OUR ASTRONOMICAL COLUMN

CONDITIONS FOR BEST TELESCOPIC DEFINITION.—Dr. T. J. J. See brings together a few facts and remarks regarding the conditions essential to good seeing with large telescopes and high magnifying powers (*Astr. Nachr.*, No. 3438). These are based not only on his own experience under very favourable circumstances during the past year, but many of the suggestions developed are, as he says, the outcome of Mr. Douglass' work on atmospheric currents and their relation to astronomical seeing. At the Harvard station in Peru the seeing at three o'clock in the morning was nearly always bad, caused, as was discovered, by a current of cold air from the valley draining the great mountains above and rushing down the adjacent gorge flowing over the observatory, and completely ruining the seeing almost instantaneously. Such currents as these must always be avoided when fixing upon a position for an observatory, and this is one of many causes which produce bad definition. The country in which good conditions might be depended on should be free from mountains and cyclonic causes which disturb the equilibrium of the atmosphere. A high and dry table-land, distant from oceanic influence, like the northern part of Arizona, presents conditions which are almost ideal when snow is not present. Mountain sites are always less satisfactory than broad table-lands, because currents forced up from below are cooled by expansion due to diminished pressure, and rapid changes are likely to take place when the wind is strong. When covered with snow and overflown by currents of a different temperature, mountain sites are wholly incapable of giving good definition.

ASTRONOMICAL PHOTOGRAPHY FOR SMALL AND LARGE APERTURES.—In this column (April 8, vol. lv. p. 544) we have previously referred to the remarks which Dr. Isaac Roberts published in *Knowledge* (vol. xx. p. 100) regarding the probable limit in the length of the time of exposure for astronomical photography. In these he showed that his experience led him to conclude that in consequence of prolonged exposure to the latent sky luminosity the film of the negative darkened on development to a degree that would obscure faint nebulosity and faint stars, and that longer exposures of the plates would not reveal additional details of nebulosity, nor more faint star images.

Prof. F. L. O. Wadsworth is not, however, inclined to agree with Dr. Roberts' statement in every particular, and contributes to the *Astronomischen Nachrichten* (No. 3439) an article of great interest, dealing with the question under discussion, in which he states his reasons. This should be read by all who employ the camera for astronomical photography, whether the apertures they use be half an inch or twelve inches. We give here the conclusions.

The absolute intensity of the image of a celestial object, and therefore the absolute photographic light action (product of intensity by time), for a given time of exposure will vary (1) for extended sources as the square of the angular aperture only; (2) for point sources as the product of the square of the angular aperture times the square of the linear aperture.

The contrast between the image of any celestial object (not very near the horizon) and the general field depends upon (1) the brightness of the sky at the time; (2) the efficiency of the image-forming lens as regards perfection of figure and curvature of surfaces, &c.; and (3) upon the square of the linear aperture. If the objectives are good, the sky effect (1) and (3) is the most important.

For faint extended objects, such as nebulæ, irresolvable star clouds, &c., in which we have to deal with the delineation of a surface rather than with individual points, this contrast can only be increased by decreasing the focal length. When the sky effect (1) and (3) is predominant, it will vary inversely as the square of the latter quantity.

For point sources the contrast can only be increased by increasing the angular aperture. Under the same conditions as just mentioned in the last paragraph, it will vary directly as the square of this quantity.

It is the degree of contrast and not size of objective (except in so far as this latter influences the contrast) that determines the limiting magnitude of the faintest object that can be photographed. This limiting magnitude for stars depends, therefore, only on the angular aperture, for nebulæ on the focal length.

The time of exposure also depends very largely on the contrast between image and field, and not on the absolute intensity of the former.

As regards the influence of the character of the objective upon the illumination of the field, the refractor seems to have a decided advantage. The angular aperture of the latter should not, however, be greater than 1 to 5.

