Mr. J. B. Mackintosh has kindly analysed a small fragment with the following results, which, for comparison with other irons seen to fall, I have placed in tabular form :—

	Mazapil.	Rowton. Flight.	Charlotte. Smith.	Estherville.[1] Smith.
Iron.....	91·260	91·250	91·15	92·000
Nickel.....	7·845	8·582	8·05	7·100
Cobalt	0·653	0·371	0·72	0·690
Phosphorus...	0·300	.....	0·06	0·112
	100·058	100·203	99·98	99·902

Carbon is distributed all through the iron between the crystalline plates, and it is noteworthy that this element was observed with the spectroscope as present, in the "Bielids" of November 27, 1885. Chlorine is also present and shows itself by a slight superficial deliquescence. Of this latter I will state that most of the surface oxidation of the ferrous chloride has occurred since August last. As yet no tests have been made to ascertain the amount of occluded gases, or to analyse the graphite nodules, and it is probable that this might only lead to results similar to those already obtained. Over the mass, where the crust has been accidentally removed, the lines of crystallisation (Widmanstätten figures) can readily be traced without etching the surface. The abrasion due to impact was very slight.

In conclusion, we cannot, from the very circumstantial account of the fall, and the corroborative evidence of the iron itself, which in several particulars contains heretofore unrecorded observances, decline to receive this meteorite as the ninth recorded fall of an iron mass to the earth; and perhaps at another period of the November "Bielids" this fall will be confirmed in all its interesting details. The interest connected with this meteorite, because of its beautifully marked and fresh surface, is enhanced by the concurrence of the time of its fall with the shower of the Biela meteors.

I wish to express here my deep obligation to Prof. Bonilla for the interesting data concerning this meteorite and for the gift of the meteorite itself, and to Mr. Mackintosh also for his kind interest in making the chemical analysis.

WILLIAM EARL HIDDEN

SOCIETIES AND ACADEMIES

LONDON

Royal Society, March 24.—"On Ellipsoidal Current Sheets." By Horace Lamb, M.A., F.R.S.

The paper treats of the induction of electric currents in an ellipsoidal sheet of conducting matter whose conductivity per unit area varies as the perpendicular from the centre on the tangent plane, or (say) in a thin shell of uniform material bounded by similiar and coaxial ellipsoids. The method followed is to determine in the first instance the normal types of free currents.

When the normal types and their persistencies have been found, it is an easy matter to find the currents induced by given varying electromotive forces. Supposing that we have an external magnetic system whose potential varies as e^{ipt}, we can determine a fictitious distribution of current over the shell, which shall produce the same field in the interior. If $\bar{\phi}$ denote the current-function for that part of the distribution which is of any specified normal type, ϕ that of the induced currents of this type, it is shown that

$$\phi = -\frac{ip\tau}{1 + ip\tau}\bar{\phi},$$

where τ is the corresponding persistency of free currents. When $p\tau$ is very great this becomes

$$\phi = -\bar{\phi},$$

in accordance with a well-known principle.

This method can be applied to find the currents induced by rotation of the shell in a constant field, it being known from Maxwell's "Electricity," § 600, that the induced currents are the same if we suppose the conductor to be fixed, and the field to rotate in the opposite direction. When the conductor is symmetrical above the axis of rotation, the current-function of any normal type contains as a factor $\cos s\omega$ or $\sin s\omega$, where ω is the azimuth, and s is integral (or zero). When we apply Maxwell's artifice, the corresponding time-factor is $e^{isp't}$, where p' is the angular velocity of the rotation; and we easily find that the system of induced currents of any normal type is fixed in space, but is displaced relatively to the field through an angle,

$$\frac{1}{s}\text{ arc tan }ps\tau$$

in azimuth, in the direction of the rotation.

In the most important normal types the distribution of current over the ellipsoid is one which has been indicated by Maxwell ("Electricity," § 675) as giving a uniform magnetic field throughout the interior.

