mass from which he separated, and 95% of the total momentum of the nebula. These same discrepancies occur also in the other planets with no apparent regularity. The present discrepancies can not be due to transfer of energy through tidal action. The computations show an irregular distribution of mass and momenta throughout the system which could not be derived by known laws under the nebular hypothesis, and so necessitates the construction of a new hypothesis which will give this unsymmetrical distribution. Some of the lines along which this new hypothesis may be sought are suggested. W. G. T.

American Chemical Journal, March, 1900. 'Anethol and its Isomers,' by W. R. Orndorff and D. A. Morton. 'The supposed Isomeric Potassium Sodium Sulphites,' by G. S. Fraps. It was found impossible to obtain the two sodium potassium salts of sulphurous acids which are theoretically possible, if the acid has the asymmetrical structure. 'Condensation Compounds of Amines and Camphoroxalic Acid,' by J. B. Tingle and A. Tingle. 'A Method for the Determination of the Melting-Point,' by M. Kuhara and M. Chikashige. The authors place the substance between a pair of thin cover-glasses. These are held in a holder of platinum and inserted into a test-tube, which serves as an air-bath. 'The Symmetrical Chloride of Paranitro-orthosulphobenzoic Acid,' by F. S. Hollis. 'Stereoisomers and Racemic Compounds,' by H. C. Cooper.

The March issue of *Terrestrial Magnetism and Atmospheric Electricity* contains the following articles:

The physical decomposition of the permanent magnetic field of the United States. No. 1. The assumed normal magnetization and the characteristics of the primary residual field, by L. A. Bauer and D. L. Hazard.

Die Aufgaben der erdmagnetischen Forschung der Vereinigten Staaten Nordamerikas, by L. A. Bauer.

Biographical sketch and portrait of the late Alexis de Tillo.

Einige Gesichtspunkte für die Einrichtung Erdmagnetischer Simultan-beobachtungen zur Erforschung der Ursachen der Erdmagnetischen Störungen, by Ad. Schmidt.

A comparison of the isogonic charts for the year 1900, issued by the 'Deutsche Seewarte' the United States Hydrographic Office, and the United States Coast and Geodetic Survey, by J. A. Fleming.

The United States Coast and Geodetic Survey: Its origin, development, and present status, by E. D. Preston. [Illustrated.]

Notes regarding magnetic instruments:

A source of error in the Kew magnetometer, by H. Morize.

The Coast and Geodetic Survey magnetometer, by L. A. Bauer.

The effect of glass covers in magnetic instruments, by E. G. Fischer.

The number concludes with 16 pp. of abstracts reviews, and notes on terrestrial magnetism and atmospheric electricity.

The *Journal of the Boston Society of the Medical Sciences* for February 20th, opens with an article by H. G. Beyer, on the 'Relation between Mental Work and Physique,' in which the author arrives at the same conclusions as those reached by Dr. W. T. Porter, that precocious children weigh more and dull children less than the average of their age. C. S. Minot briefly describes 'A hitherto Unrecognized Form of Blood Circulation without Capillaries in the Organs of Vertebrates.' D. A. Sargent discusses 'The Relation of the Cephalic Index to Height, Weight, Strength and Mental Ability,' finding among eleven hundred Harvard students the brachycephalic were superior in scholarship and the dolichocephalic in athletics. W. H. Smith describes and figures 'Branching Tubercle Bacilli in Sputum,' and Harold C. Ernst gives a summary of a fully illustrated paper on 'The Development of the Microscope.'

SOCIETIES AND ACADEMIES.

NEW YORK ACADEMY OF SCIENCES.

SECTION OF ASTRONOMY, PHYSICS AND CHEMISTRY.

A meeting of the Section was held on Monday evening, March 5th. Professor R. S. Woodward gave an account of the Jubilee of Sir George G. Stokes, which he attended as a delegate from Columbia University. The Jubilee was held on the 1st and 2d of June, 1899, on the fiftieth anniversary of the professorship of Sir George G. Stokes at Cambridge. Stokes'

most important work was done between 1842 and 1855. Among other things, he showed that in fluid motion the conditions under which the equations of motion were integrable were the conditions that the motion should be irrotational. He made researches in the elastic solid theory of light. He made advances in the theory of physical geodesy. He showed that the shape of the earth's surface should determine the law by which gravity varied from place to place. He cleared up a good many obscurities in the work of Fourier in regard to Fourier series.

