(+4° to −2°) have been completed. The astrographic catalogue is complete, except for the printing of some of the constants. Some of the constants are being recomputed with the aid of the Abbadia Catalogue.

Besançon.—The meridian instrument has been used for time-determination and the observation of the Moon and planets. With the equatorial coudé 88 and 78 observations of minor planets were obtained in the two years. A few observations were also made of comets and of the phenomena of Jupiter's satellites.

Bordeaux.—About 2500 stars were observed in each year with the meridian-circle in a revision of the reference-stars of the Bordeaux astrographic zone. The observations and their reduction should be finished in 1925. The manuscript for press of the first observations is ready and the printing about to commence. The reduction of the observations of fundamental stars interrupted by the war has been completed. They are still to be discussed and a copy for press prepared. A determination of the longitude made in 1920 will be published soon: it shows a correction of about a whole second on the old value. Some miscellaneous observations were made in 1921 with the visual refractor, but these have been discontinued. A few catalogue-plates and 93 chart-plates have been taken with the photographic refractor. 104 plates have been measured. The printing of the chart is proceeding steadily.

[To be continued.]

NOTES.

The Theory of Relativity and the Displacement of Spectral Lines.—The following paragraph is taken from *Science* of September 28:—

"Confirmation of the third prediction of Einstein resulting from the application of his general theory of relativity was announced to the American Association for the Advancement of Science at its recent fall meeting at Los Angeles by Professor Charles E. St. John, of the astronomical staff of Mt. Wilson Observatory. The lines of the solar spectrum are not identical in position with those due to incandescent samples of the same elements when observed on the Earth, and the displacement is towards the red end of the spectrum. This indicates a slowing up of the rate of atomic vibration, as predicted by Einstein, as a result of the difference of the position of the two samples of incandescent elements with reference to the gravitational field of the Sun.

"Einstein has stated that his theory of relativity stands or falls according to whether or not this effect is obtained. Professor St. John has calculated that the displacements of the lines in the

solar spectrum predicted by Einstein amount to 86 per cent. of the total observed effect, the remainder being due to other well-known effects resulting from the conditions in the solar and terrestrial atmospheres and to the Sun's rotation on its axis. Dr. St. John considers as proved the main prediction of Einstein, that in the vicinity of the centre of the gravitational field of the Sun the rate of vibration of atoms is slowed up as compared with their rate of vibration when as far away from the Sun as is the Earth."

Dr. Evershed, who had at a much earlier date arrived at the same conclusion, gave a valuable summary in his article in our last number of his latest results, which further confirmed him in his opinion. It is of great interest to learn that Dr. St. John, who at first took the contrary attitude, has now, as a result of his careful and painstaking researches at Mt. Wilson, changed his views. The details of the observation upon which his conclusions are based will be awaited with interest. With the further confirmation from the 1922 eclipse of the deviation of the light rays by the action of the gravitational field of the Sun, first established by the observations in 1919, it can now hardly be denied that all three of Einstein's predictions from his generalized theory of relativity have been satisfactorily confirmed.

A HITHERTO UNKNOWN STAR ATLAS.—Messrs. Henry Sotheran and Co., the well-known booksellers, have just issued Part iii. of their 'Catalogue of Science and Technology, No. III.,' containing an annotated and classified list of works on Astronomy, Astrology, Chronology, Geodesy, Horology, and Dialling. Many of these are from the libraries of Prof. Pierre Duhem and of Col. G. L. Tupman.

