Research Items.

A Late La Tène Spear-head from the Thames.—In *Man* for September, Mr. T. D. Kendrick describes and figures a remarkable ornamented iron spear-head found in the Thames at London and now in the possession of Captain Ball. It is 11·8 inches long and has a broad triangular blade with rounded base angles. The wings are flat; but the blade itself is bisected on each face by a raised mid-rib, sharp-edged and triangular in section. This extends from tip to base, where it merges into the socket, which is faceted for a short length and then runs on round-sectioned. The forging is excellent and shows no trace of the annealed joint. Bronze plates are affixed to the lower part of the wings on each face—thin strips of metal with bevelled edges about 3½ inches long. They are applied as four separate pieces, being fastened in position by a number of neat little pins, of which two have the heads traversed by the ornament on the plates. No two of the plates are alike, but each is cut into a sinuous form with eccentric leaf-shaped protuberances, and each is ornamented with an incised design in which a disc-ended S-shaped scroll, set off against a basket-work background, is the principal element. The pattern is not in the best tradition of this sort of work. The form of the spear-head would suffice to date it to the La Tène period. A large number of decorated spear-heads have been found abroad and some in Ireland. Yet this single English specimen is unique among all decorated La Tène spear-heads because of the manner of its ornament. Other spear-heads are decorated by inlay or by incised or openwork devices in the iron blade, but here it is in the form of applied plates of a different metal. In richness of decoration it is surpassed by a specimen from Hungary and one from Switzerland; but it is much later than either. It belongs to the middle of the first century A.D., and must be regarded as an important document for the study of 'Celtic' art in Britain, marking the complete disappearance of the fluid elegance of the earlier foliate design.

Speed of Flight of Birds.—An important contribution to our knowledge of the speed of flying birds is made by T. H. Harrisson in *British Birds* (Sept., p. 86). The data were obtained by well-designed methods of using a motor-car and motor-cycle; they cover 103 records for thirty-six species, and they refer only to normal daily flight. Comparison of the figures here with those which have been published by other observers suggests that in some species at least (for example, rook, swallow, and lapwing) there may be a difference between the speed of migratory and of normal daily flight. But it is evident also that speed for a species is not a constant: ten sets of records for the starling give speeds ranging from 48 to 24 miles an hour, the non-migratory speeds ranging from 32 to 24 m.p.h.; and eight readings gave the ring-dove a range from 51 to 27 m.p.h. The speeds of different species show striking differences: the fastest speed recorded by the author was 59 m.p.h. for a stock-dove, the slowest 17 m.p.h. for a herring-gull, and the seemingly slow tawny owl gave speeds of 45 and 41 m.p.h., while the swallow (eleven observations) yielded no better than a range from 23 to 32 and an average of 27·3 m.p.h.

Japanese Nematodes.—Dr. Shigemoto Imamura in his paper "Nematodes in the Paddy Field" (*Journal of the College of Agriculture*, Imperial University of Tokyo, vol. 11, No. 2; 1931) investigates the nematodes of the rice fields and their numbers before and after irrigation. This is an exceedingly interesting and important subject. Forty-eight species belonging to twenty-five genera are described and figured. The Anguillulidæ are by far the most numerous, amounting to more than seventy-five per cent of all those found in the fields before irrigation. The worms belonging to this family are more or less injurious to the higher plants, and it is found that after irrigation their numbers are reduced to less than one-third. The whole nematode population after irrigation was reduced to about half as many as before, but whereas before irrigation they were chiefly those which were injurious to the crops, after irrigation they were chiefly those which fed on other animals, including the Anguillulidæ, the predatory genus *Mononchus* being much to the fore. The results of these investigations suggest that the irrigation either causes the injurious nematodes to be drowned or to be devoured by other nematodes such as *Mononchus*. Most of the nematodes both before and after irrigation occurred in the layer of soil in which were the roots of the rice plants.

