ASTRONOMICAL PHOTOGRAPHY.—The *New Princeton Review* for May 1887 contains an interesting article, by Prof. C. A. Young, with the above title. The article is, of course, of quite a popular character, but none the less is it deserving of perusal by astronomers—professional as well as amateur. In a rapid survey of the history of astronomical photography, Prof. Young refers briefly to the labours of J. W. Draper, Bond, Rutherfurd, Gould, Henry Draper, and Pickering, in America; of De la Rue, Common, and Roberts, in England; of the Brothers Henry, in France; of Vogel, in Germany; and of Gill, in South Africa. He then goes on to discuss the relative advantages and disavantages attending the employment of the reflector and of the refractor respectively in this particular department of astronomical science; pointing out, in the case of the refractor, the two directions in which, at the present time, efforts are being made to overcome the difficulties arising from the want of perfect achromatism of the object-glass, viz. Prof. Abbe's researches on the production of glass which shall be perfectly achromatic, and Herr Vogel's investigations on a new sensitizing medium which may be as sensitive to the yellow and green rays as the salts of silver are to the violet rays. In the remaining portion of the article Prof. Young distinguishes two classes of astronomical photographs: those in which the end is to produce a *picture* of the object; and those which are made for purposes of *measurement*, and the determination of precise numerical data. He gives various examples of each class, with a brief account of the progress which has been made in solar, lunar, planetary, stellar, and nebular photography, as thus classified, concluding with an account of the very remarkable results which have recently been obtained by Prof. Pickering in the photography of stellar spectra.

COMET 1887 *e* (BARNARD, MAY 12).—Dr. H. Oppenheim (*Astron. Nachr.* No. 278) has computed the following elements and ephemeris of this comet from an observation made at Cambridge, U.S., on May 12, and from two others made at Rome on the 15th and 17th:—

T = 1887 June 24·5559 Berlin M.T.

$$\left.\begin{aligned}\pi - ☊ &= 24^\circ\ 21'\ 30''\\ ☊ &= 244\ \ 54\ \ 32\\ \iota &= 17\ \ \ 9\ \ 21\end{aligned}\right\}\text{Mean Eq. 1887·0.}$$

$\log q = 0·11510$

Ephemeris for Berlin Midnight.

1887.	R.A. h. m. s.	Decl. ° ′	Log Δ.	Log *r*.	Brightness.
June 1	15 49 55	16 12·3 S.	9·5323	0·1299	2·0
5	16 0 2	12 19·1	9·5185	0·1253	2·2
9	16 10 46	8 17·1	9·5097	0·1216	2·3
13	16 22 1	4 13·9	9·5062	0·1186	2·4

The brightness on May 12 is taken as unity.

ASTRONOMICAL PHENOMENA FOR THE WEEK 1887 JUNE 5-11.

(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 June 5.

Sun rises, 3h. 48m.; souths, 11h. 58m. 10·2s.; sets, 20h. 8m.; decl. on meridian, 22° 33′ N.: Sidereal Time at Sunset, 13h. 4m.

Moon (Full on June 5) rises, 19h. 31m.; souths, 0h. 4m.*; sets, 4h. 32m.*; decl. on meridian, 18° 7′ S.

Planet.	Rises. h. m.	Souths. h. m.	Sets. h. m.	Decl. on meridian. ° ′
Mercury ...	4 15	12 44	21 13	25 6 N.
Venus ...	6 47	15 1	23 15	23 8 N.
Mars ...	3 14	11 15	19 16	21 13 N.
Jupiter ...	15 26	20 44	2 2*	8 56 S.
Saturn ...	6 29	14 35	22 41	21 56 N.

* Indicates that the southing and setting are those of the following morning.

Variable Stars.

Star.	R.A. h. m.	Decl. ° ′		h. m.	
U Cephei ...	0 52·3	81 16 N.	June 8,	1 16	*m*
δ Libræ ...	14 54·9	8 4 S.	,, 11,	1 52	*m*
U Coronæ ...	15 13·6	32 4 N.	,, 7,	23 48	*m*
W Scorpii ...	16 5·2	19 51 S.	,, 7,		*M*
U Ophiuchi ...	17 10·8	1 20 N.	,, 10,	0 14	*m*

M signifies maximum; *m* minimum.

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

June.	Star.	Mag.	Disap. h. m.	Reap. h. m.	Corresponding angles from vertex to right for inverted image. ° °
5	29 Ophiuchi	6	20 52	21 59	60 224
6	B.A.C. 6081	6	20 40	21 39	20 258
10	45 Capricorni	6	23 49	0 53†	42 275
10	44 Capricorni	6	23 58	near approach	156 —

† Occurs on the following morning.

Saturn, June 5.—Outer major axis of outer ring = 38″·1; outer minor axis of outer ring = 15″·2; southern surface visible.

Meteor-Showers.

	R.A. °	Decl. °	
Near Antares ...	249	20 S.	
β Ophiuchi ...	261	5 N.	Rather slow.

GEOGRAPHICAL NOTES.