In the higher types the current-function ϕ is a Lamé's function, degenerating into a spherical harmonic when two of the axes of the ellipsoidal shell are equal. Of the special forms which the conductor may assume, the most interesting is that in which the third axis (that of symmetry) is infinitesimal, so that we have practically a circular *disk*, whose resistance ρ' varies according to the law

$$\rho' = \rho_0' \sqrt{\{1 - r^2/a^2\}},$$

where ρ_0' is the conductivity at the centre, a is the radius, and r denotes the distance of any point from the centre. In the most persistent type

$$\tau = \frac{\pi^2 a}{2\rho_0'}.$$

This result is of some interest, as showing that the electrical time-constant for a disk of *uniform* resistance ρ_0' must at all events be considerably less than $4\cdot93\ a/\rho_0'$.[1]

The problem of induced currents is then discussed, more particularly in the case of a circular disk, of the kind indicated, rotating in any constant magnetic field. In view of the physical interest attaching to the question, it would be interesting to have a solution for the case of a *uniform* disk; but in the absence of this, the solution for the more special kind of disk here considered may not be uninstructive.

In the most important types of induced currents, the magnetic potential $\bar{\Omega}$ due to the field $\propto xz$, so that the lines of force at the disk are normal to it, but the direction of the force is reversed as we cross the axis of z. The current-function relatively to axes displaced through the proper angle η in the direction of rotation, varies as

$$y\sqrt{\{1 - r^2/a^2\}}.$$

In the next type $\Omega \propto z(x^2 - y^2)$, and the current-function, relatively to displaced axes as before, varies as $xy\sqrt{1 - r^2/a^2}$.

"Note to a Memoir on the Theory of Mathematical Form" (Phil. Trans. 1886, vol. clxxvii. p. 1). By A. B. Kempe, M.A., F.R.S.

The object of this note is to make some slight but important amendments of certain sections of the original memoir (viz. secs. 5, 7, 73 to 77, and 167), relating to the definition and use of what the author terms "aspects" of collections of things. An "aspect" of a collection of n things is that which is under consideration when to each individual thing of the collection we mentally affix a distinctive degree of prominence or other mark. These n marks may be regarded as interchangeable with each other, and we thus get $\lfloor n$ aspects of the collection, of which some are undistinguishable from each other. If the interchanges corresponding to a complete system of undistinguishable aspects of the collection are given we know the "form" of the collection.

March 31.—"On Clausius's Characteristic Equation for Substances applied to Messrs. Ramsay and Young's Experiments on Alcohol." By Prof. Fitzgerald, Trinity College, Dublin.

This paper is an investigation of how far Clausius's equation

$$\frac{P}{R\tau} = \frac{1}{v - \alpha} - \frac{1}{\odot(v + \beta)^2}$$

represents accurately Messrs. Ramsay and Young's experimental results. It is shown that, considering the enormous range of values to be represented, it represents the results remarkably accurately, except that from the volume of the liquid, where alone the value of α is of much consequence, it follows that α is not constant, but is a function of both the temperature and pressure.

The paper contains a short discussion of the geometrical forms of the curves—a particular case of which is represented by this equation.

[1] Fell May 10, 1879, and contained embedded nodules of nickeliferous iron surrounded by silicates.

[1] I find by methods similar to those employed by Lord Rayleigh for the approximate determination of various acoustical constants, that the true value lies between $\pi a/\rho'$ and $2\cdot26\ a/\rho'$. For a disk of copper (ρ=1600 C.G.S.), whose radius is a decimetre and thickness a millimetre, the lower limit is 0·0014 sec. For disks of other dimensions the result will vary as the radius and the thickness conjointly.

It concludes with a hope that the velocity of sound in a substance near the critical point may be investigated, in order that we may know the two specific heats under these exceptional circumstances.

