

Observers were stationed at various distances up to 5.4 kilometres from the signals, and naked-eye records were taken. There were three sets of experiments, to determine (1) the relative advantages of circular and flat-wick lamps; (2) the range of red and green lights; and (3) the distance at which two separate lights can be distinguished. The results showed (1) that the light from the flat wicks was considerably brighter at a distance than that from the round wicks, particularly when the line of vision formed a right angle with the sides of the wick, and (2) that the range of the red lights (flat wicks) was approximately double that of the green, the latter being scarcely visible at 3 kilometres, while the former were still bright at 5 kilometres. In the third set of experiments observations were taken at distances of 2 and 3 kilometres of pairs of lights separated by intervals of 2, 3, 4, and 5 metres. At 3 kilometres none of the pairs were distinguishable as separate lights when the space between them was less than 4 metres. With a separation of 2 metres red or green pairs were merged into one bright light. When red and green lights were shown simultaneously, the green light was eclipsed altogether by the red at 2 kilometres if the distance separating them was not more than 2 metres.

PART 15 of the *Verhandlungen* of the German Physical Society contains a description of a mechanical pump for high vacua recently devised by Dr. W. Gaede, which makes use of a principle not previously utilised in the construction of such apparatus. If a shaft revolving in a well-fitting bearing has a circular slot cut in it, the air in the slot will to a large extent be carried round with the shaft. If at one part the bearing projects into the slot so as to fill it completely, the gas in the slot will be carried round with the shaft from one side of the projection to the other, and the pressure will in consequence be less on one side than on the other. If two openings are made through the bearing, one on each side of the projection, air will be drawn in through one and delivered through the other. By making a number of slots in the shaft and connecting the openings into them in series, the action will be intensified. A pump constructed on these lines exhausts five or ten times as fast as one of Dr. Gaede's well-known mercury pumps taking the same power, and deals with the water vapour as well as the gas, so that no drying materials are necessary. As it works better at low than at high pressures it is run in conjunction with another pump, which reduces the pressure to a few centimetres of mercury.

In a publication of the *R. Accad. delle Sci. dell' Inst. di Bologna*, which has recently come to hand, Prof. A. Righi describes some interesting experiments on the emission of ions in directions perpendicular to that in which the main discharge passes. Two wire electrodes are sealed into a cylindrical vacuum tube, perpendicular to the axis, with only their points exposed. When an impulsive discharge is passed between them it is found that ions are shot along the axis of the tube. The distance they penetrate and their relative numbers under different conditions are studied by collecting them in a suitably placed Far-

aday cylinder. By an ingenious arrangement of vanes, which rotate when the ions strike them, it is possible to follow the paths of the particles. This transverse emission of ions is most vigorous near the ends of the main discharge. When the tube is placed in a magnetic field parallel with its axis the neutral doublets, already investigated by Prof. Righi in earlier papers, are formed, and, as would be expected, the Faraday cylinder collects less charge. On the other hand, owing to the large mass of the doublets, the mechanical effects are increased.

An article in *Engineering* for October 11 recalls the discussion of a few years ago on the distribution of shearing stresses on the horizontal layers of a dam. Messrs. Wilson and Gore showed experimentally in 1908 that the stresses did not follow a parabolic distribution, but were much more uniform. Prof. E. G. Coker has lately described experiments at the Royal Society on thin celluloid sheets under shearing stress, the conditions resembling that of the web plate of a plate girder. It has been contended that the shearing stresses in the girder web follow the parabolic law, but these experiments indicate that this law is only approached when the plate is shallow. Otherwise the shear curve had no maximum at the centre of the specimen, but showed two equal maxima, which are at points situated at a distance from the ends equal to rather less than the width of plate under test. Reducing the depth of the plate causes these two maxima to approach each other, and they finally coalesce when the depth of the specimen is about equal to its width.

A SECOND edition of Mr. T. H. Byrom's "Physics and Chemistry of Mining: an Elementary Class-book for the Use of Mining Students," has been published by Messrs. Crosby Lockwood and Son. In this edition the chapter on magnetism and electricity has been omitted, and additional matter has been introduced in both the physical and chemical sections. The price of the volume is 3s. 6d. net.

MESSRS. H. F. ANGUS AND CO., of Wigmore Street, London, have issued a new catalogue of second-hand scientific apparatus and accessories which are available for sale, exchange, or hire. We notice that all the instruments listed, unless otherwise stated, have been tested, adjusted where necessary, and are capable of work of equal precision as when new. Interesting particulars are given in the list of microscopes and accessories, as well as of various other optical instruments.

OUR ASTRONOMICAL COLUMN.

GALE'S COMET, 1912a.—London urban skies have remained comet-proof for some time now, but Mr. Franks, writing to *The Times* (October 15), reports that he saw Gale's comet very well, with a 6-inch refractor, during the week ending October 11, at East Grinstead. He states that it appeared to be brightening, for it was about fifth magnitude when he first saw it, and was nearer fourth on October 11. On this date it was a fine object, plainly seen in the finder, and, by sighting along the telescope, it could be seen by the naked eye as a misty spot about half a

degree below α Serpentis. When seen on a dark sky it presented an extensive coma with a large bright nucleus and a tail at least half a degree in length. Mr. Franks also reports that it was nearly a degree north of its predicted position on October 11, and that the difference is increasing, but it seems probable that he was using the earlier ephemeris published by Dr. Ebell, and not the later one from which we gave an extract last week. The following is a continuation of the corrected ephemeris:—

1912	α (true) h. m.	δ (true)	1912	α (true) h. m.	δ (true)
Oct. 18...15	49'9...+13	20'0	Oct. 22...15	54'1...+16	52'0
19...15	51'0...+14	14'6	23...15	55'1...+17	42'5
20...15	52'1...+15	8'2	24...15	56'1...+18	32'0
21...15	53'1...+16	0'6	25...15	57'0...+19	20'5

According to this ephemeris, the magnitude should now be 6'6, and decreasing slowly, but, as Mr. Franks remarks, the comet is exceeding expectations, and, with its indications of abnormal brightening, may well repay careful observation, especially in the form of a close series of photographs, by those who are favourably situated; on October 21 the comet will be about one-third of a degree east of γ Serpentis.

