it was coming into view around the sun's east limb. Shortly after the eclipse had been observed in South America (about 2h G.M.T.) the prominence, hitherto of a stable character, became eruptive, and by 8½h G.M.T. had risen to a height of more than 450,000 miles, after which it suddenly dissipated. The two columns from which it arose in latitudes 37° and 41° S. were seen at each return to the sun's limbs for two months after the eclipse.

May 29, 1920. Louth Floods.—A thunderstorm of unusual severity broke over Lincolnshire during the afternoon, accompanied by exceptionally heavy rain over the Wold country to the west and south-west of Louth. At Elkington Hall, 3 miles west of Louth, 4·69 in. was measured, of which 4·59 in. fell in three hours, and at Hallington two miles to the southward it is estimated that 6 inches fell in three hours. The river Lud rose 16 feet in fifteen minutes and a deep torrent 200 yards wide swept through the town. The damage done in Louth alone was estimated at £100,000, while the flood came as a complete surprise to most of the inhabitants, who were sheltering indoors, and 22 persons were drowned. The flood was probably accentuated by the blocking of the valley by débris at a bridge just above Louth.

May 29, 1928. Shower of Fish.—Dozens of tiny red fish were found on the roof of a bungalow at Drumhirk, near Comber, Ireland, and on the ground in the vicinity. Just before the discovery of the fish there had been an exceptionally violent thunderstorm with heavy rain. There is no river in the neighbourhood, the nearest sheet of water being Strangford Lough, 2 miles distant, and it was believed that the fish had been lifted from the sea by a waterspout.

May 31, 1911. Thunderstorm at Epsom on Derby Day.—The severest thunderstorm and heaviest rainfall since records started in 1905 occurred between 5 P.M. and 8 P.M. at Epsom on May 31, 1911. The day had been humid and close, with a thunder haze gathering about 3 P.M. Thunder was heard and at 5 P.M. three distant storm centres became apparent north and north-east, north-west, and south to south-west. Two cloud currents were visible at 5 P.M., an upper one from south-west, and a lower one from north-east. Fork lightning and thunder were practically continuous. The thunder was in sharp decisive cracks, and the lightning of dazzling intensity. At 5.30 P.M. the north and south centres coalesced, and rain commenced falling in a torrent at 5.20 and continued until 6.0, 2·44 in. falling in fifty minutes. The thunder ceased at 7.59 P.M. but the lightning remained visible until 9.30 P.M. Seventeen people and four horses were killed, and three hayricks fired by lightning.

Societies and Academies.

LONDON.

