Our Astronomical Column.

THE LUNAR ECLIPSE OF OCTOBER 16.—The three interesting phenomena of the present year—the solar and lunar eclipses and the occultation of Venus—have all been favoured with fine weather in London. The chief interest of the lunar eclipse on October 16 was the varied colouring of the shadow. The outer portion was bluish- or slate-grey, the inner portion decidedly ruddy. It is not difficult to give an explanation; the light reaching the outer portion needed only a small amount of refraction, and passed through the higher regions of the earth's atmosphere, suffering but little absorption, while that near the centre of the shadow underwent large refraction, and must have passed close to the earth's surface, so that only the long red waves could get through. Some have reckoned this as a dark eclipse; the present writer would class it as of average character, having seen both darker and brighter eclipses. There was a large amount of lunar detail plainly visible in the outer region of the shadow; a Greenwich photograph with 40 seconds' exposure showed the Maria and bright rays conspicuously. Two of the predicted occultations were successfully observed at Greenwich. The sky near the moon was too bright to permit the others to be seen.

REFORM OF THE CALENDAR.—The Astronomical Union will meet next year in Rome, and among the committee meetings that will be held there is one on calendar reform. This committee is presided over by Cardinal Mercier, and includes Sir F. W. Dyson and Prof. Sampson from Great Britain, MM. Bigourdan and Deslandres from France, M. Lecointe from Belgium, and Prof. Campbell from the United States. The main outlines of the reforms to be discussed include a more uniform arrangement of the lengths of the months, alteration in the position of the leap day (the end of the year would be far more convenient from the point of view of astronomical tables), and making the incidence of the week-days the same every year by placing one day a year (two in leap year) outside the weekly reckoning. The further question of the fixation of Easter may be raised, but the committee will, of course, not attempt to make any change without seeking ecclesiastical co-operation. The question of calendar reform has been mooted for many years, but it is much easier to recognise the inconveniences of the present system than to agree on an alternative one.

THE SPECTRUM OF ϕ CASSIOPEIÆ.—Major W. J. S. Lockyer and Mr. D. L. Edwards contribute a paper on this spectrum to the June Monthly Notices. They show that it is intermediate between those of α Cygni and γ Cygni. Thus the hydrogen lines and the enhanced lines of manganese and iron progressively weaken from α to γ, while the remaining iron lines and the enhanced lines of titanium progressively strengthen. Seven stars are indicated with spectra almost exact replicas of that of ϕ Cassiopeiæ, including Canopus and α Leporis. Eight other stars are indicated with spectra intermediate between those of ϕ Cassiopeiæ and γ Cygni; they include the two Cepheid variables, η Aquilæ and δ Cephei; it is further stated that the spectra of these two approach that of ϕ Cassiopeiæ at maximum, and that of γ Cygni at minimum. Reasons are given for inferring that all the stars discussed are giants, with temperatures highest in the α Cygni type and lowest in that of γ Cygni.

The paper also discusses the differences between the spectra of giant and dwarf stars of spectral type F, Procyon being taken as a representative of the dwarfs. The hydrogen lines are much sharper in the giant stars, and the enhanced metallic lines more pronounced.

Reproductions are given of five of the spectra discussed, and it is also pointed out that the research has some importance in connection with the interpretation of the spectra of novæ, the earlier stages of which resemble the α Cygni type.

MINOR PLANETS.—*Astr. Nach.*, No. 5122, contains an important research by Edzard Noteboom on the perturbations of Eros, in continuation of work on the subject by Prof. Witt, the discoverer of Eros. The actions of Mercury, Uranus, and Neptune, though almost insensible, are included for completeness. The observations of eleven oppositions, from 1893 to 1914, are compared with theory and twenty-four normal places formed. After correcting the earth's mass, the comparison shows that the largest discordance is 4″, most of them being under 2″. The research was undertaken mainly to investigate the large terms produced by the earth, and thus obtain a correction to its mass. The combined mass of the earth and moon was found to be $1/(328370 \pm 102)$, leading to a solar parallax of 8·799″.