There is one item of particular interest in this list:—

[Bevis (or Bevans) (John, M.D., F.R.S.). Uranographia Britannica, or Exact View of the Heavens:] *consisting of a fine engraved frontispiece, representing an idealized George II. dressed as Imperator, and accepting the atlas from Urania, and* 51 *finely engraved star maps*, oblong folio, *hf.-leather* (*binding worn, and frontispiece dust-soiled*). [1750]

To this there is appended the following interesting bibliographical note:—

This is in all probability the only copy that remains of what would have been the fifth star-atlas ever published. Its existence has hitherto been quite unknown. The story is told in the *Dictionary of National Biography*. The author was born on October 31st, 1693, at Tenby in Pembrokeshire. "Having been entered at Christ Church, Oxford, he took the degrees of B.A. and M.A. respectively 13th October, 1715, and 20th June, 1718. He studied medicine as a profession, but Newton's 'Optics' was his inseparable companion, and on the termination of his University career he travelled in France and Italy, then settled in London as a Physician some time before

1730. He was successful, but unsatisfied, until in 1738 he removed to Stoke Newington, where he had built and fitted up an observatory. Here he worked with such diligence, frequently taking 160 star-transits in a single night, that in 1745 he found himself in a position to undertake the compilation of a 'Uranographia Britannica,' or exact view of the heavens, in fifty-two large plates, including many more stars than had been given in Bayer's maps. An explanation accompanied each plate, and a catalogue of stars was added with two hemispheres, representing the constellations according to the ancients. The work was all but ready for the press when, in 1750, John Neale, the publisher, became bankrupt. The plates, already completely engraved, were sequestered by the court of Chancery, as it proved, irrevocably; and Bevis's heavy toils remained without fruit."—*Miss Agnes M. Clerke.*

The work is also referred to by Lalande, in a note to Bayer's Atlas.

The star maps, which are numbered from I. to LI., are primarily based on Bayer's Atlas, but contain approximately five times as many stars as the latter, including all stars, as far as known to the author, to the eighth magnitude (each magnitude being differently marked), besides "extinct stars" and nebulæ.

All Bayer's positions are corrected, but his numbering has been adopted, save for a number of stars not given by Bayer, which are marked by Bevis in Gothic letters. This appears to have been a novelty introduced by him. The size of the maps, which are remarkably well executed, is $16\frac{1}{2}$ by 13 inches.

The last two plates represent the Northern and Southern Hemispheres, according to Ptolemy.

The resurrection of a hitherto quite unknown star atlas, the fifth printed in order of chronology, after those of Bayer, Cellarius, Doppelmayer, and Flamsteed, more than 170 years after the date when its publication should have taken place, is no mean scientific and bibliographical event, and puts it on quite a different level from those unique works reprinted in the early publications of the Roxburghe Club, of which it was said that if only one copy was known to exist, one copy was printed too many.

Later.—We find that this star atlas, although rare, is not so rare as Messrs. Sotheran, following such authorities as Lalande, Miss A. M. Clerke, and the *Dicitonary of National Biography* had supposed. There is a copy in the Library of the Royal Observatory, Greenwich, and we have also heard of two private collectors who possess copies. It is not known how these copies were published.

Solar Activity, October 1923.—During October the general activity decreased as regards new groups, the chief disturbances observed being recurrences of groups which appeared during September. The disturbances have been in well-defined separate

groups of low and high latitude, characteristic of the time preceding the spot-minimum. In the first week the only sign of activity was a weak scattered flocculus (N.E.) and a few small prominences along the S.W. limb. On Oct. 9 a well-formed group was observed close to the N.E. limb, from 3° to 6° latitude, consisting of a regular spot with fairly large flocculus and a second detached flocculus without any spot-centre. This group remained without much alteration until it passed the west limb on Oct. 21. Numerous small prominences were distributed round the limb. On Oct. 22 there were two disturbances: one in S. lat. −5°, with well-formed leader-spot at −7° and several smaller spots at lower latitude; a smaller group near the S.E. limb, in S. lat. −18°, at a position suggesting its being a recurrence of the group visible during the latter part of September. These two groups survived, with slight changes, till their passage over the west limb from Oct. 29 to Nov. 1. Moderate prominences appeared on the N.W.; a large pillar-formation on the S.W. limb, extending from −45° to 49° S. lat.; and a large plume-eruption on the S.E. limb at −30°. On Oct. 29 a new group was observed in high latitude, −30° S. This showed evidence of rapid change, and by the time it reached the centre of the disc had developed into a large multiple group, the following spot being largest. C. P. B.

