snow crystals reaching the ground are the end products of growth processes caused by changes in temperature, humidity and wind conditions through the atmosphere. As it sets on the ground the density increases from 0·6 to 0·9, partly owing to the weight of accumulating layers, partly owing to continued crystalline transformation. Sharp edges and points of the crystals are smoothed and a spherical form is approached. Surface tension appears to act as though a liquid film were covering the crystals. After some time the original crystal forms re-appear as prismatic discs. The grain-size distribution in a thick layer of snow depends on the temperature gradient and temperature variations. The plastic properties of snow have been investigated by torsion tests on a hollow cylinder and are somewhat similar to those of a hot metal. Yield point and recovery are masked by a remarkable after-effect. For microscopic examination of thin slides, the pore volume of snow was first filled with tetrabromoethane (f.p. + 0·1°c) and the whole mass frozen solid. It was then possible to cut the aggregate into slices of a few tenths of a mm. J. A. W.

551.590.24 : 551.510.535 *see Abstr.* 1408

551.594.5 1415

A study of auroral arcs and draperies. HARANG, L. *Terr. Magn. Atmos. Elect.*, **50**, 297–306 (*Dec.*, 1945).—By means of parallactic photographs at Tromsö the heights and directions of 355 auroral arcs and the heights of 293 draperies have been studied. From the height-statistics it is shown that the heights of arcs and draperies show a continuous decrease according to classifications faint, medium, strong, and very strong. For the auroras of medium intensity it is shown that there is definite evidence of a displacement of the height-curves from ebb-tide to flood-tide conditions. The diurnal variation of the direction of the arcs during 16^h to 24^h, MET, is demonstrated for Tromsö, and a secular change in the mean directions is demonstrated when compared with Bravais' determinations in Bossekop during 1839–40.

551.594.5 1416

Note on methods of determining the direction of auroral arcs from a single station. HARANG, L. *Terr. Magn. Atmos. Elect.*, **50**, 311–13 (*Dec.*, 1945).

551.594.6 : 523.5 1417

Meteoric impact ionization observed on radar oscilloscopes. FERREL, O. P. *Phys. Rev.*, **69**, 32–3 (*Jan.* 1 *and* 15, 1946).

551.594.6 : 551.510.535 1418

Scattering of radio waves from great virtual distances. HARANG, L. *Terr. Magn. Atmos. Elect.*, **50**, 287–96 (*Dec.*, 1945).—Using a pulse-transmitter of high power, scattered reflections corresponding to virtual reflection-distances of 500 to 2 500 km have been obtained. The test-frequencies used (10–11 Mc/sec) were usually greater than the critical penetration-frequencies of the F_2-layer. Records on a fixed frequency over a number of days have been taken in

order to study the diurnal variation and dependence on geomagnetic activity and aurora, and 4 different phases in the diurnal variation have been recorded. During the 2 day-phases it has been shown that the scattered reflections cannot come in vertically as they are not cut off by the *F*-layer. During the 2 night-phases the echoes are reflected from scattering areas lying in or near the zenith at heights of 500–800 km. Small geomagnetic disturbances increased the scattering at these heights. Stronger perturbations were accompanied by scattering from heights down to 100–200 km.

BIOLOGY 57/59

576.8.093.3 : 545.828 *see Abstr.* 1388

576.8.095.14 1419

The inactivation of viruses by radiations. LEA, D. E. *Brit. J. Radiol.*, **19**, 205–12 (*May*, 1946).—Recent experiments on the inactivation of plant, animal, and bacterial viruses by γ rays, X-rays, and α rays are reviewed. In sufficiently dilute aqueous solutions the inactivation is mainly indirect, i.e. is due to the production of ionization in the water rather than in the virus itself. If the virus is irradiated dry, however, or in an aqueous solution of sufficiently high solid content, larger doses are required and the inactivation is mainly direct, i.e. the inactivation of a virus particle is due to the production of ionization in the virus particle itself. There is evidence that a single ionization suffices to inactivate a virus particle. A correlation exists between the inactivation dose for the direct effect and the size of the virus, the inactivation dose being greatest for the smallest viruses. The experimental relation between inactivation dose and virus size is compared with the relation calculated on the hypothesis that a single ionization anywhere in the virus particle leads to inactivation. The conclusion is reached that probably not every ionization is certain to lead to inactivation, but that if attention is confined to viruses of diameter smaller than 100 mμ, the diameter calculated on the assumption that every ionization in the virus is effective will not be in error by a factor exceeding 2.

