

## Societies and Academies.

LONDON.

**Royal Society, Feb. 16.**—A. Fowler and E. W. H. Selwyn: The arc spectrum of carbon. Further observations of the arc spectrum of carbon (C I) have been made, and the classification of the lines has been considerably extended. The deepest term is a triplet  $P_0$ , the value of which is estimated as 90107, corresponding to an ionisation potential of 11.2 volts.

**R. H. Fowler:** The chemical constant of hydrogen vapour and the failure of Nernst's heat theorem. Dennison's theory of the specific heat of hydrogen requires that at ordinary and low temperatures it should behave as a non-combining mixture of two different sorts of molecules, the symmetrical and the antisymmetrical, in the proportion 1 to 3. It follows that the observed constant in the vapour pressure equation will be given only if liquid and solid hydrogen are equally mixtures of the two non-combining molecules in the same proportion. It then follows that the weight of the lowest state of solid hydrogen cannot have the value 1, so that the entropy of the solid remains positive at the absolute zero.

**A. H. Wilson:** The ionised hydrogen molecule. Schrödinger's method is applied to the quantisation of a molecular system consisting of one electron and two protons. If wave functions which are bounded in the whole of three dimensional space are used, the system admits of no stationary states. By employing a wave function which becomes infinite at the two nuclei and along the line joining them, stationary states exist for all distances apart of the nuclei. Formulæ are given for the calculation of the energy of the lowest state, and the minimum value of this for different nuclear separations gives the energy of the ion  $H_2^+$ .

**A. H. Wilson:** A generalised spheroidal wave equation. The equation is a second-order differential equation with three real singular points, two regular and the third irregular. It contains three independent parameters, and there are many types of solutions, but only two are of importance. The first class consists of those functions which are bounded in the real interval joining the two regular singularities. To obtain these functions it is necessary to impose one relation on the parameters. The second class of functions consists of those bounded in the real interval joining a regular singularity to the irregular point, and two algebraic relations must be imposed on the three parameters.

**O. H. Walters and S. Barratt:** The alkaline earth halide spectra and their origin. A method has been found by which the alkaline earth halide spectra can all be observed in absorption. The conditions of experiment prove that the spectra originate from subhalide molecules, probably of the type  $MX$ , and not from the normal salts. These subhalides exist in stable equilibrium with the metal and the normal salt as vapours at 1000° C. The spectra have been examined by the absorption method, and new band groups have been observed in the ultra-violet. The calcium fluoride band 5292 has been examined under high dispersion. Its structures, in absorption and emission, have proved to be very different.

**T. R. Merton:** On a new effect in the electric discharge. A new type of electric discharge has been observed in vacuum tubes containing helium and carbon. The principal feature consists in the formation of bright discs which, unlike the striæ usually observed in vacuum tubes, are unaffected by weak magnetic fields. A violent disturbance, such as the passage of a condensed discharge, is necessary to

start the formation of the discs, which can only be maintained with alternating currents. When a direct current is superposed on the alternating current the disc moves towards the anode. When the tubes are excited by direct current there is a migration of carbon compounds to the cathode. The phenomena have been investigated by stroboscopic methods. Carbon monoxide is decomposed in the discs with the formation of a particulate cloud of carbon. The effects are discussed in relation to the phenomenon known as ball lightning.

**P. A. M. Dirac:** The quantum theory of the electron (Part 2). Proof is given of the conservation theorem, and further developments are made in the application to spectra of atoms with single electrons. The various series of terms are described by a single quantum number  $j$ , taking both positive and negative integral values. The selection rule for  $j$  is equivalent to the two selection rules of the previous theory. Relative intensities of lines of a multiplet, and the anomalous Zeeman effect for weak and strong fields, also give results in agreement with previous theories.

**S. W. Watson and M. C. Henderson:** The heating effects of thorium and radium products. A resistance thermometer method was employed, the calorimeter wall having an absorbing thickness equivalent to 0.7 mm. of aluminium. Using the known rate of emission of particles by thorium C relative to radium C, the ratio of observed to calculated heating is constant within experimental error for all five products, and agrees well with Hess and Lawson's value of  $Z$ , namely,  $3.72 \times 10^{10}$   $\alpha$ -particles per gm. per sec. The discrepancy in the worst case, namely, thorium (B + C), is 2 per cent. If Geiger and Werner's value of  $Z$ , namely,  $3.40 \times 10^{10}$ , be correct, the excess heat over and above that provided by the known radiations must be a nearly constant fraction of the whole (9 to 12 per cent.) for all the substances investigated. It must also be in a form easily absorbed by 0.7 mm. of aluminium, and if electromagnetic would require about 40 quanta at least per atom disintegrating.

