THE CLINTON CATALOGUE.—The *Sidereal Messenger* for December announces that the great catalogue of 30,000 stars, upon which Dr. Peters and his assistant, Prof. Borst, have been engaged for several years past, is virtually completed, and ready for the press, and its publication is expected during the present winter. In the prosecution of this work Prof. Borst has gathered the stars from the various astronomical publications of the last fifty years, and reduced them to the epoch of the forthcoming catalogue.

OCCULTATIONS OF STARS BY PLANETS.—Herr A. Berberich calls attention in the *Astronomische Nachrichten*, No. 2814, to the importance of observations of occultations of stars by the planets, and supplies a list of stars which may possibly be occulted by either Venus, Mars, Jupiter, or Saturn, during the course of the present year. Such observations have been extremely rare, yet they would prove extremely important, for they would throw light on the extent and density of the planetary atmospheres, and would afford a means in the cases of Mars and Venus for the determination of parallax and diameter. Herr Berberich adds that in the case of the three outer planets the occultation of a star by the primary would afford a specially favourable opportunity for the determination of the positions of the satellites, since micrometer measures of their places as referred to the occulted star would be free from many errors to which the direct comparison of the planet and its satellites is exposed.

The following stars may possibly undergo occultation during the next fortnight :—

| Planet. | G.M.T. of Conjunction in R.A. h. m. | Star. | Mag. | Pl − * Δδ ′ | Max Duration. m. |
|---|---|---|---|---|---|
| ♀ | Jan. 5 16 29·2 | S.D. − 17° No. 4187 | 9·7 | −0·13 | 6·0 |
| ♀ | 9 18 1·4 | 18 4279 | 9·5 | +1·05 | 5·8 |
| ♂ | 12 3 41·4 | 4 3445 | 9·3 | −0·18 | 7·4 |
| ♀ | 12 8 32·3 | 19 4401 | 9·3 | +0·84 | 5·7 |
| ♀ | 14 18 40·8 | 19 4441 | 9·5 | −0·19 | 5·6 |
| ♀ | 15 1 31·9 | 20 4446 | 9·5 | +0·38 | 5·5 |
| ♀ | 17 23 22·5 | 20 4635 | 9·3 | −0·57 | 5·4 |

The maximum duration is the interval between immersion and emersion for a central occultation.

## *ASTRONOMICAL PHENOMENA FOR THE WEEK* 1888 *JANUARY* 8-14.

(FOR the reckoning of time the civil day, commencing at Greenwich mean midnight, counting the hours on to 24, is here employed.)

*At Greenwich on January* 8

Sun rises, 8h. 7m. ; souths, 12h. 6m. 49·1s. ; sets, 16h. 7m. : right asc. on meridian, 19h. 16·8m. ; decl. 22° 17′ S. Sidereal Time at Sunset, 23h. 18m.

Moon (New on January 13, 9h.) rises, 2h. 14m. ; souths, 7h. 34m. ; sets, 12h. 44m. : right asc. on meridian, 14h. 43·4m. ; decl. 10° 21′ S.

| Planet. | Rises. h. m. | Souths. h. m. | Sets. h. m. | Right asc. and declination on meridian. h. m. | ° ′ |
|---|---|---|---|---|---|
| Mercury.. | 7 55 ... | 11 40 ... | 15 25 ... | 18 50·0 ... | 24 27 S. |
| Venus..... | 4 36 ... | 9 1 ... | 13 26 ... | 16 10·3 ... | 18 29 S. |
| Mars ..... | 0 11 ... | 5 53 ... | 11 35 ... | 13 1·9 ... | 4 14 S. |
| Jupiter.... | 4 16 ... | 8 38 ... | 13 0 ... | 15 47·4 ... | 19 4 S. |
| Saturn.... | 17 28*... | 1 19 ... | 9 10 ... | 8 27·1 ... | 19 39 N. |
| Uranus ... | 0 23 ... | 5 55 ... | 11 27 ... | 13 4·3 ... | 6 8 S. |
| Neptune.. | 12 51 ... | 20 31 ... | 4 11*... | 3 42·5 ... | 17 56 N. |

* Indicates that the rising is that of the preceding evening and the setting that of the following morning.