578.087.87 1420

Electrical tissue. Relations between the structure, electrical characteristics, and chemical processes of electrical tissue. COX, R. T., COATES, C. W., AND BROWN, M. V. *J. Gen. Physiol.*, **28**, 187–212 (*Jan.* 20, 1945).—An analysis of the electrical measurements and the relations between the electrical characteristics and the structure of the electrical organs of *Electrophorous electricus L.* (electrical eel) is given. A transverse layer of the organs one electroplax thick has certain characteristics which are roughly uniform along the organs. These are its volume, its max. voltage, its max. current per unit area, and the resistance of unit area at the peak of the discharge. Measurements of the voltage developed by a segment of the organs across different external resistances at different instants during the discharge are all well described by representing the segment with the adjacent non-electric tissue, as a simple combination of e.m.f. and ohmic resistance. The internal resistance of the tissue varies during the discharge; its e.m.f. is practically constant during the greater part of the discharge. The total electric energy is approximately equal to energy supplied by the decrease of phosphocreatine and the formation of lactic acid. C. J. G.

578.088.5 : 537.531.9 1421

Biological evaluation of 20 million volt Roentgen rays. I. Acute death in mice. QUASTLER, H., AND CLARK, R. K. *Amer. J. Roentgenol. and Radium Ther.*, **54**, 723–7 (*Dec.*, 1945).—Experiments upon mice were carried out with a 20 million volt betatron. Whilst such energy radiation should be useful in the treatment of deep-seated cancer it cannot be predicted how it will affect living tissues, which must be established by biological evaluation. Mice were subjected to 20 million volt X-rays and the clinical and pathological effects were qualitatively as with conventional X-rays. Quantitatively it was found that 1 r at 20 million volts is equivalent to 0·65 r excited at 200 kV owing to the difference of depth dosage of the more penetrating and less absorbed higher voltage radiation. B. J. L.

578.088.5 : 537.531.9 : 539.185.9 1422

A comparison of two levels of Roentgen and neutron irradiation of normal and lymphadenomatous mice, using radiophosphorus as an indicator of cellular activity. SCOTT, K. G. *Radiology*, **46**, 173–5 (*Feb.*, 1946).—Radiophosphorus has previously been used as a tracer of the phosphorus exchange of normal and lymphomatous tissue. In the present biological investigations it was found that both X-rays and neutron radiation depress the phosphorus uptake in mice as measured by radiophosphorus. This method offers a new technique for the study of various radiations on normal and neoplastic tissues. B. J. L.

578.088.5 = 3 1423

The present position of the main problem in radiobiology. I. Mechanism of the primary biological action of radiations. MINDER, W., AND LEICHTI, A. *Experientia*, **1**, 298–307 (*Dec.* 15, 1945) *In German.*—Two theories have been put forward to explain the biological action of ionizing radiations, the quantum or ion "hit" theory and the photochemical or radiochemical theory. These are discussed and compared with existing experimental facts. In the case of the "hit" theory, a number of discrepancies are pointed out. The claims of some workers to have obtained an exponential relation between biological action and radiation dose are criticized as not being in strict accord with the facts. Evidence is put forward in favour of the indirect, radiochemical theory of action. Experiments by a number of workers on the irradiation of simple chemical systems provide the chief support for the theory. The primary action of the radiation is the activation of the water or other solvent. The energy thus absorbed is then transferred from the point of absorption to the radiosensitive molecules or biological objects by electronic transport or diffusion,

the latter being more probable in biological systems. The question of the mode and form of activation of the water or other medium is left open. J. E. R.

