by Mrs. George Quish; a Gannet (*Sula bassana*), British, presented by Mr. J. H. Gurney, F.Z.S.; two Common Chameleons (*Chamæleon vulgaris*) from North Africa, presented respectively by Mr. Charles T. Port, F.Z.S., and Mr. T. H. Carlton Levick; a Common Viper (*Vipera berus*), British, presented by Mr. W. H. B. Pain; a Porto Rico Pigeon (*Columba corensis*), a Triangular-spotted Pigeon (*Columba guinea*), bred in the Gardens.

OUR ASTRONOMICAL COLUMN

M. Thollon's Map of the Solar Spectrum.—M. Thollon, in the *Bulletin Astronomique* for July, gives some interesting details concerning the great map of the solar spectrum which he presented to the Paris Academy of Sciences about a year ago. He had completed an earlier design in 1879, but the positions of the lines in it had not been determined with the precision he desired. He therefore resolved to go over the work again, and to make a chart which should represent the positions, breadths, and relative intensities of the lines as faithfully as possible. The work has required four years of continuous toil to carry it from A to *b*, at which point M. Thollon now leaves it. M. Trépied proposes to carry it on to the violet. M. Thollon's map shows the spectrum under four different aspects: as seen when the sun is 10° high, and the air contains but little water-vapour; then as with the sun at 30° of altitude, first with the air saturated with water-vapour, and next when the air is very dry; and, lastly, the solar spectrum as it would be seen outside our atmosphere. It is therefore easy to see which lines are truly solar, which due to water-vapour in our atmosphere, and which to dry air. M. Thollon finds the dry-air lines limited to the great groups A, B, and *a*, which M. Egoroff ascribes to oxygen. Besides the water lines, which are arranged in seven groups, M. Thollon on a single occasion observed a vast number of telluric lines between *a* and D, the special origin of which he was not able to determine.

The measures were made with a very fine glass pointer, which allowed a bisection of a line to be made with great exactness, the probable error of an observation being less than 1/700 of the interval between the D lines. The breadth of a line was determined by observing at what distance from its extreme point, the glass pointer was equal to it in breadth. The intensity of the lines were estimated by eye. The map, which will be published in the *Annales de l'Observatoire de Nice*, is more than 33 feet in length, and embraces more than a third of the visible spectrum. From the scale on which it is drawn, the number of lines—about 3200—which it contains, the precision of the measures, and the fullness of the information given concerning the telluric lines, it will be, that which its author has striven to make it, the fullest and most perfect chart of the spectrum yet published. One of the chief purposes which it will serve will be to afford information as to the occurrence of changes in the spectrum, and M. Thollon shows by a diagram of the spectrum between B and C that we have strong reason to suspect that several lines have greatly altered in intensity since the date of Ångström's famous chart.

Comet Finlay.—Mr. Finlay, of the Cape of Good Hope Observatory, discovered a comet on September 26. It appears to be probably identical with Comet 1844 I., its elements being given by Dr. Holetschek as follows:—

T = 1886 Nov. 22·6821 Berlin Mean Time.

$\pi - \Omega$ = 299° 14′ 21″
Ω = 48 35 55 } Mean Eq. 1886·0.
i = 3 23 0
log q = 0·08793

Ephemeris for Berlin Midnight

1886	R.A.	Decl.	Log Δ	Log r	Brightness
	h. m. s.	° ′			
Oct. 19	18 8 10	26 40·2 S.	0·1442	0·1249	1·37
23	18 21 52	26 33·9	0·1410	0·1173	1·44
27	18 36 11	26 22·2	0·1378	0·1105	1·50
31	18 51 6	26 4·7 S.	0·1347	0·1044	1·57

The brightness on September 26 is taken as unity.

New Minor Planet.—A new minor planet, No. 260, was discovered by Herr Palisa at Vienna on October 3.

New Comet.—A new comet was discovered by Mr. E. E. Barnard on October 4. It was independently observed by Dr. Hartwig on the following night. October 5, 16h. 2m. G.M.T., R.A. 10h. 37m. 24s.; Decl. 1° 3′ N. It is described as bright and round. Daily motion + 1·5s. in R.A., and + 3′ in Decl.

