1904–7 show that ζ Gruis is a binary with a range of velocity from −8·7 to +1·7 km.

Variations in the radial velocities of the following stars have also been detected from Lick and Santiago observations, and are reported by Prof. Campbell:—16 Aurigæ, o_2 Canis Maj., 12 Comæ Berenices, 4 Ursæ Min., *i* and 36 Ophiuchi, *f* Draconis, A Sagittarii, and α Cygni. In the case of *i* Ophiuchi, a plate taken on April 28, 1910, shows that the line at λ 4481 distinctly double, giving radial velocities of −77 km. and +9·2 km. for the two components. Fifteen plates of α Cygni, taken between August, 1896, and December, 1909, show that the variability of the velocity is not great, the range being from 0 to 7·9 km.

OBSERVATIONS OF JUPITER'S GALILEAN SATELLITES.—In No. 5 of the Transvaal Observatory Circulars, Mr. Innes gives an account of the observations of Jupiter's satellites made at the observatory during December, 1909, to August, 1910. The observations were made with the 9-inch refractor, and, in addition to the times of occultations and transits, remarks are added as to the appearance of the satellite, the phenomena of its disappearance or reappearance, and the appearance of various belts on the planet itself. Mr Innes records that on February 16, 1910, the final occultation of J III was long drawn out; whereas five-sixths of the satellite was occulted in 6½ minutes, the remaining one-sixth took another 6m. 10s. When half the satellite was occulted, the remaining half had the appearance of a close double star alongside Jupiter's edge. Satellites I and III were occasionally remarked to be oval rather than round, and several spots and markings were seen on their discs. An unpredicted partial transit of IV across the N. pole of Jupiter occurred on August 14, 1910.

A CONFIRMATION OF THE DISINTEGRATION THEORY.[1]

IT is probable that the transition from radium through the emanation to radium D involves the loss of four α particles, that is, four atoms of helium. The atomic weight of radium may now be taken to be 226·4, and if, on changing into niton, one α particle is lost, it is to be expected that the atomic weight of niton should be 222·4, for 226·4−4=222·4. But attempts to estimate the density of niton by determinations of its rate of diffusion have in most cases yielded the value 176 to 180, though Perkins, comparing the diffusion-rate with that of mercury vapour, obtained the value 235; and Debierne, using Bunsen's method of causing the gas to issue through a minute hole, arrived at the value 220. Undoubtedly the emanation belongs to the series of the inactive gases, and to complete the series—helium, 4; neon, 20; argon, 40; krypton, 83; and xenon, 130—there is room for two higher members with atomic weights 178 and 222·4.

It might happen that, in the disintegration of radium to niton, a non-radio-active substance might be produced of atomic weight 44; the change would then be:—radium (226·4)=helium (4)+(say) scandium (44)+niton (178·4).

The only certain method of ascertaining the molecular weight of a gas is the determination of its density; and in this case it is almost certain that the gas is monatomic, and that its molecular and atomic weights are identical. This constant has now been determined by the help of a balance closely resembling one recently described by Steele and Grant in the Proceedings of the Royal Society.

For details of the construction and use of the balance, the original paper must be referred to; suffice it to say here that its sensibility is about two or three millionths of a milligram. The weight is ascertained by the alteration of the pressure in the balance-case, thus altering the buoyancy of a small bulb of silica containing about 20 cubic millimetres of air, the weight of which is 0·027 milligram, or 27,000 millionths of a milligram.

A preliminary experiment, in which 0·0977 cubic millimetre of xenon was weighed, gave its weight as 578 millionths of a milligram instead of the calculated 577; it was thus shown that fairly good results might be expected in determining the density of the emanation.

In a month, the emanation may be taken as having wholly changed into its degradation products, the chief of which is radium D; and an experiment was made in which a minute density-tube was left on the balance for three months before it was opened, evacuated, and reweighed. The loss was helium, and its weight was 27 millionths of a milligram; the calculated weight, on the assumption that the density of niton is 222·4/2=111·2, and that each volume of the emanation yields three volumes of niton on disintegrating, should have been 38 millionths. This helium, judging from previous experience, had probably penetrated the glass of the density-tube and been retained there. The tube was therefore heated *in vacuo*, and the evolved helium washed out with a cubic centimetre of oxygen; the gases were transferred to a measuring apparatus, and after absorbing the oxygen by charcoal cooled with liquid air, the helium was measured. Calculating the volume to weight, its weight must have been 8 millionths; and the sum of 8 and 27 gives 35, instead of the calculated 38 millionths of a milligram. A further proof is thus given of the conclusion drawn by Ramsay and Soddy from the measurement of the volume of niton, and of the helium into which it changes, that the latter is three times the former.

