as 4·2°; the coldest period is at the end of January, 12·5°, and the warmest in the middle of July, 16·7°. The mean temperature of the northern hemisphere, 15·3° C., is nearly 1½° higher than that of the southern. The work includes seven isothermal charts between 30° and 90° S. latitude for the year, for mid-January, and each alternate month.

THE *Halbmonatliches Literaturverzeichnis* of the *Fortschritte der Physik*, issues under the auspices of the German Physical Society, still continues to furnish more promptly than any other periodical a list of the papers dealing with topics of interest to physicists which appear in the various journals and proceedings of societies. As instances of the promptness with which titles of papers are published, we may mention that the number for June 15 contains the titles of several papers read at the meetings of the Royal Society and of the Physical Society of London in April and May.

THE prestige of the "principle of relativity" as a basis for our treatment of electrodynamics in moving media has been increased by a preliminary communication made to the German Physical Society by Dr. E. Hupka, an account of which is given in the *Verhandlungen* of the society for June 15. Three or four months ago Dr. A. H. Bucherer announced that the results of his experiments on the inertia of the negatively charged particles of the β rays from radium were distinctly in favour of the principle as against its most formidable rival the "sphere theory." Now Dr. Hupka, working with the electrons produced when light falls on negatively charged bodies, has shown that when these electrons are accelerated by the action of an electric field, and then deflected by passing through a magnetic field, the deflections observed are again in favour of the principle, which may be stated as follows:—The electrodynamic phenomena exhibited within two systems moving with respect to each other in a straight line will follow the same laws, provided that in each system the unit of time be so chosen that the velocity of light is expressed by the same number.

"SUPPLEMENTARY INVESTIGATIONS OF INFRA-RED SPECTRA," by Prof. Wm. W. Coblentz (parts v., vi., vii.), has been received from the Carnegie Institution of Washington. This publication contains supplementary data on the doubtful points which arose in the author's preceding work, and also some additional observations on the emission spectra of metal filaments and insulators, thus rounding up the subject as completely as possible at the moment. Although, as Prof. Coblentz goes on to say, the programme of investigation is completed, the subject is not exhausted—not even thoroughly initiated. The value and importance of the author's work in the infra-red region of the spectrum are too well known to need any further diploma of merit at this time; moreover, it is impossible to deal in detail with the account of the many new observations described in the present monograph. There are three separate lines of work, namely, infra-red reflection spectra, transmission spectra, and emission spectra. To these is added a valuable chapter on the instruments and methods used in the work. Two points of special interest may be noted, one of which is the relation between the maxima in the reflection spectra of the carbonates and the atomic weight of the metal, where the maxima steadily shift towards the red with increase in molecular weight. The second point of interest is the infra-red spectra of the colloidal metals in relation to the coloured glasses. There is no doubt that, quite apart from its general importance, Prof. Coblentz's work, owing to the range of spectrum dealt with, will have considerable bearing upon the relation between absorption and chemical constitution.

A NEW form of gearing, which has been invented by Mr. Jules Lecoche, and is being introduced by the Anglo-Foreign Inventions Syndicate, Ltd., of 10 Camomile Street, E.C., is illustrated in *Engineering* for July 2. The gearing essentially consists of two wheels having spiral or helical teeth which run out of contact, a mechanical clearance of about 1/32-inch separating the tops of the teeth on the two wheels. One of the wheels is provided with field magnets in such a way that a magnetic flux is generated between its teeth and the corresponding teeth on the other wheel. The mechanical drive is obtained entirely by means of the magnetic flux, the form of the teeth being such that, when the wheels are running together, the tops of any two teeth in magnetic mesh lie immediately one over the other, and follow each the same path. As two teeth leave each other, the magnetic flux will be transferred from the leaving teeth to the approaching teeth, thus ensuring continuity of drive. As there is no contact there can be no friction; and as the power consumed in the field coils is only about 3 per cent. of the power transmitted, a gearing efficiency of about 97 per cent. is attainable. Another advantage lies in the high speed of transmission possible. Ball bearings are used for the spindles, an example at present being shown in London by the Albany Engineering Company, of Ossory Road, S.E., having a gearing loss of 1·79 per cent. and an over-all efficiency of more than 90 per cent. The advantages of this gear should open a wide field for its applications.