591.181 1424

On the stimulating effect of electric currents of extremely short duration. LIPPAY, F. *Aust. J. Exp. Biol. Med. Sci.*, **22**, 157–67 (*Sept.*, 1944).—The results of nerve stimulation with electric currents of very short duration using galvanic currents (rectangular waves) and condenser discharges are essentially the same. At durations under 0·2 millisecond or for capacities under 0·1 μF the electric quantities required for minimal stimulation decrease with decreasing duration (capacity), in a progressive degree. The corresponding part of the quantity-duration curve shows a strong concavity towards the abscissa. No lower threshold for the effective electric quantities could be found within the range examined. Some features of the stimulation curve for longer duration are also considered. The relations of the results obtained to some of the more important formulae for electric stimulation are discussed; but the validity of these or of any other formulae for the whole range of durations will largely depend not only on the form of the curve for short duration, but also on that for long durations, the actual form of the latter, i.e. whether straight or concave towards the abscissa, not yet being known with certainty. C. J. G.

591.181 1425

Relation between fibre diameter and action potentials of single nerve fibres. HERTZ, H. *J. Physiol.* **104**, *Proc.* 1–2 (*June*, 1945).—Single fibres of the frog's sciatic nerve were stimulated with brief condenser discharges, and monophasic potentials were recorded with a push-pull amplifier and c.r.o. The diameter of the fibre was measured with an eyepiece micrometer and water-immersion objective. Osmotic experiments to determine how far the propagation of the nervous impulse depends on ionic exchange through the nervous membrane, or on processes on the surface of the membrane, show the impermeability of the membrane around the axis cylinder. It appears unlikely that any great exchange of ions could take place in the short time required for the action potential to reach its maximum. C. J. G.

591.181 1426

Resting and action potentials in single nerve fibres. HODGKIN, A. L., AND HUXLEY, A. F. *J. Physiol.*, **104**, 176–95 (*Oct.*, 1945).—From experiments which are described and the apparatus illustrated it is concluded that the difference between action and resting potentials is too large to be explained by a liquid junction potential between the axoplasm and the microelectrode. It must be due to a reversal of potential at the surface membrane of an active section of nerve. Possible ways in which this might arise are discussed. C. J. G.

591.181 = 393 1427

The influence of electrode distance on the optimum frequency with a.c. nerve stimulation and on the accommodation-constant. DUYFF, J. W., AND WALTER, W. G. *Versl. Ned. Akad. Wet. Afd. Natuurk.*, **53** (*No.* 5) 334–44 (1944) *In Dutch.*—It was found that (1) a decrease of interpolar length leads to an increase of the optimum frequency; (2) the shift of the optimum brought about by a change of inter-electrode distance is too large to be explained on the basis of the reduction of k with interpolar length alone (k = Hill's time const., *Proc. Roy. Soc. B*, **119**, 305, 440, 1936); (3) this apparent discrepancy is due to the fact that accommodation is the more marked as the inter-electrode distance becomes smaller, in other words that λ (the accommodation coeff.) as well as k is smaller in the case of small interpolar length.

MEDICAL SCIENCE 61

612.663.53 : 539.16 1428

Biological risks of atomic fission. *Nature, Lond.*, **157**, 222 (*Feb.* 23); 435–6 (*April* 6, 1946).

612.813 : 517.512.2 = 393 1429

The analysis of physiological curves. I. Electro-encephalograms. TOMEY, A. H. J. M., AND KAISER, L. *Versl. Ned. Akad. Wet. Afd. Natuurk.*, **53** (*No.* 6) 410–31 (1944) *In Dutch.*—The method used permits an almost exact determination of components with a variable amplitude which, in general, are more real than the stable sinusoids found by Fourier's method. The method is based on the exhaustion method of H. Labrouste, which gives components having a variable amplitude according to their true shape. By certain combinations, a curve is replaced by others of a simpler shape. One sinusoid of a certain frequency is finally obtained, the other components being eliminated.

