with bibulous paper; upon the desired dew-point being attained, the action ceases.

The range of the instrument is regulated by means of a spiral spring at one end of the tube, and an adjustable weight at the other.

By means of a pencil attached to one of the levers, the instrument may be made self-registering.

An ordinary Mason's hygrometer is attached to the instrument for regulation and comparison.

With a variation of one degree in the moisture of the atmosphere, the instrument is capable of supplying ten quarts of water per hour to the surface of the pipes from which it evaporated.

III. "On the Spectrum of a New Star in Corona Borealis"*. By William Huggins, F.R.S., and W. A. Miller, M.D., Treas. R.S. Received May 17, 1866.

Yesterday, May the 16th, one of us received a note from Mr. John Birmingham of Tuam, stating that he had observed on the night of May 12 a new star in the constellation of Corona Borealis. He describes the star as "very brilliant, of about the 2nd magnitude." Also Mr. Baxendell of Manchester wrote to one of us giving the observations which follow of the new star, as seen by him on the night of the 15th instant.

"A new star has suddenly burst forth in Corona. It is somewhat less than a degree distant from ϵ of that constellation in a south-easterly direction, and last night was fully equal in brilliancy to β Serpentis or ν Herculis, both stars of about the 3rd magnitude."

Last night, May 16, we observed this remarkable object. The star appeared to us considerably below the 3rd magnitude, but brighter than ϵ Coronæ. In the telescope it was surrounded with a faint nebulous haze, extending to a considerable distance, and gradually fading away at the boundary†. A comparative examination of neighbouring stars showed

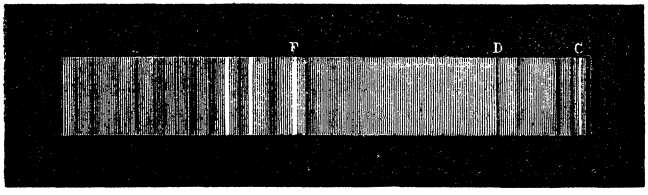
* The Astronomer Royal wrote to one of us on the 18th, "Last night we got a meridian observation of it; on a rough reduction its elements are—

R.A. 1866, May 17..... $15^h\ 53^m\ 56^s{\cdot}08$,
N.P.D..... $63°\ 41'\ 53''$,

agreeing precisely with Argelander, No. 2765 of "Bonner Sternverzeichniss," declination + 26°, magnitude 9·5." Mr. Baxendell writes on the 21st, "It is probable that this star will turn out to be a variable of long or irregular period, and it may be conveniently at once designated T Coronæ." Sir John Herschel informs one of us that on June 9, 1842, he saw a star of the 6th magnitude in Corona very nearly in the place of this strange star. As Sir John Herschel's position was laid down merely by naked eye allineations, the star seen by him may have been possibly a former temporary outburst of light in this remarkable object.

† On the 17th this nebulosity was suspected only; on the 19th and 21st it was not seen.

that this nebulosity really existed about the star. When the spectroscope was placed on the telescope, the light of this new star formed a spectrum unlike that of any celestial body which we have hitherto examined. The light of the star is compound, and has emanated from two different sources. Each light forms its own spectrum. In the instrument these spectra appear superposed. The principal spectrum is analogous to that of the sun, and is evidently formed by the light of an incandescent solid or liquid photosphere, which has suffered absorption by the vapours of an envelope cooler than itself. The second spectrum consists of a few bright lines, which indicate that the light by which it is formed was emitted by matter in the state of luminous gas *. These spectra are represented with considerable approximative accuracy in a diagram which accompanies this paper.



Spectrum of Absorption and Spectrum of Bright Lines forming the Compound Spectrum of a New Star near ε Coronæ Borealis.

Description of the spectrum of absorption.—In the red a little more refrangible than Fraunhofer's C are two strong dark lines. The interval between these and a line a little less refrangible than D is shaded by a number of fine lines very near each other. A less strongly marked line is seen about the place of solar D. Between D and a portion of the spectrum about the place of *b* of the solar spectrum, the lines of absorption are numerous, but very thin and faint. A little beyond *b* commences a series of close groups of strong lines; these follow each other at small intervals, as far as the spectrum can be traced.

