In connection with the production of undamped electrical oscillations of high frequency by the arc and condenser method, Messrs. M. Kimura and K. Yamamoto, of the Kyoto University, have carried out a series of determinations of the effects of atmospheres of various vapours on the volt-ampere "characteristic curves" of the carbon-copper arc. The carbon electrode was solid, and was used as the kathode. The copper anode was water-cooled. The curves obtained are all of the usual form, which suggests a rectangular hyperbola, and show that the vapours tried stand in the following order of relative efficiency:—hydrogen, hydrogen mixed with benzene, methyl alcohol, methyl and ethyl alcohols mixed, ethyl alcohol, air, the volts absorbed for a given current being highest for hydrogen. The complete paper is contained in part iv. of the second volume of the Memoirs of the College of Science and Engineering of Kyoto University, just to hand.

The following figures for the solubility of ether in water are given by Mr. Y. Osaka in the Memoirs of the College of Science at Kyoto, and will be of interest to people who are constantly making use of this solvent:—

Temperature	0°	5°	10°	15°	20°	25°	30°	
Solubility (Osaka)	13·13	11·18	9·55	8·22	7·08	6·13	5·39	gr. per 100 gr. water.
Solubility (Seidell)	13·12	11·4	9·5	8·2	6·95	6·05	5·4	gr. per 100 gr. water.

Prof. Bone and Dr. H. F. Coward have replied, in the Journal of the Chemical Society, to the criticisms by Berthelot and others of their work on the production of methane by the direct union of hydrogen with carbon. In their most recent experiments they have obtained yields of 95·8, 95·6, and 91 per cent. of that theoretically obtainable from the weight of carbon used. The carbon used was particularly pure, containing not more than 0·06 per cent. of hydrogen, or 0·06 per cent. of ash. The gas produced (at 1150°) contained only a trace of carbon monoxide, never exceeding 0·03 per cent., and the amount of nitrogen was also very small.

It is seldom now that one firm is entrusted with the order for as many as ten vessels for any navy, and the successful completion of such an order by Messrs. Yarrow and Co. for the Brazilian Government forms the subject of an article in *Engineering* for August 19. The ten torpedo-boat destroyers are all of one design, an important advantage both from the tactical point of view and also from the standpoint of management by Brazilian officers and crews. They partake generally of the British "river" class, in which were embodied greater strength and other qualities to enable the vessels to maintain their speed in a heavy sea. The guaranteed speed of 27 knots has been easily exceeded by every ship. The length between perpendiculars is 240 feet, and the displacement is 650 tons. The ratio of length to beam is 10·2 to 1. Each vessel has two sets of four-cylinder triple-expansion engines, balanced on the Yarrow-Schlick-Tweedy system, and supplied with steam from two double-ended Yarrow boilers. The greatest power developed on an official trial was 8877 indicated horse-power, in the case of the *Parana*. The coal-consumption trials showed that at 14 knots speed the radius of action was 3690 nautical miles.

Engineering for August 19 directs attention to the important and continuous increase in Germany's imports of British coal—from 1899 to 1909 the increase is more than 115 per cent. The figures are 4,873,555 tons in 1899 to 10,498,118 tons in 1909. In no place, perhaps, has British coal to a more marked extent encroached upon German coal than in Berlin. In 1890 British coal consumption in Berlin amounted to 105,894 tons, or 7·53 per cent.; last year the respective figures were 946,102 tons, and 39·88 per cent. The total consumption in Berlin in the two years was respectively 1,406,961 tons and 2,372,310 tons. Coinciding with this increase in British coal consumption is a notable decrease in the consumption of coal from Silesia, and it is from this quarter also that complaints are loudest. Fears are openly expressed that British coal is in a fair way of, lastingly and fully, securing the Berlin market unless proper precautions are taken soon and with the greatest possible energy. The increase in import of British coal to Berlin is to a great extent owing to the growing consumption of British gas-coal at the Berlin gas-works.

Many ingenious pieces of apparatus for illustrating the principles and laws of heat are described and illustrated in a new catalogue (List 56) just issued by Messrs. A. Gallenkamp and Co., Ltd. The aim of the makers has been to produce at a moderate price instruments which can be used continuously by students without getting out of order, and will yield accurate results. A noteworthy feature is the inclusion of a number of new devices which have been described in text-books or periodicals, or before scientific societies. Teachers of physics will find the catalogue of service in the selection of experiments for the lecture-room and laboratory.

OUR ASTRONOMICAL COLUMN.

The Perseid Meteoric Shower.—Observations of this phenomenon have been received by Mr. Denning from twelve stations, and he informs us that the results are fairly satisfactory. Clouds, it is true, greatly interfered with watching on the important nights of August 11 and 12, but August 10 was clear.