Duration of the Pleistocene Period.—An address to the American Association for the Advancement of Science by G. F. Kay on the classification and duration of the Pleistocene is published in the *Bull. Geol. Soc. Amer.*, **42**, pp. 425-466, 1931. Reasons are given for the interpretation that Pleistocene history involves four cycles from the time of advance of the first ice-sheet, the Nebraskan, to the retreat of the last, the Wisconsin, each being recorded in the deposits laid down during the early glacial stage and in the changes which those deposits underwent during the interglacial stage. New names have been chosen for the four epochs so defined: *Grandian* (Nebraskan and Aftonian), *Ottumwan* (Kansan and Yarmouth), *Centralian* (Illinoian and Sangamon), and *Eldoran* (Iowan, Peorian, and Wisconsin). The evidence used in estimating the durations of the interglacial stages was gained from field studies in Iowa of the relative depths of the leaching of calcium carbonate in similar materials which throughout their times of leaching were similarly situated topographically and climatically. The results in years are: post-late Wisconsin, 25,000; post-Iowan, 55,000; Sangamon, 120,000; Yarmouth, 300,000; and Aftonian, 200,000. The *minimum* duration of the times of actual glaciation is estimated at 30,000 years. The combined estimates give for the whole of the Pleistocene in Iowa a minimum of about 700,000 years. In so far as the rate of downward leaching may well have decreased as the depth increased, it is judged that the Pleistocene deposits may actually represent a much longer time, possibly up to two million years.

A Connexion between Electricity and Magnetism.—It is invariably found in experimental investigations that magnetic poles have to be dealt with in quantities equal in amount and opposite in sign. With the usual method of formulation, this fact is taken over into quantum mechanics, which is thus applicable only when there are no isolated magnetic poles. In a paper in the September number of the *Proceedings of the Royal Society*, Dr. P. A. M. Dirac shows that this restriction can be removed by a natural development of quantum mechanics. The new theory leads to a simple formula $hc/2\pi e\mu_0 = 2$, where μ_0 is a quantum of magnetic pole strength and the other symbols have their conventional significance. Comparing this with the well-known relation $hc/2\pi e^2 = 137$, which is known to be closely true from experiment independently of any theory, shows that $\mu_0/e = 137/2$. In other words, the

attractive forces between two one-quantum poles of opposite sign is almost 5000 times that between electron and proton, a result which may explain why a separation of poles of opposite sign has never been effected.

Estimation of Dissolved Metals.—In the September number of the *Proceedings of the Royal Society*, F. Twyman and C. S. Hitchen describe an improved spectrophotometric method for the estimation of metals in solutions. It consists in principle in the measurement of the intensity of a line from its length in the spectrum photograph obtained when a disc of special contour is rotated in front of the slit of the spectrograph during the exposure. Much attention has to be paid to details of procedure, such as the operation of the spark source of light and the development of the plate, but it appears that the necessary operations, which are described in full detail, are neither unduly laborious nor intrinsically difficult. The method, as given for minor constituents in solutions of metals, seems to have as great advantages as the corresponding method for the analysis of alloys; it is rapid, sufficiently accurate, and often superior in many respects to a chemical analysis, whilst the spectrogram gives a permanent record of the analysis.

Constitution of Cyanidin Chloride.—In a communication to the *Journal of the Indian Chemical Society*, vol. 8, p. 329, Dr. M. Nierenstein discusses the constitution of cyanidin chloride, a substance which is of interest both to chemists and to botanists on account of its relationship to the anthocyanidin pigments of flowers. Since cyanidin chloride breaks down on hydrolysis to phloroglucinol and protocatechuic acid, it is necessary to ascertain the mode in which the two nuclei of these products are linked in cyanidin. Willstätter ventured in 1914 to assign a definite structure to the latter compound, since it was supposed that it could be produced from the anthoxanthone quercetin by reduction. The fact that this reduction theory, though strongly favoured by Everest, Willstätter, and other chemists, appears to conflict with botanical evidence led Malkin and Nierenstein to reinvestigate the matter. These authors (*Jour. Amer. Chem. Soc.*, **52**, 2864; 1930) were able to show that reduction of quercetin leads to a dimolecular product, quercetylene chloride, and not to the monomolecular pentahydroxyflavylium chloride, which has the structure assigned by Willstätter to cyanidin chloride. It appears that both quercetylene chloride and pentahydroxyflavylium chloride have been identified with natural cyanidin chloride, but the evidence on which identity of composition is based is stated to be inconclusive. Furthermore, X-ray analyses of the natural cyanidin chloride and the synthetic product have revealed their dissimilarity. Thus there appears to be some doubt about the actual structure of cyanidin chloride. A possible solution of the problem, based on the fact that Freudenberg has reduced the compound to epicatechin, is tentatively suggested in the paper.