*Occultation of Star by the Moon* (visible at Greenwich).

| Jan. | Star. | Mag. | Disap. h. m. | Reap. h. m. | Corresponding angles from vertex to right for inverted image. ° ° |
|---|---|---|---|---|---|
| 9 ... | η Libræ ... | ... 6 ... | 6 18 ... | 6 46 ... | 341 298 |

Jan. h.
9 ... 11 ... Jupiter in conjunction with and 4° 12′ south of the Moon.
10 ... 0 ... Venus in conjunction with and 2° 16′ south of the Moon.

*Variable Stars.*

| Star. | R.A. h. m. | Decl. ° ′ | | h. m | |
|---|---|---|---|---|---|
| U Cephei ... ... | 0 52·4 ... | 81 16 N. ... | Jan. 10, | 22 22 | *m* |
| ζ Geminorum ... | 6 57·5 ... | 20 44 N. ... | ,, 9, | 3 0 | *m* |
| | | | ,, 14, | 3 0 | *M* |
| R Canis Majoris... | 7 14·5 ... | 16 12 S. ... | ,, 11, | 22 53 | *m* |
| | | | ,, 13, | 2 9 | *m* |
| U Monocerotis ... | 7 25·5 ... | 9 33 S. ... | ,, 11, | | *m* |
| S Cancri ... ... | 8 37·5 ... | 19 26 N. ... | ,, 9, | 23 12 | *m* |
| R Leonis ... ... | 9 41·5 ... | 11 57 N. ... | ,, 8, | | *m* |
| R Ursæ Majoris ... | 10 36·7 ... | 69 22 N. ... | ,, 8, | | *M* |
| T Ursæ Majoris ... | 12 31·3 ... | 60 6 N. ... | ,, 12, | | *m* |
| W Virginis ... ... | 13 20·3 ... | 2 48 S. ... | ,, 8, | 22 0 | *m* |
| δ Libræ ... ... | 14 55·0 ... | 8 4 S. . | ,, 11, | 4 34 | *m* |
| U Coronæ ... ... | 15 13·6 ... | 32 3 N. ... | ,, 8, | 0 45 | *m* |
| U Ophiuchi .. ... | 17 10·9 ... | 1 20 N. ... | ,, 8, | 4 38 | *m* |
| | | and at intervals of | | 20 8 | |
| T Vulpeculæ ... | 20 46·7 ... | 27 50 N. ... | Jan. 11, | 0 0 | *m* |
| | | | ,, 12, | 1 0 | *M* |
| Y Cygni ... ... | 20 47·6 ... | 34 14 N. ... | ,, 10, | 21 7 | *m* |
| | | | ,, 13, | 21 0 | *m* |
| W Cygni .... ... | 21 31·8 ... | 44 53 N. ... | ,, 14, | | *M* |
| δ Cephei ... ... | 22 25·0 ... | 57 51 N. ... | ,, 8, | 4 0 | *M* |
| | | | ,, 11, | 22 0 | *m* |

*M* signifies maximum ; *m* minimum.

*Meteor-Showers.*

| | R.A. ° | Decl. ° | |
|---|---|---|---|
| Near ξ Virginis... ... | 174 ... | 9 N. ... | January 11. |
| ,, ζ Boötis ... ... | 220 ... | 14 N. ... | Very swift ; streaks. |
| ,, β Boötis ... ... | 222 ... | 42 N. ... | Very swift ; streaks. |

## *DUNÉR ON STARS WITH SPECTRA OF CLASS III.*[1]

I.

IN publishing a few days before his death the last part of his discoveries relating to the spectra of stars of the third class, D'Arrest pronounced the opinion that henceforward there would be nothing essential to add to the knowledge then possessed of the stellar spectra of this class in the northern heavens. When D'Arrest died, 123 well-developed objects of Class III.*a* were known, and counting all the objects known, 150; the stars known in Class III.*b* were 23. Actually, the well-developed stars of III.*a* are 214, and if all are reckoned, 475 ; the stars of III.*b* are 55 at least.

The number of objects in Class III. with which we are acquainted has been tripled by recent researches, but, besides, the relation between the numbers of the stars in the two lower classes has been considerably altered, considering that at present there are 8·5 stars III.*a* instead of 6·5, to 1 star III.*b*. However, we should commit a serious error if we drew the conclusion that in reality the spectra III.*b* were not more than nine times rarer than III.*a*. On account of the enormous width of the bands, one is able without any difficulty to recognize the nature of a spectrum III.*b* in very faint stars, which one is not able to do in III.*a*, unless in the rare objects of this class in which the bands are more marked and broader than usual.