612.843.3 = 4 1430

Rayleigh's equation and the independence of chromaticity and luminosity factor. DURUP, G., AND PIÉRON, H. *Rev. Opt.* (*Théor. Instrum.*) **22**, 224–31 (*Oct.–Dec.*, 1943) *In French.*—A number of observers with normal colour vision were examined to determine (*a*) the relative amounts of a red and a green light which appeared to have equal luminosity, and (*b*) the proportions of the same red and green which gave a match with a certain yellow. It was concluded that the variations encountered among the various subjects showed no sign of correlation such as would result from, for example, differences of macular pigmentation. J. W. T. W.

612.843.5 : 541.14 1431

Visual critical flicker frequency as a function of intensity. JAHN, T. L. *J. Opt. Soc. Amer.*, **36**, 76–82 (*Feb.*, 1946).—An equation for visual critical flicker or fusion frequency as a function of intensity has been derived on the basis of the photochemical theory. It is assumed that the flicker frequency is a function of the concentration of photo-sensitive substance and also of the manner in which the maximal value is approached as the frequency of equivalent stimuli is increased. This equation has the same general form as the equation of Hecht, but the parameters have quite a different significance. Because of this, the flexibility of the new equation allows much more freedom in adjusting the equation to fit experimental data, and all known flicker data can, therefore, be fitted reasonably well. According to the new equation a rise in temperature should lower the intensity at which fusion occurs. This is in agreement with experimental data and contrary to predictions on the basis of the old equation. The new equation also

predicts the observed shift in the flicker-intensity curves when the ratio of the light to dark period is changed, and it makes no assumptions regarding the photochemical cycle which contradict the chemical evidence.

612.843.53 :≔ 3 1432

Remarks on the flicker of moving objects and the definition of degree of flicker. GOLDMAN, H., KÖNIG, H., AND MÄDER, F. *Bull. Ass. Suisse Élect.*, **37**, 25–30 (*Jan.* 26, 1946) *In German.*—An experimental investigation of the extent of flicker, and its effects on the perception of moving objects, for lights of different kinds. It is concluded that the first term in the Fourier series expressing the light fluctuation controls the degree of flicker noticeable. This is measured in terms of the proportion of steady light which must be added to the flickering light in order to make the flicker just cease to be noticeable. J. W. T. W.

612.843.6 : 541.14 1433

Brightness discrimination and visual acuity as functions of intensity. JAHN, T. L. *J. Opt. Soc. Amer.*, **36**, 83–6 (*Feb.*, 1946).—New equations have been derived on the basis of the photochemical theory. These equations can be fitted to all existing data and are not in conflict with the available chemical evidence. They may also be modified to fit data on dark adaptation and instantaneous threshold.

612.843.613 1434

Effects of exposure to ultra-violet light on visual threshold. WOLF, E. *Proc. Nat. Acad. Sci., Wash.*, **31**, 236–41 (*Aug.*, 1945).—Experiments, designed to study the response to flicker, were carried out on baby chicks and a curve was obtained showing the relation between the flicker frequency and the mean critical intensity of light. It is concluded that the visual mechanism is impaired by ultra-violet light between 300 and 365 mμ, in absence of exterior pathological conditions recognizable by ophthalmoscopic inspection. L. S. G.

612.845.5 1435

Effect of quality of illumination on the results of the Ishihara test. HARDY, L. H., RAND, G., AND RITTLER, M. C. *J. Opt. Soc. Amer.*, **36**, 86–94 (*Feb.*, 1946).—A study of the effect of using tungsten lamps, instead of daylight, for illuminating the Ishihara charts for testing colour abnormality. It is found that all deuteranomalous subjects and deuteranopes score higher with the tungsten light. Protanopes are not affected. The test thus ceases to be valid for deuteranopia or deuteranomaly. There is also a decrease in the number of cases which are correctly classified for type of red-green defect. J. W. T. W.

612.85 : 534.756 = 3 1436

Pitch sensitivity and acoustic trauma. RUEDI, L., AND FURRER, W. *Experientia*, **1**, 201–2 (*Sept.* 15, 1945) *In German.*—The exposure of a human ear to a very loud pure tone produces not only an increase of the threshold but also modifications of the pitch. These observations lead to a new "two-place" mechanism of the inner ear, where pitch and loudness are perceived at two different and locally separated places of the basilar membrane.