Description of the gaseous spectrum.—A bright line, much more brilliant than the part of the continuous spectrum upon which it falls, occupies a position which several measures make to be coincident with Fraunhofer's F †. At rather more than one-fourth of the distance which

* The position of the groups of dark lines shows that the light of the photosphere, after passing through the absorbent atmosphere, is yellow. The light, however, of the green and blue bright lines makes up to some extent for the green and blue rays (of other refrangibilities) which have been stopped by absorption. To the eye, therefore, the star appears nearly white. However, as the star flickers, there may be noticed an occasional preponderance of yellow or blue. Mr. Baxendell, without knowing the results of prismatic analysis, describes the impression he received to be "as if the yellow of the star were seen through an overlying film of a blue tint."

† On the 17th, the lines of hydrogen, produced by taking the induction-spark through the vapour of water, were compared in the instrument simultaneously with the bright lines of the star. The brightest line coincided with the middle of the expanded line of hydrogen which corresponds to Fraunhofer's F. On account of the faintness of the red

separates F from G, a second and less brilliant line was seen. Both these lines were narrow and sharply defined. Beyond these lines, and at a distance a little more than one-third of that which separates the second bright line from the strongest bright one, a third bright line was observed. The appearance of this line suggested that it was either double or undefined at the edges. In the more refrangible part of the spectrum, probably not far from G of the solar spectrum, glimpses were obtained of a fourth and faint bright line. At the extreme end of the visible part of the less refrangible end of the spectrum, about C, appeared a line brighter than the normal relative brilliancy of this part of the spectrum. The brightness of this line, however, was not nearly so marked in proportion to that of the part of the spectrum where it occurs, as was that of the lines in the green and blue *.

General Conclusions.—It is difficult to imagine the present physical constitution of this remarkable object. There must be a photosphere of matter in the solid or liquid state emitting light of all refrangibilities. Surrounding this must exist also an atmosphere of cooler vapours, which give rise by absorption to the groups of dark lines.

Besides this constitution, which it possesses in common with the sun and the stars, there must exist the source of the gaseous spectrum. That this is not produced by the faint nebulosity seen about the star is evident by the brightness of the lines, and the circumstance that they do not extend in the instrument beyond the boundaries of the continuous spectrum. The gaseous mass from which this light emanates must be at a much higher temperature than the photosphere of the star; otherwise it would appear impossible to explain the great brilliancy of the lines compared with the corresponding parts of the continuous spectrum of the photosphere. The position of two of the bright lines suggests that this gas may consist chiefly of hydrogen.

If, however, hydrogen be really the source of some of the bright lines, the conditions under which the gas emits the light must be different from those to which it has been submitted in terrestrial observations; for it is well known that the line of hydrogen in the green is always fainter and more expanded than the brilliant red line which characterizes the spectrum of this gas. On the other hand, the strong absorption indicated by the

end of the spectrum, when the amount of dispersion necessary for these observations was employed, the exact coincidence of the line in this part of the spectrum with the red line of hydrogen, though extremely probable, was not determined with equal certainty.

* The spectra of the star were observed again on the 17th, the 19th, the 21st, and the 23rd. On these evenings no important alteration had taken place. On the 17th and succeeding evenings, though the spectrum of the waning star was fainter than on the 16th, the red bright line appeared a little brighter relatively to the green and blue bright lines. On the 19th and 21st the absorption lines about *b* were stronger than on the 16th. From the 16th the continuous spectrum diminished in brightness more rapidly than the gaseous spectrum, so that on the 23rd, though the spectrum as a whole was faint, the bright lines were brilliant when compared with the continuous spectrum.

line F of the solar spectrum, and the still stronger corresponding lines in some stars, would indicate that under suitable conditions hydrogen may emit a strong luminous radiation of this refrangibility*.