Five determinations of the density of niton were made; stated as atomic weights, the figures are:—227, 226, 225, 220, and 218; the mean is 223. This number is the one calculated on the assumption that when radium disintegrates, the only immediate products are niton and helium, 226·4=222·4+4.

In suggesting the name niton for the cumbrous expression "radium emanation," the authors point out that it is advisable to indicate by a similar name the fact that this gas belongs to the argon series; were its radio-active relations to be emphasised, as in the term "radium emanation," it would be necessary to rename radium as a derivative of uranium by some such name as would introduce the word uranium.

The authors regard the work as a further proof, if any were needed, of the beautiful disintegration theory of Rutherford and Soddy.

[1] "The Density of Niton (Radium Emanation) aud the Disintegration Theory." By R. Whytlaw Gray and Sir William Ramsay, F.R.S. Abstract of paper read before the Royal Society on January 12.

SAFETY LAMPS AND THE DETECTION OF FIRE-DAMP.

WE have received from the Home Office a leaflet and a card in a convenient form for carrying about in the pocket, upon which are shown, reproduced in colour, the appearances presented by the miner's lamp in the presence of fire-damp. The difficulty of reproducing the appearances presented by a fire-damp "cap" in the safety lamp is very great, but it must be admitted that the illustrations issued by the Home Office are of a very high standard of excellence, whether considered from the artistic or from the technical point of view. Necessarily, these illustrations suffer from various defects: the Home Office does not state what class of lamp was employed or the nature of the oil burnt in it, and it is a well-known fact that these conditions influence greatly the nature and appearance of the cap. It is, for example, very well known that the Wolf lamp, burning benzene, is more sensitive than an ordinary Massant lamp burning, say, colza, or a mixture of colza and mineral oi.

We very much doubt whether one man in ten would be able to see 1½ per cent. of fire-damp, as indicated on the card, the lower limit of visibility with most men being about 2 per cent. It is, of course, well known that men's eyes differ very considerably in the power of seeing these faint caps, and the representations here given are of caps as they appear to a man whose eyesight is well developed by training and well fitted by nature for seeing these delicate phenomena. It is a pity that the Home Office has not directed the attention of miners more strongly upon the card, in the same way as it has done in its leaflet, to the danger attending far smaller proportions of fire-damp than the lamp can detect in the presence of coal-dust.

It is to be feared that the issue of the card without such a caution as we have referred to, will induce among miners the fixed opinion that they are perfectly safe so long as their lamp shows no cap. But it is well recognised that a far smaller percentage of fire-damp than any lamp will detect may be the source of the gravest danger in the presence of coal-dust, and we hope that, in subsequent issues, the Home Office will see its way to lay the strongest possible stress upon this fact. The average pitman is only too prone to believe that anything which the Home Office does not distinctly declare to be dangerous, must be absolutely safe, and every care should be taken to dispel so fatal a confidence.

FLIES AS CARRIERS OF INFECTION.[1]

THE reports referred to below include the results obtained in the further investigations concerning flies as carriers of infection. These are considered under the following heads:—(1) observations on the ways in which artificially infected flies (*Musca domestica*) carry and distribute pathogenic and other bacteria, by Dr. G. S. Graham-Smith; (2) summary of literature relating to the bionomics of the parasitic fungus of flies (*Empusa muscae*), by Mr. Julius Bernstein; (3) note as to work in hand, but not yet published, and as to proposed further work in reference to flies as carriers of infection, by Dr. S. Monckton Copeman, F.R.S.

Dr. Graham Smith gives the results of an elaborate series of experiments in connection with the *rôle* which house-flies are supposed to play in the dissemination of disease. He has proved conclusively (*a*) that in artificially infected flies non-spore-bearing pathogenic bacteria do not survive on the legs and wings for more than a few hours (five to eighteen); (*b*) that these bacteria (*a*) frequently survived within the crop for several days, and usually for a longer period in the intestine; (*c*) that the fæces and regurgitated fluids ("vomit") often contain the organisms (*a*) in considerable numbers, and that they may remain infective for varying periods; (*d*) that "the only spores (*B. anthracis*) with which experiments were made survived on the legs and wings, in the crop and intestine, and also in the fæces, for many days.

His somewhat premature conclusions regarding naturally infected flies are that cultures of pathogenic organisms may occasionally be obtained from them, but that this does not "afford conclusive evidence that such flies are a frequent source of disease in man by infecting food materials." Several of the photographic illustrations accompanying this memoir are extremely poor and of little scientific value.

Dr. Bernstein's contribution consists of a short *résumé* of the literature relating to the fungus *Empusa muscae* (Cohn).