612.858.7 = 3 1437

Build-up and decay processes in the ear. LÜSCHER, E., AND ZWISLOCKI, J. *Experientia*, **1**, 231 (*Oct.* 15, 1945) *In German.*

613.647 : 537.531.08 : 621.386.86 1438

An integrating radiation meter. MONTGOMERY, C. G., AND MONTGOMERY, D. D. *J. Franklin Inst.*, **241**, 55–58 (*Jan.*, 1946).—An instrument for permanent installation in a department, indicating the quantity of gamma and X-radiation received by personnel in its vicinity. A Geiger counter chamber is connected to an amplifier, the output current of which is integrated by an electrolytic cell: the quantity of gas liberated is proportional to the number of discharges of the chamber, and the instrument is calibrated in terms of the tolerance dose received by workers in a day. F. T. F.

614.485 : 621.327.311 = 4 1439

Germicidal lamp and the practical measurement of sterilizing radiation. LEMAIGRE-VOREAUX, P. *Bull. Soc. Franc. Élect.*, **5**, 298–300 (*Oct.*, 1945) *In French.*—[Abstr. 1133 B (1946)].

614.72 : 539.16.08 1440

Radon micro determination by the Curtiss–Davis α-particle counting method. ROTH, G. E. *N.Z. J. Sci. Tech. B*, **27**, 147–53 (*Sept.*, 1945).—Modifications of the design and of the routine operation of a radon micro determination equipment, based on the Curtiss–Davis α-particle counting method, are described. [See Abstr. 2849 (1943)].

615.831 : 551.521.63 : 535.247.4 *see Abstr.* 1279

615.831.4 = 4 1441

Use of infra-red radiation in therapeutics. Numerical data and relative measurements of radiations and sources. DÉJARDIN, G., AND LATARJET, R. *Rev. Opt. (Théor. Instrum.)* **22**, 206–14 (*Oct.–Dec.*, 1943) *In French.*—Examines the essential facts on which the use of infra-red radiation in therapeutics should be based, including the transmission of skin and tissues, suitable wavelengths, mode of action of the radiation, etc. The production of radiation is discussed, the various sources and their efficiencies being considered at length. A. H.

615.849 : 621.385.83 1442

On increasing the effectiveness of a betatron. WANG, T. J. *Phys. Rev.*, **69**, 42 (*Jan.* 1 *and* 15, 1946).—[Abstr. 1168 B (1946)].

615.849.1 : 537.531 : 535.341 1443

Effective atomic number and energy absorption in tissues. SPIERS, F. W. *Brit. J. Radiol.*, **19**, 52–62 (*Feb.*, 1946).—The energy absorbed per cm^3 of tissue exposed to a dose of one röntgen depends on the effective atomic number and on the electron density of the tissue. An experimental determination is made of the linear absorption coefficient of a number of representative body tissues, using a narrow wavelength band selected by a pair of balanced Ross filters. The effective atomic number of these tissues and the energy absorption per röntgen over a wide range of wavelengths are then calculated. Estimates are made in some typical cases of clinical interest of the dose distribution in a heterogeneous medium compared to that measured in a homogeneous medium of unit density, and of the variation of energy absorption throughout the medium. Finally the variation with wavelength of the energy absorption at a bone surface situated at varying depths below the skin is calculated

and some consideration given to the clinical importance of these results. H. M.

615.849.7 : 539.16 1444

Energy absorption in radium therapy. BUSH, F. *Brit. J. Radiol.*, **19**, 14–21 (*Jan.*, 1946).—Methods are developed by which the total energy absorption, i.e. the integral dose, in a cylinder of finite length and of circular or elliptical cross-section due to a point source of Ra may be calculated. Values are tabulated for the energy absorption in cylinders of tissue with a point source at the end of the axis. Numerical values are then obtained for the integral dose per mg-hr for a point Ra source situated in a large number of positions relative to a model "patient." The model "patient" is assumed to be built up of cylindrical sections. Results of calculations are given for Ra in deep positions near the axis and in a large number of superficial positions. The integral dose in gm-röntgen per mg-hr can thus be obtained for Ra used in intercavitary, interstitial and in superficial therapy. The integral dose in hollow cylinders is discussed in consideration of certain corrections applied to the method. H. M.