Physical Society, March 26.—Prof. Balfour Stewart, President, in the chair.—The following paper was read:—On the production, preparation, and properties of the finest fibres, by Mr. C. V. Boys. The inquiry into the production and properties of fibres was suggested by the experiments of Messrs. Gibson and Gregory on the tenacity of spun glass, described before the Society on February 12, and the necessity of using such fibres in experiments on which Prof. Rücker and the author are engaged. The various methods of producing organic fibres such as silk, cobweb, &c., and the mineral fibres, volcanic glass, slag wool, and spun glass, were referred to, and experiments shown in which masses of fibres of sealing-wax or Canada balsam were produced by electrifying the melted substance. In producing very fine glass fibres, the author finds it best to use very small quantities at high temperatures, and the velocity of separation should be as great as possible. The oxyhydrogen jet is used to attain the high temperature, and several methods of obtaining a great velocity have been devised. The best results obtained are given by a cross-bow and straw arrow, to the tail of which a thin rod of the substance to be drawn is cemented. Pine is used for the bow, because the ratio of its elasticity to its density (on which the velocity attainable depends) is great. The free end of the rod is held between the fingers, and when the middle part has been heated to the required temperature the string of the cross-bow is suddenly released, thus projecting the arrow with great velocity and drawing out a long fine fibre. By this means fibres of glass less than 1/10,000 of an inch in diameter can be made. The author has also experimented on many minerals, such as quartz, sapphire, ruby, garnet, feldspar, fluor-spar, augite, emerald, &c., with more or less success. Ruby, sapphire, and fluor-spar cannot well be drawn into fibres by this process, but quartz, augite, and feldspar give very satisfactory results. Garnet, when treated at low temperatures, yields fibres exhibiting the most beautiful colours. Some very interesting results have been obtained with quartz, from which fibres less than 1/100,000 of an inch in diameter have been obtained. It cannot be drawn directly from the crystal, but has to be slowly heated, fused, and cast in a thin rod, which rod is attached to the arrow as previously described. Quartz fibre exhibits remarkable properties, as it seems to be free from torsional fatigue, so evident in glass and metallic fibres, and on this account is most valuable for instruments requiring torsional control. The tenacity of such fibres is about fifty tons on the square inch. In the experiments on the fatigue of fibres great difficulty was experienced in obtaining a cement magnetically neutral, and sealing-wax was found the most suitable. An experiment was performed illustrating the fatigue of glass fibres under torsion, and diagrams exhibited showing that the effect of annealing them is to reduce the sub-permanent deformation to about 1/10 its original amount under similar conditions. Annealing quartz fibres does not improve their torsional properties, and renders them rotten. Besides the use of quartz for torsional measurements, the author believes that quartz thermometers would be free from the change of zero so annoying in glass ones. He exhibited an annealed glass spiral capable of weighing a millionth of a grain fairly accurately, and also a diffraction grating made by placing the fine fibres side by side in the threads of a fine screws. Gratings so made give banded spectra of white light. The author regretted that his paper was so incomplete, but thought the results already obtained would be of interest to the Society. Prof. W. G. Adams congratulated the author on his most interesting paper, and considered the results to be of great importance. He believed the banded spectra exhibited by the grating were probably due to internal reflection within the fibres. Mr. Cunyngham asked whether the glass mirror used in the torsional experiments was magnetic, to which the author replied that this was probable, but even this assumption did not explain all the peculiarities observed.—A paper by Prof. Pickering was postponed till the next meeting, on April 23.

EDINBURGH

Scottish Meteorological Society, March 30.—Half-Yearly Meeting.—Mr. John Murray in the chair.—It was reported that four new stations had been recently added, viz., Aberlour, Oban, and Ailsa Craig and Oxcar Lighthouses; and an arrangement had been entered into with the Meteorological Council by which daily observations of temperature and rainfall are transmitted for the Weekly Weather Report issued by the Council for agricultural and sanitary purposes from the Society's stations at Lairg, Glencarron, Fort Augustus, Braemar, Ochtertyre, Marchmont, and Glenlee. Messrs. R. M. Smith, John Murray, and J. Y. Buchanan were re-elected members of the Council. The work of collecting and discussing the sea temperatures round the Scottish coast, for which a grant of 50*l.* has been obtained from the Government Grant Committee, has been transferred to Mr. H. N. Dickson. The report from the Council enters somewhat in detail into the physical and biological work carried on at the Scottish Marine Station. Six trips have been made since July by the *Medusa* in the Firth of Clyde and connected lochs, during which observations of sea temperatures were taken at all depths from the surface to the bottom, special attention being directed to the further investigation of the remarkable and unexpected distribution of temperature occurring in this part of the ocean at certain seasons, as disclosed during previous trips of the *Medusa*. Dredging was also vigorously prosecuted, and all the specimens obtained have been determined, their anatomy investigated, and the results prepared for publication by the staff of the Scottish Marine Station. This Station continues to be largely taken advantage of by biologists, for whom tables are provided in the laboratory free of charge, for prosecuting their zoological researches. As regards the Ben Nevis Observatory, it was reported that the subscriptions raised since the commencement of the present year for clearing off the debt and founding a low-level station of the first order at Fort William now amounted to 822*l.*, thus bringing up the amount contributed by the public since the establishment of the Observatory in 1883 to nearly 8000*l.*—An address was then delivered by the Hon. Ralph Abercromby, at the request of the Council, on modern developments of cloud knowledge, with lime-light illustrations of clouds from all parts of the world. It was shown that clouds were everywhere the same, and that the different forms of clouds which he had exhibited from all regions of the globe could be seen in Scotland. A modification of the present classification of clouds which has been proposed by Prof. Hildebrandsson, of Upsala, and himself, was explained and illustrated. He then dealt successively with the structure of clouds and their height, the atmospheric conditions concerned in the formation of the different kinds of clouds, the remarkable results to which cloud-motions led as regards the nature of cyclones and anticyclones, the forecasting value of clouds, and finally the necessity of attending, in all efforts to interpret the indications of clouds, not merely to their forms, but also to their surroundings. In moving a vote of thanks to the lecturer, Prof. Chrystal took occasion to refer to the great beauty of the photographs shown by the lime-light, which were highly appreciated by a large and influential audience.

