ments. (2) By displacing the air during electrolysis with a neutral gas (nitrogen) no appreciable difference was observed in the weight of silver deposited; this is in agreement with the recent measurements made at the National Physical Laboratory, and contrary to the older measurements of most of the earlier observers. (3) The value found in the course of this research for the Weston normal cell, in terms of the international ohm and international ampere, agrees in a most satisfactory manner with the same results of the Reichsanstalt in 1908, and shows a satisfactory agreement with the recently published results of the National Physical Laboratory.

THE explanation of the electrical and thermal properties of metals as due to the existence of freely moving electrons in the intervals between the molecules of the metal has been a favourite theme with physicists for the last ten years since Prof. Riecke first published his theory. Although most of the theories have succeeded in giving properties for the metals in general agreement with the results of experiment, the quantitative agreement has not been all that could be desired. In particular, the quotient of the electrical and thermal conductivities, which has throughout been a favourite quantity with regard to which theory and experiment were compared, has, according to the theories, been a simpler function of the temperature than experiment has proved it to be. In No. 13 of the *Verhandlungen der deutschen physikalischen Gesellschaft* for 1908 Prof. P. Gruner, of Berne, suggests a modification of the theory of Prof. Lorentz which will do something to remove this objection. The negative electrons alone are supposed to be in motion, and when one impinges on a neutral molecule with sufficient velocity it is supposed to be capable of expelling an electron from the molecule, and when it impinges on a positive molecule with the requisite gentleness it may combine with the molecule. Since the critical velocities can be chosen at will, it is evident that Prof. Gruner's theory admits of a closer fit between theory and experiment than has hitherto been possible.

THE general report on the operations of the Survey of India administered under the Government of India during 1906–7 has been received. The report was prepared under the direction of Colonel F. B. Longe, R.E., Surveyor-General of India. We notice that the scale on which field surveys are to be executed and the larger scale standard maps published has been decided. The general scale of survey is to be 1 inch = 1 mile, but reserved forests and special areas will be surveyed on the scale 2 inches = 1 mile if required. The general scale for publication will be 1 inch = 1 mile. Among special observations carried out during the year under review may be mentioned those in connection with the gravimetric survey. The deflection of the plumb-line was determined at eleven stations in Káthiáwár and round the Gulf of Cambay, and the values obtained were in accordance with the general character of the deflections in Rajputana. Pendulum observations to determine the variation in the value of gravity were made at twelve stations in the neighbourhood of the Himalayas and of the Siwáliks, and on or near the Great Arc. The general character of the variations found was in accordance with expectation, but local anomalies of considerable amount were also disclosed. The results obtained have been found to agree with those obtained by Prof. Hecker in 1905. The magnetic survey was extended during the year into Burma and Assam. The systematic observations of Himalayan peaks in connection with the problem of refraction were continued, and though the results are of great interest many more are required before definite conclusions can be drawn. The total out-turn of detailed topographical and forest surveys on all scales was at the time of the report 25,740 square miles, against 23,312 square miles of similar surveys during the previous year. The total area triangulated and traversed for survey purposes was 31,851 and 1684 square miles respectively, against 27,134 for the previous year.

MESSRS. BOWES AND BOWES, of Cambridge, have just issued their latest catalogue of books on pure and applied mathematics, dealing more particularly with books published in the nineteenth century.

PROF. J. PERRY'S well-known work on "Applied Mechanics" has been translated into German by Herr Rudolf Schick. "Angewandte Mechanik" is published by the firm of Teubner, of Leipzig and Berlin, at the price of 18 marks.

FOUR new volumes in the Philosophische Bibliothek published by the Dürr'schen Buchhandlung, Leipzig, have been received. No. 28 deals with Descartes's principles of philosophy, and is edited by Dr. A. Buchenau; some of the Emperor Julian's philosophical works, translated and explained by Herr R. Asmus, form No. 116; a critical analysis of Schleiermacher's "Weihnachtsfeier," by Herr H. Mulert, appears as No. 117; and No. 118 is an "Einführung in die Erkenntnistheorie," by Prof. A. Messer.

MESSRS. CHAPMAN AND HALL have published a third edition of Mr. Frederick Hovenden's book, "What is Life? or Where are we? What are we? Whence did we come? And whither do we go?" The first issue of the work was reviewed in NATURE for April 7, 1898 (vol. lvii., p. 535), and it is sufficient to say that the present edition has been revised in the light of the progress made since the publication of the last edition, and an appendix has been added.