The Pulkowa Observatory.—M. Struve has issued his Annual Report for the year ending May 25, 1886. During the year the fundamental determinations of star places for 1885·0 were regularly persevered in with the great transit instrument and the vertical circle. With the former Herr Wagner and his assistants, Wittram and Harzer, observed 4785 transits. With the exception of 110 observations of the sun these refer exclusively to the 383 Pulkowa fundamental stars. With the vertical circle Herr Nyrén obtained 739 complete observations, including 105 observations of the sun. The fundamental declination determinations for 1885 would be almost completed, had not Herr Nyrén wished to repeat the observations with a reversion-prism eye-piece attached to the instrument in order to investigate certain systematic discordances. Herr Romberg, observing with the meridian-circle, obtained during the year 4359 observations, chiefly of stars with large proper motion, comet stars, &c. The great 30-inch refractor has been intrusted to Hermann Struve, and has been employed in observing the fainter double stars of Burnham's catalogues, the satellites of Mars, Saturn, and Neptune, the Maja nebula (discovered photographically at Paris), and *Nova* Andromedæ, which was easily visible on January 27. M. Struve speaks in terms of the highest approval of the instrument, both as regards its optical power and as regards the mounting, the movement of the dome, &c. The 15-inch refractor has been used by H. Struve for obtaining micrometer measures of the brighter satellites of Saturn. He has obtained 42 comparisons of Japetus with Titan, 40 of Titan with Rhea, and 23 of Rhea with Dione. Herr Backlund has continued in charge of the 4-inch heliometer, and has measured with it the relative positions of Jupiter's satellites, for a determination of the mass of Jupiter, and of the orbits of the satellites. He has also undertaken a series of measures to determine the parallax of Bradley 3077, which has a large proper motion. In the physical department of the Observatory Herr Hasselberg, using a Steinheil objective of 50 mm. aperture and 1·5 m. focal length, in combination with two bisulphide of carbon prisms, has succeeded in obtaining excellent photographic images of the solar spectrum. Between wave-lengths 4000 to 4227 on Ångström's scale, he was able to count some 650 lines, whereas Vogel's map gives but 450 in the same space. During the course of the year 140 sun pictures were taken on 110 days.

ASTRONOMICAL PHENOMENA FOR THE WEEK 1886 *OCTOBER* 17–23

(For the reckoning of time the civil day, commencing at Greenwich mean midnight, counting the hours on to 24, is here employed.)

At Greenwich on October 17

Sun rises, 6h. 29m.; souths, 11h. 45m. 24·2s.; sets, 17h. 2m.; decl. on meridian, 9° 20′ S.: Sidereal Time at Sunset, 18h. 46m.

Moon (at Last Quarter on October 20) rises, 19h. 15m.*; souths, 2h. 55m.; sets, 10h. 42m.; decl. on meridian, 16° 55′ N.

Planet	Rises	Souths	Sets	Decl. on meridian
	h. m.	h. m.	h. m.	° ′
Mercury ...	7 46 ...	12 34 ...	17 22 ...	14 33 S.
Venus	5 18 ...	11 4 ...	16 50 ...	3 32 S.
Mars	10 45 ...	14 43 ...	18 41 ...	22 45 S.
Jupiter... ...	5 52 ...	11 25 ...	16 58 ...	6 3 S.
Saturn... ...	21 51* ...	5 53 ...	13 55 ...	21 19 N.

* Indicates that the rising is that of the preceding evening.

Occultations of Stars by the Moon (visible at Greenwich)

Oct.	Star	Mag.	Disap.	Reap.	Corresponding angles from vertex to right for inverted image
			h. m.	h. m.	° °
17 ...	111 Tauri	... 5½ ...	19 24 ...	20 14 ...	69 240
17 ...	117 Tauri	... 6 ...	21 9 ...	21 17 ...	339 322
23 ...	B.A.C. 3538	... 6½ ...	0 53 ...	1 23 ...	348 274
23 ...	44 Leonis...	... 6 ...	2 6 ...	2 38 ...	344 271
23 ...	B.A.C. 3562	... 6½ ...	2 14 ...	2 49 ...	347 268

Oct.	h.	
20 ...	7 ...	Saturn in conjunction with and 3° 16′ north of the Moon.
21 ...	4 ...	Mercury at greatest distance from the Sun.
22 ...	21 ...	Venus in conjunction with and 0° 18′ north of Jupiter.