PARIS

Academy of Sciences, April 4.—M. Janssen, President, in the chair.—Researches on certain phenomena connected with the aberration of light, by M. Fizeau. The paper deals chiefly with the nature of the phenomena that may be produced in the reflection of a pencil of light on the surface of a mirror, assuming this mirror to be endowed with a velocity comparable to that of light.—Stroboscopic method for comparing the duration of vibration of two diapasons, or that of the oscillation of two pendulums, by M. Lippmann. A description is given of a very accurate process of making these comparisons derived from the stroboscopic method.—On the central calm in cyclonic storms, by M. H. Faye. This central stillness is found to be present in all tropical cyclones, persisting even beyond the 50° latitude, but becoming modified according as the storm approaches the Pole without ever disappearing altogether.—On various effects of irritation in the throat, and especially on loss of sensibility and sudden death, by M. Brown-Séquard. Numerous experiments tend to show that the skin of the throat possesses, like the larynx, but to a less degree, the power of arresting sensibility; also that the larynx, the trachea, and also, perhaps, the cuticle covering them, possess the power of causing death under a mechanical irritation in the same way as the rachidian bulb.—On the seismic phenomena of February 1887, by M. Ch. V. Zenger. A parallelism is suggested between these disturbances and atmospheric, electric, and magnetic phenomena and volcanic eruptions so often occurring simultaneously.—Rectification of right, unicursal, circular cubics by means of the elliptical integrals, by M. G. de Longchamps. In supplement to his recent note, the author

here establishes the important generalisation that all these cubics may be rectified by means of the elliptical integrals.—On the voltaic arc, by M. G. Maneuvrier. A new process is described, by means of which the voltaic arc may be excited without previous contact of the two electrodes.—Law of distribution of the rays and bands common to several spectra of bands, by M. Deslandres. Having already shown that the rays composing the same band may be divided into a series of identical rays, such that in each series the intervals between one ray and the following run pretty well in arithmetical progression, the author here extends this simple law of distribution to the bands of the same spectrum of bands, indicating an analogy with the law of succession of sounds in a solid body.—Fatal accidents in electric workshops, by M. A. d'Arsonval. Some remarks are presented on the causes of these accidents, on their physiological effects, and on the means of preventing them.—Quantitative analysis of vanadic acid, by M. A. Ditte. It is shown that by observing certain precautions the method indicated by Berzelius, based on the insolubility of the vanadate of ammonia in sal ammoniac may be applied to the analysis of vanadium in the form of vanadic acid with satisfactory results.—On some ammoniacal combinations of the sulphate and nitrate of cadmium, by M. G. André. Some details are given for the preparation of the ammoniacal sulphates and nitrates of cadmium, with indications of their possible relations to the corresponding salts of zinc and copper.—On the extraction and analysis of the vanadium occurring in rocks and mineral ores, by M. L. L'Hôte. The method here described involves two operations: the extraction of the vanadium in the form of vanadic solution, and its analysis by means of titrated liquors, or by weighing.—On the preparation of the propylamines and iso-amylamines, by M. H. Malbot. The observations recently made by the author on the isobutylamines are here extended to the amines derived from various alcohols.—On the power of multiplication of the ciliated Infusoria, by M. E. Maupas. This power is shown to depend on three factors: the quality and abundance of nourishment; temperature; and the biological adaptation of each species from the alimentary standpoint.—Results obtained by the preventive inoculation of the attenuated virus of yellow fever at Rio de Janeiro, by MM. Domingos Freire, Paul Gibier, and C. Rebourgeon. Of the 1675 cases terminating fatally between January 1885 and September 1886, only 8 had been vaccinated, and these at a time when the treatment was still imperfectly understood. In general, the mortality is now 1 per 1000 for the vaccinated, and 1 per 100 for all others.