THE Expedition which went out to explore the New Siberian Islands, has returned to St. Petersburg with interesting results. The Expedition was organized by the Academy of Science, St. Petersburg, 26,000 roubles being contributed by the Emperor Alexander. Operations commenced in 1885, and considerable preparations had to be made. A winter retreat was chosen in the district of Kasachje (under 71° N. lat.), 30 kilometres south of Ustjansk at the mouth of the Jana. About 270 kilometres distant from Kasachje, were discovered the remains of a mammoth. At the end of March 1886, Dr. Bunge left for the Swatoinoss Mountains, where the real march with 240 dogs was to begin; 19 sledges drawn by 12 dogs, led the expedition over the frozen sea. In the latter half of April, the Jakutes returned with the sledges, and reported that the journey had been successfully accomplished. Dr. Bunge devoted his attention in particular to the Liachow Island, while Baron Toll attempted not only Kotelni Island, but also the Island of New Siberia. In May both explorers were at the Medweshi foothills, to the south of Kotelni Island. Liachow Island has a very uniform but rough appearance; it is 300 kilometres in circumference, the surface being uneven and hilly. The prevailing winds are east and west. The latter is extraordinarily violent, and works great mischief; it brings first rain, and then frost. Winter retires about the beginning of June, although the summer is never quite free from snow, mist, storms, &c. Enormous masses of perpetual ice inclose the island; only once could Dr. Bunge make a sea passage free from ice. In clear weather, looking northwards from Kotelni Island land is visible, which appears to be only 150 kilometres distant. The possibility of reaching this land is increased by the fact that a warm current flowing in a fixed direction prevents the sea from freezing over. The highest observed temperature in Liachow Island was only 8° (Réaumur). The snow melted in the beginning of June, and about the middle of the same month the first flower was found. Wild reindeer, wolves, Arctic foxes, and mice are found on these islands, as also sea-gulls, snipe, and other birds. With the exception of the mouse, all animals on the island are merely guests; they all winter on the land.

THE Canadian Government sent out at the beginning of May an Expedition for the exploration of the region watered by the great river Yukon in the north-west of the Dominion. The geology and natural history of the Expedition will be under the care of Dr. Dawson of the Canadian Survey; while a careful topographical survey will be made by Mr. W. Ogilvy.

IN the new number (128) of the *Zeitschrift* of the Berlin Geographical Society, Prof. Blumentritt has some critical remarks on the Spanish data with reference to the distribution of the native languages in the Philippines. Colonel Schelling contributes a useful abstract of the Russian Survey work up to 1885, and Dr. Emil Deckert a paper on the country and people of the Southern United States.

THE German Government has appointed Lieut. Kund, who has done such good work in the Congo region, chief of the scientific station which has been established at the Cameroons; for when the Germans undertake the development of any region they at once recognize the necessity for scientific observations in order to accomplish their object. A surgeon and botanist will also be appointed, and the party will remain three years at the Cameroons. The surgeon and botanist will have charge of the meteorological station, while Lieut. Kund will devote himself to the exploration of the interior lying to the east of Cameroons.

THE IRON AND STEEL INSTITUTE.

THE annual meeting of the Iron and Steel Institute was held on Thursday, Friday, and Saturday of last week, in the Theatre of the Institution of Civil Engineers, under the presidency of Mr. Daniel Adamson.

In his inaugural address the President exhaustively treated the question of the selection and adoption of metals for various purposes in the arts. Commencing with the purest iron obtainable, containing only 0·08 per cent. of foreign matter, he explained that it was wonderfully malleable, and welded at a comparatively low temperature; a further exceptional characteristic of such a metal was that it suffered little when worked at a colour-heat, whilst it endured percussive or concussive force without distress much better than the mildest steel. All the alloys of iron, or the steels, were less malleable and ductile than the pure metal, but were on the other hand much stronger, or possessed a much higher carrying power. Pure iron would maintain a maximum load of nineteen tons per square inch, whilst it would set at half that amount. By an addition of 0·13 per cent. of carbon, 0·52 per cent. of manganese, and 0·10 of silicon, sulphur, and phosphorus, a steel might be produced carrying 50 per cent. more than pure iron, whilst by a further addition of these elements, the carrying power might be increased to sixty tons per square inch. In thus increasing the strength, the ductility or reliability was reduced however in nearly the same proportion. It thus becomes evident how important is the selection of material for a given purpose, but besides this the stronger the material the more skill is required in working it, and the more forethought has to be manifested by the constructive engineer.

Referring specially to the subject of steel for guns, the President drew attention to the diversity of opinion, both in England and the United States of America, as regarded the selection of the proper metal and its treatment for ordnance, the artillerists maintaining that a strong and consequently hard steel was desirable, whilst engineers contended that a mild tough metal should be used; this was a question which he thought might be decided by the Iron and Steel Institute, with the result that guns would be made, as they could be made, which would not burst. He referred to what had been done by the late Sir Joseph Whitworth towards the compression and consolidation of steel, and by the late Sir William Siemens, especially as regarded the production and introduction of soft or ductile steel, which possessed great regularity in quality by the uniformity of its composition.

