

highly indebted, and myself more than any one else. He gave me all that a younger partner can give to the older one. He took an enthusiastic part in the development of the Leyden laboratory, where he was to take over my part of the work. The plans for the extension of the laboratory in which he had all the time worked in a very disadvantageous location, were all made in conjunction with him. It is a great pity that he has been taken away before the beautiful new buildings for his department could be opened. We had both assisted in the preliminary dedication by putting, according to local use, the flag on the roof.

His many-sidedness made him spread widely the benefits of science and of its culture. He wrote, *e.g.*, an extensive and most interesting history of the development of physics in Holland during the last 150 years.

The main part of Kuenen's work lies in thermodynamics. He wrote many papers on it and also lucid and comprehensive books treating the equation of state and the equilibrium of liquid and gaseous phases of mixtures. By his masterly repetition of Galitzine's experiments he much aided science, proving that they could be explained by the influence of small admixtures.

The great achievement of Kuenen was his fundamental work on gaseous mixtures. He was the first to fill out experimentally for a complete series of mixtures of two gaseous substances in different proportions, a surface diagram that can be considered as the analogue of Andrews' line diagram for a single substance. The genius of van der Waals, then depressed by deep mourning, took a new flight when he was asked to work out in connexion with Kuenen's measurements his theory of binary mixtures given before only in sketch. Kuenen discovered then retrograde condensation, and from van der Waals' more extended theory deduced a complete explanation of this process. I

still hold in vivid remembrance how Kuenen, putting in action his magnetic stirrer, the simple but fundamental contrivance by which he succeeded in eliminating retardation, had the satisfaction of demonstrating to van der Waals the retrograde condensation, and of seeing van der Waals looking in deep reflection at the beautiful phenomenon, which at once put his theory beyond any doubt. An admirable interaction of Kuenen's experiments and van der Waals' deductions followed.

Kuenen's discovery of mixtures with minimum critical temperatures and maximum vapour pressures led to many important discussions on the properties of the transversal plait on the free energy surface for the mixtures. A happy extension of his research, partly with Robson, was the study of different pairs of substances, which are not miscible in all proportions in the liquid state. It brought experimental material for the investigation of the longitudinal plait in connexion with the transverse one, where the theory of plaits of Korteweg had to be combined with van der Waals' theory, forming an imposing whole, that showed the way in what seemed once a labyrinth. A posthumous work of Kuenen with Verschoyle and van Urk continuing the work with Prof. Clark on the retrograde condensation of mixtures of oxygen and nitrogen makes the last as well as the first of his papers belong to his great life-work. Kuenen leaves incorporated in science a diversity of images systematising in the light of theory the full life of concrete facts in a wide domain and constituting a lasting monument to his genius.

H. KAMERLINGH ONNES.

DR. ALBERT A. STURLEY, instructor in physics at Yale University, and formerly professor of physics in the University of King's College, Windsor, Nova Scotia, died in New Haven, Connecticut, U.S.A., on October 22, at the age of thirty-five years.

Current Topics and Events.

H.M. THE KING has approved of the following awards this year by the president and council of the Royal Society: A Royal medal to Mr. C. T. R. Wilson, for his researches on condensation nuclei and atmospheric electricity; and a Royal medal to Mr. J. Barcroft, for his researches in physiology, and especially for his work in connexion with respiration. The following awards have also been made by the president and council: The Copley medal to Sir Ernest Rutherford, for his researches in radioactivity and atomic structure; the Rumford medal to Prof. Pieter Zeeman, for his researches in optics; the Davy medal to Prof. J. F. Thorpe, for his researches in synthetic organic chemistry; the Darwin medal to Prof. R. C. Punnett, for his researches in the science of genetics; the Buchanan medal to Sir David Bruce, for his researches and discoveries in tropical medicine; the Sylvester medal to Prof. T. Levi-Civita, for his researches in geometry and mechanics; and the Hughes medal to Dr. F. W. Aston, for his discovery of isotopes of a large number of the elements by the method of positive rays.