Meteor Notes.—*Fireball of September 12 observed at Sea.* Commander Parker of the Royal Mail Steam Packet Co.'s 'Orbita' reports that the Second Officer saw a meteor of extraordinary brilliancy on September 12 at $5^h\ 55^m$ A.M. G.M.T. The ship was in lat. 40° 12′ N. and long. 38° 43′ W. The meteor was observed travelling at a great speed from the direction of the constellation Pegasus through Cassiopeia and vanishing in the vicinity of the Great Bear. It appeared to burst in the region of Cassiopeia, illuminating the heavens from horizon to horizon. Such was the vividness of the flash that the observer was temporarily blinded by the dazzling effect.

During a period of about 20 minutes after its passage a brilliantly luminous, vaporous gas remained in the sky, marking the meteor's trail.

The description of the path of the above fireball leads to the inference that it was directed from a well-known radiant of brilliant meteors at 347°+2° during the first half of September. This shower agrees very well, both in time and place, with the radiant computed for Daniel's Comet of 1907 by Kritzinger at 347°+3° September 12. The fireball above described may quite possibly, therefore, have belonged to the stream of Daniel's Comet. In confirmation of this particular shower it will be seen from Mr. Prentice's list below that he observed 10 meteors on the nights September 5–9 from 345°+2°.

Mr. J. P. M. Prentice has derived the following radiant-points

from the observations of 386 meteors in watches extending over 62 hours in September last :—

Date.	Radiant.	Name of Shower.	No. of ↙'s
Sept. 7–8	8°+62°	κ Cassiopeids.	6
„ 16	8+63		4
„ 7–9	11+ 8	ε Piscids.	5
„ 8–9	30+70	(50) Cassiopeids.	5
„ 5–6	36+53	θ Perseids.	6
„ 7–8	41+21	ε Arietids.	5
„ 12	41+28	(39) Arietids.	5
„ 7–8	69+63	α Camelids I.	5
„ 8–9	83+52	β Camelids ?	5
„ 9	90+15	ν Orionids.	4
„ 5–9	245+52	θ Draconids.	11
„ 5	247+61	η Draconids.	6
„ 11	253+56	μ Draconids.	4
„ 7	280+88	Polarids.	5
„ 9	307+31	ι Cygnids.	5
„ 7	320+30	ζ Cygnids.	4
„ 7–8	334− 3	γ Aquarids.	5
„ 5–9	345+ 2	β Piscids.	10
„ 11–13	357+53	β Cassiopeids.	6

Mr. Prentice remarks that, though the observations were fairly abundant, the number of well-defined radiants was small and no rich showers in progress.

Mr. Prentice made observations also on the nights of Oct. 6, 9, 12, and 14, and saw 208 meteors in 24 hours of watching. Meteors were also seen on several other nights when the conditions were not so favourable. On Oct. 6 and 9 meteors were scarce, but on Oct. 12 and 14 a considerable increase in numbers was observed.

Bright Meteor on Sept. 30.—At $7^h\ 28^m$ G.M.T. a meteor exceeding first magnitude was observed by Mr. E. J. Webb of Islip, Oxon, and by the writer at Bristol. The paths indicate a probable radiant at 214°+55° and the height of the meteor appears to have been from 77 to 45 miles. The beginning of its luminous flight occurred over Thornbury and the end ng over Devizes—length of path 52 miles, velocity 34 miles a second.

Meteor of Oct. 14.—A conspicuous meteor, brighter than 1st mag., was seen at $9^h\ 36^m$ G.M.T. by Mr. Prentice at Waldringfield and by the writer at Bristol. It pursued rather a long flight with moderate speed and left a streak. It belonged to the shower of β Ursæ Majorids and had a radiant at 162°+57°. The height of the object was from 90 to 52 miles from a little west of Wisbech to S.W. of Croydon—path 108 miles, velocity 36 miles per second. This observation supplies excellent corroboration of a meteor seen on 1917 Oct. 13 by the writer and the late Mrs. Fiammetta Wilson which indicated a radiant at 163°+60°.