To photograph the very faintest stars (beyond 17th mag.) a reflector of the largest possible angular aperture, *i.e.* 1 to 3 or 1 to 2, if possible, is the only instrument that can be used.

NEW VARIABLE STARS.—Mr. Thomas D. Anderson communicates to the *Astronomischen Nachrichten* (No. 3440) the discovery of a new variable star in the constellation of Hercules; its position for 1855·0 being R.A. 16h. 55·0m., Declination +31° 26′. Mr. Anderson noted this star some time ago as being a very faint star of the 9th magnitude, and of about the same brightness as B.D. +31°·2949. Several times in the autumn of last year he was unable to see it with his 2·25 inch-refractor, although he could always see a 9·6 mag. star which is not given in the B.D., but whose coordinates for 1855 are approximately 16h. 55·2m. and +31° 34′, This year, on the 22nd and 26th of last month, he has found the missing object, and it was then brighter than the neighbouring star just mentioned. Its brightness was then estimated as being the same as B.D. +31°·2949 with a magnitude of 9·2. As a guide to those who wish to observe this variable, Mr. Anderson says that it lies further from +31°·2951 than from 2949, and also that +31°·2945, 2946, 2949, the variable, and the 9·6 mag. comparison star are nearly in a straight line.

In the same number of the *Astronomischen Nachrichten*, Mr. Stanley Williams gives a list of seven probably new variable stars which he observed on his way to Australia and back. These variables are, however, all of considerable southern declination, but we may mention three of which the variability "appears to be almost beyond doubt."

Star.		R.A. 1875. h. m.		Decl. 1875. °
L 1713 Cœli	...	5 0·0	...	−35 53
δ Antliæ	...	10 23·8	...	−29 58
L 4959 Crucis	...	11 51·9	...	−55 37

PLANETARY NOTES.—At the oppositions of Jupiter in 1895-96 and 1897, M. Quénisset made some interesting observations of this planet, using a refractor of 16 centimetres aperture, which will be found recorded in the *Bulletin de la Société Astronomique de France* for the present month. Accompanying these are some excellent drawings made by him during those periods of observation. We notice that he has adopted the nomenclature of Lord Ross, Knobel, and Campani for the different zones of the planet by which the positions of special surface markings can be easily located. Why should not all observers of Jupiter adopt the same method, for would not comparisons of different observations be thus rendered more simple? Dr. Fontséré's observations of Venus, which appear in the same number of the *Bulletin*, were made in the first months of this year at the Barcelona Observatory. The surface markings seem to have been clearly seen and recorded, while projections on the terminator and limb were very commonly visible. This observer deduces a long period of rotation for this planet. The observations made by Dr. Peyra during the 1896–97 opposition of Mars appear in the *Memorie della Société degli Spettroscopisti Italiani* (vol. xxvi. 4[a]). These were made with a 24-centimetre Merz refractor, and are well worth comparing with those of other observers made about the same time. The drawings accompanying the observations are on rather a small scale, and show only the more prominent markings and canals.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

DR. RODET, the well-known bacteriologist of Lyons, has been appointed Professor of Bacteriology in the University of Lyons.

MR. STANLEY DUNKERLEY, of the Department of Applied Mechanics, Cambridge, has been appointed Professor of Applied Mechanics at the Royal Naval College, Greenwich, in succession to Prof. J. H. Cotterill, F.R.S., who is about to retire after over twenty-four years' service.

THE candidates successful in this year's competition for the Whitworth scholarships and exhibitions are as follows:—(1) Scholarships of 150*l.* (tenable for three years): George M.

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Russell, George M. Brown, William Du B. Duddell, George Wilson. (2) Exhibitions of 50*l.* (tenable for one year): George Service, Edgar J. Kipps, Frank Piercy, Arthur Morley, A. Marshall Downie, John R. Powell, Alfred D. Owen, Charles C. Allen, William J. Rouse, Arthur E. Holmes, Alfred T. J Kersey, Edward C. Horsley, John Berry, James Turnbull, Thomas Taylor, Robert L. Wills, James Paton, Henry T. Sisson, Leonard Ward, Arthur W. Loveridge, Timothy A. Thomas, William Bell, John R. Billington, George Powell, Edgar W. Riley, John S. Marshall, John S. Hague, Frederick Walford, James Davidson, Robert Nelson.