THE Royal Swedish Academy of Sciences, Stockholm, has awarded the Nobel prizes for physics and chemistry for 1921 and 1922 as follows: Physics, 1921, Prof. Albert Einstein, Berlin, for his theory of relativity and general work in physics; 1922, Prof. Niels Bohr, Copenhagen, for his researches on the structure of atoms and radiation. Chemistry, 1921, Prof. F. Soddy, Oxford, for his contributions to the knowledge of the chemistry of the radioactive elements and the nature of isotopes; 1922, Dr. F. W. Aston, Cambridge, for his investigations of elements and isotopes with the mass-spectrograph. The Nobel prize for medicine is reserved for next year, and that for peace will be announced on December 10, the anniversary of the death of Alfred Nobel, when the prizes will be presented by the King of Sweden.

THE well-known periodical, *Curtis's Botanical Magazine*, which appeared regularly from its foundation in 1787 until the end of 1920, has now fortunately reappeared under new auspices. The first part of Volume 148 has just been published by Messrs. H. F.

and G. Witherby, for the Royal Horticultural Society, the new proprietors of this valuable publication, and the Society has been so fortunate as to secure Dr. O. Stapf, late Keeper of the Herbarium and Library of the Royal Botanic Gardens, Kew, as editor. The long connexion between Kew and the magazine will thus, we hope, be maintained in the future as in the past, and in fact the legend on the cover which states, "Hand-coloured figures with descriptions and observations on the Botany, History, and Culture of new and rare Plants from the Royal Botanic Gardens, Kew, and other Botanical Establishments," gives good assurance that this will be the case. Indeed it is difficult to imagine that a work of this kind, to be of real value, could be prepared without the close connexion with Kew being fully maintained. This part, the first of the new venture, is one on which the new proprietors as well as the editor and publishers deserve to be highly congratulated. The plates are beautifully drawn and are both accurate and artistic, while the colouring leaves very little to be desired. There is the same fidelity to botanical detail with which readers of the older volumes are familiar and which makes the plates of so much value. The drawings in this part are the work of three different artists, and we think it is not undue praise to say that they are worthy of the magazine in its best days. The beauty and fidelity of such plates as those of *Stapelia tsomoensis*, a very difficult subject; *Bulbophyllum triste*, a delicate and very remarkable orchid from India, and *Symphytum grandiflorum*, leave nothing to be desired. An ample description both in Latin and English accompanies each plate, and there is much additional matter of an interesting and very useful nature. The English descriptions might possibly be somewhat abbreviated and also some of the general discussion, but it is all of value and shows how much care and trouble the editor must have spent to produce the letterpress, which is a mine of useful information. A volume for the year 1921 to preserve the continuity of the magazine is being prepared by private enterprise.

THROUGH the courtesy of Admiral of the Fleet Sir Henry B. Jackson, chairman of the Radio Research Board under the Department of Scientific and Industrial Research, we are able to publish this week an article on "The Origin of Atmospherics" by Mr. R. A. Watson Watt, who is in charge of the Board's Research Station at Aldershot. The interesting results described will no doubt receive close attention from the scientific public. The members of the Radio Research Board and of its Sub-Committee on Atmospherics who are responsible for the investigations carried out at the Aldershot Station are as follows: *Radio Research Board*.—Admiral Sir Henry B. Jackson (chairman), Captain C. E. Kennedy-Purvis, Lieut.-Col. A. G. T. Cusins, Wing-Commander J. B. Bowen, Mr. E. H. Shaughnessy, Sir Ernest Rutherford, Sir J. E. Petavel, Prof. G. W. O. Howe, Mr. O. F. Brown, and Mr. L. C. Bromley (secretary). *Sub-Committee B on Atmospherics*.—Colonel H. G. Lyons (chairman), Prof. S. Chapman, Major H. P. T. Lefroy, Mr. A. A. Campbell Swinton, Mr. R. A.

Watson Watt, Mr. G. I. Taylor, Mr. C. T. R. Wilson, Mr. H. Morris Airey, Dr. G. C. Simpson, and Mr. O. F. Brown (secretary).

At a general meeting of the Royal Scottish Geographical Society, held on November 7, the Society's gold medal was awarded to Prof. J. W. Gregory, University of Glasgow, in recognition of the scientific importance of results obtained by him through explorations in Spitsbergen, Australia, East Africa, and South-west China.

THE Thomas Hawksley lecture of the Institution of Mechanical Engineers will be delivered at 6 o'clock on Friday, December 1, by Dr. T. E. Stanton, who will take as his subject, "Some Recent Researches on Lubrication."

MR. R. T. A. INNES, the Union Astronomer at Johannesburg, who is at present in Paris and will be in England in a few weeks' time, has had the degree of doctor of science, *honoris causa*, conferred upon him by the University of Leyden.

