OUR ASTRONOMICAL COLUMN.

THE NOVA, OR VARIABLE, 87.1911 PERSEI.—Photographs of the region surrounding the questionable object recently announced by Herr D'Esterre as a possible nova were secured by Herren Miethe and Seegert, of Charlottenburg photographic observatory, between January 12 and 16, and are discussed in No. 4555 of the *Astronomische Nachrichten*. Six photographs, showing images of fifteenth-magnitude stars, exhibit no certain trace of the object, but on two particularly good plates there appears, in the position of D'Esterre's object, the trace of a nebulous, indefinite image, which is probably connected with it. Further observations are to be made.

OBSERVATIONS OF JUPITER.—Vol. iv. of the *Recherches astronomiques de l'Observatoire d'Utrecht* is devoted to the publication and discussion of the observations and drawings of Jupiter made by Prof. Nijland during the period 1895–1906. In the first part, Prof. Nijland discusses 156 of the drawings in detail, giving a tabulated statement of the conditions under which they were severally made, and then directs attention to some of the general features remarked. Changes of colour of the several bands, spots, and streaks were noted from time to time, and although the material does not confirm the suggestion of periodicity made by Mr. Stanley Williams, it does not contradict it.

Part ii. deals with the spots, taking the observations *seriatim*, and there are some interesting notes concerning the variability of appearance—*e.g.* the white spots occasionally seen on the Red Spot area—of these peculiar features. In part iii. the Red Spot and its mutability are treated specially, and the volume concludes with fine reproductions of the 156 drawings of the planet.

PHOTOMETRIC OBSERVATIONS OF THE ASTEROIDS.—The importance of determining the light of the asteroids, which in several instances shows strange and puzzling variations, is emphasised by Prof. E. C. Pickering in Circular 169 of the Harvard College Observatory.

To clarify matters, Prof. Pickering tabulates the photometric measures made by different observers in seven series of forty-three asteroids, and then discusses the differences of the means from the calculated values given for the magnitudes at mean opposition in the *Berliner Jahrbuch*. He finds that the term $0{\cdot}2(m_0-9{\cdot}0)$ gives the relation between m_0 (the *Jahrbuch* magnitude) and the mean of the residuals obtained by subtracting the mean observed magnitudes from the computed magnitudes. The photometric magnitudes corresponding to the values of m_0 given in the *Jahrbuch*, 7·0, 8·0, 9·0, 10·0, 11·0, 12·0, and 13·0, are shown to be 6·6, 7·8, 9·0, 10·2, 11·4, 12·6, and 13·8, respectively.

Prof. Pickering remarks on the convenience for photometric observations of the ephemerides for the first four asteroids given in the British Nautical Almanac, and wishes that they should be extended to Eros and several other special objects, also that they should include the values of the phase angle.

OBSERVATIONS OF COMETS.—Observations of several of the comets of 1911 are reported in Nos. 4555–56 of the *Astronomische Nachrichten* from Bothkamp, Vienna, Utrecht, and Warsaw.

Dr. Schiller gives positions and describes the appearance of 1911*b*, 1911*c*, 1911*f*, and 1911*g*, and shows in a table of reduced magnitudes the probable oscillation of the intrinsic brightness of comet 1911*c* (Brooks). Prof. Holetschek gives measures of the brightness and the diameters of comets 1911*c*, 1911*f*, and 1911*g*, while Herr Tscherny gives places for, and describes the appearance of, comets 1911*c*, 1911*f*, and 1911*g*. On September 20, 1911, an eleventh-magnitude star was easily visible through the head of 1911*c*.

OCCULTATIONS OF MARS AND THE QUESTION OF THE EXISTENCE OF A LUNAR ATMOSPHERE.—During the occultation of Mars on December 4, 1911, Prof. W. Luther, observing with the refractor of the Dusseldorf Observatory, saw the half of the planet's disc which was nearest to the moon's limb become green, as though overcast by a shadow, while the outer half was as bright as usual; this was at about 17h. 7m. 22s. (Dusseldorf M.T.). Looking through his old observations, he found a note of a similar phenomenon taking place on October 16, 1902, and suggests that these observations indicate that there exists some material, extending to about 100 km. or more above the moon's surface, which is capable of modifying, or absorbing, light given out by a body passing behind it (*Astronomische Nachrichten*, No. 4556).

SOUTH AFRICAN METEORITES.—A preliminary note on the meteorites in the Bloemfontein Museum is contributed to part iii., vol. ii., of the Transactions of the Royal Society of South Africa by Mr. W. A. Douglas Rudge.

There are in the museum three specimens, two of them portions of the same fall, which occurred at Kroonstadt on November 11, 1877, and the third a single mass which fell at Winburg in 1881.