Dr. Monckton Copeman has elaborated an excellent organisation for the elucidation of the question as to the range of flight of house-flies, and trials will also be made of the respective value of various baits that have been proposed from time to time for attracting and killing flies. The results of these investigations will doubtless prove of great value, and materially assist in the methods of controlling this ubiquitous pest.

REPORTS OF METEOROLOGICAL OBSERVATORIES.

MADRID OBSERVATORY (1902–5).—The meteorological observations for these four years are included in one volume (recently published). The data for each year are divided into three sections:—(1) daily observations and monthly means; (2) monthly and annual summaries, with differences from normal values; (3) daily sunshine observations, with monthly and yearly summaries. This volume completes the series of these valuable observations, which for subsequent years have been published in yearly volumes. The observations call for no special remark, except that they appear to have been very carefully made, and that full information of instruments and methods is supplied. The average amount of sunshine during the four years was 66 per cent. of the possible amount, as compared with twenty-five years' normal of 44 per cent. at Jersey.

[1] Further Reports (No. 3) on Flies as Carriers of Infection. Reports to the Local Government Board on Public Health and Medical Subjects (new series, No. 40). Pp. 48+7 plates. (London: Printed for His Majesty's Stationery Office, 1910.) Price 9*d*.

Royal Magnetical and Meteorological Observatory, Batavia (1907).—The observations include hourly readings and results, and a list of the earthquakes and tremors registered by Milne's seismograph and Ehlert's horizontal pendulum. The mean temperature of the year was 26·0° C., which is practically normal. The month with highest mean of daily maximum was October, 31·0° C., and that with lowest mean minima August, 22·6° C. The absolute maximum was 34·5°, in October; minimum, 20·4°, in June. The mean magnetic results were:—declination, 0° 52·21′ E.; horizontal intensity, 0·367105 (C.G.S.); dip, 30° 55·17′ S.; vertical force, 0·219877 (C.G.S.). A new series of observations of upper clouds was started in 1907, and the observatory is cooperating with the Zürich astronomical observatory for the observation of sun-spots. A regular service of kite and balloon ascents has also been recently established.

Odessa Observatory (1908).—The meteorological observations for this year have been published by Prof. B. V. Stankevitsch, who has been appointed director in the place of Prof. Klossovsky. In addition to the usual observations for the year, a useful summary of the results for 1870–1908 is given. The mean annual temperature is 50·2°; January 26·6°, July 73·8°; absolute maximum, 96·4° in July, minimum, −18·8° in February. The average number of days of frost is 91. The average annual rainfall is 15·98 inches; the wettest year, 24·62 inches, the dryest, 8·97 inches. The greatest fall in one day was 3·1 inches. An appendix contains an account of magnetic determinations made by the director in the summer of 1908 in the governments of Smolensk and Kaluga.

Mysore, Rainfall Registration (1909).—The tables show monthly, seasonal, and yearly values for stations and districts, also averages extending over many years. The values for 1909, and average annual values, are also exhibited on maps. The rainfall of 1909 was very favourable as compared with that for 1907 and 1908. For the whole province, the year's aggregate was 42·44 inches, being 5·50 inches, or 15 per cent., above the normal. On the whole, the excess was greatest in January, caused by a cyclonic storm crossing the south of the peninsula to the Arabian Sea. The greatest falls in twenty-four hours were 11·10 inches in Shimoga district (July 12) and 13·96 inches in Kadur (June 6).

ASSOCIATION OF TECHNICAL INSTITUTIONS.

THE eighteenth annual conference of the Association of Technical Institutions was held at the Stationers' Hall on February 10 and 11. Sir Henry Hibbert, the president for the forthcoming year, delivered his address in the afternoon of Friday. In the course of the address he pointed out that modern labour conditions render it difficult for a boy to learn every branch of his trade. It is therefore necessary that workshop practice should be supplemented by the technical school. Day training classes must be developed in order that those who are to take the leading positions in great industrial concerns—the master, his sons, managers, and foremen—may be scientifically equipped, but the bulk of the provision of technical education must be made by and through evening classes. He would like to extend the day-school life—no boy to leave school before the age of fourteen, and then to have a part-time system up to seventeen. Students should not be allowed to specialise too early. He would make preparatory classes compulsory before students were allowed to join trade classes. To avoid irregularity of attendance, employers of labour must be got thoroughly in sympathy with the organised efforts of education authorities. Conditions have changed since the time when a man could say he had succeeded without education. The education provided at the secondary schools under the regulations of the Board of Education is not that required by children who are able to remain at school for a limited period prior to entering on industrial pursuits. For these special schools are required. He believed that British employers are not awakening to the necessity of strengthening their producing power by the employment of highly skilled workmen.