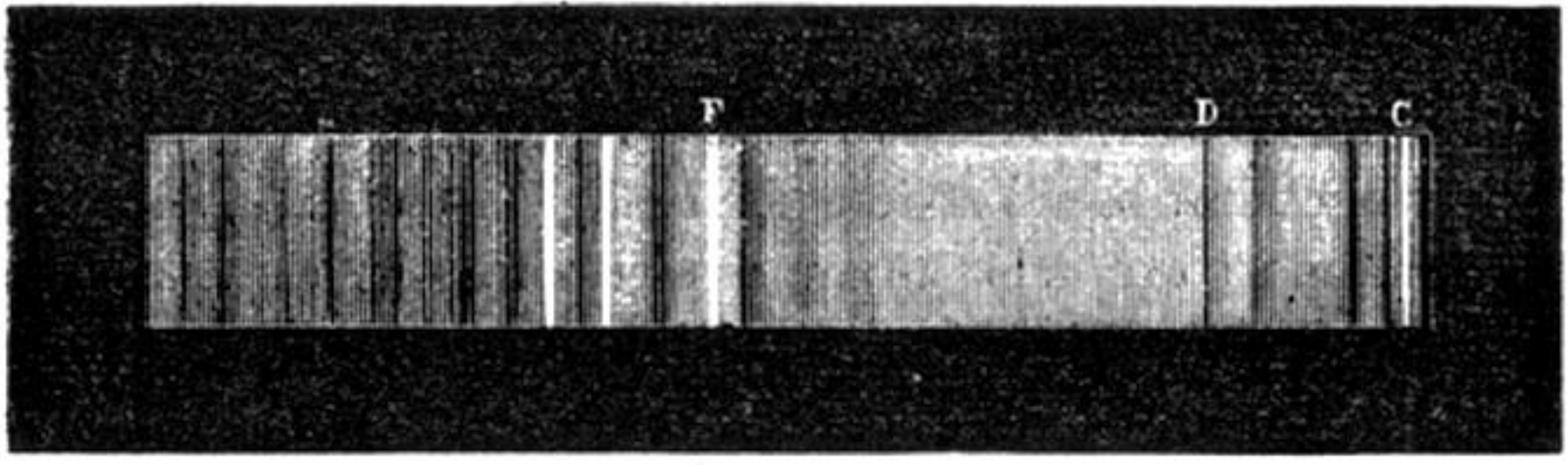
The character of the spectrum of this star, taken together with its sudden outburst in brilliancy and its rapid decline in brightness, suggest to us the rather bold speculation that, in consequence of some vast convulsion taking place in this object, large quantities of gas have been evolved from it, that the hydrogen present is burning by combination with some other element and furnishes the light represented by the bright lines, also that the flaming gas has heated to vivid incandescence the solid matter of the photosphere. As the hydrogen becomes exhausted, all the phenomena diminish in intensity, and the star rapidly wanes.

In connexion with this star, the observations which we made upon the spectra of α Orionis and β Pegasi, that they contain no absorption lines of hydrogen, appear to have some new interest. The spectra of these stars agree in their general characters with the absorption spectrum of the new star. The whole class of white stars are distinguished by having hydrogen lines of extraordinary force. It may also be mentioned here that we have found that the spectra of several of the more remarkable of the variable stars, namely those distinguished by an orange or ruddy tint, possess a close general accordance with those of α Orionis, β Pegasi, and the absorption spectrum of the remarkable object described in this paper. The purely speculative idea presents itself from these observations, that hydrogen probably plays an important part in the differences of physical constitution which apparently separate the stars into groups, and possibly also in the changes by which these differences may be brought about†.

* On the dependence of the relative characters of the bright lines of hydrogen upon conditions of pressure and temperature see Plücker and Hittorf, Phil. Trans. 1865, p. 21

† Mr. Baxendell sends us the following Table of magnitudes:—

	h	m			
May 15 at	12	0	G.M.T.,	T Coronæ	= 3·6 or 3·7 magnitude.
„ 16 „	10	30	„	„	= 4·2
„ 17 „	11	0	„	„	= 4·9
„ 18 „	12	30	„	„	= 5·3
„ 19 „	12	15	„	„	= 5·7
„ 20 „	12	30	„	„	= 6·2
„ 21 „	12	0	„	„	= 7·3
„ 22 „	11	15	„	„	= 7·7
„ 23 „	10	30	„	„	= 7·9
„ 24 „	10	30	„	„	= 8·1



Spectrum of Absorption and Spectrum of Bright Lines forming the Compound Spectrum of a New Star near ϵ Coronæ Borealis.