I find this opinion confirmed by the fact that the researches of M. Vogel give more than 200 new spectra III.*a*, and have scarcely led to an acquaintance with one new spectrum III.*b*. It is very probable therefore that we are already acquainted with all these stars to the magnitude of 7·5 inclusive ; this is rendered still more probable by the following table, which gives the number of the stars III.*a* and III.*b* belonging to different magnitudes :—

| Magnitude. | Class III.*a*. Observed. | Calculated. | Class III.*b*. Observed. | Calculated. |
|---|---|---|---|---|
| 1·0–1·9 | ... 2 | ... 1 | ... 0 | ... 0 |
| 2·0–2·9 | ... 5 | ... 3 | ... 0 | ... 0 |
| 3·0–3·9 | ... 9 | ... 11 | ... 0 | ... 0 |
| 4·0–4·9 | ... 31 | ... 28 | ... 0 | ... 1 |
| 5·0–5·9 | ... 88 | ... 90 | ... 2 | ... 2 |
| 6·0–6·9 | ... 134 | ... 380 | ... 11 | ... 8 |
| 7·0–7·9 | ... 151 | ... — | ... 18 | ... 24 |
| 8·0–8·9 | ... 37 | ... — | ... 14 | ... — |
| 9·0–9·9 | ... 18 | ... — | ... 10 | ... — |

[1] We have already referred generally to M. Dunér's important memoir published in the Transactions of the Swedish Academy. We now give a translation of his general conclusions.—ED.

In the columns headed "Calculated" are the numbers obtained by multiplying by 4/3 the numbers of the stars in the classes of different magnitude given in the "Wunder des Himmels," by Littrow, 5th ed. p. 577, deduced from the *Durchmusterung* of Argelander, and then dividing the result by 15 and 750 respectively. For the stars III.*a* the agreement is almost perfect up to the magnitude of 5·9 inclusive, and for III.*b* up to 6·9; up to 7·9 the agreement is pretty good, whilst after that the numbers observed are more and more in arrear of the numbers obtained by calculation. We may conclude therefore that our knowledge of the spectra III.*a* is almost complete up to the magnitude of 5·9 inclusive, and of spectra III.*b* up to 7·5 inclusive. The researches of M. Vogel have not added any new star III.*a* with a magnitude higher than 5·0, and only very few between 5·0 and 6·0, and, as I have already said, no new star III.*b* above the magnitude 7·5, although he has examined all the stars up to this limit of magnitude between − 2° and + 20° of declination. As to the difference existing between "observation" and "calculation" in the case of the III.*a* feebler than 6·0, we must remember that as yet no systematic spectroscopic research has been made of the stars between − 2° and − 23°, nor between + 20° and the North Pole. Consequently the number of stars III.*a* between 6·0 and 7·5 will probably be much increased before very long, and will approach the theoretic number. On this account I imagine the stars of III.*b* are fifty times rarer than those of III.*a*.

The list of these rare stars is probably already very complete for that part of the sky visible in Europe, for the nearer the researches of an astronomer are to the present time the feebler are the stars with spectra of this class which he discovers (Secchi 6·7, D'Arrest 7·0, Vogel 7·1, Duner 8·3, Pickering 9·1). The conclusions, therefore, which we can draw as to the manner in which these stars are distributed over the heavens deserve some confidence. Such a research is very interesting. We have already seen that the principal bands in these spectra owe their origin to the presence of a carbon compound in the atmosphere of the stars. It is important to know whether there is a certain direction in the heavens in which these stars are more numerous than in others, especially when we consider that the same substance is present in comets, which come from interstellar space. I have made such a research, and have come to the conclusion that the objects in question are grouped similarly to stars in general, being closer together in the neighbourhood of the Milky Way. Setting out from the position of the Pole of the Milky Way given by Heis, R.A. = 12h. 42m., Decl. = + 26° 8′, for the equinox 1900·0, I have calculated the quantities P, or the distances of the stars from this Pole, given in my catalogue. But to have my list a little more complete for the part of the heavens invisible in Europe, I have calculated the same quantity also for the following stars, whose spectra have been examined by M. Pechüle ("Expédition Danoise pour l'Observation du Passage de Venus," 1882, pp. 40-43).

