present pamphlet treats exclusively of the magnifications produced by lenses, the paths of the rays, and the principles of the microscope and telescope.

THE danger which may accompany the teaching of elementary chemistry to children has been sadly illustrated by the death of a girl of fifteen years of age—a pupil at the Plymouth Secondary School—caused by swallowing a strong solution of caustic soda while working in a practical chemistry class. The coroner's inquest showed that the child—one of a class of eight—misinterpreted the directions given by the instructor, and sucked into a pipette a concentrated solution of the alkali without previously diluting it, as she had been told to do; in doing this she managed to swallow some of the solution. In view of the fact that three other pupils out of the eight in the class gave evidence showing that they also had not followed the directions given, it is clear that, in order to guard against such accidents, the experiments should be devised in such a way that, in the event of a misunderstanding, no evil results may accrue. In the present case, for instance, in which the neutralisation of sulphuric acid by caustic soda was being studied, the concentrated solutions might have been diluted by the demonstrator in front of the class, and the diluted solutions thus prepared then have been used for the pupils' measurements. Other simple expedients could readily be suggested in which the use of an ordinary pipette is avoided. In the practical study of chemistry there are many possibilities of accident, and this should be borne in mind by the examining and inspecting authorities which prescribe the work to be done in school laboratories, and by the teachers who devise experiments for their pupils. It should be unnecessary to add that the instructor, particularly when he has to deal with children, should not only have seen chemical experiments performed, but have acquired by a prolonged course of laboratory work a real knowledge of manipulation and of the dangers likely to be incurred in any case.

MESSRS. JOHN J. GRIFFIN AND SONS, LTD., have issued a third edition of their well illustrated list of apparatus for electrochemistry, arranged for students working through Dr. Lüpke's "Grundzüge der Electrochemie."

A POPULAR article, with several striking illustrations, upon the eye-spots exhibited by various creatures as ornaments or for protective purposes appears in the April number of *Pearson's Magazine*.

THE current issue of the *Home Counties Magazine* contains, among other interesting matter, a reprint of a lecture by Mr. M. J. C. Meiklejohn on the place-names of Northwood and district, and the first of a series of articles in which the editor, Mr. W. Paley Baildon, has collected all available references to Paul's Cross, and arranged them in chronological order.

THE current number of *Past and Present*, the successor to the *Natural History Journal*, published in connection with the Friends' Schools, is before us. The magazine shows that great encouragement is given in these schools to observational science, and that the boys are in the habit of making and recording outdoor observations in biological and meteorological science. The illustrations of the school buildings are proof enough that the claims of science are not forgotten in the school curriculum.

SEVERAL parts of volumes of Transactions of the Royal Society of Edinburgh, containing papers read before the society during the sessions 1902–3, 1903–4, and 1904–5, have just been received; and also vol. xliii. of the Transactions, edited by Dr. A. Buchan, F.R.S., and Mr. R. T. Omond, devoted to the Ben Nevis observations during the years 1893–7. As abstracts of the papers read before the society appear periodically among our reports of meetings, it is unnecessary to refer again to the many important contributions now printed in full in the Transactions recently issued.

THE fifth part of vol. ii. of the Proceedings of the University of Durham Philosophical Society has been received. The number contains five papers read before the society between February 9 and April 27, 1905, together with the proceedings for the academic year 1904–5. Prof. H. Stroud contributes a paper on spark-gap experiments for detecting radio-activity, Dr. J. A. Smythe a note on a contact rock from the Island of Mull, Mr. A. Brennan notes on abnormal flowers of *Lilium Martagon* (Linn.), Dr. D. Woolacott a paper on the pre-Glacial "wash" of the Northumberland and Durham coalfield, and Mr. G. Thomson one on the effect of light on selenium.

OUR ASTRONOMICAL COLUMN.

ASTRONOMICAL OCCURRENCES IN APRIL:—

April 5. 5h. 48m. to 6h. 42m. Moon occults α Leonis (Regulus, mag. 1·3).
6. 7h. 3m. to 7h. 57m. Moon occults χ Leonis (mag. 4·7).
,, 15h. 50m. to 16h. 19m. Moon occults σ Leonis (mag. 4·1).
11. 11h. 30m. Minimum of Algol (β Persei).
14. 8h. 19m. ,, ,, ,,
15. Venus. Illuminated portion of disc = 0·967. Of Mars = 0·978.
16. 15h. 48m. to 16h. 29m. Moon occults θ Capricorni (mag. 4·2).
18. 23h. Saturn in conjunction with Moon. Saturn 0° 22′ N.
24. 8h. 22m. Transit (ingress) of Jupiter's Satellite III. (Ganymede).
,, 15h. Venus in conjunction with Moon. Venus 5° 11′ N.
26. 4h. Jupiter in conjunction with Moon. Jupiter 4° 16′ N.
,, 5h. 42m. Near approach of Moon to α Tauri (Aldebaran).
27. 8h. 51m. to 9h. 48m. Moon occults 119 Tauri (mag. 4·6).
30. 11h. 33m. to 12h. 28m. Moon occults ζ Cancri (mag. 4·7).