WE have received a copy of the report of the Indian Association for the Cultivation of Science for the year 1907. The association arranges courses of lectures upon scientific subjects, maintains a laboratory and library, and conducts an annual examination of candidates for prizes and medals. Interesting speeches were given at the annual meeting held last November, and altogether the association appears to be doing useful work in spreading a knowledge of and interest in science.

THE July number of the *Fortnightly Review* contains an article by Dr. Marie C. Stopes entitled "An Expedition to the Southern Coal Mines." Dr. Stopes was sent by the Royal Society for special palæobotanical work to Japan, where she spent a year and a half in close touch with the Japanese. In addition to devoting a large part of her stay to research work in the Imperial University, Dr. Stopes travelled widely on tours of inspection and investigation. She entered a great many of the coal mines in Japan, and penetrated to the heart of the country searching for interesting specimens. Her article is in the form of a diary, not written for scientific workers, but intended to supply a series of pictures of life in many parts of Japan.

OUR ASTRONOMICAL COLUMN.

RADIAL MOTION IN SUN-SPOT VAPOURS.—Referring to some comments and queries, by Mr. Buss, in the May number, Mr. Evershed gives further details of the radial motion discovered in sun-spot vapours, in No. 411 of the *Observatory*. He has found that when the slit of the spectroscope does not bisect the spot symmetrically, but crosses the penumbra on the side of the spot nearer to the centre of the sun's disc, the lines are always convex towards the violet; whereas if the slit crosses the opposite side of the penumbra they are convex towards the red. That the line displacements are due solely to motion is shown by the change in position angle of the maximum shift as the spot traverses the disc. The maximum displacement is always such as to indicate that the maximum motion is along the radius, but the observations are not yet sufficiently delicate to disprove the existence of a superimposed,

relatively slow spiral motion; on the other hand, there is no direct evidence that such an outward spiral motion exists.

Recent work shows that the radial motion is confined to the lower chromosphere—the "reversing layer." In the higher chromosphere the absorption lines H_3, K_3, and probably $H\alpha$, are usually twisted in the opposite direction to the other lines, thus indicating an inward movement of the vapours. This apparently agrees with Prof. Hale's observation of a dark flocculus moving towards the centre of the spot. There is still an apparent discrepancy between this radial movement and the vortex motions invoked by Prof. Hale to explain the Zeeman effect in sun-spot lines, and, according to Mr. Evershed's results, the vortex, if it exists, either above or below a sun-spot, does not affect the absorbing gases of the "reversing layer" in the penumbræ of spots.

BINARY STAR ORBITS.—In No. 4, vol. xxix., of the *Astrophysical Journal*, Father Stein discusses the photometric observations of the binary star *RZ* Cassiopeiæ on the assumption that it is an Algol variable. Assuming that the orbit is circular, and that the mean densities of the two components are equal, he finds that the mass of the system is 1·002 the sun's mass, the mass of the bright body, the primary, being 0·646 sun's mass; the radius of the bright body is 1·43, and that of the satellite 1·17 the sun's radius, the mean density of each body being 0·222 that of the sun's density. The centres of the two bodies are separated by 0·022 astronomical unit.

No. 13, vol. i., of the publications of the Allegheny Observatory, contains a discussion of the orbits of the spectroscopic components of 2 Lacertæ, by Mr. R. H. Baker. In spectrograms of this star taken on fine-grained plates, the lines of the components are, at certain epochs, separated, and it is interesting to note that the "blend" curve differs considerably from various parts of the primary curve, thus suggesting that for all spectroscopic binaries having a large range of velocities it is desirable that spectrograms should be taken on the finest-grained plates obtainable at the epochs of maximum velocity. The measurement of such plates might, supposing the lines to be separated, considerably modify the results obtained from coarser-grained plates on which the component spectra are inseparable. Mr. Baker finds the period of this star to be 2·6164 days.

MICROMETRIC MEASURES OF DOUBLE STARS.—In No. 4336 of the *Astronomische Nachrichten*, Mr. Phillip Fox publishes the measures of a number of miscellaneous double stars made with the 12-inch and 40-inch refractors of the Yerkes Observatory. The 40-inch is not used regularly for this work, but is employed when conditions are not suitable for securing parallax plates. Mr. Fox's observing-list is mainly made up of Holden double-stars, about half of which have now been observed, but these measures are reserved until the complete list is ready. The present publication includes the measures, made during 1907–8, of about 130 multiple systems.