W. F. Denning.

Bristol, 1923, Oct. 19.

Comet Notes.—Comet 1923 *a*, magnitude 8·0, was discovered independently by Mr. Arthur Bernard at Madrid and Prof. Dubiago at Kasan. The following positions are to hand; those marked *r* are rough:—

G.M.T. d h	R.A. h m s	S. Decl. ° ′ ″
Oct. 11 16 *r*	7 29 —	9 0 —
12 — *r*	7 37 —	12 22 —
14 13·3	7 46 42·7	20 37 31
15 — *r*	—	25 — —
16 — *r*	—	30 — —

The material is insufficient to find a reliable orbit, but the following has been deduced:—

$$T = 1923 \text{ Nov. } 20{\cdot}55 \text{ G.M.T.}$$
$$\omega = 281^\circ\ 16'$$
$$\Omega = 243\ 58$$
$$i = 152\ 14$$
$$\log q = 9{\cdot}8226.$$

For this the following ephemeris has been formed:—

	R.A. h m s	S. Decl. ° ′		R.A. h m s	S. Decl. ° ′
Nov. 11·5	17 41 13	43 0	Dec. 2·0	17 40 20	32 41
14·9	17 43 44	40 40	5·1	17 38 48	31 38
20·5	17 44 28	37 32	9·2	17 36 44	30 18
26·2	17 43 0	34 59	14·7	17 34 16	28 37
29·6	17 41 30	33 37	22·4	17 31 12	26 30

$\log \Delta$: Nov. 9, 9·9318; Nov. 29, 0·1772; Dec. 22, 0·2779.

A. C. D. C.

Obituary.—*A. Bowden.* A link with the astronomy of the past has been broken by the death of Mr. Arthur Bowden, which happened on September 10 in the 84th year of his age. Arthur Bowden came to Greenwich as a computer in March 1855, and served chiefly in the Magnetic and Meteorological Department. He passed from there to the Cambridge University Observatory, where he was Assistant until the year 1863, being succeeded by Mr. Graham. He then left astronomy for a time and spent some years in France, where he had family-connections, and saw active service in the war of 1870–71. Bowden resumed astronomy later, and was Assistant at the Glasgow Observatory under Prof. Grant about the year 1878, and was appointed by Mr. Stone First Assistant at the Radcliffe Observatory in 1879. His name will be found here and there in the volumes of the *Monthly Notices* of that period. After a few years at Oxford he gave up astronomy finally, and having some knowledge of the subject became a prospector for mining and other companies, and had an

adventurous career in South America and Africa. On retirement from this occupation, he married and settled in Blackheath, where he spent the last twenty-five years of his life engaged in pursuits of a literary nature.

Sir Frank Dyson has been appointed to represent the International Astronomical Union on the International Research Council.

M. Jean Bosler has been appointed Director of the Marseilles Observatory.

From an Oxford Note-Book.

It had been known for some months that Dr. Rambaut, the Director of the Radcliffe Observatory at Oxford, was seriously ill, but his death came as an unexpected shock to his many friends. He was only 64—an early age for an astronomer. But he lived to see the completion of the work to which the last 20 years of his life had been devoted. The introduction to the 'Radcliffe Determinations of Stellar Parallaxes' is dated 12 May, 1923, when Dr. Rambaut was already very ill, but with the loyal cooperation of his Assistants it was completed in time for him to sign it, and the volume itself was issued some weeks before his death. He was the fourth to hold the office of Radcliffe Observer since it was separated from the Chair of Astronomy in 1839, his predecessors being Manuel Johnson (1839–1859), who reobserved Groombridge's stars for the well-known 'Radcliffe Catalogue,' erected a heliometer, and started photographic registration with the meteorological instruments; the Rev. Robert Main (1860–1878), who acquired Carrington's transit-circle for the observatory, produced the Second Radcliffe Catalogue, and commenced work for a Third; and E. J. Stone (1879–1897), whose Radcliffe Catalogue was a counterpart to the great Cape Catalogue which he had previously produced. By the time of Stone's death the instrumental equipment of the observatory had become somewhat antiquated, and to Dr. Rambaut is due its renovation by the great 26-inch refractor with which he made his comprehensive parallactic survey above-mentioned. On Wednesday, Oct. 17, after a service in Queen's College attended by the Astronomer Royal and other astronomers, he was buried in Holywell Cemetery, where Professor Pritchard also lies. His predecessors Stone and Main were interred in Walton Street Cemetery.