COMET 1906*b*.—A part of the ephemeris for comet 1906*b* (Kopff), calculated by Herr M. Ebell and published in No. 4080 of the *Astronomische Nachrichten*, is given below:—

Ephemeris 12h. M.T. Berlin.

1906		α (true) h. m. s.	δ (true) ° ′	log r	log Δ	Brightness
April	6	11 22 53	2 24	0·5355	0·3983	0·81
	14	11 21 18	2 28	0·5397	0·4128	0·74
	22	11 20 38	2 26	0·5440	0·4291	0·67
	30	11 20 58	2 20	0·5484	0·4468	0·61

Unit brightness on March 3 = about mag. 11·0.

This comet is still in the constellation Leo, near to the star τ, which is on the meridian at about 11 p.m.

The suggestion that this object was a periodic comet of short period is not confirmed by the observations.

Observing at Strassburg on March 17, Dr. Wirtz recorded that the comet had a nucleus of mag. 11·5, the total magnitude being 11·0. The nebulosity was only 0′·7 in diameter, and appeared to be extended towards position angle 270°.

COMET 1905*c*.—The following is an extract from Herr Wedemeyer's ephemeris for comet 1905*c* (Giacobini) as published in the supplement to No. 4080 of the *Astronomische Nachrichten*:—

Ephemeris 12h. M.T. Berlin.

1906	α (true) h. m. s.	δ (true) ° ′	log r	log Δ	Brightness
April 5	3 36 46	+ 8 12	0·2390	0·3763	0·20
9	3 45 22	+ 9 8	0·2559	0 3943	0·17
13	3 53 33	+ 9 59	0·2718	0·4114	0·15
17	4 1 22	+10 46	0·2870	0·4275	0·13
21	4 8 53	+11 28	0·3014	0·4428	0·11

An observation at Strassburg on March 17 gave corrections of −11s. and −3′·9 to this ephemeris. The comet was pale, with no certain nucleus, and the ill-defined nebulosity was about 2′ in diameter; total magnitude about 11·5.

This faint object is now apparently traversing the constellation Taurus towards the Pleiades, and will be some 3° south of that asterism on April 23. It sets, a little to the N. of W., at about 9 p.m.

A SYSTEMATIC STUDY OF FAINT STARS.—Apropos of Prof. Kapteyn's plan for studying faint stars, Prof. Pickering gives a detailed account of how similar work is being performed at Harvard College Observatory in *Circular* No. 108.

It is impossible to describe the whole work here, but both photometric and photographic methods are being employed, and by using the two 24-inch reflectors Prof. Pickering hopes to extend the survey to stars fainter than Phœbe.

In studying the spectra, the 8-inch Draper and Bache telescopes have been employed, and stars down to the eleventh magnitude have been observed successfully. Using the 24-inch reflectors, Prof. Pickering hopes to photograph the spectra of much fainter stars.

By following the stars precisely, so that the resulting spectrum is merely a line, thirteenth magnitude stars have been dealt with, and, on a photograph obtained with the 8-inch Draper telescope, the spectrum of a star of mag. 13·3 is sufficiently clear to be classified; the same plate shows the spectra of 110 stars within 1° of the North Pole.

STARS HAVING PECULIAR SPECTRA.—In *Circular* No. 111 of the Harvard College Observatory, Prof. Pickering gives a list and details of twenty-four stars which, from a study of the Henry Draper memorial photographs, Mrs. Fleming has found to have "peculiar" spectra.

One or two of the objects call for special remark. The star D.M.+21° 1609 is identical with N.G.C. 2392, which was found to have a continuous spectrum, with three bright lines, by Wenlock and Peirce on January 7, 1869. D'Arrest, also, found it to be gaseous. Photographs taken at Harvard on November 21, 1900, and November 27, 1905, show no traces of the bright lines characteristic of gaseous nebulæ, but that its spectrum is of the fourth type. This star is in Gemini, its approximate right ascension and declination (for 1900) being 7h. 23·3m. and +21° 7′ respectively.