Royal Society, May 15.—M. L. E. Oliphant and P. B. Moon: The liberation of electrons from metal surfaces by positive ions. When helium ions strike a metal surface they liberate electrons, the number depending upon the metal and the condition of its surface. Velocity distribution of electrons, liberated from a clean surface of molybdenum by positive ions of helium, shows a sharp cut-off at a lower limit of 2·3 volts, and a sharply defined upper limit at 20·2 volts. Maxima were observed in experimental curves at 2, 5, 6·8, 17·0, and 20·0 volts. The results can be explained quantitatively on the basis of modern theories of the metallic state.—**O. W. Richardson and U. Andrewes:** A comparative study of the excitation of soft X-rays from single crystal surfaces and from polycrystalline surfaces of graphite and aluminium. The curves obtained by plotting the photoelectric yield of the soft X-rays per unit thermionic current against the exciting primary voltage show discontinuous rates of increase at certain voltages which coincide with those which give similar discontinuities with the polycrystalline specimens. They are, however, fewer in number and tend to run in groups. The voltages at which the discontinuities occur appear to have a numerical structure resembling that which connects the null frequencies of band systems. The crystal curves are steeper at moderate voltages and flatter at high voltages than the polycrystalline curves.—**O. W. Richardson and S. Ramachandra Rao:** (1) The excitation of soft X-rays from some polycrystalline metal surfaces. Measurements have been made of large numbers of soft X-ray critical potentials for cobalt, nickel, tungsten and pure and also impure copper. Variation of photoelectric yield with magnitude of thermionic current and with inclination of anticathode is examined. Many of the inflections only appear after the targets have been heated to a high temperature.—(2) The excitation of soft X-rays from a single crystal face of nickel. The soft X-ray critical potentials for the 100 face are less numerous than for polycrystalline nickel. The total yield is also lower at high and higher at low voltages with the crystal specimen. —**S. Ramachandra Rao:** (1) Total secondary electron emission from polycrystalline nickel. Applied potentials from 1 to 550 volts were used. Several peaks are obtained below 30 volts and a large number of inflections above 30 volts. The effect of bombarding in hydrogen is also studied.—(2) Total secondary electron emission from a single crystal face of nickel. The potentials at which inflections appeared agree very well with the soft X-ray discontinuities from the same crystal face obtained by Richardson and Rao. The bearing on soft X-ray discontinuities is discussed.—**O. W. Richardson:** The emission of secondary electrons and the excitation of soft X-rays. The first act seems to be the excitation of a *structure* electron by the primary which is returned as part of the high energy group of secondaries. The low energy group and the X-rays result from the return of the excited structure electrons to the ground state. The agreement of the soft X-ray with the secondary electron breaks is accounted for, since both are excitation potentials of the structure electrons. The hypothesis gives a natural explanation of the band-like structure of the discontinuities already found empirically for C and Al and here extended to Ni.—**W. A. Bone, L. Horton, and S. H. Ward:** Researches on the chemistry of coal (6). The main coal-substance can be readily oxidised by means of alkaline permanganate to carbonic anhydride, acetic, oxalic, and benzene carboxylic acids; about one-third of the carbon of the coal substance appeared in C_6-rings of benzenoid acids. Under 'optimum conditions' the character and proportions of the various oxidation products do not vary much with the maturity and geological age of the coal, and colloidal 'humic acids' are formed as intermediate oxidation products. The constituents of bituminous coals mainly responsible for their 'coking propensities' are benzenoid in character, and in all probability during the 'maturing process' they developed from phenols and phenolic esters, found in immature brown coals. On carbonising coals at various temperatures up to 1000° C. their proportionate 'benzenoid' structure first increases, attaining a maximum at about 500° - 600° C., but afterwards diminishes, although a completely 'carbonised' coke still retains some of it.—**L. Rosenhead:** The spread of vorticity in the wake behind a cylinder. The trail of vortices in the wake behind a cylinder is taken to be a symmetrical double row of rectilinear vortices of circular

section. The stability of such a system to three-dimensional disturbances is investigated. There is also a discussion of the stability of an isolated rectilinear vortex of circular section to three-dimensional disturbances.—**L. J. Freeman**: The spectra of trebly-ionised oxygen (O IV) and trebly-ionised nitrogen (N IV). About 50 lines in the spectrum of trebly-ionised oxygen (O IV) have been newly classified. All the doublet and quartet terms of principal quantum number 3 have been identified. In the spectrum of trebly-ionised nitrogen (N IV), combinations of the $3p$ term with $3s$ ^2S and $3d$ ^2D have been observed. Provisional classifications have been given for four other lines.—**G. Temple**: (1) The group properties of Dirac's matrices. An account of the group properties of a set of operators (A_1, A_2, A_3, A_4), with operand ψ, particularly with reference to a generalised form of Dirac's wave equation

$$\sum_n^4 p_n A_n \psi + (2\pi imc/n)\psi = 0,$$

in which the A's are not restricted to be matrices. (2) The operational wave equation and the energy levels of the hydrogen atom. Dirac's methods can be modified and generalised to suit an extension of his linear wave equation based on the preceding paper, which is applied to the problem of the undisturbed hydrogen atom. It proves possible to obtain the energy levels, quantum numbers, and wave functions. —**J. Hargreaves**: The effect of nuclear spin on the optical spectra. (3) The interaction energy of the nuclear and electron magnets is calculated for the cases of nuclear spins of $\frac{1}{2}$, 1, $1\frac{1}{2}$, and $4\frac{1}{2}$ quanta. A description is also given of the hyperfine structure of the Zeeman effect, and it is found that the 'cosine' law holds. The results agree very well with observations for bismuth.