The Jubilee began with the Rede lecture delivered by Professor Cornu, of the École Polytechnique, on the 'Wave Theory of Light,' and its influence on modern physics. Besides dinners, garden parties, etc., the most important ceremonies were the presentation of addresses by the delegates representing about seventy institutions, and the conferring of the honorary degree of Doctor of Science upon Messrs. Cornu, Darboux, Michelson, Mittag-Leffler, Quincke and Voigt. At the dinner which ended the celebration, Sir George Stokes made a speech in the course of which he said that he wished he had done more scientific work, but that if he had, he might not have been there to celebrate his Jubilee.

Mr. A. C. Longden read a paper on the resistance of thin films deposited by kathode radiation. He described his method of depositing thin films on glass and showed some specimens. These films can be used as high resistances instead of the very expensive wire resistances ordinarily used. Films of gold or platinum can be deposited, which have not the lack of durability of alloys. At the same time, unlike the metals in the form of wire, they have very low positive or even negative temperature coefficients. The films are deposited from a kathode of the same material by the discharge of electricity through a vacuum, and can be deposited in any thickness desired, and of any metal, gold and platinum being however the most convenient. The speaker showed a gold film of varying thickness in different parts, the thickest part showing the green color like gold leaf when viewed by transmitted light, and the color varying through blue to violet as the film became thinner.

At the suggestion of Mr. C. C. Trowbridge, Mr. Longden attempted to deposit a thin conducting film of selenium, but he was unsuccessful, as the film deposited was non-conducting. He obtained, however, a film of varying thickness which exhibited the phenomenon of Newton's rings in a beautiful manner.

An election of officers of the Section was held. Professor William Hallock was elected Chairman, and Dr. William S. Day, Secretary, for the ensuing year.

WILLIAM S. DAY,
Secretary of Section.

THE TORREY BOTANICAL CLUB.

AT the meeting on February 18th, a paper was presented by Dr. H. H. Rusby, entitled 'The Tendency of Entomophilous Flowers to Antero-posterior Irregularity.' Its object was to show the distribution among plant-families of cases of such irregularity. Irregularities originating without reference to insect-pollination were classified and excluded. The irregularities considered and connected with insect-pollination, are not found among the 21 lowest of the 43 families of monocotyledons. Of the 10 next higher, 5 show none, 4 show slight or doubtful forms, while the highest, Liliaceæ, with 197 genera, twice as many as the other 9 families combined, shows, amidst general regularity, a few highly irregular genera, two of them simulating Orchidaceous forms. Of the 12 highest families, only 3 are regular. Five of the highest 6 are very irregular, indeed, the highest, Orchidaceæ, phenomenally so. It thus appears that an increased tendency to irregularity is indicative of higher development, but it is liable to occur in families and groups of families usually distinguished for its absence.

This principle was then shown to be even more clearly illustrated by the dicotyledons. In the 53 lowest families, but 4 show irregularity. Only one of these is found among the first 39, and this is Aristolochiaceæ, with a single irregular genus. Among the next 120 families, 27 show irregularity, and these are rather uniformly distributed among the others. Then come 19, several showing slight irregularity and one very irregular, indeed. The next 17 are, with one exception, highly irregular, one of them,

however, being so in only a few of its genera. The 11 highest families are very peculiar. While mostly regular, some of them are noted for irregularity, but this is so peculiarly adjusted in the inflorescence as to bring about the condition of regularity so far as the latter is concerned. Thus the daisy, while an inflorescence, is essentially a regular flower, by virtue of the arrangement of its irregular florets. It is also noticeable that as these ray flowers are usually pistillate, this arrangement reverses the position, so far as the head is concerned, of the distinctively pistillate portion. The various types of irregularity in composite flowers were discussed, and these were contrasted with other families exhibiting radiant inflorescences.

It was pointed out that irregularity was not a fundamental characteristic, but was readily called into existence by the exigencies of any group, or even species, and might be expected to develop anywhere. Special attention was called, as illustrating this principle, to the marked irregularity of *Cotyledon gibbiflorum* and *Saxifraga sarmentosa*, species in notably regular genera. It was also noted as significant that the most irregular families, such as Leguminosæ, might have extensive series of genera perfectly regular; also that almost exactly equal forms of irregularity might develop in families most widely separated, as the Liliaceæ and the Capparidaceæ. The fact that irregularity is more frequent in the higher families of the two classes is due to the fact that an essential property of such families is a greater power of adaptation, floral irregularity being only one manifestation of this character.