THE following new appointments in the Peabody Museum of Natural History have recently been announced by Yale University: to be director, Dr. R. S. Lull, professor of vertebrate palæontology; to be curator of mineralogy, Dr. W. E. Ford, professor of mineralogy, in succession to Prof. E. S. Dana, who has held the curatorship since 1874.

IN connexion with the Liverpool section of the Society of Chemical Industry a Hurter Memorial Lecture will be delivered at 8 o'clock on Wednesday, November 22, in the Chemistry Lecture Theatre of the University, Liverpool, by Mr. W. Macnab. The subject will be "Some Achievements of Chemical Industry during the War, in this Country and in France."

THE council of the Institution of Civil Engineers has made the following awards in respect of papers printed without discussion in the Proceedings for the session 1921-1922: A George Stephenson gold medal to Dr. B. C. Laws (London); Telford premiums to Prof. L. Bairstow (London), Dr. A. J. Sutton Pippard (London), Mr. E. A. Cullen (Brisbane), Mr. H. H. Dare (Roseville, N.S.W.), and Mr. F. W. Stephen (Aberdeen). And for papers read before meetings of students in London and the provinces: A Miller prize and the James Forrest medal to Mr. F. H. Bullock (Cardiff); and Miller prizes to Mr. J. G. Mitchell (London), Mr. A. G. M'Donald (London), and Mr. Harry Wolf (Manchester).

THE twenty-fifth annual Traill-Taylor memorial lecture was delivered by Dr. Reginald S. Clay at the house of the Royal Photographic Society on October 10, and is printed in full with numerous illustrations in the November number of the Society's Journal. The subject was "The Photographic Lens from the Historical Point of View," and the discourse is probably the most complete, if not the most extensive treatment of the subject now available. The lecturer referred to "two great inventions"—first, the anastigmats of Schroeder, Rudolf, and von

Hoegh, and second, the Cooke lens of Harold Dennis Taylor, and remarked that only time can show which of these has been of greatest value, and upon which, if either, the objective of the future will be based. He adds, "I do not think the great step which the Cooke lens marks is as well appreciated here as on the Continent . . . the Zeiss Unar and Tessar were based on the same principle as the Cooke lens. . . . Harting has also made several lenses which are modified Cookes."

THE Optical Society of America held its seventh annual meeting and exhibition of optical instruments at the Bureau of Standards, Washington, on October 25-28. Special sessions were arranged for the consideration of radiation, atmospheric optics, physiological optics, photometry, optical pyrometry and photography, and the whole process of manufacturing optical glass was available for inspection during the meeting. Reports of committees which have been considering the combination of the Journal of the Society with the Instrument Makers' Journal and the possibility of publishing a translation of Helmholtz's "Physiologische Optik" were received. Informal accounts of the present position of the work of the committees on nomenclature and standards of polarimetry, reflectometry, spectroradiometry, refractometry, visual sensitometry, optical glass and instruments, wave-lengths, illumination and photometry, photography, pyrometry, and spectrophotometry were also given. Visitors not members of the Optical Society were allowed at both meetings and exhibitions of apparatus.

THE annual report of the Chief Medical Officer of the Ministry of Health for the year 1921, recently issued, is entitled, "On the State of the Public Health." The death-rate for that year was 12.1 per 1000 persons living, the lowest on record; the birth-rate 22.4, a decline of 3.1 on the previous year. The infant mortality was 83 per 1000 births, a very low figure, though slightly higher than that of 1920. Of 1000 deaths from all causes, cancer accounted for 100, bronchitis for 73, pneumonia for 76, heart diseases for 117, and nervous diseases for 105. As regards infective diseases, no cases of plague, cholera, or typhus fever occurred, and influenza remained at a very low ebb during the greater part of the year, but 336 cases of smallpox were recorded. Only 12 new indigenous cases of malaria were detected, as compared with 36 in the previous year and 103 in 1919. Encephalitis lethargica increased, 1470 cases being recorded, as compared with 844 cases in 1920. Tuberculosis is decreasing, the number of cases notified being the lowest recorded. Much information is given on schemes for maternity and child welfare, on the prevention of venereal diseases, on the care and after-care of tuberculous cases, on the relation of food to health and disease, and on the medical and sanitary administration of the country.