615.849.7 : 539.167.3 = 3 1445

The application of artificial radioactive isotopes to the production of localized biological radiation effects. MÜLLER, J. H. *Experientia*, **1**, 199–200 (*Sept.* 15, 1945) *In German.*—The author made a first attempt to utilize an artificial radioactive isotope for the production of localized biological radiation-effects, by means of intraperitoneal injections of radiozinc (Zn^{63}) suspended in a solution of pectine. Experiments were performed on mice and rabbits and the procedure was applied, for the purpose of preliminary therapeutic investigations, to a case of carcinoma of the ovary with severe peritoneal extension.

616–073.75 : 621.386.84 : 778.83 1446

An evaluation of automatic exposure control equipment in photofluorography. MORGAN, R. H., AND HODGES, P. C. *Radiology*, **45**, 588–93 (*Dec.*, 1945).—[Abstr. 1174 B (1946)].

616.5.012.9 : 537.533.9 1447

Superficial "burns" of skin and eyes from scattered cathode rays. ROBBINS, L. L., AUB, J. C., COPE, O., COGAN, D. G., LANGOHR, J. L., CLOUD, R. W., MERRILL, O. E. *Radiology*, **46**, 1–23 (*Jan.*, 1946).—Owing to wandering of the focal spot of a 1 200 kV electrostatic generator 6 persons entered the room whilst the tube was in operation, for a period probably not longer than 2 min. As a result all, particularly one who for a very short time, until warned, went nearer than 3–5 ft from the central beam, received very extensive radiation burns. These burns are described in great detail in respect of their distribution on the body, and their course, with coloured illustrations. There were differences with respect to sun, heat and X-ray burns which are dealt with. A bibliography is given. B. J. L.

654.91 : 535.312 *see Abstr.* 1281

666.22(44 + 43) 1448

Production of optical glass in Germany and France. *CIOS Rep.* XXIX—41, (*H.M. Station. Off.*; *U.S. Dep. Comm.*) 7 *pp.* (1946).—A new process was noted, consisting of casting optical glass into slabs and then breaking and sawing the slab into blocks; this is an improvement on the old process of allowing the glass to cool in pots. Methods of annealing, pressing, etc., were observed, but were in general no better than current English and American practice. N. C.

681.4 1449

The production of binoculars by Zeiss. *CIOS Rep.*, XXIX—42 (*H.M. Station. Off.*; *U.S. Dep. Comm.*) 3 *pp.* (1946).—Describes the machining of the metal parts of Zeiss binoculars; this is done with great accuracy and the prisms are located correctly without further adjustment in 90% of the cases. A brief description of the optical system is given; aspheric surfaces are used in the eye-piece. N. C.

681.4(43) 1450

German optical production. *CIOS Rep.*, XXIX—52 (*H.M. Station. Off.*; *U.S. Dep. Comm.*) 9 *pp.* (1946).—Summarizes methods used by Germany for manufacture and testing of optical glass. Nothing new was observed in manufacture of the actual glass, but there appeared to be new techniques in use for moulding prisms and lenses. Al was preferred for blocking bodies. Aspheric surfaces were used in some instruments. Testing was carried out by straightforward means against a master optical flat. A new equipment for edge grinding of lenses is described. N. C.

PHOTOGRAPHY 77

771.36 = 3 1451

New method of testing photographic shutters. KÁLMÁN, L. *Schweiz. Arch. angew. Wiss. Tech.*, **11**, 175–81 (*June*, 1945) *In German.*—Describes photoelectric apparatus for testing shutter speeds. An emission-type cell charges a condenser to a voltage which is proportional to the exposure given by the shutter. The method of calibrating the instrument is described, and there is a discussion of the characteristics of central opening, focal plane and special types of shutter. Typical results, obtained with certain shutters fitted to high-price cameras, are given. The departures from the nominal values are small, but with less carefully constructed shutters errors may be very considerable. Accuracy of shutter speed is increasing in importance, especially for colour film. J. W. T. W.

