OUR ASTRONOMICAL COLUMN.

Melbourne Observatory.—The Annual Report of this Observatory, dated August 14, 1887, states that the buildings and equipment of the Observatory were in good condition with the exception of the mirrors of the great Cassegrain reflector, which had become so dull as materially to interfere with the observation of the fainter nebulæ. It was proposed to substitute mirror A, the less tarnished of the two, for mirror B, now in the telescope, and either to have B repolished on the spot or to send it to Dublin to be re-polished under the care of Sir H. Grubb. The new transit circle was in excellent order, and 2487 right ascensions and 1301 polar distances had been observed during the year. Eighty-seven southern nebulæ had been examined with the great reflector, and four searched for, but not found. The use of the photo-heliograph, which had been altered in July 1886, so as to take pictures on a scale of 8 inches to the solar diameter, had been much interfered with by bad weather, and only 121 photographs had been secured. The principal fresh work proposed for the Observatory was the co-operation in the photographic survey of the heavens; the Victorian Government having consented to the Observatory joining in that undertaking, and having placed £1000 on the estimates of the current year towards the necessary expenditure.

The American Nautical Almanac Office.—The Report of Prof. Newcomb, Superintendent of the Office, for the year ending 1887 June 30 has recently appeared. From this we learn that the printing of the several Nautical Almanacs published by the Office fell a little into arrear in 1887, the printing of the American Ephemeris for 1890, which should, according to custom, have appeared in June, not being quite ready in October. The computations for the following years were in their usual state of forwardness. The principal part of the Report deals with the new tables of the planets on which Prof. Newcomb and his assistants are engaged. The work is divided into four sections—viz.: (I.) The computation of the general perturbations of the planets, the work now in hand relating to those of the four inner planets; on twelve of the fourteen pairs of planets which come into play in this part of the undertaking, the work has already been completed. The incomplete perturbations are those of Venus and Mars by Jupiter. (II.) The re-reduction of the older observations, and discussion of the later ones, with a view of reducing them all to a uniform system. In this section Maskelyne's Greenwich observations from 1765 to 1811, and Bradley's, 1750 to 1762, have been already reduced, the latter by Dr. Auwers. Airy's Greenwich observations, the Paris observations from 1800 as reduced by Leverrier, and Bessel's Königsberg observations, will need no discussion except that necessary to reduce them to the adopted standard system. The re-reduction of Piazzi's Palermo observations, 1791–1813, is in hand, but it is not yet decided as to whether Taylor's Madras observations should be included. (III.) The computation of tabular places of the planets from Leverrier's tables up to the year 1864—the most laborious and difficult part of the work—is in a fairly advanced state. (IV.) The final discussion of the results. Prof. Newcomb estimates that the equations of condition for correcting the elements of the four inner planets will be ready for solution towards the end of 1889, but they will involve extended discussion and comparison in order to get the results in the final form for publication. Of the work on the four outer planets, Uranus and Neptune are yet untouched; but Mr. Hill's new theory of Jupiter and Saturn is in the hands of the printer, and Mr. Hill is now engaged in the construction of the tables and ephemerides for finally correcting their elements. In connection with the lunar theory, the principal work on hand is the comparison of Hansen's tables with observed occultations since 1750. Another branch of the planetary work is the determination of the mass of Jupiter from the motions of Polyhymnia: the perturbations of the planet have been computed from its discovery in 1850 to October 1888, and the work awaits the observations during the approaching opposition to be brought to a final discussion.

ASTRONOMICAL PHENOMENA FOR THE WEEK 1888 *FEBRUARY* 19–25.

(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 February 19

Sun rises, 7h. 9m.; souths, 12h. 14m. 6·2s.; sets, 17h. 19m.: right asc. on meridian, 22h. 9·7m.; decl. 11° 22′ S. Sidereal Time at Sunset, 3h. 15m.

Moon (at First Quarter February 20, 2h.) rises, 10h. 25m.; souths, 17h. 46m.; sets, 1h. 18m.*: right asc. on meridian, 3h. 42·8m.; decl. 14° 34′ N.

