The kind of plate used is not very sensitive at about λ 5000, and this may account for the absence of the band λ 5016, which, however, is exceedingly faint in this Nova. Hγ is present, but scarcely strong enough to measure, and merges into a brighter band which extends from λ 4347 to λ 4371 (mean at λ 4359).

A reproduction of the spectrogram is given, and it is seen that the spectrum corresponds to those of Nova Aurigæ and Nova Persei at the later stages of their development.

A very faint bright band in the spectrum of Nova Geminorum in the region of the chief nebula lines is far too weak to measure.

PARALLAX OF THE BINARY SYSTEM δ EQUULEI.—Mr. W. J. Hussey publishes in *Bulletin* No. 32 of the Lick Observatory the results of his calculation of the parallax of δ Equulei, based on the micrometrical and spectroscopical measurements made at the Lick Observatory during the past three years. The method pursued is theoretically absolute, for in no way is the result dependent upon the assumption of values for comparison stars, as it is in the ordinary method of calculating parallax.

The formula used was published by Prof. A. A. Rambaut (*M.N.* March, 1890),, and gives the absolute parallax of a system when the elements of the orbit, the relative velocity of the components in the line of sight, and the orbital velocity of the earth at the time are known.

The determination of the elements of the orbit made at Lick has led to the adoption of 5·7 years as the periodic time of revolution; using this value for the period, and taking the mean distance as 0″·28, the eccentricity as 0·46, the apastron and periastron distances as 0″·409 and 0″·151 respectively, the relative velocity in the line of sight, determined by the observers using the Mills spectrograph, as 20·5 miles per second, and the orbital velocity of the earth at the time as 18·2 miles per second, Mr. Hussey obtains

$$\pi = 0''\cdot071$$

as the parallax of this system, but states that this is probably not the final value, for the elements may be appreciably modified during the critical observations it is proposed to make during the next three years.

Taking this value for the parallax and the mean distance and period given above, the mass of the system becomes 1·89, the mass of the sun being taken as unity, and, as the components are not quite equal in magnitude, the brighter may have a mass equal to, but not greatly exceeding, that of the sun. The mean distance of the components is about four times that of the earth from the sun, but, owing to the great eccentricity of the orbit, the actual distance at periastron is just more than twice, and at apastron about five times, that unit. As the spectra of the components are both of the solar type, and as their masses are comparable with that of the sun, it might be reasonably assumed that their densities do not differ to any great extent from the density of that body.

A REGULATING OR RECORDING THERMOMETER.

A THERMOMETER which is capable of regulating the temperature of a room with considerable accuracy, or of keeping a continuous record of the temperature, is frequently required in laboratory work. Such a thermometer is described in the present article. Although there is little essentially new in its construction, the details on which success depends are the result of considerable practical experience, and as the manufacture of such an instrument should be within the powers of most laboratories employing a mechanic, it has been thought desirable to publish an account of it.

The estimation of temperature in this thermometer depends on the alteration in shape of a piece of flat brass tubing bent into spiral form and filled with a liquid possessing a large coefficient of expansion. If one end of the tube is fixed, the motion of the other end, magnified by a suitable arrangement of levers, serves as a measure of temperature. As the thermometer is intended for use within a range of temperature of at most three or four degrees, we are not concerned with the equality of the graduations per degree at different parts of the scale.

The illustration (Fig. 1) shows the general appearance of the thermometer arranged as a recording instrument. The brass tubing of which the spiral is formed has a section in the shape of a very flat ellipse, the longer diameter being $\frac{7}{8}$ inch, the shorter 3/16 inch, while the thickness of the wall is 0·02 inch. The tube is bent into the spiral form by filling it with melted resin and bending it round a cylinder 8 inches in diameter, on which is cut a spiral groove. After the resin has been removed by heating the tube, brass plugs[1] are soldered into the ends, each plug having a central hole for the purpose of filling the tube with liquid. In the thermometer illustrated, these holes are shown closed by steel screws. A simpler and more efficient plan is to solder a short length of lead tubing into the brass plug. Then, when the thermometer has been filled with liquid, the end of the lead tube is pinched together and soldered. The spiral can thus be hermetically sealed without loss of liquid.

In order that the thermometer may acquire the temperature of the surrounding air as rapidly as possible, the surface is increased by soldering to the spiral a strip of thin sheet copper about four inches wide. The whole is painted dead black.

For filling the tube creosote has been found to answer well. The process of filling the tube is the most troublesome part of the work, as it is difficult to get rid of the air bubbles which cling to the interior. While it is being carried out the tube should be placed in melting ice.