Edward S. Burgess,
Secretary.

THE ACADEMY OF SCIENCE OF ST. LOUIS.

At the meeting of the Academy of Science of St. Louis of March 19, 1900, fifty-eight persons present, Dr. H. von Schrenk exhibited some burls on the white spruce (*Picea Canadensis*). The burls, unlike most of those so far known, are almost round, and are covered with smooth bark. They grow of various sizes, and occur on the trunk and branches of a group of spruces limited to a small area. The wood fibres are arranged in annual rings; they differ from normal wood fibres because of their thinner walls and greater internal diameter, giving the wood a spongy character. Long rows of secondary resin passages occur in each ring. The largest burls, which are from one to three feet in diameter, have rows of long holes within each ring. These holes are diamond-shaped in cross-section, the longer diameter extending radially. Between the holes the wood fibres are compressed tangentially. The speaker explained that the holes must have resulted from an excessive radial pressure exerted from without, probably by the bark. No holes were found where the bark pressure had been released, *i. e.*, where the bark had burst. These results are not in harmony with the findings as to bark pressure reached by Krabbe. The speaker described the manner in which burls are usually formed, and showed the way in which these burls form, by excessive growth, induced by a wound or branch stump.

Professor F. E. Nipher exhibited stereopticon slides made from a large number of photographic negatives which had been taken by the electric spark from a Holtz machine. The negatives show a complete picture of the object acted upon by the spark, and also show the electrical radiations in the field around the object photographed. The plates were greatly over-exposed to light before they were used. They were allowed to lie fully exposed in a well lighted room, for from one to nine days. One of the best negatives was developed from a plate thus exposed for nine days. The best results are obtained by darkening the room when the electrical image is produced. Light is found to counteract the electrical effects when their action is simultaneous and also when it follows the electrical exposure.

The pictures are developed in the dark room, by the light of an incandescent lamp. When the negative begins to fog, it is taken nearer to the lamp, and it at once clears up. All of these methods are in total disregard of all ordinary photographic procedure. The plates used are extra rapid, and the developing solution is that in common use in photography.

The result which is most interesting from a scientific point of view is shown on twelve negatives which reveal ball lightning effects. Ball

lightning is to the electrician what the sea serpent is to the zoologist. It has often been seen, but never by those who are most competent to study and describe it, and all efforts to produce ball lightning effects by artificial means have hitherto failed. But these twelve negatives show with perfect distinctness discharges of this character. They could be seen while they were being photographed. They looked like little spheres of light, which traveled over a non-conducting plate, forming the insulation of a condenser. They traveled very slowly among the sparks of the ordinary disruptive discharge. Their speed was usually at the rate of an inch in three or four minutes. Their tracks showed with the greatest sharpness among the more indistinct flashes of miniature lightning. They sometimes jump for a quarter to a third of an inch, with such quickness that the eye can hardly follow them. Five or six such spheres of light sometimes appear at once, each following its own track. Sometimes one will cross a track previously traced by another, but it never follows the track of another.

By proper illumination of the room the effects of the spark discharges can be nearly obliterated in the negative, but the paths of the ball discharges are not materially affected. One negative thus treated had been exposed for thirty-five minutes, and the ball lightning tracks were most elaborate. The branching network of lines must have been produced by hundreds of these little spheres.

The same results can be obtained by fixing the negatives without any developing process. Everything then vanishes from the plate but the ball discharges.

Professor Nipher stated that this phenomenon could not be identified as the same thing as ball lightning, since the latter had not been studied. But it responds to the same description in many ways. As soon as the ball lightning effects appear, the behavior of the machine changes in a very remarkable way.

Mr. Koch exhibited an electrical fire annunciator.

Five persons were elected to active membership in the Academy.

WILLIAM TRELEASE,
Recording Secretary.

THE PHILOSOPHICAL SOCIETY OF WASHINGTON.

AT the 515th meeting of the Philosophical Society of Washington, held at the Cosmos Club, March 17th, Mr. Abbe called the attention of the members to three interesting works in meteorology:

1. The work in theoretical physics, viz, the memoir of Professor Marcel Brillouin, explaining the formation of cloud and rain in accordance with the principles developed by Helmholtz and von Bezold. The full memoir is published by the Central Meteorological Bureau of France.