In *Scribner's Magazine* for November, Dr. George E. Hale describes the buildings now being erected in Washington for the National Academy of Sciences and the National Research Council. The architect

is Bertram Grosvenor Goodhue of New York, and the sculptural decoration has been entrusted to Lee Lawrie. The complete plan is a hollow square with a frontage of 260 feet, the centre of which will be occupied by a domed hall surrounded by seven top-lit exhibition rooms. For the present only this central area and the front block are being erected. The two upper floors of the front block will contain the offices of the Academy and the Research Council; the entrance hall on the ground floor will be flanked by a library, lecture-rooms, and conference rooms. The central hall, though primarily intended for exhibits, will be capable of transformation into a lecture-room or meeting-room. The novelty of the scheme lies in the utilisation of the central space for a museum of discovery. Those natural phenomena which for the time being provide the chief fields of investigation, the apparatus for studying them, and the means by which fundamental discoveries in pure science are applied for the public welfare will all be demonstrated in a permanent but ever-changing exhibition, kept constantly up-to-date, and covering the whole range of the physical and biological sciences. At the same time the provision of a convenient and dignified headquarters for the National Academy and the Research Council will greatly assist those two bodies in their tasks of advising the Government and organising the scientific work and resources of the United States. The building will doubtless justify the title of Dr. Hale's article as "A National Focus of Science and Research."

THE annual report of the Lancaster Astronomical and Scientific Association has recently been received. The rules and regulations of the Association are such as could with advantage be imitated and followed by many other similar institutions up and down the country. It is apparently conducted entirely by honorary officials, and the motto borne by the Association is clearly the whole spirit of the work—"If we succeed in giving the love of learning, the learning itself is sure to follow"—Lord Avebury. The Association has a total of 281 members. Lectures are given monthly and they are of a scientific and educational character. Meteorology forms an important feature of the report. Monthly and weekly results from readings taken at the Greg Observatory are sent to the Meteorological Office and are used in the official publications. Mean values for each month throughout the year 1921 are given in the report for barometer as well as the extreme readings, the duration of bright sunshine and the number of sunless days. Monthly rainfall statistics are tabulated, and during 1921 the total measurement was 41.25 in., which fell on 194 days. Lancaster escaped the drought from which so many other places suffered, and the showers during the summer kept the ground from being dried up. The mean air temperature for the year was 50°·2 F., which is warmer than either of the two preceding years.

THE recently issued report of the museums of the Brooklyn Institute (N.Y.) for 1921 shows that the children are well catered for, not only in the delightful

Children's Museum, but also at the Central Museum. Here it is the higher grade schools that receive chief attention, and an attempt is made to correlate the demonstrations with their curriculum. Besides the classes at the Museum, full use was made of the collection of lantern slides, more than 2800 being sent out on loan. The department of ethnology continues to furnish suggestive material to the American clothing and allied industries; four rooms have been constructed and equipped for the increasing number of artists and manufacturers consulting these collections.

ONE way in which the Smithsonian Institution pursues "the increase of knowledge" is by exploration and field-work. A richly-illustrated pamphlet describing the work so accomplished during 1921 has been issued as Publication 2669. The prevailing high costs restricted the number of expeditions, but fourteen of the more important ranged from China to Chile and brought back large collections to the United States National Museum. Our own museums do their share of exploration, but the great advantage possessed by the museum at Washington is that it seems able to detail its own staff for this purpose. This is to the benefit of both the individuals and the eventual study of the collections. Dr. C. D. Walcott continued his exploration of pre-Devonian strata in the Canadian Rockies. Dr. Bassler collected fossils in Tennessee for study and for exhibition. Mr. Gilmore collected fossil vertebrates in New Mexico, and Mr. Gidley did the same in Arizona, California, and Nebraska. Dr. Hitchcock collected and studied grasses and bamboos in the Philippines, Japan, and China. Dr. Bartsch visited the Tortugas and the Bahamas in connexion with his breeding experiments on the mollusc *Cerion*. Dr. Aldrich was sent to Alaska to collect insects. Seven other expeditions were devoted to archaeological field-work in the United States and Dominica, and on them also many members of the staff were engaged. The health and enthusiasm gained by this contact with Nature in the open air must be a great help to the workers during the rest of the year.