THE IDENTITY OF COMETS 1908*a* AND 1908*b* (ENCKE).—In No. 4332 of the *Astronomische Nachrichten*, Dr. Ebell discusses the question of the identity of comet 1908*a* with Encke's comet. It will be remembered that when 1908*a* was first discovered by Prof. Wolf, it was announced as being Encke's comet, but the latter was not discovered until May, 1908, when it was found by Mr. Woodgate at the Cape Observatory. Dr. Ebell finds that both the motion and the brightness of comet 1908*a* are against the theory of identity with Encke's, for the latter was, theoretically, much fainter, about 3·5 magnitudes, than the observed object. There still remains the question as to whether 1908*a* was a fragment of Encke's, split off by some accidental encounter or explosion, and this question is being investigated at Pulkowa.

COMET 1909*a*.—Photographs of comet 1909*a* (Borrelly-Daniel) were obtained at the Greenwich Observatory, with the 30-inch reflector, on June 22 and 30, and the resulting positions are published in No. 4337 of the *Astronomische Nachrichten*. The same journal also contains a set of elements computed by Prof. R. T. Crawford, and elements and ephemeris calculated by Prof. Kobold.

THE KING ON INCREASED PROVISION FOR ADVANCED SCIENTIFIC INSTRUCTION AND RESEARCH.

IMPERIAL COLLEGE OF SCIENCE AND TECHNOLOGY.

THE King laid the first stone of the new buildings of the Imperial College of Science and Technology on Thursday, July 8. The plans exhibited were those of the Royal School of Mines and an extension of the City and Guilds of London Institute, which will occupy the block of ground at the corner of Exhibition and Prince Consort Roads, South Kensington, and extend as far west as the Royal College of Music. The Imperial College of Science and Technology consists at present of the Royal School of Mines, the Royal College of Science, and the City and Guilds of London Institute, and is administered by a Board of governors appointed by Royal charter, and under the presidency of Lord Crewe.

It is interesting to note that the first building to be erected by the governors of the Imperial College is the much-needed one for the Royal School of Mines, and that the funds for the purpose have been provided chiefly by the late Mr. Alfred Beit and Sir Julius Wernher, of the mining house of Messrs. Wernher, Beit and Co.

The life of the Royal School of Mines has been one of many vicissitudes. Even from the time of its foundation in 1851, difficulty has been experienced in providing adequate accommodation. The move from Jermyn Street to South Kensington, which began in 1872, and, as was stated by Lord Crewe in his address to his Majesty, was not completed until 1880, furnished better accommodation for subjects such as chemistry, physics and mechanics; geology was probably in but little worse position than in Jermyn Street, and metallurgy had better laboratories than before, but mining, which was the last to move, has had but poor quarters. The demand for scientific education, however, has grown so rapidly that even the laboratories for chemistry and physics soon became too small, and the fine buildings in Imperial Institute Road, in which the Royal College of Science has its chemical and physical laboratories, have for the past two years received the students. The buildings now to be erected will comprise well equipped laboratories, museums, lecture- and class-rooms, and drawing offices for the mining, metallurgical, and geological sections, and, in a one-storied building, 250 feet by 120 feet, under a separate roof, ore-dressing testing works and an experimental metallurgical laboratory are to be erected, the equipment being provided by the Bessemer Memorial Committee.

The extension of the City and Guilds of London Institute will include a laboratory for the study of hydraulics, equipped by Mr. G. Hawksley, but the extension is chiefly necessary on account of the number of students having already outgrown the space available, and the introduction of advanced courses on special subjects requiring more room. Here, again, top-lighted courts will allow the extension of the mechanical laboratories of the institute. The Goldsmiths' Company has provided a large sum towards this work.

In the course of his reply to the address delivered by Lord Crewe on behalf of the governors, professors, students, and staff of the Imperial College, the King said:—

"The concentration of various associated colleges into one institution, which was effected by our Order in Council of July, 1907, has always seemed to me to be an admirable scheme for the furtherance of scientific instruction, which my dear father had so much at heart; and the names which appeared in the first list of the members of the governing body were sufficient in themselves to give the college a very high status in the educational world.

"The purposes of the college, as stated in the charter, are to give the highest specialised instruction and to provide the fullest equipment for advanced teaching and research in various branches of science, especially in its application to industry. In recent years the supreme importance of higher scientific education has, I am happy to say, been fully recognised in England; and as time goes on I feel more and more convinced that the prosperity, even the very safety and existence, of our country depend on the quality of the scientific and technical training of those who are to guide and control our industries. The rapid