**H. F. Baker:** Note on the paper "Commutative Ordinary Differential Operators" by J. L. Burchnell and T. W. Chaundy. In the classical theory of Abelian functions, the passage from the algebraic functions to the theta functions is made by a function which is the exponential of a sum of integrals of the third kind; the upper limits of these depend on arguments determined by an inversion theorem. Messrs. Burchnell and Chaundy's paper deals with the particular case of this when all these arguments except one are zero. They use an extended inversion theorem which disguises the essential character of the coefficients in the differential equations obtained. Simplification is possible in the modular expression of algebraic integrals when the fundamental algebraic equation has the canonical Weierstrass form.

**L. S. Ornstein, W. Kapuscinski, and J. G. Eyners:** Intensity measurements in the secondary spectrum of hydrogen. The intensities of the lines in the secondary spectrum of hydrogen have been measured in the region 4500-4900 Å. by the Utrecht method.

**Optical Society, Jan. 19.**—T. Smith: (1) On toric lenses. A system of toric lenses having a common normal to all their surfaces possesses in general ten independent primordial coefficients. A single surface has only three degrees of freedom, and this number also holds for any system of negligible axial depth. Formulæ are given for the calculation of the ten coefficients, which are only all independent when the system includes at least three separated toric refract-

ing surfaces with their planes of principal curvature finitely inclined to one another. An eye with both its cornea and its crystalline lens astigmatic and the meridians of principal curvature different has more independent coefficients than a spectacle lens has effective degrees of freedom. (2) Canonical forms in the theory of asymmetrical optical systems. Canonical forms for the quadratic terms of the eikonal and of the characteristic function for any optical instrument involve only six arbitrary constants. The seven constant canonical form of the characteristic function obtained by Larmor is not general. Larmor's theorem on the equivalence of any optical system to a symmetrical instrument together with two thin astigmatic lenses also fails. Three separated astigmatic lenses are needed to represent the general system.—M. Herzberger: Some remarks on an extension of the optical cosine law. In this note reference is made to an extension of the optical cosine law, a full description of which will appear in the *Zeitschrift für Physik*.

Physical Society, Jan. 27.—W. E. Pretty: The Swan band spectrum of carbon. The Swan spectrum has been obtained in carbon monoxide and in the carbon spark in the absence of hydrogen. A discussion of the results of experiment and theory leads to the conclusion that the emitter of the Swan band system is the molecule of carbon ( $C_2$ ).—T. Smith: On some misapplications of the law of errors and on the intrinsic error in focometry. In some physical measurements the uncertainty due to a single cause is not infinitesimal, and the precision of the mean of a large number of observations given by the law of errors is not then physically significant. An example is afforded in attempts to identify the position of an optical image. According to geometrical optics, this lies in a definite surface; but, owing to the physical properties of light, this surface cannot be identified experimentally. The use of a double cylindrical lens as a means of limiting more narrowly the space in which this surface lies is discussed.—A. H. Davis: Some acoustical phenomena illustrated by ripples—transmission through Quinke filters, curved conduits and vibrating partitions. The paper employs ripple photographs to illustrate the action of the Quinke acoustical filter, and directs attention to the filtering action which is likely to occur at bends in curved sound conduits or in curved horns owing to resonant transverse vibration of the contained air. It also illustrates by the ripple analogy the transmission of sound through partitions.

## EDINBURGH.

Royal Society, Jan. 9.—Penelope M. Jenkin: Note on the sympathetic nervous system of *Lepidosiren paradoxa*. A slender sympathetic trunk without obvious ganglionic swellings runs along each side of the dorsal aorta, receiving a *ramus communicans* from each spinal nerve throughout the length of the splanchnocœle. The trunk could be traced for a short distance into the tail region; anteriorly it could not be traced farther forwards than the first spinal nerve. Ganglion cells were found diffusely scattered through the trunk. No communication with the vagus ganglion, no collateral trunk, no medullated fibres, could be detected. On the whole, the sympathetic of *Lepidosiren* shows most close affinity to that of *Salamandrina urodeles*.—D. Noël Paton: Reflex postural adjustments of balance in the duck. A series of reflexes in the intact and in the decerebrated duck induced by disturbing the balance round antero-posterior and a transverse axes are described and analysed and explained as developed for the

readjustment of equilibrium.—E. A. Baker: The law of blackening of the photographic plate at low densities (3). The dependence of the density of a photographic deposit on the conditions of exposure and development, in particular when the density is low, is interpreted as indicating that several distinct latent images are formed, the most important being a slowly developing image involving two consecutive quantum absorptions; a rapidly developing image involving three absorptions, together with an intervening 'emission' and a very slowly developing 'reversed' image involving three consecutive absorptions. Various phenomena, including those involving two separated exposures, are successfully predicted.—Edith Philip Smith: A comparative study of the stem structure of the genus *Clematis*, with special reference to anatomical changes induced by vegetative propagation. The genus includes 160 species, of cosmopolitan distribution, ranging in habit from lianes to woody herbs. Of these, 137 were examined. The general vascular anatomy of the genus is remarkably consistent, centring round the simple Vitalba-type with 12 foliar bundles. The origin of callus is from the interfascicular cambium: adventitious roots come from the fascicular cambium. Propagation by stem cuttings is made easier by previous partial etiolation: the anatomical effects of this treatment are discussed.