The character of the display seems to have been of an average character. Meteors were not strikingly abundant, but there were enough to make the event exciting and to attract the interest of the general public. In Norfolk one observer was very successful, and relates that he counted twenty-one meteors in eight minutes between 1h. 16m. and 1h. 24m. on the morning of August 12, and estimated that they were falling at the rate of about 250 per hour! Other observers give the number as much less, but testify as to the brilliancy of some of the individual meteors.

Mr. C. L. Brook, of Meltham, saw splendid Perseids on August 8, 11h. 26½m., and on August 10, 12h. 5½m., with paths from 319°+68° to 279°+50° and 7½°+41½° to 350°+25° respectively. Mr. W. H. Steavenson, at Cheltenham, recorded the latter as moving from 90°+58° to 120°+48°, and saw another magnificent meteor at 13h. 11m., twice as bright as Venus, shooting from 120°+48° to 135°+40°. Others, comparable with Jupiter, followed at 13h. 18m. and 13h. 30m. The fireball of 12h. 5½m. fell from a height of 81 to 51 miles over the eastern region of Yorkshire. Its length of path was 45 miles, and velocity about 31 miles per second. It was a true Perseid, with radiant at about 45+56, but the exact place is not defined, as at Meetham Mr. Brook saw the meteor moving westwards, while at Cheltenham Mr. Steavenson observed it travelling to east.

Miss Warner, at Bristol, saw a number of meteors on August 10, the finest being a Perseid equal to Venus at 10h. 25m. It was, however, very low in the east, passing under Andromeda and Pegasus. Mr. D. E. Packer, of Birmingham, saw 200 meteors in watches of twenty-one hours between July 31 and August 14. There were thirty of the apparent brightness of Jupiter and twenty equal to Saturn.

Mr. W. Johnson, of Lastingham, witnessed a fine meteoric display on August 12. During the evening there were many brilliant meteors, including two of quite exceptional lustre. The display seemed at its best between 11 and 12 p.m.; clouds prevented observations after midnight.

Metcalf's Comet, 1910*b*.—Numerous observations of the comet discovered by the Rev. J. H. Metcalf on August 9 are recorded in No. 4434 of the *Astronomische Nachrichten*.

The magnitudes given for the whole object range from 9·0 to 11·0, and show no marked increase or decrease with the date. While some observers report a stellar nucleus, others say that there is no definite nucleus, but there is a central condensation in the nebulosity forming the head. A short tail is reported by the majority of observers, M. Guillaume, using the equatorial *coudé* of the Lyons Observatory, with a power of 360, giving the length on August 11 as about 1·5′, and the direction as towards E.

From observations made on August 11, 13, and 15, Dr. Kobold has calculated parabolic elements and an ephemeris, the former giving the time of perihelion as August 30·018 (Berlin M.T.). The later part of the ephemeris is given below :—

Ephemeris for 12h. (M.T. Berlin).

1910	α	δ	Mag.
	h. m.	° ′	
August 24 ...	15 46·6 ...	+16 15·0	
,, 25 ...	15 45·4 ...	+16 18·8 ...	10·7
,, 26 ...	15 44·2 ...	+16 22·4	
,, 27 ...	15 43·1 ...	+16 25·9	
,, 28 ...	15 42·1 ...	+16 29·2	
,, 29 ...	15 41·0 ...	+16 32·3 ...	10·9

Owing to the short arc yet observed, the elements are, of course, somewhat uncertain. From this ephemeris we see that the comet is now moving very slowly in a direction slightly N. of W. through the constellation Serpens.

PHOTOGRAPHS OF DANIEL'S COMET, 1907*d*.—The advantages to be secured from widespread cooperation, especially in the study of the physical features of comets, are well illustrated in a paper by Prof. Barnard which appears in No. 194, vol. xlix., of the Proceedings of the American Philosophical Society. There Prof. Barnard publishes twenty-five plate reproductions of photographs secured by him, with the 3·4 and 10-inch Bruce portrait lenses, during the period July 11 to September 8.

The physical changes depicted from day to day are very remarkable; but Prof. Barnard shows, by comparing his plates with series taken at Lick and Juvisy, that much shorter periods produced such great changes that some of the features became recognisable with difficulty. The time difference in the case of the Lick photographs is, generally, about two hours, for the Juvisy plates about six hours, yet even in the comparison between Yerkes and Lick there are very distinct changes shown. In several cases it is shown that a detached portion of the tail, although receding from the head, was still moving sunwards in the path followed by the comet.

PRECESSION AND THE SOLAR MOTION.—In No. 614 of the *Astronomical Journal* Prof. Boss publishes the results of an investigation of the proper motions of more than 5000 stars, uniformly distributed over the whole sky, and deduces therefrom the position of the solar apex and corrections to Newcomb's values for precessions and for the equinox of 1874. For the position of the apex he derives, for 1875·0, R.A.$=270·52° \pm 1·08°$ to $\pm 1·53°$, dec.$=+34·28° \pm 0·90°$ to $\pm 1·28°$. Other solutions, for selections of stars, such as those of different magnitudes or large proper motions, are obtained, but they show no sensible modifications of these values.