THE RECENT TOTAL ECLIPSE OF THE SUN.—It is with much regret that we learn from Greenwich that all attempts to make observations of the recent total eclipse of the sun were frustrated by the heavy rain which prevailed in the eclipse region of Brazil on eclipse day, October 10. The Greenwich observers, Messrs. Eddington and Davidson, were located at Alenas, an elevated village some 185 miles north of Santos, where there were also eclipse parties from France, Germany, Brazil, and other countries. The Brazilian officials rendered all the assistance they could, and the Government voted a sum of 5000*l.* for the reception of the visiting astronomers at Rio. According to a characteristically interesting letter from Mr. J. J. Atkinson, which appeared in *The Morning Post* on October 8, the Greenwich equipment weighed about three tons, and had to be transported from Rio to the terminus of the State railway, a distance of about 150 miles towards the mountains; owing to the sharp incline the latter part of the track has to be worked on the cog system. Mr. Atkinson, who accompanied the Greenwich observers as a volunteer, also recites some interesting reminiscences of his previous eclipse experiences.

THE CONSTANT OF ABERRATION.—In No. 15, vol. xxvii., of *The Astronomical Journal*, Prof. C. L. Doolittle gives the result of twenty-two determinations of the aberration constant derived from thirty-two years' latitude work at the Sayre and Flower Observatories. The observations were made at two different places, with what are practically four different instruments, only the observer remaining the same, and the mean probable error is less than 0'01". Taking the weighted mean of all the observations, Prof. Doolittle finds for the constant the value $20'525'' \pm 0'0043''$, and the corresponding value for the solar parallax is 8'780".

THE AUTUMN MEETING OF THE INSTITUTE OF METALS.

THE papers presented at the autumn meeting of the Institute of Metals, which took place at the Institution of Electrical Engineers on September 25 and 26, may be divided into two groups according as their interest lies principally on the practical or on the scientific side.

Among the "practical" group two papers dealing

with the joining of non-ferrous metals and alloys may be mentioned. In these Prof. Carnevali, of Turin, and A. E. Tucker, of Birmingham, discuss the question of autogenous welding, although the latter paper also deals in an interesting if somewhat scrappy manner with many other processes, such as soldering and brazing, &c. In view of the great extension of autogenous welding by means of oxygen and acetylene, the question how far the results of this process can be trusted is an important one. Tucker appears to regard a weld as satisfactory if it is found on testing it to destruction that the fracture occurs away from the weld itself. As a matter of fact, however, the weakest portion of a welded joint, as Carnevali points out, is not the weld itself, but the region of injured metal on either side of it. According to this author the strength of welds in copper and its principal alloys cannot be depended upon, and this conclusion agrees with the views on autogenous welds in iron and steel recently expressed by Fremont and others. In regard to pure aluminium, however, Carnevali finds the method to give satisfactory results, but the efficiency of a weld is much reduced as soon as it is applied to one of the stronger light alloys of aluminium. Broadly speaking, these papers lead one to view the rapid development of autogenous welding practice with some suspicion.

Still on the "practical" side were a number of papers dealing with impurities in copper and copper alloys. An interesting and suggestive paper by E. F. Law dealt with oxygen and oxides as deleterious impurities in alloys. This author took the view that progress in non-ferrous alloys was largely a question of the better elimination of oxides, and this view was strongly supported in the discussion by Rosenhain. The paper by Prof. Turner, however, emphasised the existing difficulties in the way of analytical determination of oxygen in brass, and an appeal was made to chemists to devise a satisfactory method for this purpose. F. Johnson dealt with the effect of impurities, chiefly antimony, on the properties of tough-pitch copper, and here again discussion centred round the part played by oxygen. The lenient view as to the deleterious effects of antimony put forward by the author was, however, strongly opposed by all those who have to deal with copper on the large scale. Other papers of a "practical" character dealt with high-temperature tensile tests on copper and its alloys, and with the annealing of coinage alloys, and both these papers were vigorously criticised in the discussion on the ground of the experimental methods employed by the authors.

The "scientific" papers were not so numerous, but of special interest. Prof. H. C. H. Carpenter contributed two papers dealing in further minute detail with the inversion which he has discovered in a certain range of copper-zinc alloys (brass) at a temperature of 470° C. In one of these papers the author deals with the effect of impurities on this inversion and finds that any addition of a third metal to these alloys tends to facilitate rather than to inhibit the transformation in question; since the change renders the metal weak and more brittle, it is evident that the use of the purest copper and zinc is desirable in the manufacture of those varieties of brass containing the constituent.

In a very short note Dr. G. T. Beilby, F.R.S., discusses the phenomena of the solidification of metals from the liquid state in reference to the "foam cell" theory of Quincke. In his May lecture to the institute, Dr. Beilby had suggested the importance of a full experimental investigation of the views put forward by Quincke, and the present note is intended to