In the spectrum of the star D.M.+36° 3907 the hydrogen line Hβ appears as a fine bright line centrally superposed on a dark line, on photographs taken on July 4 and November 4, 1905.

A spectrogram of the variable star R Cygni, obtained on November 19, 1890, showed the hydrogen lines Hγ and Hδ bright, but a photograph taken on December 7, 1904, with the same instrument, shows a spectrum of the fourth type containing no trace of bright hydrogen lines.

THE LUNAR ECLIPSE OF FEBRUARY 8.—The total eclipse of the moon which took place on February 8 this year was fully observed at the Goodsell Observatory, Northfield, Minn. (U.S.A.), and an account of the observations is given in No. 3, vol. xiv., of *Popular Astronomy*.

Dr. Wilson especially remarks on the brightness of the eclipsed moon, and on the remarkable contrasts of colour seen on the darkened surface.

Five photographs were secured, and the last one, taken with a small camera attached to the telescope, exposure 5m., shows the details of the lunar surface and its unequal colouring very plainly.

Similar observations were made by M. Quénisset at the Nanterre Observatory, and four of his photographs are reproduced in the March number of the *Bulletin de la Société astronomique de France*. He records the shadow as "very transparent."

PARALLEL RUNNING OF ALTERNATE CURRENT GENERATORS.

THE *Bulletin des Séances de la Société française de Physique* for the second quarter of last year contains an interesting article by M. Boucherot on the general principles which enter into the design and construction of alternating current generators.

After a brief description of the present methods of construction, the author passes on to consider, first, the wave form; secondly, the regulation; thirdly, parallel running; and, finally, methods of compounding.

The most important part of the article is that devoted to the question of parallel running, and, although the mathematical treatment is not very clearly explained, the conclusions arrived at are interesting.

The question is considered under two headings. In each the subject of inquiry is the influence of the fly-wheel, or the fly-wheel effect of the rotating parts, on the oscillations about a state of uniform angular velocity; but under the first heading the oscillations are caused by the variations of turning effort of the prime mover during a single revolution, and under the second heading the oscillations are produced by the action of the engine governor.

In dealing with the first of these there are two quantities which are of prime importance in the calculations viz. the energy stored in the rotating parts, $W(=\frac{1}{2}J\Omega^2)$, and the elastic couple or restoring force, C_s, which is defined as the couple which tends to restore the rotating parts to phase coincidence with the network to which the armature is connected, when the deviation is one radian. Then it is shown that the natural period of the system is $2\pi\sqrt{J/C_s}$, and the restoring force $C_s = C_S pk$, where C_S is the full load torque, p the number of pairs of poles, and k the ratio of the short-circuit current to the normal current.

Next, the analysis of the turning moment is given for single-cylinder and for multiple-cylinder engines as follows:—

	Order of harmonic	Half load	Full load
Single cylinder	1	0·12	0 14
,, ,,	2	0·9	0 9
,, ,,	3	0·12	0·11
,, ,,	4	0·4	0·11
Multiple cylinder	1	0·1	0·1
,, ,,	2	0·5	0·2
,, ,,	3	0·35	0·15
,, ,,	4	0·4	0·4

the mean constant turning moment being reckoned as unity.

Each harmonic produces its own oscillation in the rotating system, the amplitude of which is proportional to the value of the harmonic multiplied by $\frac{1/2n^2}{W - W_n}$ (not $W/W - W_n$ as stated in the original), where n is the order of the harmonic and $W_n = C_s/2n^2$. If the total fly-wheel effect happens to be such that $W = W_n$, resonance will occur, and this expression will enable the designer to proportion the rotating parts so as to avoid serious trouble.

More interesting is that part of the article devoted to the effect of the engine governor on parallel running and hunting. The subject is confessedly a difficult one, and at present there is no accepted theory. The suggestion put forward by the author is somewhat compressed and difficult to follow; and, even so, only the chief points of the argument can be mentioned here.

The generating set with its governor is treated as being composed of two interdependent oscillating systems, each with its own natural period and its own coefficient of damping. In addition to these four quantities, two others are of great importance, viz. K, the percentage variation of speed between no load and full load, and T_d, the time lag of the governor. The latter quantity is defined as the time which elapses between the governor reaching its extreme position and the turning moment of the engine taking up its corresponding value. This time lag is greater in compound and triple expansion than in simple engines, due to the passage of the steam through the cylinders.

Considering, first, the case of a generating set connected to an external network assumed to be of infinite capacity, it