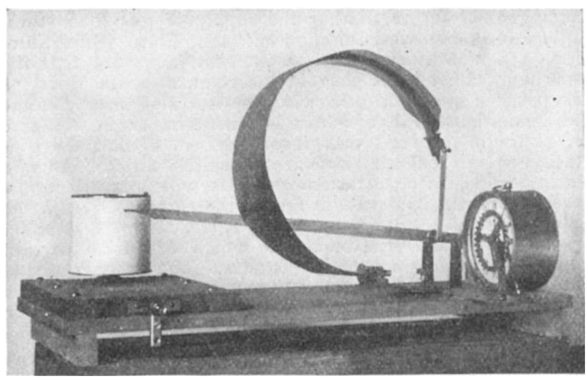

FIG. 1.—Recording Thermometer.

Funnels may be attached to the open ends of the spiral to facilitate the introduction of the liquid. When the tube is nearly full, liquid should be poured into either end in turn until the creosote rises in the other funnel free from air bubbles.

When the tube has been hermetically sealed, it is ready for attachment to the stand. Instead of fixing one end of the tube directly to the base board, it is fastened to one flap of a common brass hinge, the other end of which is screwed to the board. A hole is tapped in the upper flap and fitted with a screw the point of which bears against the lower flap, thus providing an adjustment for the distance between the two. This is a very simple method of giving a small alteration to the position of the fixed end of the spiral, and so adjusting the pen to any desired height on the recording cylinder.

The free end of the spiral is attached by a connecting rod of thin aluminium to a brass lever, half an inch in length, fixed to the spindle that carries the tracing arm. The length of the light arm which carries the pen is sixteen inches. Thus the actual motion of the end of the spiral is multiplied by the factor 32 at the recording drum.

The bracket carrying the spindle is formed of two uprights of thin sheet brass, screwed and soldered to a thicker base plate. The spindle itself is made of steel wire about three-sixteenths of an inch in diameter; the ends forming the pivots are turned down to a somewhat smaller diameter and ground into holes bored in the uprights. On the outer side of each upright is screwed a short length of flat steel

[1] The plugs should be of drawn brass, as it is found that creosote gradually percolates through cast brass.

spring, which bears against the projecting point of the spindle and so controls any lateral movement.

In addition to the recording cylinder a second clock will be noticed in the illustration. This was introduced because it was found that the pen was inclined to stick to the paper, so that the full range of temperature was not recorded. The clock once in every minute draws the pen away from the paper, so that it is free to take up its natural position. Hence the trace is made up of a series of dots instead of being a continuous line. The minute hand of the clock is replaced by a wheel in which sixty teeth are cut. Every minute one of the teeth engages with a short pin supported by a flat steel spring. When this pin is pushed aside it draws after it one of the springs referred to above as pressing against the point of the spindle. The spring at the opposite end of the spindle consequently comes into play and pushes the spindle in the direction of its length, thus relieving the pen from the paper.

In this thermometer the motion of the pen for a change in temperature of one degree Fahrenheit is about one inch (4·5 cm. per degree C.) at ordinary temperatures.

The thermometer selected for description is adapted for securing a continuous record of temperature. When it is desired to use such a thermometer to regulate the temperature, the pen may be replaced by a platinum point which is arranged to complete an electric circuit by contact with a platinum terminal or by dipping into a mercury cup. The current so set up may be used to operate a relay, and so switch on a stronger current, if heating by electricity is employed, or it may actuate some suitable mechanical arrangement for regulating the supply of gas to a stove. When it is necessary to maintain a uniform temperature for days or weeks together, it is most important that the sparking which takes place at the contact should be as far as possible reduced, otherwise the surfaces may become so contaminated that contact is uncertain, or in the case of platinum contacts may fuse together so that the contact is never broken. These are difficulties which those who have worked with such arrangements will appreciate. To overcome them it is well to reduce the current through the contact to the smallest possible value, and to place in parallel with the electromagnet which will form part of the circuit a non-inductive resistance. This resistance may be kept comparatively small, even at the expense of a somewhat larger current. A condenser inserted between the points of contact may be of service, but is not so effective as the plan mentioned.

It may be of interest to give some account of the success which has attended the use of these methods of regulating temperature in connection with the Blythswood dividing engine. The engine is placed in a detached building in a room fifteen feet long, ten feet wide, and ten feet high. Local conditions render it impossible to make use of a cellar. The room has double windows and shutters; it is warmed by two gas stoves, of which one is controlled by the regulating thermometer. During the greater part of the year this room can be kept at a temperature of 60° F., the variation in temperature being not more than one degree. The controlling thermometer in this instance actuates, by an electromagnetic release, clockwork which supplies the necessary power for turning the gas on or off.