2. A work in experimental laboratory physics conducted by Mr. C. T. R. Wilson, showing how the condensation of aqueous vapor takes place by preference upon the negative ions and that such negative nuclei can be formed in the atmosphere by the action of various forms of radiation including the Röntgen Rays, the Uranium rays, sunlight, etc. That, finally, according to Professor J. J. Thomson, we must no longer regard the earth as primarily electrified negatively, and acting by induction upon the atmosphere to make it positive. We must regard the atmosphere as a mixture of neutral atoms and positive and negative ions; the latter being brought down to the earth's surface by rain make the earth negative while leaving the atmosphere positive.

3. A work of observation in the free air, viz: the Report of Professor H. Hergesell of Strasburg, published in the last number of the *Zeitschrift* of the German and Austrian Societies. In this report Hergesell presents isotherms, isobars and movements for sea level and at 5000 meters and, also, 10,000 meters elevation for three different dates, as deduced from 32 balloon ascensions, thus demonstrating the existence of the descending cyclones with cold centers first described by Ferrel. The three memoirs above mentioned were submitted for the personal examination of the members present.

Mr. L. P. Shidy read a paper on the State of Progress of our knowledge of the Tides, in which after briefly reviewing the steps by which our knowledge has been increased, he presented some of the views of Dr. R. A. Harris in regard to the tidal movements in the great oceanic

basins. This mode of explanation of the tides, which has not yet been published, asserts that "In most cases the dominant ocean tides have their origin in definite systems whose free periods of oscillation are very nearly those of the tidal forces; and that the time of high or low water in each is the time when the virtual work of the tidal forces upon the system becomes zero." The time and height of the tides in Lake Superior and the eastern portion of the Mediterranean Sea, as computed by the corrected equilibrium theory, were found to agree with observations quite well. A number of localities forming fractional areas having dependent stationary waves were enumerated, the tides in the Gulf of Suez and in the Gulf of Maine being selected as examples which were somewhat fully explained.

Mr. L. A. Bauer then exhibited a number of lantern slides showing photographs of distinguished men in the line of Meteorology and Magnetism. A number of views of noted magnetic observatories were also given. On account of the lateness of the hour Mr. Bauer was obliged to omit a descriptive paper which he had prepared on the subject.

E. D. Preston,
Secretary.

DISCUSSION AND CORRESPONDENCE.

ELECTRICAL UNITS AND THE INTERNATIONAL CONGRESS.

In Mr. Wolff's interesting article on the 'Electrical Standards of the Office of Weights and Measures (Science, March 16, 1900), there is an unjustifiable criticism (unintentionally so, I have no doubt) of the work of the International Congress of 1893, in defining the three fundamental units.

A careful reading of the official report of the Chamber of Delegates will show that a special effort was made to avoid the error which Mr. Wolff thinks the Congress committed. As the official Proceedings include little of the discussion which occurred during sessions lasting nearly a week, a brief reference to the history of these definitions may be useful. A large part of one of the early sessions was spent in discussion, which almost became controversy, of the definitions of the ohm, ampere and volt. A set of definitions was submitted by the American delegates which were *primarily* rigorous, essentially those of the British Association Committee, the material representations being defined as approximations. The idea was to adopt definitions which in themselves would never need revision, leaving the way open, however, to any better approximations in material standards that might be possible in the future. These definitions were advocated by the American and English delegates, but they were opposed by the German and French members of the Chamber. At the end of the day it looked as if the Chamber might not be able to come to an agreement upon even the fundamental units, and to avoid so unfortunate an issue a Committee consisting of Messrs. Von Helmholtz, Mascart, Ayrton and Mendenhall, with the President of the Chamber, Professor Rowland, was appointed to bring in a report defining the ohm, ampere and volt at the next session.

This committee reported on Thursday, August 24th, and its conclusions, which were unanimously adopted by the Chamber, became the basis of all subsequent work.

It will thus appear that the definitions of the fundamental units as issued by the International Congress were not exactly what the American and English delegates would have chosen, but some sort of a compromise was necessary in order to avoid a failure. Care was taken, however, to see that there was really no inconsistency or absurdity present or possible in the language used. The ampere is said to be '*represented sufficiently well for practical use by, etc.*,' and in the definition of the volt the same phrase occurs so that the ampere is *not* declared to be a current of a certain silver depositing power, nor is the volt declared to be a certain fraction of the E. M. F., of a Clark cell. A variation of the same language is used in defining ohm but it was found impossible to get exactly the same words in. When, in 1894, Congress enacted a law legalizing these units, a few slight verbal changes were made without altering the meaning.

T. C. M.