FURTHER OBSERVATIONS ON NOVA PERSEI.[1]

SINCE the preliminary note on this star was communicated to the Royal Society on February 28, observations have been possible on the nights of February 28, March 1, 3 and 5, and twenty-four photographs of the spectrum have been taken with the instruments before detailed.

It may be stated generally that the light is slowly waning. On February 28 the star was only slightly brighter than α Persei. On March 1 it was estimated as about equal to α Persei *i.e.* about 2·0 magnitude. When it was again visible, on the evening of March 3, it was distinctly less bright than β Persei, and its magnitude probably near 2·5. On the 5th its estimated magnitude was 2·7.

The above refers to the visual brightness. A photograph of the region occupied by the Nova on March 3 showed it to be photographically brighter than α Persei.

General Description of the Spectrum.

The photographs show that the bright hydrogen lines are successively feebler as the ultra-violet is approached, and the whole of the series of hydrogen lines have, during the past week, become relatively brighter with respect to the remaining lines and the continuous spectrum. The spectrum extends far into the ultra-violet.

Among the changes which have taken place in the visible part of the spectrum, it may be mentioned that, while the lines of hydrogen have become relatively brighter during the past week, the remaining lines, with the possible exception of the prominent one at λ 5169, have become distinctly dimmer. There has also been a diminution of the intensity of the continuous spectrum. The line in the yellow, the identity of which has not yet been definitely determined, has gradually decreased in intensity with the diminution of brightness of the star. The bright green-blue F line of hydrogen has become more conspicuous as the neighbouring green lines have become fainter, and the bright C line is intensely brilliant.

From all these causes, which give us blue light on the one hand and red on the other, the star should present to us the precise quality of red which has been observed.

Colour.

At discovery the star was described as bluish-white. No observations on its variation in hue during its brightening were possible, owing to unfavourable weather conditions. The observations during the period of decline have indicated a change to the present colour of a decided claret-red. In comparison with this it is interesting to note that in the case of the Nova which appeared in 1604, Kepler alludes to purple and red tints assumed by the star.

Changes in the Photographic Spectrum.

Between February 25 and March 5, to take the extreme difference of dates on which photographs were obtained, it has been noted that while some of the dark lines were absent on the later date, either new lines had come in or previously feeble lines had become intensified. There has not yet been time to determine accurately the positions of these lines. The appearance of the bright lines of hydrogen, which I described as being reversed on February 25, had very materially changed by March 3.

In inspecting the dark band representing the bright hydrogen at Hϵ, two darker fine lines are seen nearly coincident in position with the edges of Hϵ in the spectrum of α Persei photographed on the same plate.

The appearance in the case of the "F" line (Hβ), is seen by the accompanying light curve (Fig. 1).

[1] Abridged from a paper read at the Royal Society on March 7, by Sir Norman Lockyer, K.C.B., F.R.S.

No doubt the differences in the appearances are due to a fact that at Hϵ we are dealing with the lines both of H and Ca.

Rough measurements on the bright line Hβ show that the interval between the centres of the two extreme maxima shown in the light curve corresponds to about 25 tenth-metres. This would give a differential velocity of 960 miles per second between the different sets of hydrogen atoms in the bright line swarm itself.

It may be, then, that the appearances described as reversals of the hydrogen lines on February 25 were but the beginning of the subsequent changes.

The comparisons with stars which have been taken with the slit-spectroscope on each evening of observation, indicate that no great change in the velocity of the dark line component has occurred. So much, however, cannot

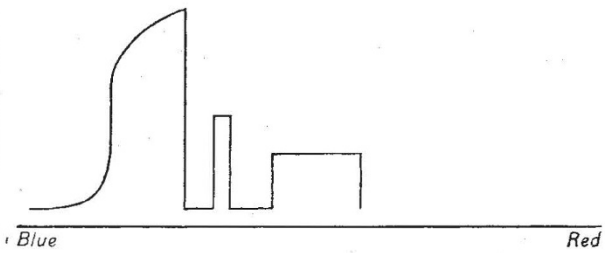

FIG. 1.

be said of the bright lines in which a change has been observed.