The dividing engine is enclosed in a wooden case inside this room. Originally the interior of the case was heated by electricity under the control of a regulating thermometer. The variations in temperature that were introduced by this method were sufficient to produce disastrous results in cutting a diffraction grating. Accordingly the case was surrounded with a lining of six inches of wool, and all the arrangements for securing a uniform temperature were made in the room outside. When this was done it was found that the temperature inside the case fell slowly but continuously. This was shown to be due to leakage of heat through the stand of the machine, which rested on a large stone block. To prevent this a space was cleared round the bottom of the stand, and this space was kept at a uniform temperature by electrical heating. This precaution was found to be effective, and the temperature of the case can now be kept constant with very considerable accuracy, the variation in four or five days not amounting to more than two-tenths of a degree Fahrenheit.

H. S. Allen.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

Cambridge.—The Public Orator, Dr. Sandys, spoke as follows on May 14, in presenting Mr. Robert Bell, LL.D., F.R.S., Director of the Geological Survey in Canada, for the degree of Doctor in Science *honoris causa*:

Magnum profecto est provinciae maximae penitus explorandae et scientiarum terminus latius proferendis vitam suam totam dedicasse. Salutamus virum, qui per annos plus quam quadraginta provinciae maximae Canadensis flumina, lacus, montes, campos denique latissime patentes exploravit; ibi locis plurimis nomina primus imposuit, et, ipse mortalium modestissimus, flumini a se primum indagato suum nomen ab aliis inditum audivit. Atqui nomen suum non in aqua scriptum, sed provinciae tantae in saxis potius insculptum reliquit; regionis illius immensae geologiam, geographiam, biologiam, archaeologiam libellorum in serie longa illustravit, et non modo provinciae ipsius terminos ubique definivit, sed etiam scientiarum fines ubique propagavit.

Duco ad vos Reginae Universitatis Canadensis doctorem, Societatis Regiae Londinensis socium, provinciae Canadensis exploratorem indefessum, Robertum Bell.

A university lectureship in mathematics, stipend 50*l*. a year, is vacant by the election of Prof. Larmor to the Lucasian chair. Candidates are to send their names to the Vice-Chancellor by June 3, with statements of the branches of mathematics on which they are prepared to lecture.

In a report on the administration of the engineering laboratory it is proposed that two readerships, one in mechanical engineering and one in electrical engineering, should be established for Mr. Peace and Mr. Lamb, the present demonstrators; that two new university demonstrators should also be appointed, and that, in addition to their stipends, each of these should receive certain payments from the fees of students receiving instruction in the department. The growth of the latter under Prof. Ewing's direction may be gathered from the fact that in 1892 the number of students was 39, and the fees 546*l*., while in 1902 there were 211 students, who paid 5005*l*. in fees. In the present year there are twelve teachers, in addition to the professor and the two demonstrators, engaged in the work.

The syndicate report that the new building for the medical school is almost completed, and that the last stone of the Humphry Museum has been laid. A sum of 8062*l*. is required for fittings, furniture, electric lighting, and heating appliances.

The discussion in the Senate on the proposed reestablishment of the professorship of surgery turned chiefly on the question whether or not full residence should be required of the professor. If non-residence were permitted, a smaller stipend might suffice, and the field of choice might be widened. Prof. Liveing, Prof. Woodhead and others urged strongly that the professor's usefulness would depend on his being resident in the University.

Mr. Edwin Edser has been appointed head of the physical department of the Goldsmiths' Institute, New Cross.

A conversazione of the Parents' National Educational Union will be held at the Kensington Town Hall on Monday, June 8. The Countess of Aberdeen will preside, and a paper will be contributed by Miss Mason, founder of the Union.

The Court of Governors of University College, Sheffield, has adopted resolutions to the effect that in the interests of higher education in the city and district it is essential that Sheffield College shall have the powers and *status* of a university similar to those granted to Birmingham, Liverpool, and Manchester, and also that application be made to the Privy Council for a charter.

The Secretary of State for India has appointed a small committee to inquire and report to him on the question of the expediency of maintaining the Engineering College at Coopers Hill, as a Government institution for the supply of officers to the Public Works Department in India. The committee will be composed as follows:—Sir Charles Crosthwaite, Sir James Mackay, G.C.M.G., Sir William Arrol,