

Bureau of Standards at Washington has selected the Harcourt 10-candle pentane lamp as the best of the gas-flame lamps to serve as a secondary standard. This decision has been arrived at after an extensive test of the various lamps, and the conclusions with regard to the best method of using the standard are embodied in a paper by Messrs. E. C. Crittenden and A. H. Taylor, which appears in the tenth volume of the bulletin. They cover the question of the fuel and the effects of pressure and moisture on the candle-power.

A SUCCESSFUL modification of General Sterneck's pendulum apparatus has been designed and employed by Sig. Vincenzo Reina and Gino Cassinis in the determination of gravity (relative) at Rome, Arcetri (Florence), Livorno and Genoa in Italy, and also at Vienna and Potsdam (*Memorie R. Acc. Lincei*, series v., vol. ix., No. 17, pp. 751-839). In the earlier forms, such, for instance, as those used in the gravimetric survey of the Indian Peninsula, and more recently in Egypt, the pendulum support is a solidly constructed tripod resting on and clamped to a masonry pillar. Although maximum rigidity is aimed at, yet under the alternating strains induced by the swinging pendulums the support is found to be appreciably yielding, and the determination of the effect of flexure constitutes one of the necessary pieces of preliminary work. It is obtained by observing the oscillation of the invariable pendulum induced by a heavier synchronous (variable) auxiliary pendulum swinging in the same plane (method of Schumann). In the Italian modification the means for applying this method is made an inherent feature of the design. The trustworthiness of the correction is increased by securing (1) greater equilibrium in the distribution of parts, (2) that the correction is obtained with the invariable pendulum swinging in the position used in the actual determinations. These improvements are realised by mounting the single perforated agate plate on which the knife edges of the pendulums bear when they are in motion on two consoles, which can be bolted to a vertical surface. Only one invariable pendulum is swung at a time. With this arrangement the effect of flexure is less than one-tenth of that of the tripod type, the maximum correction of nine different groups being -3.9×10^{-7} secs., whilst the minimum was -1.5×10^{-7} secs.

WE have received a reprint of a paper read before the eleventh International Congress of Pharmacy, held at Scheveningen last September, by Prof. Hans Haller, of Leyden, on the application of comparative phytochemistry to systematic botany. Illustrations are given of the growing importance of a knowledge of the chemical substances elaborated by plants in elucidating vexed questions of classification and in throwing light on phylogenetic relations. The field is one which has as yet been little worked, but it will in the future undoubtedly become more and more fruitful.

THE *Società Tipografica Editrice Barese*, of Bari, Italy, announces the forthcoming publication of a series of reprints of scientific and philosophical classics

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under the title, "Classici delle Scienze e della Filosofia." In some respects this series will resemble the valuable collection already issued by Ostwald in Germany, under the title "Klassiker der exakten Wissenschaften," but the venture will be on an even more ample scale; it will render easily accessible to the student of the historical development of science many classical papers which have hitherto been obtained only with great difficulty. Each volume will contain about 300 pages, and will cost about 3 lire. The whole series is under the general editorship of Messrs. Aldo Mieli and Erminio Troilo. All scientific workers will wish success to this praiseworthy enterprise. The following are specimens of the titles of volumes already issued:—Spallanzani's "Saggio sul sistema della generazione" (1777); Biringuccio's "De la Pirotechnia" (1540), vol. i., and a translation of Descartes's "Principia Philosophiæ." Amongst those to appear at an early date are Francesco Redi's "Esperienze intorno alla generazione degli insetti," Galileo's tracts on motion, and several reprints of the scientific works of Leonardo da Vinci, Volta, Giordano Bruno, and Vico, to mention only a few of those announced as already in the press.

MESSRS. NOVELLO AND CO. have published a second edition of Dr. Jamieson B. Hurry's "Sumer is icumen in." The attractive volume was originally published at the time of the unveiling at Reading Abbey of a memorial tablet, bearing a facsimile of the canon, which, it may be remembered, was written by a monk at Reading Abbey, about the year 1420.

OUR ASTRONOMICAL COLUMN.

COMET 1914a (KRITZINGER).—Circular No. 145 from the Central Bureau at Kiel contains the following elements and ephemeris, communicated by Prof. Kobold, deduced from observations on March 29, 30, and 31:—

Elements.

T = 1914 May 31^h 18^m 16^s M.T. Berlin.
 $\omega = 67^{\circ} 0' 95''$
 $\Omega = 198 36' 68''$
 $i = 23 30' 86''$
 $\log q = 0.09910$

Ephemeris for 12h. M.T. Berlin.

	R.A.			Decl.	Mag.
	h.	m.	s.		
April 8	16	43	30	-3 36.4	10.1
9	46	56	2 53.8		
10	50	24	2 10.2		10.0
11	53	54	1 25.4		
12	16	57	27 -0 39.9		

The ephemeris shows that the comet is reducing its southern declination; it is situated in the constellation of Ophiuchus.

THE NEW SOLAR CYCLE.—The long period of apparent rest which the solar atmosphere has been recently undergoing has now been broken by the comparatively large sun-spot which developed during the course of last week. The sun-spot activity of the last few years has been well summarised in the annual report of the council of the Royal Astronomical Society (*Monthly Notices*, February, 1914). In this we are told that the past year has been a year of minimum activity of sun-spots, more than a century having elapsed since the sun exhibited such complete and

prolonged quiescence. The following brief table is gathered from the report above mentioned, and brings out clearly the exceptional nature of the year 1913:—

Year	Days with-out pots	Mean daily spotted area in millionths	No. of separate groups
1911 ...	183 ..	64 ...	62
1912 ...	246 ...	37 ...	39
1913 ...	320 ...	5 ...	15

It is stated that no year since 1810 has given such a barren record as that just elapsed. The new cycle was indicated last year by two groups in high latitude, the chief criterion for the beginning of a new cycle.