Variable Stars

Star	R.A. h. m.	Decl. ° ′		h. m.	
U Cephei	0 52·2	81 16 N.	Oct. 19,	5 11	*m*
R Sculptoris ...	1 21·7	33 8 S.	,, 22,		*M*
Algol	3 0·8	40 31 N.	,, 19,	5 25	*m*
			,, 22,	2 14	*m*
λ Tauri	3 54·4	12 10 N.	,, 18,	0 46	*m*
			,, 21,	23 38	*m*
R Canis Minoris...	7 2·4	10 12 S.	,, 21,		*M*
S Cancri	8 37·4	19 27 N.	,, 21,	4 38	*m*
U Ophiuchi	17 10·8	1 20 N.	,, 18,	4 25	*m*
		and at intervals of		20 8	
β Lyræ...	18 45·9	33 14 N.	Oct. 18,	0 0	*m*
			,, 21,	5 0	*M*
η Aquilæ	19 46·7	0 43 N.	,, 19,	2 0	*M*
			,, 23,	21 30	*m*
δ Cephei	22 24·9	57 50 N.	,, 18,	2 0	*m*

M signifies maximum ; *m* minimum.

Meteor Notes

There are a large number of active radiants visible during the present week, the chief shower being the *Orionids*, R.A. 90°, Decl. 15° N. Other radiants are that of the *Arietids*, R.A. 31°, Decl. 9° N. ; near ψ Aurigæ, R.A. 78°, Decl. 32° N. ; that of the *Gemellids*, R.A. 108°, Decl. 24° N. ; near μ Leonis, R.A. 143°, Decl. 28° N. ; and near Vega, R.A. 283°, Decl. 43° N. October 18 is a fireball date.

THE NEW ELEMENT, GERMANIUM[1]

SOME months ago Dr. Clemens Winkler announced the discovery of a new element which he named germanium, a preliminary account of which has already appeared in these columns. Dr. Winkler has since been able to make a more systematic examination of the subject, and he now describes in detail the preparation and properties of the new element and also of a number of its compounds. The view he first held, that germanium occupied a position in the periodic system intermediate between antimony and bismuth, he now shows to be untenable, there being now no doubt that it is the *ekasilicium* of Mendelejeff prophesied fifteen years ago. This latter view was, in fact, expressed by Richter, Mendelejeff, and Lothar Meyer shortly after the discovery of germanium.

The new element occurs, as previously stated, in the recently-discovered mineral, argyrodite. Its isolation is, however, difficult, especially from the presence of arsenic and antimony in minerals which accompany argyrodite. The formula assigned to the latter mineral is $3Ag_2S,GeS_2$.

The following is the best method for separating the germanium. The finely-powdered mineral is intimately mixed with an equal weight of soda and sulphur, and the whole submitted to the action of a moderate red heat in a Hessian crucible. The product is powdered whilst still warm, and repeatedly boiled with water; the aqueous extract is slightly acidulated with sulphuric acid, and the precipitated sulphides of arsenic and antimony allowed to settle. On then adding a considerable excess of hydrochloric acid, the germanium sulphide is thrown down as a white voluminous precipitate ; this is gently roasted, then heated with concentrated nitric acid, and finally ignited. The germanium oxide obtained may be reduced by ignition in hydrogen.

Germanium has a melting-point apparently somewhat lower than that of silver—that is, about 900°—and at a temperature a little higher than this it appears to volatilise. It crystallises in octahedra, is extremely brittle, has a perfect metallic lustre, and a grayish-white colour ; its specific gravity is 5·469 at 20°·4. It is insoluble in hydrochloric acid, is readily dissolved by aqua regia, is converted into a white oxide by nitric acid, and into a soluble sulphate by concentrated sulphuric acid.

Determinations of the atomic weight of germanium were made by estimating the percentage of chlorine in the chloride, $GeCl_4$, and the number 72·32 was obtained as the mean of four experiments, this number agreeing closely with the atomic weight of Mendelejeff's ekasilicium.