The larger of the twin fragments is very hard, yet easily friable, so that sections could not be cut; but by grinding, a surface was exposed showing masses of malleable nickel-iron set in a matrix of hard stone. The specific gravity was found to be 3·54, and that the mass was porous was shown by the fact that the weight in water increased from 989·5 to 991·4 grams after an hour's immersion. Qualitative analysis revealed the presence of iron, nickel, aluminium, calcium, silicon, sulphur, and traces of manganese, but no carbonic acid. A preliminary quantitative analysis gave:—insoluble matter 54·68, iron 30·38, and nickel 13·21 per cent.

The Winburg meteorite is very peculiar in having veins of lustrous iron-nickel alloy running through its mass of otherwise nearly pure iron. The general mass is very soft, but the crystals are harder and much brighter. The weight of the whole is about 50 kilograms, but there is evidence that it is only a portion of a larger mass. The preliminary analysis gives:—iron soluble in dilute H_2SO_4, 92·32 per cent.; iron in crystals, 2·35 per cent.; nickel in crystals, 2·00 per cent.; and carbon and earthy matter, 0·3 per cent. It would thus appear that practically all the nickel is concentrated in the bright crystalline material forming the veins.

ASTROPHYSICS IN CANADA.[1]

THE general report presented by the chief astronomer of the Dominion of Canada, Mr. W. F. King, gives detailed reports of progress made in the departments of time service, astrophysics, and geophysics.

Meridian Circle and Time Service.—The installation of this instrument has been attended with many unusual difficulties. Considerable trouble was experienced with the foundations of the meridian circle room owing to the percolation of surface water. A partial remedy was found by constructing a reservoir of 1200 gallons capacity, but as this was still insufficient during heavy rain, the pier footings becoming waterlogged, a system of drains surrounding the outside walls would seem to be necessary. Provision has been made in the collimator piers for underground lenses as permanent marks, similar to the system which has proved so satisfactory at the Cape Observatory.

The observers appear to have also had a most unusual experience with the transit circle itself. The graduated circles were not adjusted properly on their seatings; the axis pivots were found to be made of comparatively soft metal, rendering it necessary to shrink on collars of hardened steel and rework the surfaces with the lathe at the Royal Mint workshop.

Astrophysics.—The principal work in the astrophysical division has been the spectroscopic observations of radial velocities of binaries, determined from photographic spectra taken with the prism spectrograph. Five orbits have been thus investigated, η Boötis, θ Aquilæ, α Coronæ Borealis, ϵ Herculis, β Orionis. In other systems variable velocities have been discovered. Detailed records are included of measures of the spectrograms of the above stars, with the individual velocities from each plate.

A new single-prism spectrograph for radial velocity work has been designed and constructed with a strain-free mounting similar to that at the Lick Observatory. The body of the instrument is supported at two points, with a balanced action on a third, and the system is so successful that it is stated the flexure is inappreciable when the spectrograph is turned through 180°.

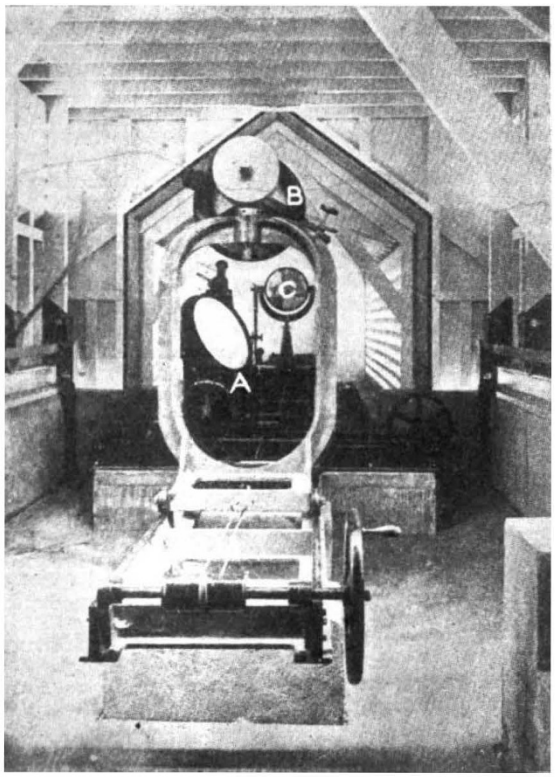
Considerable time has been spent in testing the various

[1] Report of the Chief Astronomer, Ottawa, for the year ending March 31, 1909. Department of the Interior, Sessional Paper No. 25*a*. (1910.)

instruments and experimenting on the best methods of observation. A thorough test of the new Brashear doublet for stellar photography has been made by Hartmann's zonal method, and comparison photographs with different adjustments are given in illustration of the method.

Other work in this division included micrometric measurements of double stars, comet photographs, star occultations, solar photography, and adjustment of the new large grating spectrograph and cœlostat.