Planet.	Rises.	Souths.	Sets.	Right asc. and declination on meridian.	
	h. m.	h. m.	h. m.	h. m.	° ′
Mercury..	7 29 ...	13 17 ...	19 5 ...	23 13·3 ...	3 7 S.
Venus.....	5 39 ...	9 49 ...	13 59 ...	19 44·5 ...	20 46 S.
Mars......	22 38*...	3 57 ...	9 16 ...	13 51·7 ...	8 43 S.
Jupiter....	2 3 ...	6 17 ...	10 31 ...	16 12·1 ...	20 12 S.
Saturn....	14 20 ...	22 16 ...	6 12*...	8 13·4 ...	20 29 N.
Uranus...	21 36*...	3 9 ...	8 42 ...	13 3·3 ...	6 0 S.
Neptune..	10 5 ...	17 45 ..	1 25*...	3 41·7 ...	17 56 N.

* Indicates that the rising is that of the preceding evening and the setting that of the following morning.

Occultations of Stars by the Moon (visible at Greenwich).

Feb.	Star.	Mag.	Disap.	Reap.	Corresponding angles from vertex to right for inverted image.	
			h. m.	h. m.	°	°
20 ...	Aldebaran	... 1 ...	15 56	near approach	346	—
21 ...	119 Tauri...	... 5½ ...	19 10	near approach	7	—
24 ...	*d′* Cancri ...	... 6 ...	21 30 ...	22 28 ...	112	226

Feb.	h.	
23 ...	1 ...	Mercury stationary.
24 ...	20 ...	Saturn in conjunction with and 1° 22′ north of the Moon.

Variable Stars.

Star.	R.A.	Decl.			
	h. m.	° ′			h. m.
U Cephei	0 52·4 ...	81 16 N. ...	Feb. 19,	19 38	*m*
			,, 24,	19 17	*m*
R Arietis	2 9·8 ...	24 32 N. ...	, 22,		*M*
R Tauri	4 22·2 ...	9 55 N. ...	,, 21,		*M*
R Leporis	4 54·5 ...	14 59 S. ...	,, 23,		*M*
R Canis Majoris...	7 14·5 ...	16 12 S. ...	,, 21,	20 26	*m*
			,, 22,	23 42	*m*
δ Libræ	14 55·0 ...	8 4 S. ..	,, 22,	1 58	*m*
U Coronæ	15 13·6 ...	32 3 N. ...	,, 21,	21 51	*m*
U Ophiuchi	17 10·9 ...	1 20 N. ...	,, 19,	3 2	*m*
		and at intervals of		20 8	
X Sagittarii	17 40·5 ..	27 47 S. ...	Feb. 19,	2 0	*M*
W Sagittarii ...	17 57·9 ...	29 35 S. ...	,, 19,	4 0	*M*
Z Sagittarii... ...	18 14·8 ...	18 55 S. ...	,, 25,	1 0	*M*
β Lyræ...	18 46·0 ...	33 14 N. ...	,, 24,	0 0	*M*
S Sagittarii	19 12·9 ...	19 14 S. ...	,, 24,		*M*
δ Cephei	22 25·0 ...	57 51 N. ...	,, 20,	2 0	*M*
			,, 23,	20 0	*m*

M signifies maximum; *m* minimum.

Meteor-Showers.

	R.A.	Decl.	
Near β Trianguli... ...	30° ...	35° N. ...	February 24.
From Canes Venatici...	181 ...	34 N. ...	February 20.
Near δ Serpentis	234 ...	11 N. ...	Swift; streaks.
,, π Herculis	262 ...	36 N. ..	Feb. 20. Swift.

GEOGRAPHICAL NOTES.