In addition to the hydrogen lines, the strong lines in the green already ascribed to iron appear to be double in the photographs most recently obtained.

Comparison with α Cygni.

The view of the apparent similarity between the spectra of Nova Persei and Nova Aurigæ, to which I drew attention in my previous paper, has been strengthened by the comparisons which have since been made.

The bright lines in the spectrum of Nova Persei are so broad, especially in the blue and violet, that accurate determinations of their wave-lengths are difficult to obtain. The lines less refrangible than F, however, besides being more isolated, are narrower than those in the more refrangible part of the spectrum. A direct comparison of these with the lines in the spectrum of a star which is known to contain the enhanced lines of iron, &c., has been considered a better method of arriving at some definite conclusion as to the connection between the Nova lines and the enhanced lines than that of determining the wave-lengths of the broad lines and comparing the results with the known wave-lengths of the enhanced lines.

The best star for this purpose is α Cygni, but, unfortunately, no good photograph has been obtained at Kensington of the green portion of the spectrum of that star. The star most nearly approaching α Cygni in relation to enhanced lines is α Canis Majoris, which, in the Kensington classification, has been placed nearly on a level with the former star, but on the descending side of the temperature curve. In the spectrum of this star the enhanced lines of iron at $\lambda\lambda$4924·1, 5018·6, $\left\{\begin{matrix}5169·0,\\5169·2\end{matrix}\right.$ and 5316·9 occur as well-marked lines. This spectrum has been directly compared with that of Nova Persei, taken with the same instrument, and the fact that all the lines apparently coincide affords good evidence that the connection is a real one, and that the first four strong Nova lines beyond F on the less refrangible side are the representatives of the enhanced lines of iron. These are the only enhanced lines which occur in that part of

the iron spectrum, with the exception of a weak one at λ 5276. There is only a trace of this line in the spectra of either the Nova or α Canis Majoris which have been compared. In the spectra of the Nova obtained with lower dispersion, however, a line is distinctly shown in this position, though it is considerably weaker than the four lines previously mentioned.

The absence of the strong lines which are familiar in the arc spectrum and in the ordinary spark spectrum in this region is to be ascribed to higher temperature; experiments which are in progress show that under certain conditions the two lines λλ 5018·6 and 5169 are by far the strongest lines in the spectrum of iron between λ 500 and D, while that at λ 4924·1 is distinctly stronger than any of the well-known group of four arc lines in which it falls.

The published wave-lengths of the lines of Nova Aurigæ show that the same lines were present in that star. Further investigations of the spectrum of Nova Aurigæ have strengthened the conclusion that most of the lines, after we pass from those of hydrogen, are enhanced lines of a comparatively small number of metals.

When the inquiry is extended into the regions more refrangible than Hβ, the evidence in favour of the similarity of the spectra of the two Novæ with that of α Cygni is not so conclusive, because of the greater breadth of the lines (since the spectra have been obtained by the use of prisms) and because of the fact that in this region the enhanced lines of iron frequently occur in groups.

In the region between Hδ and Hγ, however, there is a well-marked enhanced line of iron at λ 4233·3, and also two doubles at λλ 4173·7, 4179·0, and λλ 4296·7, 4303·3, and a comparison of α Cygni with Nova Persei indicates that these fall on broad bright bands of the Nova spectrum.

NORMAN LOCKYER.

MR. BORCHGREVINK'S ANTARCTIC EXPEDITION.[1]

MR. BORCHGREVINK succeeded in an enterprise of which he may be justly proud. Unknown and without external influence, by the force of his immense ambition and determination, he obtained the support of a man of great wealth, and unaided, if also untrammelled, by Government, learned societies or committees of any kind, he equipped an expedition, selected a scientific staff, spent a winter on land in the Antarctic regions for the first time in history, and made his way to a point nearer the South Pole than had ever been reached before. For doing this he deserves praise and honour. With his motives we have no concern; they appear to have been partly commercial and partly scientific, but in these columns we can only treat the expedition from a purely scientific point of view, forming our opinions from the facts placed before us in the book.