| Star. | Magnitude. | R.A. 1900·0. h. m. | Decl. 1900·0. ° ′ | P. ° |
|---|---|---|---|---|
| 65 Schj. | 8 | 5 40 | − 46 30 | 60·6 |
| 103 Schj. | 8 | 7 54 | − 49 43 | 80·6 |
| 125 | 7·5 | 9 51 | − 41 7 | 78·6 |
| 126 | 8·5 | 9 57 | − 59 45 | 87·0 |
| 128 | 7 | 10 8 | − 34 30 | 71·5 |
| 130 | 6·5 | 10 31 | − 39 3 | 72·6 |

By the help of the P's found, I have obtained the following table, which indicates the numbers of those stars which are between the different limits of distance of the Poles, boreal or austral, of the Milky Way.

| Limits of Polar Distance. ° ° | No. of Stars. | Mean Magnitude. |
|---|---|---|
| 0-35 | 3 | 6·6 |
| 35-60 | 8 | 6·6 |
| 60-70 | 8 | 7·2 |
| 70-80 | 13 | 7·4 |
| 80-90 | 29 | 8·3 |

It is at once seen that there is an immense accumulation between 80° and 90° of polar distance, and that the polar regions are totally empty up to 19° distance from the Pole; and this relation would doubtless become still more striking if our knowledge of these stars which are invisible in Europe was more complete; for, whilst the two Polar regions are for the most part visible, a great part of the Milky Way is always below our horizon. Besides the number of stars in the different zones, I have also calculated their mean magnitudes, and it will be seen that for them, as well as for other stars, there is this rule that in the Milky Way the faint stars are much closer together than in the neighbourhood of its Poles.

One might perhaps suppose that there is a certain portion of the Milky Way where the stars III.*b* are more frequent than elsewhere. In order to decide this it is necessary first to calculate for each star the quantity which has the same relation to the Milky Way as the right ascensions have to the equator; and then make a table, on the distribution, having this quantity as its foundation. Such a research cannot, however, lead to good results as long as our acquaintance with the stars between 25° of south declination and the South Pole is almost *nil*. I will only say, then, that there is a great number of these stars around R.A. 305°, Decl. + 40°, but almost an equal number around R.A. 85°, Decl. + 25°. Now both these points are precisely those in which, in the northern hemisphere, the stars are closest together. It seems that they are grouped almost according to the same laws as all other stars, and that, properly speaking, there is no region where stars of the Class III.*b* abound.

A similar research of the stars III.*a* could not give exact results, as our acquaintance with these stars below magnitude 6·0 is still too imperfect. However, the researches which M. Pechüle undertook, with the aid of the *Uranometria Argentina*, on the distribution of the coloured stars, render it probable that these also are closest together in the neighbourhood of the Milky Way.

I have already said that in all probability the spectra of fixed stars must be subject to variations on account of the diminution in the temperature of stars which must take place sooner or later, and I observed that it is precisely on the supposition of such a diminution that the classes of M. Vogel are based. There are, however, eminent *savants* who have combated the correctness of this opinion, and who have formed ingenious hypotheses to prove the possibility that the sun, and consequently the stars also, may regain the heat which emanates from them. But it would be too much to say that these theories have victoriously withstood criticism, and the spectroscopic examination of the stars has given results fatal to them. Although the spectra of stars may be divided into very distinct classes, according to their characteristics, there are, on the other hand, numerous spectra of all possible grades between any two classes, so that it may be difficult, if not impossible, to decide to what class a star belongs, and that even when it is sufficiently brilliant for all the details of its spectra to be distinctly recognized. Besides, we see that the more the star resembles the first class, the brighter is its violet part, whereas the violet part becomes fainter and fainter or even invisible when the spectrum resembles that of α Orionis (III.*a*). On that account it seems certain that the spectra owe their characteristics to the greater or less degree of incandescence of the stars, so that the temperature of stars of Class III. must be relatively low.

Doubtless these changes do take place in the stellar spectra, although we must suppose that, as regards the spectra of the first two classes, they are almost exclusively secular, and operate so slowly that millions of years may pass before they become apparent.