Geological Society, April 30.—**Emily Dix** and **A. E. Trueman**: Some non-marine lamellibranchs from the upper part of the coal measures. The higher part of the *Pulchra* Zone and in the *Phillipsi* and *Tenuis* Zones are discussed. Nearly all the shells found in these higher measures are members of the genus *Anthracomya*, and most of them are related to the group of *A. phillipsi*; but there is evidence that another group, represented by shells which resemble *A. lanceolata* Hind, occurs more rarely at widely separated horizons. The sequences determined in many British coalfields are remarkably similar, and reasons are advanced for the view that at certain periods in the late Carboniferous Period there was considerable uniformity in the conditions over large parts of Britain. There are also great similarities in the sequence in the upper part of the Westphalian of the Continent.—**Emily Dix**: The flora of the upper portion of the Coal Measures of North Staffordshire. The paper deals with the distribution of fossil plants in the Upper Coal Measures, and in the upper part of the Middle Coal Measures of North Staffordshire above the horizon of the Ash Coal. Few plants have hitherto been recorded from the measures for some distance below the Bassey Mine Ironstone, and the chief purpose of this paper is to give an account of these measures with the view of determining the horizon which marks the entrance of the Staffordian flora in North Staffordshire. For some hundreds of feet below the Bassey Mine Ironstone the measures yield a flora in which Radstockian and Yorkian species are mingled, and therefore it is concluded that the base of the Staffordian should be drawn below the Chalky Mine Ironstone, about 400 feet below the Bassey Mine Ironstone. This conclusion is of importance in the correlation of such areas as South Wales, Staffordshire, and Somerset by means of fossil plants.

Society of Public Analysts, May 7.—**L. H. Lampitt, E. B. Hughes**, and **H. S. Rooke**: The diastatic activity of honey. Honey diastase behaves in a similar way to other enzymes under varying conditions of temperature and pH, the optimum pH for both the dextrinogen-amylase and the saccharagen-amylase being about 5·3.—**A. R. Powell** and **W. R. Schoeller**: A new method for the separation of titanium from zirconium and hafnium. The method is based on the precipitation of the titania by tannin from a neutralised oxalate solution half-saturated with ammonium chloride: a repetition of the procedure results in the quantitative precipitation of the titania with only traces of zirconia, if any.—**E. R. Bolton** and **K. A. Williams**: The composition and polymerisation of Chinese wood (tung) oil. The authors confirm the value of Toms's method of determining the elæostearic acid in tung oil by the difference between the iodine value obtained by the bromine vapour and that obtained by the action of Wijs solution until four of the six bonds are saturated. The elæostearic acid glyceride corresponded with the amount of polymerisable matter separated by the authors' method of extraction, and for the oils examined ranged from 70 to 74 per cent.—**D. R. Wood**: The examination of milk for tubercle bacilli. A survey is given of the experience and results obtained in the examination of 1000 herds in the County of Somerset during the last four years. Present methods are inadequate for the elimination of tuberculous milk.

DUBLIN.

Royal Dublin Society, April 29.—**J. Reilly, R. Wolter**, and **P. P. Donovan**: Study of the polysaccharides (3). Acetamide as a polysaccharide solvent.—**J. H. J. Poole**: A new form of recording galvanometer. A transparent scale about 4 cm. long at a distance of about 10 cm. is employed instead of the usual 50 cm. scale at 100 cm. distance. A small lamp with a condensing lens behind the scale illuminates the latter uniformly. After reflection in the galvanometer mirror, which is preferably plane, an image of a short portion of the scale is formed on a film of a Baby Pathe kinematograph camera at a convenient distance—say 20 cm.—by means of a good lens. A fine wire almost in contact with the film casts a shadow the reading of which on the scale measures the galvanometer deflection. A mechanical device which causes one exposure per minute (or at any other convenient interval) enables a permanent record to be obtained. The method is cheaper than the more usual revolving drum apparatus as it employs standard commercial articles. The camera may be replaced by an eyepiece with cross wires for direct observation. The method is then well adapted for observing the deflections of sensitive portable galvanometers for outdoor work. In this case the lamp and condensing lens may generally be omitted and the scale illuminated by daylight.

PARIS.

Academy of Sciences, April 7.—**Ernest Esclangon**: The new celestial body discovered at the Lowell Observatory. Data worked out from photographs taken at the Paris Observatory between Mar. 26 and April 4.—**H. Deslandres**: A new cause which intervenes in increasing or modifying the intensity of lines and bands in the spectra of atoms and molecules. —**Marcel Brillouin**: Dynamical tides with continents. The law of any depth. Attraction of the ring.—**Charles Richet** and **Michel Faguet**: The action of irradiated sea water on lactic fermentation. After ten minutes irradiation, there is an acceleration of the fermentation as measured by the acidity produced:

after thirty minutes irradiation there is an inversion, no acceleration being produced.—**C. Gutton**: The properties of ionised gases in electromagnetic fields of high frequency. The observations described confirm the explanation given by H. Gutton of the results of his researches. It is suggested that the formula of Eccles and the theories based on it require modification.—**E. Mathias**: The conception of Stephen Gray on the identity of lightning and the sparks of electric machines. In one respect the view of Stephen Gray is imperfect; lightning transports only positive electricity, whereas the induction spark is formed of two discharges in opposite directions.—**L. Leger**: *Sphœrospora pernicialis*, a new Myxosporidium pathogenic to the tench.—**J. Dieudonne**: The roots of algebraic equations.—**L. Escande**: The excess pressure caused by the stopping of a motor pump group in a water main.—**F. Baldet**: The calculation of the photometric diameter of the celestial body of the Lowell Observatory (see NATURE, May 3, p. 672).—**Jean Jacques Trillat**: Researches on the internal and superficial structure of organic liquids with long chains. The results of an X-ray study, with special precautions against the errors due to the presence of a halo arising from the filtration of the continuous background. In several cases, the superficial structure of liquids differs from the internal structure, as a result of a statistical orientation of the molecules. The results of McBain and of Hardy are confirmed.—**H. Mutel**: The measurement of the effective intensity of high frequency currents. Experiments with a differential ammeter consisting of two glass tubes arranged as arms of a differential air thermometer, with a fine platinum wire in the axis of each. One carries the high frequency current and is balanced by a direct current. Even after correction for the skin effect for very high frequencies, there is an error due to the heating of the heat insulation material by the high frequency electromagnetic field.—**J. Urbanek**: The diffusion of light by polished surfaces. A description of a photographic method serving to characterise the perfection of polishing of a vitreous surface.—**C. Marie and Gerard**: The electrolytic deposit of copper in the presence of amino acids. Copper deposited electrolytically from a solution of copper sulphate containing glycocoll, contains both copper sulphate and the amino acid. Leucine behaves similarly.—**Guy Emschwiller**: The photolysis of the organic iodides: the influence of temperature. The temperature coefficient of the photolysis varies with the nature of the radiation. The phenomena are complicated and experimental verification of the theories suggested to explain the existence of a temperature coefficient of photochemical reactions is difficult.—**Augustin Boutaric and Mlle. Genevieve Perreau**: The flocculation produced by the mixture of two colloidal solutions of the same nature but the granules of which have opposite electric signs.—**F. Bourion and Mlle. O. Hun**: The determination, by the boiling-point method, of the molecular equilibria of pyrocatechol in solutions of potassium and sodium chloride.—**J. Golse**: The action of silver nitrate on solutions of potassium mercuric iodide.—**A. Travers and Avenet**: The estimation of phenols in coke oven effluents.—**Albert Kirrmann and Jean Grard**: An abnormal reaction of the dihalogen propylenes. 1, 3: dibromopropylene, in a previous communication, has been shown to react in an anomalous manner with organo-magnesium compounds: the 3, 3: dichloropropylene is now found to behave similarly.—**Roger Dolique**: The normal *n*-butylbenzyl and dibenzylethyl alcohols, the isomers methyl-*n*-butylbenzyl and ethyldibenzylcarbinols.—**Mlle. M. Cabanac**: The catalytic decomposition of some acetals of the fatty series by metallic oxides. Diethylacetal, at 400° C. in the presence of thoria, gives the unsaturated ether $CH_2=CH.O.C_2H_5$ (13 per cent) together with aldehyde, alcohol, and a gaseous mixture of ethylene, hydrogen, carbon monoxide, carbon dioxide, and methane.—**Albert Nodon**: The effects of ionisation by solar action.—**H. Colin and E. Guéguen**: The seasonal variations of the proportion of sugar in the Florideæ.—**H. Belval**: The transformations of the glucides in the banana: the formation of starch in the fruits.—**Mlle. Germaine Py**: The evolution of the cytoplasmic constituents during the formation of pollen grains and of the nutrient layer in *Senecio vulgaris*.—**F. Maignon and Ch. Grandclaude**: The hardening action of intravenous injections of glycerol. Sensitising effects of a single injection.—**L. Lutz**: The soluble ferments secreted by the Hymenomycetes fungi. Hydrolysis of the hemicelluloses.—**A. Paillot**: Bacterial parasitism and symbiosis in *Aphis mali*.

Official Publications Received.

BRITISH.

Proceedings of the Royal Irish Academy. Vol. 39, Section B, Nos. 14, 15: Azo Dyes derived from Diacetoresorcinol, by Dr. Joseph Algar and Mary Boylan; The Action of Grignard Reagents on Phthalide, by Dr. Joseph Algar and Albert V. Flaegel. Pp. 343-357. (Dublin: Hodges, Figgis and Co.; London: Williams and Norgate, Ltd.) 6*d*.