## PARIS.

Academy of Sciences, Jan. 16.—Pierre Termier: The *pays de nappes* of the French Alps.—E. Leclainche and H. Vallée: Vaccination against anthrax. A description of improved methods of preparing immunising sera from *Clostridium Chauvei*. Filtration has been abandoned for supercentrifugation with subsequent addition of formaldehyde, and a mixed culture of various strains and different ages is used. Details are given of the results of the practical application of the sera, which is shown to be safe and effective.—Nemours-Auguste and A. R. Barrieu: The treatment of angina pectoris by radiotherapy.—G. Nicoladzé: An arithmometer with purely electrical direct multiplication.—d'Ocagne: Remarks on the preceding communication.—Charles Colombi: The number of specific turns of steam turbines.—Emile Merlin: Fluids with cylindrical stratification in rotation round an axis.—Jean Fieux: A new gyroscopic apparatus for preventing rolling of vessels. A description and drawing of the proposed apparatus is given, together with a curve showing the result of applying the apparatus to a vessel of 880 tons displacement.—A. Lévêque: The difference of the variation of temperature along the surface of exchange on the transmission of heat between this surface and a fluid in motion.—A. Lafay: The electromotive force of friction of metals. Subject to certain precautions described, it has been proved experimentally that the E.M.F. produced by the friction of metals is proportional to the relative velocities of the rubbing substances, and is independent of the pressure maintaining them in contact.—H. Jedrzejowski: The phenomenon of inversion in biotite submitted to the action of the  $\alpha$ -rays. Joly, in discussing the explanation of the ring structure of the haloes in biotite, has suggested an inversion analogous with that shown by over-exposed photographic plates as the cause. This view is confirmed experimentally, and it is proved that in consequence the determination of the age of minerals by the haloes may lead to erroneous conclusions.—Frlley: Spectrography of the  $\gamma$ -rays by crystalline diffraction. The apparatus, described in detail, furnishes a parallel bundle of  $\gamma$ -rays, freed from  $\beta$ -rays, and the spectrum is obtained by the rotating crystal method (rock salt).

The lines attributable to radium *B* and radium *C* are comprised between 35 and 284 U.X.—**Georges Simon**: The development of a Daguerre plate by cathode pulverisation.—**Henri Chrétien**: Photographic method with high luminosity.—**H. Colin and Mile. A. Chaudun**: Velocity of hydrolysis and hydrogen ion concentration. The results of experiments on the hydrolysis of sugar are given, in which the effect of various acids and addition of salts were studied: it was found that the variations of the hydrolysis constant are never parallel with the variations in hydrogen ion concentration.—**Pierre Chevenard and Albert Portevin**: Causes of the variation of volume accompanying the hardening of the light aluminium-copper alloys.—**P. Laffitte and P. Dumanois**: The velocity of the explosive wave. The velocities of the explosive wave in mixtures of hydrogen and oxygen and methane with oxygen, at varying initial pressures, have been measured by the photographic method both with and without added lead tetraethyl. The velocity of propagation of the explosive wave proved to be independent of the presence of the antidetonant in the gaseous mixture.—**Max and Michel Polonovski**:  $\psi$ -scopine and scopoline.—**E. Tassilly, A. Belot, and M. Descombes**: The saponification of ethyl phenylethylmalonate by alkalis. In this saponification, some phenylethylacetic acid is always formed, this forming the main product of the saponification in hot alcoholic solution.—**J. Bougault and L. Daniel**: The sulphoxytriazines.—**A. Aparé**: The metallic complexes of the cellulose nitrates.—**Jacques Bourcart and M. E. Denaeyer**: The lithological characters of the intrusive rocks of the Central Sahara Massif (Jacques Bourcart expedition, 1922-1923).—**Paul Fallot**: The central part of the Sierras of Segura (Andalusia).—**F. Bordas and A. Desfemmes**: Rains containing dust and salt.—**A. Guilliermond**: Some new facts relative to the development of *Spermophthora gossypii*.—**P. Gavaudan**: The relations between the vacuole and the oil-bearing system of the Jungermanniaceae.—**J. Amar**: The respiratory quotient.—**A. Fessard, H. Laugier, and S. Nouel**: The recovery index of a neuro-muscular system in the course of work.—**Philippe Fabre**: The form of the muscular contractions in indirect stimulation by linear currents.—**J. M. Le Goff**: The vasodilative action of the salts of cobalt.—**C. Dawydoff**: Some observations on the development of the Enteropneusts.—**L. Léger and C. Motas**: The lacustral fauna of the Grand Lautien.—**C. Mathis**: The experimental transmission of the spirochaete of the shrew mouse by the louse.—**Cordier, Lesbouyries, and Verge**: Hypoglycaemic syndrome and vitular fever.—**Marcel Labbé, H. Roubeau, and F. Nepveux**: The action of nickel and cobalt salts on the hypoglycaemic power of insulin in diabetes.—**Léon Blum and P. Grabar**: The alterations in the renal function by hypochlorination. An account of changes in the renal secretions, simulating nephritis of toxic origin, due to a deficiency of sodium chloride.—**Jean Saidman**: The therapeutic properties of X-rays of wave-length 8 Å.