771.44 : 621.327.4 1452

Photographic light sources. BOURNE, H. K. *Photogr.J.B.*, **85**, 129–30 (*Nov.–Dec.*, 1945).—The paper describes briefly the characteristics of incandescent lamps and carbon arcs used for photographic lighting. The properties of various types of electric discharge lamps are then outlined and it is

shown that their characteristics of high actinic efficiency, long life and steadiness of operation render these lamps particularly suitable for photographic sources.

771.534.24 1453

Hypersensitizing and latensification: a preliminary survey. SHEPPARD, S. E., VANSELOW, W., AND QUIRK, R. F. *J. Franklin Inst.*, **240**, 439–68 (*Dec.*, 1945).—After discussing the general features of hypersensitizing and latensification (i.e. treatment before and after exposure) the various methods available are examined in detail. These include uniform, over-all illumination (either as a flash or by lengthy exposure at low intensity levels), the use of Hg vapour, weak acids, hydrogen peroxide and other oxidants, ammonia and amines. The mechanism involved in each case is given and the magnitude of the effect stated; it is concluded that the use of light and Hg vapour offer the most promise for an intensive study of latent image formation. Attention is drawn to the fact that with Hg vapour both Herschel and Becquerel effects are obtained. A. H.

771.534.541 1454

Variation of contrast with wavelength. DAVEY, E. P. *Photogr. J.B.*, **85**, 127–8 (*Nov.–Dec.*, 1945).—The variation of contrast of a photographic plate with wavelength is due to strong absorption by the silver halide between 250–310 mμ, which restricts the light action to a region near the emulsion surface, thus resulting in a fairly low contrast. Above 310 mμ, absorption decreases with increasing wavelength, which allows greater penetration of the light, and hence a higher contrast. This variation in absorption results also in less scattering, and so in higher resolution at the lower wavelengths. The addition of suitable absorbing substances to the emulsion can increase the absorption at the higher wavelengths without materially affecting that at the lower wavelengths, so giving rise to a more uniform contrast through an extended wavelength range.

772.1 : 519.52 *see Abstr.* 1202

778.3 : 621.317.775 1455

A continuous film-recording camera for use with standard cathode-ray oscilloscopes. SIMONS, A. H. *Electronic Engng*, **18**, 10–12 (*Jan.*, 1946).—This unit uses 85 mm film or paper in 100 ft lengths. The speed is continuously variable and enables components up to 5 kc/s to be analysed in complex records; a maximum run of 24 secs being possible at maximum speed. A viewing table and simple microscope are used to examine the film records. E. D. H.

778.33 : 621.386.86 1456

Notes on the use of protective glass in photofluorographic equipment. MORGAN, R. H., AND LEWIS, I. *Amer. J. Roentgenol. and Radium Ther.*, **54**, 403–6 (*Oct.*, 1945).—In photofluorographic (mass radiographic) procedures it has been customary to insert a sheet of lead glass between the fluorescent screen and camera lens either directly adjacent to the screen or at some distance. This is stated not only to support the screen material but to protect the camera lens and lens cement from the harmful effects of the X-rays. It is shown that by reflection of light this glass affects the sharpness of the image and reduces the intensity of the light reaching the camera, thereby increasing the necessary exposure time. As a result of tests it is considered such glass should be dispensed with since protection of the screen against dust is not of utmost importance, and given the life of a photofluorographic unit as 500 000 exposures with a dosage of 500 r at the lens during such exposures, tests have shown there is no appreciable adverse effect on the lens with test exposures totalling 1 000 r. B. J. L.