THE Johns Hopkins University Circular for December, 1908, takes the form of a memorial volume to the late President D. C. Gilman, first president of the Johns Hopkins University, who ruled its destinies from 1876 to 1901. The circular contains the impressive and appreciative addresses, delivered at the *in memoriam* services held last November at the University, by the present president, Dr. Ira Remsen, many of the University administrators and professors, and by Dr. James Bryce, our Ambassador at Washington. Numerous letters eulogising the late president received by President Remsen are included, an article from the *Nation*, and a biographical sketch.

OUR ASTRONOMICAL COLUMN.

WATER-VAPOUR LINES IN THE SUN-SPOT SPECTRUM.—In a paper read before the Dublin meeting of the British Association, and again in No. 5, vol. xxviii., of the *Astrophysical Journal*, Father Cortie directed attention to certain water-vapour lines in the solar spectrum which appear to become intensified in the spot spectrum. Examining ninety-one lines in the region D_1 to λ 5953·386, sixty-four, or 70·3 per cent., of which are due to water vapour, he found that of the sixty-four, twenty-nine, or 45 per cent., are affected in the spectrum of the spot either as widened or darkened lines. An examination of Hale's map showed that sixteen of these twenty-nine lines were also shown there as widened or darkened.

On this evidence Father Cortie suggested that steam may exist in the regions of sun-spots, and supported the suggestion by Mr. E. E. Brook's statement that he found the presence of water vapour essential for the laboratory production of Fowler's magnesium hydride bands, bands which are a prominent feature of the spot spectrum.

In No. 406 of the *Observatory* (p. 101, February) Mr. Evershed discusses the same subject from the observations made at the Kodaikanal Observatory. Dealing with the water-vapour lines of intensity 1 or more given by Rowland between λ 5850 and λ 6000, seventy in all, he finds that thirteen are not shown on his plates, forty-two are absolutely unaffected, seven are weakened, and eight are strengthened. Of the latter, four are only doubtfully strengthened; in two the strengthening is shown to be due to close titanium companions, and two are decidedly darkened. Mr. Evershed concludes that the weight of evidence is against the probability of the existence of steam in sun-spots, but, in commenting on this conclusion, Father Cortie points out that the conditions of observation at Stonyhurst and Kodaikanal were dissimilar, that the water-vapour lines recorded as strengthened at both places still have to be accounted for, and that the collateral evidence from the laboratory must also be taken into account.

THE SPECTRUM AND FORM OF COMET MOREHOUSE.—The *Astrophysical Journal* for January (No. 1, vol. xxix.) contains three papers dealing with Morehouse's comet, 1908*c*. In the first of these Prof. Frost and Mr. Parkhurst describe and discuss two series of spectrograms taken with objective-prism or with slit spectrographs, respectively, at the Yerkes Observatory. As the scale of the spectra is in each case very small, Hβ to Hθ covers about 3 mm., the wave-lengths are only approximate, but comparisons with the hydrogen lines in the spectrum of Vega, taken on the same plate with the "slit" spectra, permitted the recognition of several of the cometary condensations.

The results differ from those previously published by MM. Pluvinel and Baldet in that the Yerkes observers find the third and fourth "carbon" (hydrocarbon?) bands, whilst the Juvisy observers did not. Again, the CN band at λ 4216 could not be detected on the Yerkes spectrograms, whereas the Juvisy observers found that cyanogen was fully represented; both sets of observations agree on the absence of continuous spectrum, but are not in agreement in the matter of the wave-lengths of the bands. On the other hand, the Yerkes wave-lengths agree with those of MM. Deslandres and Bernard, but the latter were unable to identify the "carbon" bands, and they found a continuous spectrum on all their plates.

A study of the relative intensities of the spectra of the head and of the streamers leads to some important results. First, of the monochromatic images of the head, those at λλ 471 and 388 are strong, but no corresponding tail images are shown, or are very weak, thus indicating that the matter producing these radiations is mainly confined to the comet's head. Again, the tails diverging at different angles are shown in the same monochromatic images, thus indicating that they are composed of the same materials.

The second paper is by Prof. Barnard, and in it he describes his latest photographs of the comet. The changes in form which occurred in the tail strengthen his belief that the ejected matter met with resisting media, probably meteor swarms, in space.