It is different with stars of Class III. These being probably already much cooler than the others, we may reasonably expect that the changes will take place more rapidly, and perhaps also that from time to time temporary augmentations in activity will take place on their surface, followed by periodic changes in their spectra.

In the course of his observations Secchi arrived at the conclusion that the colours and spectra of these stars were subject to remarkable changes in a very short period. My observations led to the same conclusion, if observations from the years 1865 to 1874 may be trusted without reserve. For, without counting the few and unimportant discrepancies which I discovered between the aspect of several spectra and the descriptions given by earlier observers, I found that there are forty stars which have been comprised in Class III., among which there is scarcely one which now belongs to it, and there are some which ought to have been transported from one sub-class into the other. But, for reasons which I will here explain, such a conclusion would certainly be too hasty.

On the one hand, Secchi's observations date from a time which we may call the infancy of spectrum analysis, and the instruments employed were very imperfect; on the other hand, he was the first to introduce a classification of the stars according to

their spectra. Therefore it is easily understood that Secchi was only able to seize gradually the characteristics of the different types (thus it was not until late that he introduced the fourth type); and again, he once changed the order so that the second and third types changed numbers. On account of this change, some errors may have found their way into his publications. Some even may be explained without having recourse to this supposition. All the spectra which I have excluded from the third class are, according to Secchi, indeterminable, except two, which I consider intermediate between II.*a* and III.*a*, and the two stars R.A. = 9h. 18m., Decl. = − 21° 50′, and R.A. = 18h. 14m. 40s., Decl. = +25°·2, which Secchi found independently of Schjellerup's catalogue of red stars. It might happen then that with a clear sky faint bands might be perceived,[1] and as to the last we may well suspect that there is some gross error in their positions, judging from what Secchi says as to the manner in which he discovered the first of them.[2] Such a supposition would not be admissible for the star 249 Schj. This star is situated, according to Herschel, amongst a mass of stars, and Secchi says of it, "Stella di 9ª rossa con rigoni nello spettro 4° tipo certamente" ("Memoria Seconda," p. 52). I have often examined the cluster in which this star was situated, but without perceiving it. We may therefore believe that it is variable of long period.

I still have to refer to the stars which ought to have been transferred from one *sub*-class to another. In the spectra of these, variability seems to me quite inadmissible, the two subclasses being, as I shall try to prove soon, co-ordinated, and not successive phases of development which every star must undergo. I suppose that at the commencement of his observations of spectra of the third class, when Secchi met with stars III.*b* not very well marked, he did not think them different from III.*a*, and he did not perceive the difference until after having seen several spectra of this class as pronounced as those of 78 and 152 Schj. On the spectrum of the latter he still says in 1867, "In conclusione è tipo di *a* Ercole ma con zone vere mancanti" ("Catalogo," pp. 14, 15).

However, neither Secchi nor even D'Arrest examined a sufficient number of spectra III.*b* to thoroughly understand their characteristics. Both appear to admit that there are fundamental differences between spectra belonging to it. For instance, Secchi says of the spectrum of star 136 Schj., "E difficile dire se sia proprio del 4° tipo" ("Memoria Seconda," p. 42), and of the stars discovered by Wolf and Rayet with bright lines which are not hydrogen,[3] and dark bands in the spectra, and therefore certainly belonging to Class II.*b*, he says, "Accenneremo qui soltanto che esse appartengono al 4° tipo, ma sono di quelle a zone molto irregolari" ("Sugli spettri prismatici delle stelle fisse," p. 194), and "Ad ogni modo sono di 4° tipo, e le righe paiono del carbonio diretto" (*l.c.* p. 216). D'Arrest speaks as follows of the star 74 Schj., "Irregular spectrum of type IV." (*A.N.* 2016); and of the star 155*b* Schj., "Very remarkable spectrum, &c." (*A.N.* 2009). By collecting all my observations on all the spectra of this class it is seen that not one of them really departs from what may be called the normal spectrum. Doubtless there are in different stars notable differences in the darkness of the flutings, and in the brilliancy of the intervals, but all this does not prevent all the spectra being formed according to one constant type, as happens with Class III.*a*. Besides, Secchi seems to think that the aspect of a spectrum may change completely with the kind of spectroscope used. He says of the spectrum of 132 Schj., "Tipo 4° ben deciso, . . . oculare cilindrico. Coll'oculare piccolo sferico tutto questo era sparito e si credette tipo 3°." When instruments are used which give so vague an appearance to an exceptionally well-defined spectrum, presenting essential characteristics, it is easy to commit serious errors in judging of the spectra examined. Therefore I cannot see that the discrepancies which exist between Secchi's observations and mine are a sign of variations in the stellar spectra, although no doubt it is prudent to occasionally examine the stars concerning which these discrepancies have arisen.