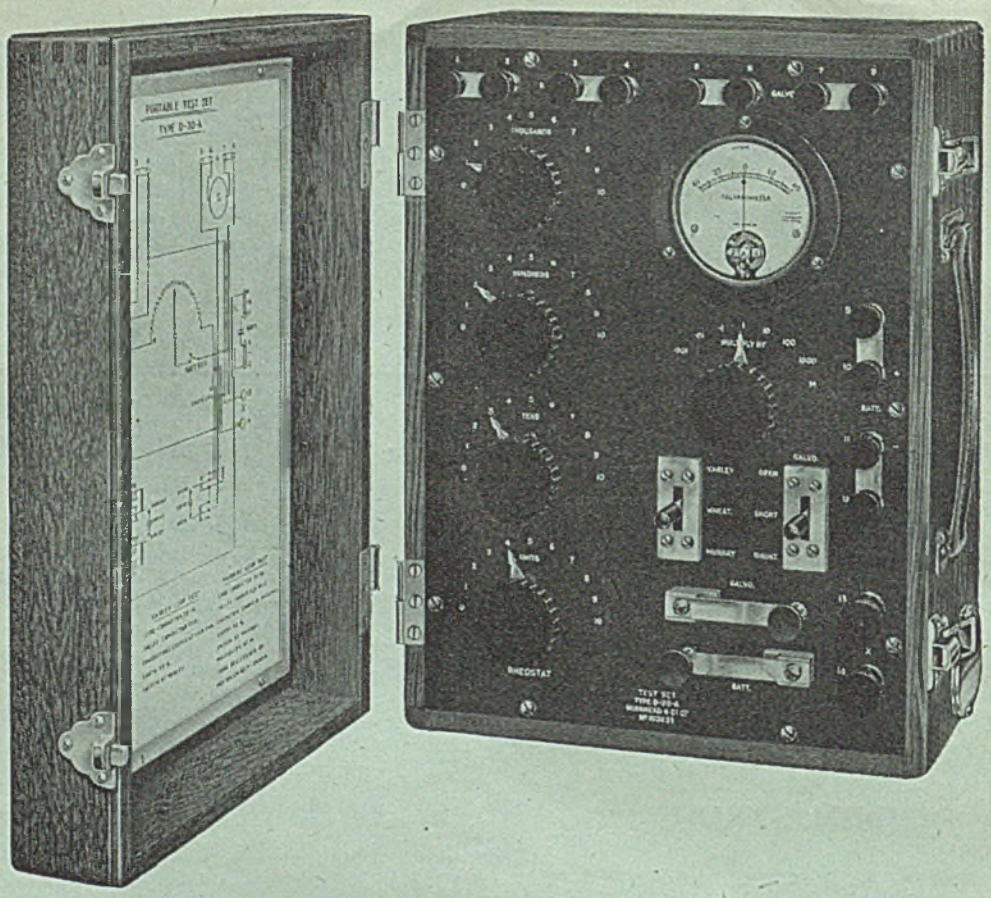
778.344 : 535.33.072–15 1457

Experiments on the use of infra-red sensitive phosphors in photography of the spectrum. PAUL, F. W. *J. Opt. Soc. Amer.*, **36**, 175–7 (*March*, 1946).—Wartime developments of infra-red sensitive phosphors have made possible the photography of infra-red spectra to wavelengths as great as 15 300 Å with practical exposure times and reasonable definition.

778.532 : 621.317.755 1458

High speed photography of the cathode-ray tube. GOLDSTEIN, H., AND BALES, P. D. *Rev. Sci. Instrum.*, **17**, 89–96 (*March*, 1946).—Some techniques are described that have been developed for the periodic recording of single, fast traces on a cathode-ray tube at rates up to 4 000/sec. The factors affecting the maximum writing speed are discussed, and it is shown that speeds as high as 70 cm/μsec can be obtained without sacrifice of deflection sensitivity and using commercially available tubes and films. Several 16 mm cameras, adaptations of existing models, are described which permit photography of as many as 4 000 traces/sec. The film in these cameras moves continuously and at high speeds and cannot normally be projected as a moving picture. Where such projection is desired, a camera is employed which provides trigger pulses to initiate the transients synchronously with the film speed. Finally, a technique is presented for placing consecutive identification numbers in each frame area.

778.83 : 621.386.84 : 616–073.75 *see Abstr.* 1446



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