closing a small hole in the observing tube by a plate of aluminium 0·003 mm. thick, it was possible to study their properties outside the tube. It was found that the rays produce a slight luminosity in air, and when they fall on phosphorescent bodies, held near the window, cause the latter to shine with the same light they show when enclosed within the vacuum tube itself. The brightness diminishes rapidly as the distance from the window increases, so that in air all glow ceases at about 6 cm. On bringing a magnet near the tube so that the kathode rays no longer fall on the inner surface of the window, all phosphorescence ceases without the tube. A quartz plate half a millimetre thick entirely stopped the rays; ordinary gold, copper, and aluminium leaf, however, allowed them to pass almost undiminished. In air at the ordinary pressure these rays are not propagated in straight lines but are diffused, so that it is impossible to obtain a sharp shadow of a body placed between the window and the phosphorescent substance. As these waves cannot be generated in a high vacuum it has been up to now impossible to say whether they are only propagated when matter is present. By enclosing the observing tube in another, the author has shown that in the best vacuum attainable with a mercury pump, these waves are transmitted with as great facility as in air at the pressures ordinarily existing within Geissler tubes. Different gases transmit the rays to very different extents, thus, with hydrogen at atmospheric pressure, phosphorescence is produced in a body placed at a distance of 20 cm. from the window. These experiments seem to show that while for light of the smallest known wave-length the matter behaves as if it completely filled the space it appears to occupy, in the case of these kathode rays even gases behave as non-homogeneous media, and each separate molecule acts as an obstacle diffusing the rays.

NOTES from the Marine Biological Station, Plymouth:—Recent captures include the Polyclada *Eurylepta cornuta*, *Cycloporus papillosus* and *Leptoplana*, the Actinian *Zoanthus Couchii*, and the Opisthobranchs *Scaphander lignarius* and *Ægirus punctilucens*. The sea has lately become increasingly richer in diatoms and floating algæ, esp. *Coscinodiscus*, *Rhizoselenia* and the so-called "gelatinous alga." In the floating fauna the Dinoflagellate *Ceratium tripos* has been constantly plentiful throughout the winter; *Noctiluca* is very scarce. Of the Hydroid medusæ, small *Obeliæ* are still abundant; medusæ of *Clytia Johnstoni* are generally present; and Forbes's *Thaumantias octona* has been again observed. The Actinian larva *Arachnactis* occurs in most townettings. Zoææ of *Porcellana* have slightly increased in number. The Actinian *Bunodes verrucosa* (= *gemmacea*) is now breeding.

THE additions to the Zoological Society's Gardens during the past week include a Leopard (*Felis pardus*) from India, presented by Admiral W. B. Kennedy, R.N., F.Z.S.; a Common Squirrel (*Sciurus vulgaris*) British, presented by Miss Edith Mackenzie; two Black Rats (*Mus rattus*) British, presented by Mr. Sydney Wedlock; a Panama Amazon (*Chrysotis panamensis*) from Panama, presented by Mrs. Mackey; a European Pond Tortoise (*Emys europæa*) European, presented by Mast. J. F. Harben; a Macaque Monkey (*Macacus cynomolgus*) from India, deposited; a Common Pintail (*Dafila acuta*) European, a Bell's Cinixys (*Cinixys belliana*), a Home's Cinixys (*Cinixys homeana*) from West Africa, purchased; a Mute Swan (*Cygnus olor*) European, received in exchange; three Coypus (*Myopotamus coypus*) born in the Gardens.

## OUR ASTRONOMICAL COLUMN.

SOLAR OBSERVATIONS AT ROME.—In the *Memorie degli Spettroscopisti Italiani* for March, Prof Tacchini communicates the solar observations made at the Royal College. These observations refer to the 4th trimestre of 1892, and are given here somewhat in detail. Taking prominences first, the numbers show a great falling off when compared with the preceding three months; thus for the northern and southern hemispheres the frequency of these phenomena for the three months was 81, 78, 61 for the former (sum 220) and 105, 138, 90, for the latter (sum 333) the foregoing trimestre giving 431 and 493 for each hemisphere. The greatest frequencies took place in latitudes + 60° + 70° N. and − 30° − 40° S., but the numbers indicate really two other maxima for each hemisphere, and they lie in the zones + 30° + 20° and − 50° − 60°.

The frequency of groups of faculæ recorded for both north and south latitudes are given as 100 and 132 respectively; the average for each month amounted to 37, but for the southern zones during October an increase to 20 above this average was noted; the greatest frequencies occurred in zones + 10° + 20° and − 20° − 30°. In dealing with the spots their frequency may be generally stated to be about half that of the faculæ. The table gives 46 and 58 for the two zones, and in this case also the greatest disturbances seem to have occurred in the southern hemisphere during October; the numbers for the monthly records are, for the northern zones 18, 13 and 15, and for the southern 26, 12, and 20, the greatest frequencies occurring in latitudes + 10° + 20° N. and − 20° − 30° S.