Spectrograms, obtained with a slit spectrograph at the Lick Observatory, are described by Prof. Campbell and Dr. S. Albrecht in the third paper. They recognise the different edges of the third and fourth carbon and the first and third cyanogen bands, but the second cyanogen band is missing. Unknown lines at λλ 3913, 4002, 4022, 4255, 4276, 4549, and 4570 are also shown on the spectrograms, and it is suggested that the last six may be related bands, similar to those of cyanogen, due to some substance as yet unknown terrestrially.

PARALLAX OF 23 H CAMELOPARDALIS.—From a photographic investigation, Herr Gustaf Strömberg finds that the parallax of 23 H Camelopardalis is $\pi = +0''.127$. $\chi = -0''.010$, with probable errors of $\pm 0''.053$ and $\pm 0''.057$ respectively, where χ is the relative correction of the aberration constant. These values were obtained by the measurement and discussion of twenty-eight plates taken between October, 1904, and April, 1908, twenty-three being employed for the estimation of the difference in right ascension and twenty-five for that in declination (*Astronomische Nachrichten*, No. 4295, p. 366).

THE STARS OF THE *c* AND *ac* SUBDIVISIONS IN THE MAURY SPECTRAL CLASSIFICATION.—In No. 4296 of the *Astronomische Nachrichten* Herr E. Hertzsprung discusses the distance, distribution, and probable general characteristics of the stars which in Miss Maury's classification of the "Spectra of Bright Stars" (Harvard) are placed in the subdivisions *c* and *ac*. From the discussion of their proper motions, parallaxes, &c., the author finds, among other conclusions, that these stars, among which many of the brightest stars in the heavens are included, are generally at a greater distance and intrinsically brighter than those of the other groups.

THE STARS SURROUNDING 59 CYGNI.—No. 25 of the Contributions from the Observatory of Columbia University contains the measures of the Rutherfurd photographs of stars surrounding 59 Cygni. The measures are discussed by Prof. Jacoby, and in the final catalogue the positions (1875·0), magnitudes, &c., are given for forty-six stars.

ERRORS OF DOUBLE-STAR MEASURES.—In Nos. 4298–9 of the *Astronomische Nachrichten* (pp. 17–39, January 22) Dr. H. E. Lau discusses the systematic errors of double-star measures, and gives in detail the peculiar errors of a large number of well-known observers. In each case a brief note gives the mean probable error at different distances and in position-angle; the magnitude equation of each observer is also discussed.

ELECTRIFICATION OF RAILWAYS.

Present Position.

SINCE the position of railway electrification was last reviewed in these columns, a number of important developments have taken place on the Continent and in America. In England the conversion of steam lines has been slower than was anticipated. On the Continent, however, its spread has been quite as rapid as was expected by any but the too optimistic.

Electrification may be considered under practically the same heads as railways themselves. That is to say, the problem is quite different according to whether the application be to main line, suburban, or purely urban traffic, while the handling of goods traffic introduces an additional consideration.

As regards the advantages of electricity for handling urban traffic there is practically no longer any discussion. Thus most of the purely urban systems in the great capitals of the world, such as the tubes, District, and Metropolitan Railways in London, the Metropolitan in Paris, the subways in New York, and the railways in Berlin and Chicago, so far as they are self-contained, are now electrically worked, steam where previously in use having been replaced.

As regards suburban lines, especially where this is carried over lines which are also used for main-line traffic, the process has not been carried so far. There are, of course, plenty of instances where the conversion has taken place both in the neighbourhood of great capitals and in less populous districts. Thus in London the Harrow extension of the Metropolitan and portions of the Great Western and South-Western now use electricity. In New York the New York Central and the New York, New Haven, and Hartford lines are now working electrically, and the Pennsylvania tunnels are being rapidly equipped. In Chicago the Illinois Central is now considering the electrification of a large number of suburban lines, while an extension of electric working to most of the suburban lines in the Berlin district will probably take place before long. In Melbourne the Railway Commissioners have recently had before them the whole question of converting their suburban system, upwards of 200 miles, to electric working. In London, however, the application of electric working to the suburban sections of the great main lines has made little progress. The Brighton Company has been engaged for some years in converting a portion of its suburban system between Victoria and London Bridge, and the result of that experiment, both financially and technically, will doubtless have its result upon the other companies. A trial trip was made a few days ago.