Astronomical Topics.

Detection of Neujmin's Comet, 1913 III.—Search for this comet has been going on for some months. A telegram from the U.A.I. Bureau, Copenhagen, on Sept. 26 announced that Dr. Nicholson, at Mount Wilson, had found it in the following position:

Sept. 17^d 12^h 18·0^m U.T., R.A. 4^h 43^m 48^s, N. Decl. 38° 29′, Mag. 15. Daily motion +40^s, N. 9′.

It was stated that there was no nebulosity; this was frequently the case in 1913.

This position and the motion are satisfied within 1′ by the following elements, which are from the B.A.A. Handbook for 1931, with adjustments to period, eccentricity, and date of perihelion:

T	1931 April 29·98 U.T.	
ω	346° 57′ 48″	1931·0
Ω	347 18 10	
i	15 9 3	
ϕ	50 47 54	
log q	0·18415	

Period 17·689 years.

EPHEMERIS FOR 0^h U.T.

	R.A.	N. Decl.	log r.	log Δ.
Oct. 2.	4^h 49^m 43^s	40°40′	0·3712	0·2566
10.	4 49 32	41 45	0·3828	0·2514
18.	4 46 31	42 42	0·3942	0·2475
26.	4 40 58	43 27	0·4054	0·2460

This comet must be ranked as belonging to Saturn's family; its orbit makes a close approach to that of Saturn in the region passed by the comet after aphelion. It is the second member of the family to be observed at a second apparition. Tuttle's comet has been observed at seven apparitions.

Collapsed Stars and Novæ.—Prof. E. A. Milne suggested, in the *Observatory* for May, that novæ are the result of the collapse of a star of ordinary density. This collapse may produce rotational instability and cause the star to split into two portions. These may then re-expand, which would give an ordinary binary star. A system like that of Sirius might result if the larger star re-expanded, while the smaller one retained its high density. The very great disparity in state of the components of Sirius, both presumably of the same age, might thus be explained.

Incidentally, Milne concludes, from the observed frequency of novæ, that every star is a nova at least once in its history. This suggests the question: Has the sun had the disease yet? The appulse of another star, which is the current explanation of the birth of the planetary system, would produce conditions in the sun that would bear some resemblance to an outburst of a nova. Milne ranks the nuclei of planetary nebulæ, also ex-novæ, and possibly the ordinary Wolf-Rayet stars, as collapsed stars that have a high density and a high temperature.

Velocity of Light from the Spiral Nebulæ.—Some months ago Prof. Perrine made the suggestion that the positions of the distant spirals with reference to stars in their vicinity should be observed at different times of the year, as a test whether they indicated the same velocity of light as that from bodies in our own galaxy. It was not anticipated that any difference would be shown, as ever since the Michelson-Morley experiment it has been generally accepted that light from any source gives the same measured velocity. It was, however, of considerable interest to make the experiment. This has been done by Mr. Gustaf Strömberg, using plates obtained with the 60-inch reflector at Mt. Wilson; the results are given in *Pubs. Astr. Soc. Pacific*, August 1931. They give the same aberration constant for the stars and the nebulæ within 0·006″, which is far below the limits of probable error. Hence the velocity of light from the nebulæ is not influenced by the large recessional speed (11,000 km./sec.) which Humason found for the nebulæ that were observed by Strömberg.