At Monday's meeting of the Royal Geographical Society, the paper read was by Mr. Randle F. Holme, on Labrador, which he visited in July–October of last year. Mr. Holme succeeded in penetrating into the heart of Southern Labrador, as far as Lake Waminikapou, and not far from the Grand Falls, which Mr. Holme believes will turn out to be the greatest falls in the world; but, as General Strachey pointed out in the discussion, Mr. Holme's conception of the height is probably exaggerated. Mr. Holme went from Newfoundland to Bonne Espérance on the south-east coast of Labrador, and sailing northwards touched at several points, proceeding up Hamilton Inlet and the Grand River, to the point mentioned above. Mr. Holme found many difficulties in the way, and much of the country he visited was virtually unexplored. With regard to the height of the Grand Falls, Mr. Holme states that the centre of Labrador, as is generally known, is a vast tableland, the limits of which are clearly defined, though of course the country intervening between this limit and the coast always consists, more or less, of a slope. Roughly speaking, it may be said that in the south and north there is a more or less gradual slope from the height of land to the coast, while in the south-east the descent is sudden, and almost immediately after leaving the tableland there is reached a level which is but little above that of the sea. In the north-east portion the edge of the tableland approaches nearest to the coast, while it trends considerably to the west in the rear of Hamilton Inlet. The most fertile part of the country is that which lies between the tableland and the sterile belt on the coast, though the height of land itself is by no means a desert. On the height of land there is found a succession of great lakes joined together by broad placid streams. When the streams of water reach the edge of the tableland, they of course commence a wild career down towards the sea. In the case of the Grand River this rapid descent commences with the Grand Falls, and almost the whole of the great drop to the sea-level is effected in the one waterfall. The elevation of the Labrador tableland is given by Prof. Hind as 2240 feet. From this height the Moisie and Cold Water Rivers descend to the sea by means of a considerable number of falls. But in the Grand River below Lake Waminikapou there is only one fall, viz. that which occurs 25 miles from the river-mouth. This fall is 70 feet. It is true that the whole of the river from Lake Waminikapou to the First Falls is rapid, but there is no place where there is any considerable drop, and indeed no place where it is necessary to take the boat out of the water. Now the lake first above the Grand Falls is on the height of land. In the channels joining the various lakes above the falls there are no rapids and there is scarcely any stream. It therefore follows, assuming the elevation of the tableland on the east to be approximate to that on the south, that in the 30 miles beginning with the Grand Falls and ending with Lake Waminikapou, there is a drop of about 2000 feet. Some of this drop is probably effected by the rapids immediately below the falls, but the greater part is no doubt made by the fall itself. The river is said by Maclean to be 500 yards broad above the falls, contracting to 50 yards at the falls themselves. The interior of the country Mr. Holme found was richly wooded, and the climate mild, though the plague of flies and mosquitoes was almost intolerable. The few Indians who inhabit Labrador belong mostly to the Cree nation, and according to Mr. Holme are probably perfectly unmixed with either whites or Eskimo. As an agricultural or pastoral country Mr. Holme thinks Labrador has no future, though something may be made of its iron, of the existence of which strong indications exist. Mr. Holme's observations have enabled us greatly to improve our maps of Labrador, and the photographs he brought home give an excellent idea of the general character of the country.

OUR ELECTRICAL COLUMN.

SOME very interesting and remarkable trials of the transmission of energy were recently made between Kriegstetten and Solothurn in Switzerland, by Prof. H. F. Weber and others, when it was found that 30 horse-power put in at the first place delivered 23 horse-power at the other, 8 kilometres away—showing an efficiency of 75 per cent. The current, 11 amperes, driven under an E.M.F. of 2000 volts, showed absolutely no loss whatever, owing to the use of Johnson and Phillips' "oil" insulators. This mode of insulation proved absolutely perfect.