The specific heat of the new element has been determined by Nilson and Pettersson, at temperatures between 100° and 440°, with the following results :—

	1	2	3	4
Specific heat ...	0·0737	0·0772	0·0768	0·0757
Atomic heat ...	5·33	5·58	5·55	5·47

Compounds of Germanium.—Oxides : There are two oxides of germanium, namely, GeO and GeO_2. The former is obtained in the hydrated condition by heating the corresponding chloride ($GeCl_2$) with sodium carbonate solution ; on heating the precipitate in a current of carbonic anhydride, the water is expelled and the grayish-black oxide, GeO, remains. The higher oxide is obtained by burning germanium in oxygen, or by decomposing the chloride, $GeCl_4$, by water ; it forms a dense white powder slightly soluble in water, possesses both basic and acid properties, the latter being, however, the more pronounced. *Sulphides:* Two of these are likewise known, corresponding to the oxides. The lower sulphide, GeS, is obtained from the disulphide either by heating it with an excess of germanium in a current of carbonic anhydride, or by gently igniting it in a current of hydrogen ; it forms beautiful thin plates of almost metallic lustre and having a gray-black colour. Germanium disulphide, GeS_2, is obtained by precipitating a solution of the dioxide by sulphuretted hydrogen with the addition of a considerable excess of a mineral acid ; it is then thrown down as a bulky white precipitate which is very appreciably soluble in water. *Chlorides :* The dichloride, $GeCl_2$, is formed when hydrochloric acid gas is passed over heated pulverulent germanium or its sulphide ; it is a thin colourless liquid, which fumes strongly on exposure to the air. The tetrachloride, $GeCl_4$, is produced by burning germanium in chlorine, or by distilling a mixture of germanium with mercuric chloride ; it is a thin colourless liquid boiling at 86° C. and fuming in the air ; its specific gravity at 18° is 1·887. *Iodide :* A tetriodide, GeI_4, only is known, and is best obtained by heating germanium in iodine vapour ; it forms a yellow powder, melts at 144°, and boils between 350° and 400°.

[1] Clemens Winkler, *Journal f. prakt. Chemie*, 1886, pp. 177-229.

AUSTRALASIA

THE following have been quite recently received from Australasia :—

Transactions and Proceedings of the New Zealand Institute for 1885, vol. xviii. (first of new series) (Wellington, May 1886). This volume commences a new series of these well-known *Transactions*, in which, "for convenience and economy" the size of the page has been reduced from the handsome royal octavo to a demy octavo size. The volume contains over 450 pages, and some 17 plates. Among the more important contributions which are printed in the *Transactions* may be noted the following :—*Miscellaneous :* E. Tregear, the Maori in Asia.—Dr. J. Haast, stone weapons of the Moriori and the Maori.—Rev. S. W. Baker, new volcano in the Friendly Islands.—*Zoology :* T. Jeffery Parker, skeleton of Notornis.—T. White, feathers of two species of Moa.—A. Reischek, numerous papers on New Zealand birds.—W. Colenso, on the bones of a new species of Sphenodon.—W. W. Smith, on the habits of *Ocydromus australis*.—J. W. Kirk, on a new species of Argonauta.—Geo. M. Thomson and Chas. Chilton, critical list of New Zealand Crustacea Malacostraca.—E. Meyrick, New Zealand Micro-Lepidoptera (Tineina, Pars.).—A. T. Urquhart, on the spiders of New Zealand (many new species described and figured).—J. W. Kirk, on some species of Vorticella from Wellington describes thirteen species, of which two are given as new, and figured.—*Botany :* W. Colenso, on some newly-discovered cryptogamic plants of New Zealand, describes some fifty-nine species ; two ferns, fourteen mosses, and forty-three Hepaticæ, and hints that it may be the last lot of novelties that, owing to age, he may himself collect and describe.—On some new or rare native plants, chiefly phanerogams ; on *Clianthus puniceus*, Sol.—D. Petrie, on new species of native plants.—R. M. Lang, on classification of Algæ, and on the Fucoids of Banks Peninsula.—T. F. Cheeseman, three new species of Coprosma.—T. Kirk, additions to the flora of Nelson.—*Geology :* Capt. F. W. Hutton, the geology of Scinde Island ; new Tertiary shells ; the Wanganui system, with a catalogue of the Mollusca.—A. McKay, on the age of the Napier limestone.—*Astronomy :* Notes on the total eclipse of the sun of September 9, 1885, being a digest of many communications.—*Chemistry :* W. Skey, on a new mineral (awaruite) from Barn Bay.—W. S. Hamilton, on platinum crystals in the ironsands of Orepuki Goldfield.

Proceedings of the Linnean Society of New South Wales, vol. x. part 4, with 18 plates (Sydney, April 1886).—Dr. R. von