THE Geological Survey of South Africa has earned the thanks of a wide circle by publishing, as Memoir No. 18, "A Bibliography of South African Geology to the end of 1920" (Pretoria, 1922, price 10s. 6d.). Mr. A. L. Hall has undertaken what must have been an arduous task, and Miss M. Wilman has generously supplied him with the data collected by her since the publication of her "Catalogue of Printed Books, Papers, etc.," in 1905. The result is a clearly printed list, classified by authors, of 5794 entries, and covering even remarks put forward in the discussions that are so usefully printed in the Proceedings of the Geological Society of South Africa. The only slips that we have noticed are in one or two initials of authors, and here and there the omission of the place of publication or of a date. "Liège," which is used throughout, is of course a repetition of a common error. The whole question of a uniform system of abbreviations has still to be considered. "Jl." for Journal and "Ro."

for Royal are unusual and unnecessary. "G.S., U.S.A." is misleading for a publication that has nothing to do with the senior Union across the Atlantic, and "Minn." means Minnesota and should not be used for Minneapolis. There should be no comma, though this has been systematically inserted, after the first "S" in "G.S.S.A." However, the complete list of serials quoted at the outset helps us over these small difficulties, and Mr. Hall's energy has cleared away a thousand greater ones from the path of the student of South African geology.

WITH the enormous increase in the production of petroleum and the widely different uses to which the commercial products are put, the various international congresses which met prior to the war, realising the importance of standard methods of testing, attempted to deal with the question internationally, but little practical success was achieved. With such products so many of the tests are empirical, depending, like the flash point and so-called viscosity, on the form of apparatus and conditions of testing, that standardisation is absolutely essential if the tests are to have real value. It remained for the greatest producing country, the United States of America, through that valuable body the American Society for Testing Materials, to accomplish successfully the work of standardisation of methods, and defining as accurately as possible the desired characters of the various products. In this country, which although not a producing country is one of the largest consumers and controls many important oil fields, the Institution of Petroleum Technologists decided last year that standardisation must be taken in hand, and at a meeting of the Institution on October 10 Dr. A. E. Dunstan gave a summary of the progress which had been made. Hearty support and assistance was given by all the Government Departments concerned with the use of oil products, and by the British oil companies, and co-operation with the British Engineering Standards Association, a body representing a most important section of users, has been arranged to deal with specifications. The work of standardisation has been divided between the six following sub-committees: naturally occurring bituminous substances (crude oils, etc.); distillates up to kerosene; kerosenes and intermediates; lubricants; liquid fuels; asphaltum and artificial residues. It is anticipated that the methods recommended will be issued early next year.

REFERRING to the article on "The Sense of Smell in Birds" in NATURE of June 17, Dr. B. S. Neuhausen, of Johns Hopkins University, Baltimore, writes to direct attention to a paper by Dr. H. H. Beck on "The Occult Senses in Birds" (*Auk*, 1920, xxxvii, 55). In this communication Dr. Beck gave an example of the great food-finding powers of carrion-eating birds. At a hunt, one frosty morning in Pennsylvania, a dog went mad and had to be shot: the body was thrown into a limestone sinkhole close at hand, where it was speedily located by turkey vultures, the nearest haunt of which was eight miles

away. One may readily agree with the author that a freshly killed dog would give off little odour at a temperature below freezing-point, and one must accept his opinion that the body was practically invisible in the hole; but there seems to be no conclusive evidence that the incident of the killing could not have been both seen and heard by the vultures. Dr. Beck's theory is that none of the ordinary senses suffices to explain events like this, and that some "occult sense," by which he means a sense not within the scope of our own subjective experience, must be invoked. He would have us believe that birds possess a special "homing sense" and a special "food-finding sense," while a "mate-finding sense" is mentioned as a third possibility. It seems more

than doubtful, however, whether naming new senses adds anything to our knowledge of the subject. The idea of a sense has little meaning if divorced from the idea of a sense-mechanism, and a "food-finding sense" implies that food (a comprehensive term in the case of birds) is capable of acting as a direct and simple physiological stimulus through some unknown channel of perception which is independent of such more obvious properties of the food as its appearance and odour. Granted that birds have powers of perception transcending our subjective experience, it is surely more reasonable to attribute these to greater acuteness of the known senses than to imagine new senses for which no physiological basis can be suggested.

Our Astronomical Column.