The Editors have handed to the writer the following letter addressed to them by Mr. R. T. A. Innes, Director of the Union Observatory, Johannesburg:—

In a recent issue I see some rather scathing comments because the Sydney Carte-du-Ciel Zone measurements are not being carried out as agreed on many years ago.

Let me ask quite explicitly what scientific or useful object will be served if the plates of the Sydney Zone are measured up and published? It is purely a scientific question which must be answered in the light of our to-day needs and knowledge.

It may be said there is a demand that the Carte-du-Ciel catalogues should be completed; that so much of the catalogue has already been published, efforts to finish it should be made.

But it must never be forgotten that another point of view can now be taken, and I am one of those who take the other point of view. In my opinion, the catalogue is all but useless. It is necessarily founded upon the photographic plates, and as evidence must always be of inferior value to the plates themselves. The exact coordinates of a faint star or of crowds of faint stars are by themselves of no value. It may be urged that the catalogue is a permanent record which can be easily multiplied and distributed. I would prefer a reproduction of the photographs themselves made by some mechanical process.

If the plate constants for such reproductions were known, then it would be quite simple to derive the place of any object on them which may be required. It should be noted that such places are only very occasionally required, and then not for the purposes of stellar astronomy at all, but only because the star has happened to be used as a comparison-star for planets or comets. From this point of view, one feels the want of a good zodiacal catalogue of stars to the 9·3 magnitude. The writer frequently requires the places of such zodiacal stars and finds them often enough in the meridian and/or photographic catalogues. Occasionally no good published place is found, and it then becomes necessary to apply to the Observatory in whose Carte-du-Ciel Zone the star is situated. It is well nigh needless to add that all such requests are most cordially received and implemented. If, now, the plate constants alone are known, it would still be quite simple to measure up the star required and to supply the information *ad hoc*. But why measure hundreds of thousands of stars whose places can never be referred to? The two inventions of the stereocomparator and blink microscope have taken away what little ground ever existed for a photographic catalogue of all the stars.

The ideal would be to have an international depository for Carte-du-Ciel photographs under competent management, which would furnish all information sought, but this is a counsel of perfection, because, as just stated, all Astronomers seem quite willing to supply information and often even to lend the plates themselves.

It is not for the first time that Mr. Innes raises this question. It would be perhaps rather cruel to put him alongside Germany, which shows a similar persistence in raising the question "Who was responsible for the War?" but the world has surely made up its mind about both answers. At the meeting of the International Astronomical Union in Rome in May last, the desirability of completing the Astrographic Catalogue was approved without a dissentient voice. It is true that some of those who undertook the work have been dilatory and some have withdrawn. Such withdrawals are much to be regretted, but they have the advantage of leaving the coast clear for some other worker, and are therefore to be preferred to half-hearted collaboration. Mr. Innes hints that the Sydney Observatory doubts the desirability of continuing the work it undertook more than 30 years ago, with no tangible result up to the present. Does he write with the approval of the Director of that Observatory?

But Mr. Innes, though himself not a participant in the work of the Astrographic Catalogue, considers that the whole question of the making of catalogues is still open for discussion; he thinks the time has come to pull up the plant for examination of its roots. When I had read his letter and was meditating for a few minutes upon it, my eye fell on the newly-arrived volume of Miss Cannon's great catalogue of spectra (19^h and 20^h), which it is such a joy to see marching triumphantly to completion: and I wondered what Mr. Innes would say about it. "Why [record the spectra of] hundreds of thousands of stars whose [spectra] can never be referred to?" Is it fair to adapt a sentence out of his letter thus? And how shall we answer a man of so little faith in the future? Would he in this case also "prefer a reproduction of the photographs themselves made by some mechanical process"? If so, he is surely exceptional, if not unique: most of us are full of gratitude to Harvard Observatory for this "permanent record which can be easily multiplied and [has been so generously] distributed."