#### ROME.

Royal National Academy of the Lincei. Communications received during the vacation, 1927.—**U. Cisotti**: Spiral vortices.—**E. Bompiani**: Darboux quadratics and projective normal in a point of a surface.—**C. Rosati**: Riemann matrices.—**S. Cherubino**: Notions of parity and the real character of real Abelian varieties (1). Subnormal Riemannian matrices.—**G. Vitali**: A covariant derivation in generalised absolute calculus.—**Francesco Sbrana**: Theorems of the mean for the solutions of certain equations with partial derivatives.—**B. Finzi**: Biharmonic functions on a surface.—**A. Terracini**: Differential

projective geometry of hyper surfaces.—**A. Masotti**: Observations on the motions of a fluid in which the distribution of the vortex is stationary.—**F. Ruda**: Explanation of the green ray. The variations in the colour of the last rays of the setting sun from green to blue may be attributed to the variable dimensions of the corpuscles held in suspension in the atmosphere, especially in the lower layers near to the earth's surface. When the absorption is very intense, the green or blue ray is naturally not seen, this being the case when the sun is red. Various factors may intervene to cause the divergence, at times considerable, between the theoretical and the actual durations of the phenomenon.—**C. G. Fontana**: Gold purple (2). Substances analogous to purple of Cassius may be obtained without the use of a stannous salt, the hydroxide of aluminium, zirconium, or thorium being utilised as a supporting material. In such cases the preparation is effected by means of a red, alkaline gold sol. The structure of aluminium gold purple and zirconium gold purple are completely analogous to that of purple of Cassius, the gold being present in the elementary condition and with the same high degree of dispersion. No such conclusion is found possible with the thorium gold purple.—**A. Desio**: The presence of the Miocene in the neighbourhood of El-Abiàr (Cyrenaica).—**S. Ranzi**: Differential inhibition in the development of cephalopods and considerations on the so-called axial gradient. The phenomena which, in embryos, seem to indicate the presence of an axial gradient, have their *raison d'être* in the special manner of development of the forms in question. The so-called axial gradient is not a regulator of the development, but a resultant, more apparent than real, of the occurrent phenomena, which in all cases diverge widely from Child's scheme of one or two dominant points (at the cephalic and caudal extremities).—**D. Cattaneo**: Ultramicroscopic investigations on the crystalline lens (3). Modifications of the ultramicroscopic structure by the action of disimbibition in dry air, of hydration in water, and of low and high temperatures. When the crystalline lens of the eye of the ox is kept in a desiccator containing calcium chloride for a period exceeding 24 hours, the surface fibres become slender and assume a diffuse and marked refractivity, the chondriosomes being then no longer visible; this condition of the fibres persists even if the lens is afterwards placed in water, in which the lenticular substance swells. When the fresh lens is immersed in water, the imbibition occurring reveals itself in gradual and rapid diminution up to complete disappearance of the chondriome, that is, of the differentiated part of the lenticular protoplasm. The changes produced in the lens by the action of cold are those which are manifested after the death of the cells and are thus not directly dependent on the lowering of the temperature. The effects of a high temperature on the crystalline fibres are a gradual disappearance of the differentiated part and a precipitation of the colloids constituting the fundamental protoplasm, which loses its homogeneity and becomes granular; this is essentially the phenomenon determined by the action of acids.—**A. Galamini**: The daily thermal curve of the albino rat. In accordance with the life habits of the albino rat, its temperature-time curve exhibits two maxima, at 7 A.M. and 10 P.M.-midnight, and two minima, at 1 P.M.-5 P.M. and 4 A.M. respectively.—**C. Artom**: The circulating elements of the hæmolymph of euphyllpod crustaceans. As is the case with other entomostracans, the functions of these elements seem to consist of elaboration of the fats absorbed by the epithelium of the intestine and of transport of the elaborated fats to the various tissues.