Prof. Tacchini, in addition to the above communication, describes in a short note a large protuberance observed on November 20 of last year, and gives 10 figures to illustrate the various forms which it successively assumed. The height and velocity of ascent can be gathered from the few numbers below:—

| ″ | | H. | M. |
|---|---|---|---|
| 146·3 | about | 10 | 57 |
| 155·5 | ,, | 11 | 22·5 |
| 188·8 | ,, | 1 | 21 |
| 184·1 | ,, | 1 | 58 |
| 186·4 | ,, | 2 | 38 |
| 154·6 | ,, | 2 | 52 |

PARALLAXES OF $\mu$ AND $\theta$ CASSIOPEIÆ.—In No. 5 of the contributions from the Observatory of Columbia College, New York, Mr. Harold Jacoby presents us with the results he has obtained with regard to the parallaxes of $\mu$ and $\theta$ Cassiopeiæ, as deduced by him from an examination of the Rutherfurd photographic measures of the stars surrounding $\mu$ Cassiopeiæ. The negatives, which were twenty-eight in number, two impressions being on each plate, were made between July, 1870, and December, 1873, and as they were specially taken for parallax determinations, the observations were restricted to the months of July, January, and December. The study of the parallax here made is based upon measures of distance only. Each pair of stars was selected so as to differ approximately 180° in position angle with respect to $\mu$ Cassiopeiæ, and the scale value was determined for each pair, on each plate, in order to make the sum of the distances from $\mu$ constant. By taking the difference of the same distances as the quantity from the variation of which the parallax should appear, "the excess of the parallax of the principal star over the mean of the parallaxes of the two comparison stars" is, satisfying certain conditions, finally obtained. The values for the parallaxes which he has obtained are—

Parallax of $\mu$ Cassiopeiæ ... 0″·275 ± 0″·024
,, ,, $\theta$ ,, ... 0″·232 ± 0·067

On comparing the former of these values with the work of other observatories the discordances, he says, are large. The Oxford photographic result was 0″·036 ± 0″·018, while the Rutherfurd plates gave 0″·249 ± 0″·045, the same pair of comparison stars being used in each case. Struve from distant measures deduced the value 0″·251 ± 0″·075, and from position angles the value 0″·425 ± 0″·072. "It is therefore plain that the photographic method of determining parallaxes cannot be regarded as free from systematic error."

FALL OF A METEORITE.—A brief account of the fall of a meteorite at a place in South Dakota, 4 km. south of Bath, on August 29 of last year, is given in the current number of *Prometheus*, No. 183. It was observed about four o'clock in the afternoon, attention being first drawn to it by the sound of a series of explosions. As the observer looked upwards he saw a meteoritic stone flying through the air, leaving a trail of smoke behind it. On reaching the ground it plunged to a depth of 40 cm., and was so hot that the observer was unable to put his hand on it. At the explosion of the meteor several small portions weighing from 30-60 gr. were scattered, while the weight of the chief mass amounted to 22 kg. The description of the exterior says that it showed the general, smooth, black crust, while from the fracture it was noticed to be finely granulated; one could also see easily small particles of iron, which could without any difficulty be separated by pulverisation. Chemical analysis showed that nickel and cobalt was present in considerable quantities.

Jahrbuch der Astronomie und Geophysik.—This volume, which is edited by Dr. Hermann J. Klein, contains a very interesting account and summary of the work done in various branches of astronomical science during the past year. Dunér's, Deslandres', Hale's, and Young's sun observations are referred to, while several other references to solar work are given. The numerous observations made with reference to the major and minor planets are here all brought together; Trouvelot's Venus observations, the opposition of Mars, and the recent discovery of Jupiter's fifth satellite being rather prominent. Under the heading of "The Moon" Wernik's enlargements, Böddiker's and Hartmann's researches and are referred to at some length. Comets, meteorites, and shooting stars also come in for a good share, and under the fixed stars, in which are included all variables, nebulæ, &c., are included references to the Nova in Auriga, stellar spectroscopic observations, motion in line of sight, &c.

The Observatory.—From the cover of the *Observatory* one quite misses the familiar name of Dr. Common, in place of which are now inserted Messrs. T. Lewis and H. P. Hollis. In an editorial notice Mr. Turner says a few words to account for this perturbation, mentioning that it is owing to pressure of work, which has made it impossible for either of them to conduct the magazine. He concludes by saying, "It would be with the keenest satisfaction that we should return to the management of the magazine if the future should have that in store for us."

## GEOGRAPHICAL NOTES.

The *Scottish Geographical Magazine* for April contains a paper of some value by Colonel Justin C. Ross on irrigation and agriculture in Egypt, giving the result of his experience as Director-General of Irrigation in that country. In consequence of the indisposition of Colonel Bailey the *Magazine* is now edited by Mr. W. A. Taylor, Librarian to the Royal Scottish Geographical Society, who has for several years had charge of the book reviews and geographical notes.