The cœlostat telescope is of the form installed by Hale at Mount Wilson, known as the Snow telescope, consisting of a plane mirror cœlostat with secondary mirror, concave image mirror, and Littrow spectrograph with plane diffraction grating. The main cœlostat mirror, 20 inches diameter, driven by clockwork, reflects the sunlight in a southerly direction to a secondary plane mirror, which in turn reflects the light northwards to a concave mirror, 18 inches diameter. This forms an image of the sun slightly less than 9 inches diameter on the slit plate of



View of the Ottawa cœlostat, looking north. A, main cœlostat mirror; B, secondary cœlostat mirror; C, concave image mirror.

the spectrograph, fixed in the basement of the main building of the observatory. This arrangement of mirrors is clearly shown in the accompanying illustration, taken from the report. The whole is covered by a louvred structure, part of which can be moved to allow of the sunlight reaching the cœlostat mirror at all seasons.

The large solar spectrograph is located in the basement, and consists of a 6-inch lens of 22 feet 10 inches focal length, together with a Michelson plane diffraction grating mounted in the Littrow form. The whole instrument is mounted so as to be capable of rotation about the collimation axis, this making it possible to place the slit tangential to any required point on the sun's limb.

Some interesting photographs of comet Morehouse are given showing the varying appearance presented by the tail during October and November, 1908.

Geophysics.—In the geophysical division reports are presented showing the progress of determinations of seismology, terrestrial magnetism, gravity measurements, and latitude and longitude work on numerous stations throughout the Dominion.

CHARLES P. BUTLER.

THE PRECIPITIN REACTION.

THE precipitin reaction is also known as the "biological reaction" for proteins; it enables us to distinguish between proteins by using the animal body as a test-tube, and to establish differences between them which no other form of test-tube will detect. It is best known as a means for distinguishing human from other forms of blood. The procedure is briefly to inject an animal (usually a rabbit) repeatedly with a foreign protein; the serum of that animal then gives a precipitate with that protein, but with no other. So if the material injected is human blood, a precipitate is produced when the serum of the blood of the rabbit is added to human blood, or at any rate to the blood of the group of animals (the higher apes) to which man belongs, but not with any other sort of blood. The reaction is of value in forensic medicine, and it is also of value to the zoologist, as it enables him to demonstrate the blood-relationships of animals, and by the amount of precipitate to ascertain the degree of the relationship in figures.

A vast amount of research has centred around this discovery, Bordet, Uhlenhuth, Tchistowitch, and Nuttall being a few among the many who have devoted themselves to working out its details. A very clear and concise account of the principal facts has been recently published in a lecture given by Dr. W. A. Schmidt before the Cairo Scientific Society (*Cairo Scientific Journal*, November, 1911). Dr. Schmidt's name is known as one of those who have within recent years examined Egyptian mummies by chemical means, and his publications on the precipitin reaction have also been important. His lecture naturally deals with the question in a general and popular way, but includes a reference to some of his own work.

Among other interesting points, Dr. Schmidt has determined is the resistance of proteins to heat. It was formerly supposed that the "biological" property of proteins was easily destroyed by an elevated temperature, but Schmidt has shown that boiling for half an hour is necessary to abolish their power of reacting with a precipitin serum; and even although this is accomplished, the heated protein still retains the power when injected into an animal of inducing the formation of a precipitin which reacts with heated or boiled protein material. Further than this, protein may still be further "denaturalised" and retain a corresponding power; when, for instance, protein is coagulated by a high temperature, so that ordinary neutral reagents no longer dissolve it, a solution of it in dilute alkali will produce precipitin-formation in the blood of an injected animal, which will react only with the "denaturalised" protein used for the injection. This discovery extends the usefulness of the precipitin reaction, for with the precautions described by Dr. Schmidt it may be employed to detect proteins even though some of their principal chemical properties have been destroyed.

SCIENTIFIC MEMORIAL VOLUME, CELEBRATION OF THE 500TH ANNIVERSARY, UNIVERSITY OF ST. ANDREWS.

A NEATLY bound memorial volume of scientific papers was issued by the University of St. Andrews to mark, with other publications, its 500th anniversary last September, and is edited by Profs. McIntosh, Steggall, and Irvine. The first paper, on concrete representations of non-Euclidean geometry, by an able mathematician, Dr. D. M. Y. Somerville, consists of a description of the most important representations which have been devised for non-Euclidean geometry within the field of ordinary Euclidean geometry, viz.:—(1) the Cayley-Klein projective metric, or representation by straight lines referred to a conic as absolute; (2) the conform representation by circles orthogonal to a fixed circle; (3) Beltrami's geodesic representation on surfaces of constant curvature; (4) McClintock and Johnson's representation by "visual geometry"; (5) the representation by a net of conics through two fixed points; and (6) Poincaré's representation by diametral sections of a quadric surface.

The second paper is on the algebraic solution of indeterminate cubic equations, by Mr. Robert Norrie. The third, by Prof. Peddie, treats of the problem of partition