BERLIN

Physiological Society, March 25.—Prof. du Bois-Reymond, President, in the chair.—Prof. Falk spoke on the influence of extremes of temperature on the colour of blood. In persons either burnt or frozen to death the *post-mortem* patches present a strikingly bright red colour. The speaker has found, as the result of an experimental investigation, that temperatures of 0° C., and below, lead to the colour of the blood becoming bright red by causing the oxygen of the air to be more readily fixed and more stably retained by the corpuscles than is the case at ordinary temperatures. If, however, the blood has stood exposed to the air until putrefactive changes have set in, in this case the action of cold no longer makes the blood brighter in colour. Other experiments have shown that in animals killed by low temperatures the blood is bright red, not only in the peripheral parts but also in the heart and great vessels. Also in human beings frozen to death the blood even in the heart is sometimes observed to be bright red, although in most cases only the blood of the peripheral parts presents this appearance; probably death has ensued from freezing only in cases presenting the first of these two appearances.—The President read a communication from Prof. Fredericq, of Louvain, on Traube-Hering curves. As is well known, a blood-pressure tracing recorded by a mercurial manometer, shows three distinct kinds of curves:—(1) Curves of the first order, which are caused by the systole of the heart. (2) Curves of the second order, which make their appearance at lengthy intervals and are synchronous with the respiratory movements: these curves represent the influence of the respiration on the blood-pressure. (3) Curves of the third order, which make their appearance at still longer intervals and were first described by Siegmund Meyer: these have usually been regarded as due to a rhythmic increase and diminution in the activity of the vaso-motor centre. The curves described by Traube and Hering have until now been regarded as belonging to the above-mentioned third order of curves. Prof. Fredericq, however, regards this as an incorrect view; he regards them as belonging to the second order, corresponding to and produced by the respiratory movements.—Dr. Wurster stated that he has treated the caseine-like substance (see NATURE, vol. xxxv. p. 455) obtained by the addition of hydrogen-peroxide to white of eggs with ammonia, and finds that a portion of this substance is thereby dissolved. Another portion, however, is converted into a ropy mass, which on being dried yields a horny substance, with a very marked affinity for colouring matters, and which exhibits nearly all the characteristics of horn. He has further found that these two bodies undergo no change by the action of nitrite of soda on the white of eggs. By the addition of lactic or acetic acid he has obtained a yellow precipitate which turned intensely red on exposure to the air: the same reagents applied to blood produced a black coloration.—Prof. Zuntz gave a short communication on the course of experiments which he has made in conjunction with Profs. Virchow and Senator on Cetti during his fast lasting over eleven days. The results of the investigation have not yet been completely put together, but will be communicated at an early sitting of the Physiological Society.

BOOKS, PAMPHLETS, and SERIALS RECEIVED

Calendar of the Royal University of Ireland, 1887 (Thom, Dublin).—Studies from the Laboratory of Physiological Chemistry, Sheffield Scientific School of Yale University, vol. ii. (New Haven).—Transactions of the Edinburgh Geological Society, vol. v. Part 2 (Edinburgh).—The Treatment and Utilisation of Sewage, 3rd edition: W. Corfield and L. Parkes (Macmillan).—Practical Solid Geometry: W. G. Ross (Cassells).—Bees and Bee-Keeping, vol. ii. Part 7: F. R. Cheshire (Gill).—British Dogs, No. 6: H. Dalziel (Gill).—Catalogus der Bibliotheek van 'Slands Plantentium te Buitenzorg (Batavia).—Nitrate of Soda: A. Stutzer (Whittaker).—Mystery of Gravity: J. Fraser (Wyman).—England as a Petroleum Power: C. Marvin (Anderson).—Circulars of Information of the Bureau of Education, Nos. 1 and 2, 1886 (Washington).—Report of the Mitchell Library, Glasgow, 1886 (Glasgow).—Geological Magazine, No. 274 (Trübner).—Journal of the Chemical Society, April (Gurney and Jackson).—Journal of the Straits Branch of the Royal Asiatic Society, June 1886; Notes and Queries (Singapore).

CONTENTS