THIS year's successful candidates for Royal Exhibitions, National Scholarships, and Free Studentships (Science), awarded by the Department of Science and Art are as follows:—Royal Exhibitions: Robert L. Sherlock, Gilbert E. James, Howard M. Rootham, Andrew W. Lehmann, William Griffiths, Frank H. Phillips, Alfred L. Oke. National Scholarships for Mechanics (Group A): Arthur W. Ashton, Paul S. Couldrey, Frank Mould, Arthur Morley, Albert Hall, Charles H. Stewart, William W. Firth, George Wall, Alfred T. J. Kersey, John S. Hague. Free Studentships for Mechanics: Arthur W. Loveridge, Percy M. Bennett, Hubert W. Bywaters. National Scholarships for Chemistry and Physics: George H. Broom, Percy M. Hampshire, Frank Wade, John A. Brown, George B. Willey, Daniel Robinson, William L. Odell, Robert L. Bennett, John A. Cunningham, Oswald F. Hudson. Free Studentships for Physics and Chemistry: Victor Lough, Charles Headland, Donald J. Browne. National Scholarships for Biology: Frank Cavers, George E. Nicholls.

THE forty-fourth Report of the Department of Science and Art has just been issued. For the benefit of those who are not familiar with this Departmental publication, it may be remarked that the contents are not merely concerned with museums connected with the Department of Science and Art, and statistics and reports upon the progress of education in science and art during 1896; for appended to the volume is the report of the Director-General of the Geological Survey of the United Kingdom (for an abstract of which see p. 178), and also the Report of the Committee on Solar Physics. The number of students under instruction in Science and Art Department Classes in 1896 was 196,185; these were distributed among 10,500 classes in 2583 separate schools. It is satisfactory to learn that practical instruction in science is making progress; but some little time must elapse before sufficient laboratories are provided to enable all students in Departmental schools to perform the experimental work, without which scientific teaching is of no value. The efficiency of the practical instruction given in certain science subjects is now judged by inspection and not by examination. This should encourage the practical side of science instruction, and prove of great benefit to the students and the teachers In evening classes as much cannot be done in the development of this kind of instruction as in classes in day schools, but even in these a good beginning has been made in some few cases. It is announced in the Report that it is proposed to divide the Honours stages of the various science subjects into two parts, the first part being intermediate in difficulty between the advanced stage and the second part of Honours. It is also announced that a new syllabus is in preparation to form part of the present elementary stage of biology, and be a preparatory study for biological science in the same way that the new section of the elementary stage of physiography is for physical science.

THE Glasgow University Court has sent us a memorandum referring to the disciplinary or penal powers of the qualifying medical authorities. Upon several occasions the General Medical Council has occupied itself with the question of the expediency of obtaining further disciplinary powers, especially as regards the Universities, to be exercised by the qualifying medical authorities over those to whom they grant diplomas entitling the holders of them to be admitted to the *Medical Register*. It was pointed out by the General Medical Council a year ago that there are six Universities which do not possess any disciplinary powers, and that there are in addition two Universities which possess only partial or limited disciplinary powers over their graduates. The result is this, that however gross the misconduct of a graduate may be, whether as a convicted felon, or declared by the General Medical Council guilty of infamous conduct in a professional respect, for which his name has been removed from the *Medical Register*, he still retains the degree and the title conferred upon him by any one of these Universities. Such a state or condition of matters must cause very considerable regret to the authorities of the University which has conferred the degree, and which it has no power to cancel. The association of their names with such black sheep amongst them must also cause much regret to be felt by the graduates, and must lead them to feel how desirable it is that the authorities of the University should obtain powers to take away degrees which are thus discredited. The Scotch Universities' Commissioners have been appealed to, but they have decided that they have no power by ordinance to alter the status of any graduate, or to confer upon the Universities powers which they do not already possess as regards deprivation in cases of discreditable conduct or proved legal offence. The Privy Council has, however, expressed a desire to aid in the matter, and has indicated that further powers might be obtained by statute, or, in the case of the Scotch Universities, by ordinance. The Glasgow University Court has, therefore, asked the Universities' Commissioners to again consider the question, and to obtain the opinion of all the Scottish Universities upon it, so that their final report may assist in bringing the Universities in line with each other, and satisfy the wish of the General Medical Council.