THE distribution of electricity for lighting purposes by means of secondary generators, is now being discussed at the Society of Electrical Engineers. This mode of working seems to have solved the question of the economical erection of conductors. Alternate currents of high tension in the main conductors allow wires of small diameter to be used, and a special form of induction coil transforms these currents of high tension, 2000 volts, to currents of low tension, 100 volts and under, for use in private houses. The system, due to Messrs. Gaulard and Gibbs, is in use at the Grosvenor Gallery installation, as well as at Eastbourne and Brighton, and is probably going to be largely used. Mr. Kapp's paper "On Alternate Current Transformers, with Special Reference to the Best Proportion between Iron and Copper," will lead to an interesting discussion. All induction coils, when used as transformers, are simply a magnetic circuit or closed iron core interlaced with an electric circuit or a closed copper core, and constructed so that the electric circuit shall embrace as many as possible of the lines of force of the magnetic circuit. Mr. Kapp divides transformers into two classes—one in which the copper coils are spread over the surface of the iron core as in a Gramme armature, and the other in which the iron core is spread over the surface of the copper coil. The former he calls "core transformers," and the latter "shell transformers." He advocates working transformers at low inductions—that is, far below the point of saturation of iron—because it increases the plant-efficiency, reduces the heat or energy lost in the iron core through hysteresis, and prevents the production of sound. The plant-efficiency of transformers sometimes reaches as high as 99 per cent., and they are perfectly self-regulating. There is very little choice between core- and shell-transformers, but the former have the advantage. Economy in construction and facility in manufacture and repair seem to be principal points of advantage to reach. It is amusing to find how, now that the system has proved to be practical, every man is devising his own transformer, and labouring to show that Gaulard and Gibbs were not the inventors of the system, and that their transformers are not the best.

PROF. EWING's discovery of hysteresis in iron has been shown, both by Kapp and Ferrari, to play a very significant figure in the efficiency of transformers.

GUGLIELMO, of Turin, has shown that no loss of electricity takes place through moist air surrounding an aërial wire unless the E.M.F. exceeds 600 volts, after which the leakage increases with the E.M.F. and the saturation of the air.

IN Boston an electric lamp has recently been used to search for a body drowned in the harbour. The U.S. steamship *Albatross* is furnished with a full complement of lamps for fishing. The glow-lamp is encased in a wire netting, which acts as a trap. The fish, being attracted by the light, swarm into the net, which is then closed and pulled in.

THE new number just issued (No. 201) of the Proceedings of the Royal Society contains the following electrical papers: "On the Photometry of the Glow-lamp," by Captain Abney and General Festing; "On the Development of Feeble Currents," by Dr. Alder Wright and Mr. C. Thompson; and "On the Heating-Effects of Electric Currents," by Mr. Preece.

MAKING GLASS SPECULA BY HAND.[1]

THE author of this paper gives a very interesting account of the construction of glass specula, discusses the actual difference in form between a spherical and a parabolic mirror, and gives an account of some experiments to determine the thickness of the silver film. In making the specula Mr. Madsen used glass for the grinding tool in place of metal, as he considered that the coefficient of expansion of iron and glass being different, greater truth would be obtained by the use of the same material for the tool, thus following the practice of Foucault and of the French opticians of the present day. When a true spherical surface was thus obtained the polish was given by rouge on pitch with a tool the same size as the mirror, and the correction of the spherical curve was obtained by a very ingenious plan of graduating the polisher in such a way that the greatest action would be on the required part of the mirror, the arrangement of the squares of pitch being such as to prevent the occurrence of rings of unequal polish. In this Mr. Madsen seems to have been most successful.

In working, the mirror was uppermost, and this is a very important point in many respects. There is no doubt that in working this way the mirror is in the condition of least strain, and if it were possible this plan should always be followed, but it is absolutely impossible to do this with a mirror much larger than the size he worked, which might almost be taken as the limiting size of mirror possible with this method of working. Short, Mudge, Herschel, and all the early workers used this plan in making their comparatively small mirrors; but since, with larger sizes, the mirrors have been worked face upwards as the only possible way, and it is to be regretted that this plan was not followed.

In discussing the actual amount of the glass to be abraded to obtain the correction, the author finds that for telescopes where the focal length exceeds twentytimes their diameter this amount is

[1] "Notes on the Process of polishing and figuring 13-inch Glass Specula by Hand, and Experiments with Flat Surfaces," by H. F. Madsen. (Journal and Proceedings of the Royal Society of New South Wales, vol. xx., 1886, pp. 79-91).