RELATION BETWEEN STELLAR SPECTRA, COLOURS, AND PARALLAXES.—In *Astronomische Nachrichten*, No. 4722, Herr P. Nashan describe the results he has obtained in comparing the colours, spectra, and parallaxes of a number of stars. Dealing first with 101 stars, he divides them first into three classes, α , β , and γ , according as the stars are white, yellow, or red; the parallaxes are also grouped with three divisions as follows:— $0.000''$ to $0.050''$, $0.050''$ to $0.100''$, and $0.100''$ to $0.200''$. The comparison shows that the white stars decrease with increasing parallaxes; on the other hand, the red stars increase with increasing parallaxes. The fact that there is a close relationship between the colour and the spectrum of a star has led him to compare the spectra of 246 stars with their parallaxes. The results are best shown as follows:—

Spectrum	No. of stars	Parallax							
		"0.000—0.050"		"0.050—0.100"		"0.100—0.150"		"0.150+	
		n	%	n	%	n	%	n	%
B	11	7	63.6	3	27.3	1	9.1	0	0
A	28	8	28.5	8	28.5	7	25.0	5	18.9
F	59	19	32.2	22	37.3	15	25.5	3	5.1
G	64	13	20.3	22	34.4	27	42.2	2	3.1
K	70	13	18.6	21	30.0	23	32.9	13	18.5
M	14	3	21.4	2	14.3	5	35.7	4	28.6

Herr Nashan then couples up the B and A stars into a white group, the F and G into a yellow group, and the K and M stars into a red group, and concludes that the relative number of white stars decreases with increasing parallaxes, while the relative number of the red stars increases with increasing parallaxes, a result similar to that obtained with colour alone. The communication concludes with the list of the 246 stars employed, giving their positions for 1900.0, parallax, type of spectrum, and colour.

SERIES LINES IN SPARK SPECTRA.¹

PREVIOUS work on series lines in spectra has dealt chiefly with lines produced in the electric arc, or in vacuum tubes with discharges of moderate intensity. The lines discussed in the present communication are some of those which are specially developed in the condensed spark, belonging to Lockyer's class of "enhanced lines." The investigation was undertaken in connection with the new lines (λ 4686, etc.) produced in 1912 by passing strong condensed discharges through helium tubes, which always contained an impurity of hydrogen. These lines are of great interest in celestial spectroscopy, and, following Rydberg, they were assigned to hydrogen, to the lines of which they seemed to have a simple relation, while having no apparent connection with those of helium.

¹ Summary of Bakerian lecture delivered at the Royal Society on April 2 by Prof. A. Fowler, F.R.S.

The evidence for assigning the lines to hydrogen, however, was still numerical rather than experimental, and further inquiry was called for, especially in view of the presence of an intermediate set of lines associated with the Rydberg series. A search for other series of this character was therefore instituted in the hope that some generalisation with regard to them might be reached. The well-known spark line of magnesium, λ 4481, was subsequently found to be the leader of a series of this kind, but no relation to other magnesium series was then traced.

The lines of the "4686" series have since become of increased importance, in connection with theories of the constitution of the atom, through the theoretical work of Dr. Bohr, who explains them as being produced during the first stage in the re-formation of helium atoms from which both electrons have been removed by the strong discharges employed. The "4686" and the intermediate series were thus united in a single series of a new type, in which the Rydberg series constant $N(=109675)$ had four times the value associated with hydrogen. A similar modification of the usual formula was found to be applicable to the magnesium series, and also to some lines of calcium, strontium, and barium observed by Lyman in the Schumann region. At this stage a valuable contribution to the investigation was made by the work of Lorensen, from which it results that the enhanced lines of the elements named form groups of series similar to those found in arc spectra. Further calculations have shown that these series are best represented by the Hicks formula with $4N$ for numerator.

A further experimental investigation of magnesium has resulted in the production of many new enhanced (spark) lines, from which it appears that the "4481" series is the fundamental series of a system of narrow doublets, in which the separation of the pairs is identical with that calculated for the *second* member of the principal series of wider doublets previously known. It has also been shown that the "4481" series consists of very close doublets with constant separation. Two well-defined combination series related to 4481 have also been identified.

From these investigations of enhanced metallic lines it follows that two kinds of series must now be recognised:—(1) Series of the arc type, having Rydberg's "N" for the series constant; and (2) series of the spark, or enhanced line, type, having a series constant equal to $4N$. No numerical relations between the two sets of series occurring in the same element have been traced.

The "4686" series produced in helium tubes is of the spark ($4N$) type, and can no longer be considered to belong to the same group as the Balmer series of hydrogen, which is of the arc (N) type. It is concluded that the lines in question are due to helium, as indicated by Bohr, and it is suggested that they should be designated "proto-helium" lines in accordance with the convenient nomenclature of Lockyer. The "Pickering" lines associated with the "4686" series probably have a similar origin, in which case the series would include intermediate lines nearly coincident with the Balmer lines of hydrogen. Observational evidence on this point is incomplete, but indirect evidence is furnished by the fact that one of the new combination series is related to the 4481 series exactly as the extended Pickering series would be related to the "4686" series of proto-helium.

Dr. Bohr has shown that the slight differences in the observed positions of alternate lines of the "4686" series and those calculated for the principal series of hydrogen by Rydberg are accounted for when his theoretical formulæ are corrected for the mass of the electron (NATURE, October 23, 1913). If the