SCIENTIFIC SERIALS.

American Journal of Science, August.—*Tamiobatis vetustus*, a new form of fossil skate, by C. R. Eastman. The only remains of this fish are a skull found in Powell County, Kentucky; exact site unknown. It is embedded in a greenish-grey limestone of a talcose structure, probably Middle or Upper Devonian. The skull presents some features that are shark-like, and differs notably from the skulls of existing rays. It indicates a very generalised condition, and it is impossible to assign it to any known genus or family, but there are resemblances to the Rhinobatidæ.—The Florencia formation, by O. H. Hershey. This is an ancient stream gravel of North-western Illinois, consisting largely of galena limestone derived from Pleistocene rock gorges.—Native iron in the coal measures of Missouri, by E. T. Allen. Native iron was found at Cameron, Weanbleau, and Holden, Missouri. It was found in every case at such a depth from the surface, and under such conditions, that there can be no doubt as to its terrestrial origin. Besides, the specimens contained no nickel, which is always associated with meteoric iron. In Cameron, Clinton Co., it was found as a vein five or six inches thick, embedded in sandstone at a depth of fifty-one feet.—On Bixbyite, a new mineral, and on the associated topaz, by S. L. Penfield and H. W. Foote. The mineral is found very sparingly on the edge of the desert, about thirty-five miles south-west of Simpson, Utah. The crystals, which are brilliant black, and of metallic lustre, are implanted upon topaz and decomposed garnet and rhyolite, and have evidently been formed by fumarole action. The composition is essentially $FeO.MnO_2$.—The separation of aluminium and beryllium by the action of hydrochloric acid, by F. S. Havens. This method is based upon the fact that the hydrous aluminium chloride $AlCl_3.6H_2O$ is practically insoluble in a mixture of strong HCl and anhydrous ether saturated with HCl gas. The beryllium is determined by weighing as oxide after conversion to the nitrate and ignition.

Bulletin of the American Mathematical Society (June).—"James Joseph Sylvester" is the title of an address delivered by Dr. Fabian Franklin at a memorial meeting at the Johns Hopkins University (May 2). This is an appreciative estimate of the genius of a man whose death "deprived Mathematical Science of a most brilliant mind, and the scientific world in general of one of its foremost workers" (NATURE, March 18, p. 468; *cf.* also March 25, pp. 492-94). Dr. Franklin closes with the remark that "his work, brilliant and memorable as it was, affords no true measure of his intellectual greatness. Those who came within the sphere of his personality could not but feel that, through the force of circumstances, combined with the peculiarities of his poetic temperament, his performance, splendid as it was, has not adequately reflected his magnificent powers. Those of us who were connected with him, cherish his memory as that of a sympathetic friend and generous critic. And in this university, as long as it shall exist, he will be remembered as the man whose genius illuminated its early years, and whose devotion and ardour furnished the most inspiring of all the elements which went to make those years so memorable and so fruitful."—Mr. C. H. Hinton, in Hyperbolea and the solution of equations, communicates some interesting remarks on the system of mathematics in vogue in Hyperbolea, and shows that a consideration of the methods of the Hyperboleans leads to a

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