It is important that Eros should be well observed at every opposition. Only two observations were available in 1903. It is still of magnitude 11½, and a continuation of Mr. Seagrave's ephemeris for Greenwich midnight is given:—

	R.A. h. m. s.	N. Decl. °		R.A. h. m. s.	N. Decl. ° ′
Oct. 19	22 1 8	10 45	Nov. 4	22 4 26	9 30
23	22 0 38	10 22	8	22 7 21	9 20
27	22 1 1	10 2	12	22 10 59	9 13
31	22 2 20	9 45	16	22 15 19	9 10

The same issue of *Astr. Nach.* contains an investigation of the orbit of the planet 887 Alinda. It was discovered four years ago by Prof. Wolf, and approaches closely to the earth's orbit in perihelion, but has large eccentricity; as its period of four years is about one-third of Jupiter's period, the perturbations by that planet will be large. They have been investigated by Mr. K. Schütte, who gives a search ephemeris for the present return. The recovery of the planet is desirable, but as the magnitude is 13·3 and the declination south, it is useless to give the ephemeris here.

THE CENTENARY OF "ASTRONOMISCHE NACHRICHTEN."—*Astronomische Nachrichten*, founded in 1821 by Schumacher with the encouragement of Gauss, has celebrated its centenary by the publication of a remarkable "Jubiläumsnummer," which contains articles by astronomers in all the continents, who join in expressing appreciation of the valuable work that this publication has done for astronomy. It has from the beginning exhibited a cosmopolitan spirit, aiming at the general and rapid diffusion of important information, and giving a large portion of its space to articles from other countries than its own. As Mr. R. T. A. Innes says in a cordial message: "Continuity has been maintained; the *Astronomische Nachrichten* is in 1921 what it was in 1821, the astronomer's newspaper, its columns ever open for astronomical news from any part of the world."

One of its features has been the absence of fixed days of publication, all important communications being published with the smallest possible delay. It has, however, conformed almost exactly to an average weekly interval. The periodical has been invaluable to workers in the special lines of comet and minor planet observation, and the advance of knowledge in these branches is largely due to its aid.

The following is a list of the principal contents of

the "jubilee number." O. Bergstrand writes on the effective wave-lengths of the galactic stars; A. S. Eddington on the dynamical equilibrium of the stellar system; P. Guthnick and A. A. Nijland on the Cepheid problem; J. G. Hagen on dark nebulæ; H. Shapley on the galactic distribution of the B stars; and H. v. Zeipel on the masses of stars in clusters. The list is not exhaustive, but will serve to give an idea of the varied contents of this memorable publication.

Geology of the South Wales Coalfield.[1]

AS is pointed out by the Director in the preface to the memoir under notice, the district, though not containing many deposits of economic importance, includes a very extensive series of rocks, ranging from the Ordovician to the New Red, and the hope is expressed that the district will be recognised as a typical area for the study of the formations represented, as developed in S.W. Wales.

The area shows considerable physical diversity. The highest ground is formed by remnants of a plateau mainly consisting of Lower Old Red Sandstone. The remnants are separated from one another by erosion-valleys and by level tracts chiefly composed of Carboniferous Limestone. The latter are referred to as the limestone flats, and considered to be probably the work of the Pliocene sea. The remarkably level character of these flats is shown in the frontispiece. The coast is deeply indented by partly drowned valleys (rias), of which the chief is Milford Haven. Many of the valleys are independent of the geological structure, and afford examples of superimposed drainage.

The oldest rocks occurring in the district are shales and sandstones belonging to the Llanvirn series exposed in the anticlines of Freshwater East and Castlemartin Corse. Here, too, are seen Silurian rocks, which both lithologically and in fossil-contents are of the Welsh-borderland type.

The Old Red Sandstone is specially interesting from the intercalation in the upper beds of bands containing a marine Devonian fauna. These bands, which were originally noted by de la Beche, and afterwards referred to by Salter, have yielded more than fifty species of fossils, by far the greater number coming from Freshwater West. The author considers that apart from these marine intercalations in the highest beds, the Old Red Sandstone represents an aqueous deposit formed under "continental" conditions. He does not believe that any of the rocks are directly æolian, the sandstones being too well bedded and conglomeratic to represent sand-dunes, and though the marls may be formed of wind-borne dust, it probably settled in water.