The April number of the *Deutsche Rundschau für Geographie* contains a coloured map of the density of population in Holland which illustrates in a manner very rare in continental map-work an ignorance of the first principles of map colouring. The objects of map-colouring are two—one is to indicate the areas occupied by discontinuous and unlike conditions, such as countries, races of people, or geological formations. For this the colours have to be as strongly contrasted as possible and the map is necessarily and properly a patchwork. The other object is to show the distribution of a continuously varying quantity, like altitude, temperature, or rainfall, and in order to attain it the colours ought to merge one into the other so that the eye is carried from the lowest to the highest value by just perceptible gradations. The Austrian map referred to applies the first method to bring out the second result, each different density of population being coloured so as to contrast with the others, and to show no definite gradation from less to greater.

*Globus* states that the Russian Government, dissatisfied with the foreign sound of the names Dorpat and Dünaburg, have resolved to rename those towns Jurjew and Dwinsk respectively.

The Paris Geographical Society held a special meeting in commemoration of the discoveries of Columbus on March 4, the four hundredth anniversary of his return from the first transatlantic voyage. A masterly address by M. Levasseur on the moral and material consequences of the discovery of America, and a paper by Dr. Hamy on the traces of Columbus in Spain and Italy were the principal features of the meeting.

Some recent measurements in Russia, noticed by M. Venukoff in the last number of the *Comptes Rendus* are valuable as leading to some conclusions regarding the form of the geoid. Determinations of the value of the degree of longitude along the parallels of 47°30′ and 52° accord closely with Bessel's geoid (polar flattening $\frac{1}{299}$) and are widely divergent from Clarke's result of $\frac{1}{293}$.

## THE AMIDE AND IMIDE OF SULPHURIC ACID.

Further details concerning these interesting substances are communicated by Dr. Traube of the laboratory of the Berlin University to the current number of the *Berichte*. It has long been surmised that an amide of sulphuric acid was capable of existence, and Regnault assumed that the product which he obtained by leading ammonia gas into a solution of sulphuryl dichloride in ethylene chloride consisted of that substance mixed with sal-ammoniac. Dr. Traube has further investigated the reaction and has at length isolated not only sulphuryl diamide, $SO_2(NH_2)_2$, but also sulphuryl imide, $SO_2NH$, the imide of sulphuric acid, and has, moreover, prepared several metallic derivatives of each.

### *Sulphuryl Diamide.*

The most advantageous mode of preparing sulphuryl diamide consists in saturating a solution of sulphuryl dichloride, $SO_2Cl_2$, in chloroform with ammonia. It is necessary to dilute the sulphuryl dichloride with 15-20 times its volume of chloroform, and to maintain a low temperature by extraneous cooling in order that the reaction may be under complete control, and the ammonia gas must be carefully dried before being allowed to bubble through the liquid. The main reaction occurs in accordance with the following equation:—

$$SO_2Cl_2 + 4NH_3 = 2NH_4Cl + SO_2(NH_2)_2.$$

The products are gradually deposited in the form of a white solid, which, after the completion of the reaction, is agitated with water until the whole of it is dissolved. The ammoniacal aqueous solution is then separated from the chloroform, acidified with nitric acid, and the whole of the chlorine removed by the addition of silver nitrate. After removal of the silver chloride by filtration the acid solution is neutralised with alkali and silver nitrate again added, when a crystalline precipitate is obtained consisting of a silver derivative of sulphuryl diamide, $SO_2(NHAg)_2$, together with another silver compound, whose composition has not yet been definitely ascertained. In order to isolate the silver compound of sulphuryl diamide, the washed precipitate is decomposed with the calculated quantity of hydrochloric acid, and the resulting acid liquid carefully neutralised with ammonia; upon now adding silver nitrate only the silver compound of unknown and complex composition is deposited. The pure silver compound of sulphuryl diamide is finally deposited upon adding a further quantity of silver nitrate and sufficient ammonia to render the liquid strongly alkaline.

When the precipitated silver compound of sulphuryl diamide is decomposed with hydrochloric acid a feebly acid liquid is obtained, which, when evaporated to a syrup *in vacuo*, at a temperature not exceeding 40°, and afterwards allowed to stand *in vacuo* over oil of vitriol, gradually deposits large colourless crystals of pure sulphuryl diamide, $SO_2(NH_2)_2$.

Sulphuryl diamide is an extremely deliquescent substance. The crystals are rapidly dissolved by water, but are practically insoluble in organic solvents. They soften at 75° and melt at 81°. As the liquid cools, however, it exhibits the property of superfusion to a very marked extent, remaining liquid many degrees below its melting-point. The moment, however, it is disturbed by contact with a sharp body, it instantly solidifies. When heated above its melting-point sulphuryl diamide loses ammonia even below 100°; up to 250° no further decomposition than the loss of ammonia occurs, the residual compound being the sulphuryl imide to be presently described. Above 250° complete decomposition ensues with the evolution of acid fumes.

The aqueous solution of sulphuryl diamide reacts neutral to litmus and possesses a bitter taste. It yields no precipitates in acid solutions either with salts of barium or platinic chloride. On long boiling with acids, however, it is gradually converted into sulphuric acid and ammonia, and then yields the usual