Another most important subject treated of was that of steel rails and weldless solid rolled steel tires. By this application of steel, the saving to railway companies had been estimated at 1 per cent. on the dividend, and this was largely due to the efforts of Sir Henry Bessemer; and he thought it was quite within the province of the Institute to suggest the most suitable material for the construction of railway and river bridges of moderate and large spans, by the application of which further economy would be effected.

After reference to the subjects of case-hardening weldable steel—for which, when manufactured with reliability and economy, there would be an enormous demand—cast-iron, and steel castings, the address concluded by drawing attention to the influence of high railway rates upon trade depression, and to the necessity of employers and employed working in unison, as by their intelligent action alone could we expect to defy the contention and competition of the world. The vote of thanks for the address was proposed by Sir Lowthian Bell, and seconded by Sir James Kitson.

A paper on the Terni Steel Works was read by Sir Bernhard Samuelson, which he prefaced with some remarks on the importance of testing commercial education, which was now under the consideration of the Oxford and Cambridge Joint Board for Local Examinations, and drew attention to the circumstance that Chinese and Japanese were being taught on the Continent in anticipation of trade being opened out with the East.

The next paper was by Mr. George Allan, on "Patent Composite Steel and Iron." After referring to the necessity for a material of this character, and the various attempts that had been made to produce it, the author proceeded to explain the method of its manufacture. This consisted in embedding fibrous iron in mild steel, and subsequently rolling the ingots into bars or plates as desired. "So perfect was the union of the two materials, that by an inspection of the samples when the covering of steel was turned down to the strands of iron and the surface polished it was quite impossible to detect any separation between the two materials, or which was iron and which steel."

The next paper read was by Prof. Chandler Roberts-Austen, descriptive of a mode of electro-deposition of iron, and illustrated by a medallion in iron of Her Majesty executed by the process, the secret of success in which appears to be the employment of very feeble currents. The adherence of the deposited iron to the surface of the copper gives rise to considerable difficulty in detaching it; this was obviated by depositing nickel in the first place, allowing it to oxidize slightly, then again depositing nickel and the iron on its surface. The subject was still under the author's investigation.

The first paper read on Friday was one by Sir Bernhard Samuelson on the "Construction and Cost of Blast Furnaces in the Cleveland District," supplementary of one read in 1870, before the Institution of Civil Engineers.

Mr. James Riley, to whom the Bessemer Medal for this year has been awarded for his excellent work in developing the manufacture and high quality of mild steel, read a paper of a most elaborate character on "Some Investigations as to the Effects of Different Methods of Treatment of Mild Steel in the Manufacture of Plates." The author compared reheating with soaking, or cooling gradually in pits; hammering with cogging; cross-rolling with rolling in one direction only, and the results due to different amounts of work.

It was found that the soaked ingots were slightly more satisfactory than those reheated, the reheating having been performed in a non-radiation furnace, and that the results of cogged and hammered ingots were almost similar. Cross-rolling and ordinary rolling were also found to give almost similar results. As regards "working" the ingot, the strength of the steel was found to increase with the quantity of work put upon it, the ductility being however diminished. The author looks upon annealing as a corrective to damage done, and thinks that as regards the ordinary operations of a well-managed works annealing is unnecessary. The paper relates to a very large number of exp riments, the bending tests alone being close upon 1300, and gave rise to a very animated discussion.

Other papers on the programme, including one by Dr. H. C. Sorby, F.R.S., on "The Microscopical Structure of Iron and Steel" were taken as read. With reference to this paper, Dr. Percy, the immediate Past-President, remarked before resigning the chair, "For twenty years, more or less, he has been engaged in this kind of research, in which of late much has been done by foreign observers. Having carefully studied whas has been published on this subject, my conviction is that, with regard to originality of contrivance, accuracy, and importance, the work of Dr. Sorby is as yet unrivalled. He has successfully explored a comparatively new and most important field of inquiry, and has thrown much light on some of the most recondite problems concerning the mechanical and physical properties of iron and steel. My first impression is that the result of such researches will prove to be of the highest practical value."

THE INSTITUTION OF MECHANICAL ENGINEERS.

AT the recent meeting of the Institution of Mechanical Engineers, the President, Mr. E. H. Carbutt, gave an address, in which he reviewed the progress made in the manufacture of guns during the last half century. The guns in use at the beginning of the present reign, in 1837, were principally the cast-iron smooth-bore 24-pounder and 32-pounder with s herical shot. Now they are made of steel, and provided with mechanical appliances for every movement; accuracy of aim is insured by rifling, and the length of range increased by the use of an elongated shot of small cross-section, and by increased powder-charges. Breechloading has l d to increased speed of firing, and to the use of guns 35 and 40 feet long on board ship. The loading is self-acting in the smaller field guns, whilst on board ship the guns are made to revolve, load, return to position, and train to firing-point by hydraulic power. Such guns