For the velocity of the sun in space Prof. Boss finds 24 km. per second as a useful constant to adopt for the present, and is of the opinion that the value (19·9 km.) determined from spectroscopic observations is open to objections inherent to that method.

Further, he finds that his results strongly support the hypothesis of the random motions of the stars, an hypothesis which is directly opposed to the several ideas of definite "star drifts" which have been published in recent years.

CALCIUM VAPOUR IN THE SUN.—No. 1, vol. xxxii., of the *Astrophysical Journal* contains a paper, by Mr. C. E. St. John, which is full of important results concerning the distribution and the circulation of calcium vapour in the solar atmosphere. The research was undertaken in order to provide data for the better interpretation of spectroheliograms in so far as they reveal the disposition and inter-relation of the various solar layers. In 1872 Young observed the reversal of the H and K lines in disturbed regions, in 1883 Lockyer photographed them, and in 1892 Hale and Deslandres noted the reversals distributed over the entire disc.

With the splendid apparatus available at Mount Wilson, Mr. St. John has measured the various parts of the K line (K_1, K_2, and K_3), and, referring these measures to Fabry and Buisson standards, has determined the apparent displacement at various points on the disc, thus deriving data which indicate the conditions, altitudes, &c., under which the emitting vapours exist.

Among other results, he finds that the vapours producing the K_3 (absorption) line show a descending motion of 1·14 km. per sec., while the vapours producing the K_2 (bright) line have, generally, an ascending motion of 1·97 km. per sec. A comparison of the angular velocities obtained points to the vapour-producing K_3 being at a greater elevation than the hydrogen which produces the Hα line. A comparison of the wave-lengths of K_2 and K_3 at, and away from, the limb indicates that these intermediate and higher levels of the sun's calcium atmosphere are not greatly disturbed by currents parallel to the solar surface.

From measurements of the widths of K_3 and H_3, and reasoning from their behaviour in the calcium arc spectrum, it appears that the quantity of calcium vapour in the upper levels must be extremely small, while, from similar considerations of the K_2 and H_2 lines, the emitting vapours would be relatively thick and dense. In approximate figures, the 5000 km. depth of the solar envelopes above the photosphere is divided into 1500 km. for the upper (absorbing) atmosphere and 3000 km. for the emitting layer, leaving 700 km. for the layer which emits the bright chromospheric radiations. A curious result is that the K line persists for some 500 or 600 km. above the level at which the H line ceases to show.

On determining the wave-lengths of H_3 and K_3, a difference of 34·810 A. was found, which differs by 0·010 Å. from the value derived from Rowland's tables; this discrepancy is probably caused by an error of that amount in Rowland's wave-length for H.

Mr. St. John's paper takes up forty-seven pages of the journal, and there are other important results which are too numerous for full discussion in these columns.

OBSERVATIONS OF THE MOTION OF THE UPPER AIR.[1]

THE two publications before us evidence the progress which is being made in different ways in our knowledge of the upper currents of the atmosphere. Dr. Figee, invalided home owing to the trying climate of Java, has taken the opportunity of discussing the observations (286) of the height of clouds, made at Batavia, 7° S., 107° E., in 1896–7, and later observations of cloud-velocity. The results for *height* agree generally with the values obtained in the same period at Manila, 14° N., 121° E. The following table gives the heights in km., the mean values for Paris and Potsdam being added for comparison :—

Cloud	Ci.	Ci.S.	Ci.Cu.	A.Cu.	Cu.
Batavia	11·5 ...	10·6 ...	6·3 ...	5·4 ...	1·74
Manila	10·9 ...	11·4 ...	6·6 ...	5·3 ...	1·7
Paris and Potsdam ...	8·7 ...	7·6 ...	5·7 ...	3·3 ...	1·5

The *motion* of the higher clouds shows different features at the two places. In both the seasons, November–April, May–October, the drift is towards the south-west at Batavia, a result corroborated by the recent work of Van Bemmelen, while at Manila it is towards the south-west in the latter season, but nearly north in the former. The value of the results in Dr. Figee's paper can be rightly appreciated only when they come to be utilised in preparing an atlas of monthly charts showing the main features of the circulation at the cirrus-level, an atlas which is much needed at present.

The second paper is a discussion of fifty-one pilot-balloon

[1] (1) Royal Magnetical and Meteorological Observatory at Batavia: Report on Cloud-Observations at Batavia made during the International Cloud-year 1896–1897 and subsequent years. By Dr. S. Figee. Appendix ii. to vol. xxx. of the "Observations." Pp. 32. (Utrecht: Kemink and Sons, 1910.)

(2) "Velocità e Direzione delle Correnti Aeree alle diverse Altitudini Determinate a Mezzo dei Palloni-Sonde e Piloti." By Dr. G. Pericle. Pp. 55—126; 5 plates. (Milana: U. Hoepli, 1910.)