The Old Red Limestones "probably represent precipitates thrown down as the fresh, tributary waters carrying the calcium carbonate in solution mingled with the more saline water of the basin of deposition." The breccias and conglomerates of the Upper Old Red contain much igneous material, chiefly acid lavas, which, Dr. H. H. Thomas points out, "show a general resemblance to the pre-Cambrian and lowest Palæozoic rocks of Pembrokeshire, more particularly of the part north of St. Bride's Bay." In the Ridgeway conglomerate of the Lower Old Red Sandstone the pebbles are chiefly quartzite, igneous material being almost unrepresented.

The Carboniferous Limestone Series (Avonian) is perhaps the most interesting formation in the area, and the full account now available will be most acceptable to all students of these rocks. The author, like all other workers on the Carboniferous Limestone, has been deeply influenced by the work of the late Dr. Vaughan, to whom he "cannot adequately express his indebtedness." The faunal subdivisions recognised are in the main those of Vaughan's original paper, but the author draws the line between the Upper and Lower Avonian at the top of the C_1 beds, where a marked transgression occurs in the northern part of the South Wales area, instead of at the top of C_2, where Vaughan originally drew it.

The study of the rock-types of the Carboniferous Limestone Series is one which the author has made peculiarly his own, but he has already treated the subject so fully in describing the rocks of Gower that there is comparatively little of a novel character in the present memoir. A description is given of the interesting reef dolomites, and of the characters which lead the author to compare them with the reef or knoll limestones of Clitheroe and the Belgian Waulsortian. They occur in the C beds of the extreme south-west corner of the district, and appear to be essentially bryozoan reefs. Oolites have been recognised at an exceptionally large number of levels in the Lower Avonian. In very numerous respects mentioned by the author the rock-types are identical with those of the Bristol district. The term "Zaphrentid-phase," which was introduced by Vaughan, but not defined, is employed by the author, who defines his use of the term. A very lengthy fossil list is included.

The "Millstone Grit"—the term used to include the sandstones and shales intervening between the Carboniferous Limestone and the Coal Measures—though well exposed, is greatly disturbed, and the strata are difficult to correlate. The lower beds are shown to contain radiolarian chert and fossils of Pendleside type, while the presence of certain plants in the upper beds appears to indicate an horizon as high as the Middle Coal Measures of the Midlands.

Certain deposits of a peculiar character preserved in fissures or cavities of the Carboniferous Limestone are the only ones referred to the New Red (Trias). The most remarkable of these are the gash-breccias, which are fully described, and illustrated by an admirable plate. The author considers that they are probably due to the collapse of the roof and sides of cavities formed by the underground solution of the limestone.

A particularly full and interesting account is given of the earth-movements which have affected the district, and while by far the most important are the post-Carboniferous (Armorican) movements, others occurred between the Llanvirn and Wenlock periods, between the Ludlow and the Lower Old Red Sandstone, between the Upper and Lower Old Red Sandstone, between the Upper and Lower Avonian, and between the Carboniferous Limestone and Millstone Grit. All the chief strike-faults are overthrusts of Armorican date, while the cross-faults, which are tabulated, also appear to belong in the main to the same period of disturbance.

The district differs from Gower and some other parts of South Wales in that glacial deposits are nowhere seen resting in clear sequence on undoubted raised-beach.

The memoir is illustrated by five fine plates and an admirable series of sketch-maps. It everywhere bears evidence of the minute observation and thoroughness which are so characteristic of the author's work.

[1] Memoirs of the Geological Survey: England and Wales. "The Geology of the South Wales Coalfield." Part 13: "The Country around Pembroke and Tenby." By E. E. L. Dixon. (Southampton: Ordnance Survey Office; London: E. Stanford, Ltd., 1921.) 8s. net.