FIREBALL ON OCTOBER 31.—In daylight on the early evening of Tuesday, October 31, at 5.10, an unusually brilliant meteor was observed from various places in the south of England, including Neath, Hereford, Bournemouth, Goring, Witney, and on the eastern boundary of South Wales. The accounts of its appearance, while they all testify to the startling lustre of the object, are yet imperfect and inexact in describing the course it traversed. There were only a few of the brighter stars visible at the time. On the basis of the available data it is impossible to compute a perfectly satisfactory real path for the meteor, but it appears probable that the radiant point was at $194^{\circ} + 33^{\circ}$, and that during its luminous flight the meteor was over the region from Brecon to Wiltshire, the height declining from 65 to 29 miles. Further observations would be valuable.

SOLAR PHYSICS OBSERVATORY, CAMBRIDGE.—The ninth annual report of the Director of the Solar Physics Observatory has recently been issued; in it is described briefly the work done during the year April 1921 to March 1922. The observations of two novæ, Nova Aquitæ III. and Nova Cygni III. (1920), have been under discussion; those of the former are expected to appear in Parts 2 and 3 of vol. 4 of the annals, while the latter have been communicated to the Royal Astronomical Society (Mon. Not. R.A.S. vol. 82, p. 44). The well-known variable β Lyræ has been investigated, and 64 spectrograms taken at Cambridge in 1921 and 96 taken in 1907 at the Allegheny Observatory are being reduced. It is stated that the indications of the results are that the system of β Lyræ contains probably at least four components in relative motion. Three lines of work relate to the investigation of the circulation of the atmosphere of the sun. The first is a detailed discussion of the shapes of the clustered masses of flocculi, recently referred to in this column, showing that these masses are inclined at certain angles to the solar equator. The second is a study of the proper motions of the sunspots and the movements of zones of prominence activity; while the third is the determination of the solar rotation by the spectroscopic method, also recently described. The observations and experiments in the department of meteorological physics have been continued. It is interesting to note that the mounting of the three-foot reflector will be completed since the staging has now been finished.

THE METEORS OF THE PONS-WINNECKE COMET.—Mr. G. Shain, of Pulkovo Observatory, discusses this

meteor swarm in *Astr. Nach.*, No. 5190, noting that the agreement of the radiant with that calculated from the cometary orbit indicates a common tangent to the two orbits, but identity is only shown if they are found to have the same secular perturbations. It will be remembered that it was in this manner that Prof. J. C. Adams showed that the period of the Leonids must be about 33 years. Since the meteors seen in June 1916 were 10 months behind the comet, their perturbations by Jupiter in the ensuing revolution were different; the meteors made their nearest approach to Jupiter (distance 0.719) in mid-May 1918. The following are the calculated perturbations between May 1917 and May 1919: $\Delta\Omega - 65'.9$, $\Delta i + 41'.5$, $\Delta\pi + 59'.5$, $\Delta\mu - 13''.5$, $\Delta\phi - 45'.5$, and $\Delta q + 0.47$. The date of the chief display went back from June 28, 1916, to June 27, 1921, in good agreement with the above change of the node. The comet itself went still nearer to Jupiter than the meteors and suffered larger perturbations. Mr. Shain considers that the indications are all in favour of connexion between the comet and meteors, and notes that a similar shower was seen in early July 1867, 1868, 1869, 1872 by several observers.

KALOCSA OBSERVATIONS OF PROMINENCES.—The Rev. B. G. Swindells, S. J., gives a useful summary in the *Observatory* for October of the work on prominences by Father J. Fenzi at Kalocsa from 1886 to 1917. The curve of prominence activity is synchronous with that for the spots, but the distribution is different. At minimum the chief prominence-development is in latitude 50° . There are none at the poles and few at the equator. The prominence-zone extends towards the poles as maximum approaches and, for a short time at maximum, the poles are the seat of greatest prominence-activity. But a state of quiescence soon returns at the poles, not to be disturbed for nearly 11 years. It is as though two waves of activity start from lat. 50° , one filling the equatorial gap, the other approaching the poles from all sides, so that there is a great heaping-up there, which soon collapses again. While these changes are different from those of the spots, they accord with the changes in the coronal rays, so that the latter appear to be closely connected with the prominences. In some eclipses coronal arches have been seen surrounding prominences, which is a further argument for connexion. It is not difficult to imagine that the more finely divided matter expelled in a prominence-eruption should rise to a great height under such influences as light pressure and electrical repulsion.