

ART. LVIII.—*Bright Lines in Stellar Spectra*; by O. T. SHERMAN.

UP to date, as far as my knowledge goes, bright lines have been admitted to form part of the spectra of but six stars, β Lyræ, γ Cassiopeiæ, and four small stars in Cygnus. The claims of four others in Orion have been advanced and denied.

In the recent volumes of the *Nachrichten*, Konkoly and Gothard have called attention to the first and second of the stars enumerated above. The result of the former work may be summed up in the identification of the bright lines D_1 , H_α , H_β , H_γ , H_δ , of the dark lines b , D , and a broad band in the violet, and the recognition of a seven day period for the variation of the spectrum of β Lyræ.* Konkoly also says:† “Ich glaube auch noch manchmal im Grün und Blau einige sehr zarte Linien gesehen zu haben, was aber auch eine durch das Flattern des Spectrums verursachte Täuschung sein kann.” With a view to following these stars and learning whatever a conscientious study of their spectra might show, the equatorial (8 in.) of the Yale College Observatory was devoted thereto.

The spectroscope employed is a direct vision by Duboscq; the distance from the slit to the collimating lens being about 14.8^{cm}. The train is broken into two series of three prisms each. Using the single series the lines b_1 and b_4 are barely separated. Using the double series the nickel line between D_1 and D_2 is seen, and b_3 is separated from b_4 by about the width of the latter. The power of the eyepiece of the observing telescope is about 130. A cylindrical lens behind the eyepiece is usually employed. Previous to each night's work the instrument was adjusted upon the sun; a solar spot, when possible, being brought sharply in focus upon the jaws of the slit. For stellar observation the slit was opened wide, 5^{mm} or more.

* *Astronomische Nachrichten*, 2539, 2548, 2651, 2581.

† *Astron. Nachr.*, 2548, p. 62.

When the series of observations was first commenced there were recognized in the spectra but a few bright lines, so situated as to be probably the hydrogen lines, D_{β} , and in addition 1474(K) and 1250(K). As the observer became accustomed to the spectrum of β Lyræ it became apparent that there were also other bright lines. With the single series of prisms ten such were counted.

Recalling now the course of reasoning which led to the daylight observation of the solar prominence, and also that many more bright lines than those already recognized were seen in the spectrum of the solar atmosphere, I employed the highest dispersion obtainable. The number of bright lines was increased to seventeen. It seems extremely probable that an increased dispersion will bring out many more. Arrangements for so improving the apparatus are in progress. The story for γ Cassiopeiæ is similar.

The instrument has been turned upon numerous other stars and in each case many or few bright lines have been seen, lines, so far as I know, formerly unsuspected. The careful description awaits the completed apparatus. At present it would seem that the lines are most easily seen in the red stars. This may be a mistake. The word lines is here used only by analogy to signify bright stellar images. At the red end under a sharp focus they stand out the full breadth of the spectrum, bearing somewhat the same relation to the background as the prominence to the solar spectrum. In the brighter portion of the spectrum they are cut down to fine star points. At the blue end they become more distinct but not so sharp as at the red. At times they shine with almost a metallic brilliancy; at other times they are faint, faded, and easily passed over. Certain sets appear to be prominent at times, others at other times.

The difficulties of the observation, and the roughness of the recording apparatus have hindered a completely satisfactory identification of the lines. Assuming the position of the hydrogen lines and of D_{β} , and on their basis drawing the curve connecting scale reading and wave length, the mean of nine observations upon γ Cassiopeiæ affords the following approximate wave lengths. The positions of the dark lines are underlined.

H_{α} , 635·6, 628, 616, D_{β} , 584 0 ? 576, 555·75, 542·2, 530·98, 516·75, 502, 499·0, 492, H_{β} , 467·35, 462·3, H_{γ} 418 ? H_{δ} , 399·3.

It is of interest to compare these with the following wave lengths taken from Prof. Young's catalogue of lines observed at Sherman :*

H_{α} , 634·6, 614·06 D_{β} , 585·27, 553·4, 544·59, 531·59, 516·83 and 516·67, 501·76, H_{β} , 457, H_{γ} , 421·5, H_{δ} .

* This Journal, Nov., 1872.

While the identification is not complete the number of the approximate coincidences renders it extremely probable that the lines observed are those of the solar atmosphere.

To quote the pioneer of American spectroscopic observations, it would seem that there are many stars in the same condition as the sun, but with the corona more pronounced.

Yale College Observatory, November, 1885.