Spectra of stars, however, are not positions, and Mr. Innes may complain that the cases are not similar. He says that the ground for cataloguing positions has been cut away by the stereocomparator and the blink microscope: for positions are only a step towards proper-motions. He has himself used these instruments *for large proper motions* to the unstinted admiration of all of us; but the limitation is important. If a proper-motion falls below a certain limit, these differential instruments leave us no record. Perhaps that is going a little too far; they leave a record similar to that of a variable-star observer who can only say "fainter than 13th magnitude" without being able to say how faint. In such cases Mr. Innes has advanced the view that the star has no proper motion at all—as though the variable-star observer should declare that the star had been annihilated because he cannot see it. But he can scarcely expect us to take him seriously. The proper-motion is merely small, and may not declare itself for many years—even until the original plate, and the distributed copies of it (made at considerable expense and trouble, by-the-way, of which Mr. Innes gives no estimate) have faded. Meantime, we presume they may have been "blinked" many times with plates subsequently taken, with on each occasion a null result for the star in question. Direct measurement, on the other hand, would give a series of results the value of which would increase by accumulation. The measurement of subsequent plates need not, of course, be independent—the "film-to-film" method might be used, for instance; but it will still be a convenience to have *one* fairly accurate position recorded to which the differential measures may be referred. The "blink" method cannot ever give us a position at all. It may perhaps be urged that a position can be measured when once a proper motion

is found; but (unless we go back to Mr. Innes's curious idea that many stars have no proper-motion at all, so that these positions will *never* be wanted) there will be no *ultimate* economy, and we might as well have the convenience of the positions from the first. But it is pretty easy to find reasons for not doing things, given certain mental attributes.

The June number of the *Astrophysical Journal* contains another of the remarkable investigations of van Maanen on the proper-motions of the bright condensations of spiral nebulæ, accompanied by one of the pictures with little arrows on them, showing these motions in a clear manner. We have become accustomed by this time to these striking pictures, and perhaps have forgotten in consequence how very wonderful they are; certainly few of us would have ventured half a dozen years ago to hope that the spiral character of the movement, however suggestive its appearance might be, would have been so clearly demonstrated by actual measurements. We probably regarded the nebulæ as too remote to betray their internal arrangements in this way, and indeed we were not far wrong, for van Maanen estimates that they have distances of from 1000 to 10,000 parsecs, and that their periods of rotation are from 60,000 to 240,000 years. Not the least important result of this beautiful work is that it has suggested to Jeans a hypothesis for the origin and development of such systems, which he has applied to the history of our solar system; and it is pleasant to find that van Maanen, who made the measures, expresses his approval of this use to which they have been put.

As Halley Lecturer of 1922 Dr. Jeans gave us a very clear and fascinating account of his hypothesis, which interested, and rather startled, Oxford. The point which especially attracted attention was his suggestion that our solar system, if it originated in the chance near approach of another star to our Sun, must represent a very rare, and possibly unique, occurrence. The idea that our solar system may be unique has thus gained support; but surely this must be an overstatement, for in any case we have to consider the other star, which made the trouble. It could scarcely have escaped an equal fate; so that there must be at least two solar systems, unless some reason to the contrary has been overlooked. Dr. Alfred Russel Wallace tried to claim a unique character for the solar system on account of its being central in the universe, forgetting that such centrality, if it existed, could be but momentary, owing to the movement of the stars. Dr. Jeans has given a very much better suggestion for our being exceptional, but we must not forget that a meeting of two stars is a mutual phenomenon, involving not only consequences to ourselves, but also to the other fellow.