The Indian Forest Records. Silvicultural Series, Vol. 15, Part 2: A Glossary of Technical Terms for use in Indian Forestry. (Adopted for Official Use by the Silvicultural Conference, Dehra Dun, March 1929.) Pp. iii+50. (Calcutta: Government of India Central Publication Branch.) 6 annas; 8*d*.

The Himalayan Journal: Records of the Himalayan Club. Edited by Kenneth Mason. Vol. 2, April. Pp. vi+206+16 plates. (Calcutta: Thacker, Spink and Co.; London: W. Thacker and Co.) 5 rupees; 8*s*.

Union of South Africa: Department of Agriculture. Science Bulletin No. 85: Structure of the Cortex of Grass Roots in the more Arid Regions of South Africa. By Dr. M. Henrici. Pp. 12. 3*d*. Science Bulletin No. 87: The Bacterial Wilt Disease of Peanuts (*Arachis Hypogaea* L.). By A. P. D. McClean. Pp. 14+7 plates. (Pretoria: Government Printing Office.)

Union of South Africa. Report of the South African Museum for the Year ended 31st December 1929. Pp. 16. (Pretoria: Government Printing Office.)

Rhodesia Museum, Bulawayo. Twenty-eighth Annual Report, 1929. Pp. 16. (Bulawayo.)

Department of Scientific and Industrial Research: Forest Products Research. Project 1: Progress Report 2. Tests of some Home-grown Timbers in their Green and Seasoned Conditions. By C. J. Chaplin and F. M. Mooney. Pp. iv+9. (London: H.M. Stationery Office.) 1*s*. net.

Air Ministry: Aeronautical Research Committee. Reports and Memoranda. No. 1248 (E. 32): Torsional Vibration of Crankshafts. A Description of the R.A.E. Mk. III Torsiograph. By the Staff of the Engine Experimental Department, Royal Aircraft Establishment. (I.C.E. 690.) Pp. 5+6 plates. 1*s*. net. No. 1252 (Ae. 402): Flow through Pipe Orifices at Low Reynolds Numbers. By F. C. Johansen. (T. 2797.) Pp. 24+14 plates. 1*s*. 3*d*. net. (London: H.M. Stationery Office.)

Stonyhurst College Observatory. Results of Geophysical and Solar Observations, 1929; with Report and Notes of the Director, Rev. E. D. O'Connor. Pp. xx+50. (Blackburn.)

University Grants Committee. Report including Returns from Universities and University Colleges in receipt of Treasury Grant, Academic Year 1928-29. Pp. 74. (London: H.M. Stationery Office.) 3*s*. 6*d*. net.

The Scottish Forestry Journal: being the Transactions of the Royal Scottish Arboricultural Society. Vol. 44, Part 1, March. Pp. xx+43+26+50. (Edinburgh.) 7*s*. 6*d*.

FOREIGN.

Report on Norwegian Fishery and Marine Investigations. Vol. 3, No. 10: The Propagation of our Common Fishes during the Cold Winter 1924; Investigations on the Norwegian Skagerrack Coast. By Alf Dannevig. Pp. 133. (Bergen: A.S. John Griegs Boktrykkeri.)

Instituts scientifiques de Buitenzorg: "'s Lands Plantentuin". Treubia: recueil de travaux zoologiques, hydrobiologiques et océanographiques. Vol. 11, Livraison 3, Fevrier. Pp. 301-371+plates 6-11. (Buitenzorg: Archipel Drukkerij.) 2.50 f.

U.S. Department of Commerce: Coast and Geodetic Survey. Serial No. 457: Magnetic Declination in Delaware, Maryland, Virginia, West Virginia, Kentucky and Tennessee. Pp. iii+112. (Washington, D.C.: Government Printing Office.) 20 cents.

Field Museum of Natural History. Anthropological Series, Vol. 19, No. 1: Melanesian Shell Money in Field Museum Collections. By Albert B. Lewis. (Publication 268.) Pp. 36+25 plates. Zoological Series, Vol. 17, No. 5: A Study of the Tooth-billed Red Tanager, *Piranga flava*. By John T. Zimmer. (Publication 269.) Pp. 167-219. Botanical Series, Vol. 7, No. 1: The Rubiaceae of Colombia. By Paul C. Standley. (Publication 270.) Pp. 175. (Chicago.)

Smithsonian Institution: United States National Museum. Contributions from the United States National Herbarium. Vol. 24, Part 9: The Grasses of Central America. By A. S. Hitchcock. Pp. v+557-762+vii-xvi. (Washington, D.C.: Government Printing Office.) 35 cents.