Mr. Borchgrevink chose his ship well, and she proved to be as stout and powerful a steam-whaler as ever put out from Norway. He chose his scientific staff well, and they appear to have worked conscientiously and to have obtained results which cannot fail to advance knowledge if they are properly discussed and published. He chose his sailing master, Captain Jansen, well, and he appears to have conducted the expedition without a hitch or any trace of insubordination. Mr. Borchgrevink was able to repeat in his steamer Sir James Clark Ross's sailing-ship voyage, and saw again Mounts Erebus and Terror; he landed on the southern ice, and advanced a few miles beyond the edge of the previously known world.

The book is short—an excellent thing in accounts of travel; the author has a certain power of observation and description, as the chapter on the habits of penguins and many little episodes of personal adventure show. His illustrations are remarkably fine, admirable reproductions of good photographs, and they are introduced with a lavish hand.

This is the bright side of the medal; the reverse is not so pleasing. Mr. Borchgrevink would have done better if he had had another chronicler, for his literary style does him less than justice. We can excuse an author, whose forte is action rather than study, for attributing incorrect titles to English men of science, but he might surely be expected to give correctly the names of his own distinguished countrymen, amongst whom Dr. Hjort appears as *Hjorth*, and Dr. Reusch in one place as *Reush* and in another as *Rusch*. Although the book is small we can hardly attribute these slips to anything but haste in correcting the proofs. We wish we could find an equally satisfactory explanation of other errors of a more serious kind.

We fear that Mr. Borchgrevink did not set his ambition high enough, and did not endeavour to make himself acquainted with the elementary principles of the various sciences which the members of his staff were pursuing. During the long Antarctic night he might easily have learned from his skilled assistants more than sufficient to have enabled him to give an intelligible sketch of the work of his expedition, even if time had been wanting at an earlier period. That he did not do so is to be inferred from the following circumstances, to which we call attention with real regret and which we would have passed over gladly were it not that the objects of the expedition have been generally spoken of as scientific.

On p. 63 there is given what purports to be a fully worked example of the calculation of the longitude from observations of the sun taken near Balleny Island,[1] by means of a Cary 10-inch sextant. The index error was found to be "14 in." off the arc—a possible printer's error for 14″, one would think; but further down the error is given as 14′ 0″. However, the sun's semidiameter is also estimated at the excessive value of 16° 17′ 1″, and this gives us a clue to the system of notation employed for the corrections, though not for the instrumental reading. It is simply to write minutes as degrees, seconds as minutes and decimals of a second as seconds. Working out the calculation on this assumption the final corrected altitude is obtained as stated. On p. 64 the curious blunder of "Lysin Sq.," probably intended for "Log Sin²," and several others equally absurd have escaped the author's vigilance, and the logarithms set down are not what we would expect.

Is this an elaborate joke played by the author on the public, or is it a joke played on the author by some person unknown and not detected by him? We cannot think that it was meant seriously, and we cannot see why the example was ever given, as no one has any interest in disputing the position of Balleny Island. The actual figures and working of the really critical observation which convinced Mr. Borchgrevink that he had got further south than Sir James Ross might have been quoted reasonably enough, but are not. If any credence is to be given to the position of the expedition at any date, the serious question raised by this worked specimen must be answered.

On p. 136 we read, "Only Jupiter and its stars and Centauri were visible." So much for astronomy.

With regard to meteorology the same indifference to figures occurs. In more than one place the height of the barometer is given in the form "29.7.1," although elsewhere the readings are expressed in the usual way. The vaguest references are made to instrumental observations; for instance, a graphic account is given of the difficulty of placing a thermograph at 2000 feet on Cape

[1] "First on the Antarctic Continent; being an account of the British Antarctic Expedition, 1898–1900." By C. E. Borchgrevink, F.R.G.S., Commander of the Expedition. With portraits, maps, and 186 illustrations. Pp. xvi+334. (London: George Newnes, Ltd., 1901.)

[1] Balleny Island is stated, on p. 3, to be a volcano 12,000 feet high; here there is evidently some confusion with Mount Erebus.