It is quite a different case with the discrepancies that I have found between my observations and those of D'Arrest, who was supplied with excellent instruments, and was a most careful and skilful observer. It is necessary therefore to examine more closely into the cases in which differences exist. There are three, two of which concern the stars 24034 Ll. = Weisse XII.ⁿ 793 and DM. + 60° 1461 = A. Oe. 13681. D'Arrest says that the latter has "a bright well-marked spectrum of type III." (*A.N.* 2044) and the former "a clear, fluted spectrum, the flutings being very distinct although pretty fine, III." (*A.N.* 2009). I found both nearly white, and their spectra II.*a*, or continuous. It is true that I examined the positions of these stars by the help of the two catalogues in which they are, and obtained the same positions, nevertheless one is tempted to believe that D'Arrest made some error in the identification of these stars, especially as he did not observe them several times. This supposition is quite inadmissible, however, for the star DM. + 36° 2772 = Ll. 30500, for here D'Arrest expressly says (*A.N.* 2009), "8·3 mag. with beautiful column-like spectrum. It is one of the stars accompanying the great Hercules nebula." I have calculated the position of this star with the help of the catalogue and of Ll., and besides that I examined all the stars in the neighbourhood of the great cluster in Hercules without finding one of Class III.*a*. The star DM. + 36° 2772 is of orange colour, but its spectrum is continuous, or at most II.*a* very poorly developed. As regards this spectrum I shall not even attempt to explain the difference between what I have seen, and the description given by D'Arrest. A variability of the spectrum seems really probable, and the star is certainly deserving of much attention. Besides this star there are others whose spectra I found very feebly developed, whilst D'Arrest says that they are beautiful or even superb. This also may be regarded as a sign of variability, and a fact which also supports this supposition is that D'Arrest has made his observations under atmospheric conditions generally regarded as similar to those found at Lund with a spectroscope of similar construction to one of ours, and a telescope very little larger than the one which I used. But it is remarkable that whereas I have often found expressions used by D'Arrest to describe spectra stronger than I should have used, the contrary is of very rare occurrence. It is possible, therefore, that the differences are only apparent, and that either D'Arrest's observations were made under exceptionally favourable circumstances, or mine under very unfavourable ones. The latter supposition is scarcely probable however, for when such differences have occurred I repeated the observation several times; and besides, Vogel's observations on the stars between − 2° and + 20° agree almost without exception with mine. It appears, moreover, that very often D'Arrest only made one observation of the same star; and, without depreciating his researches, it seems to me more probable that there are small and rare inexactitudes in the observations, than that such great changes have taken place in the stars themselves in the short period of ten years.

My researches already contradict the hypothesis that important changes in the stellar spectra take place so rapidly. My observations embrace a period of six years, and a much larger number of objects than either D'Arrest or Secchi examined. But there is no spectrum in which my latest observations have differed sensibly from my first ones. It is true that my first observations on the spectrum of R Crateris are in direct opposition to the last, the former making its spectrum III.*b* and the latter III.*a*. But that is in no way a sign of variation in the spectrum. When the bands in the spectrum III.*a* of a faint star are exceedingly broad in the green-blue, it is easy to fall into the error of regarding it as III.*b*. At the time of M. Vogel's first observation he also believed that the spectra of stars DM. + 14° 2525 and DM. + 17° 3940 were III.*b*, and it is true that these two spectra, especially the last, are strikingly like the spectra III.*b* in spectroscopes of small dispersion.

It was in order to escape such errors that I determined in the spectra of most of the faint stars of Class III *b* the approximate wave-lengths of their principal flutings; the wave-length of band 6, and also that of band 10, being a sure mark that the spectra belonged to this section of Class III. This deceptive appearance generally disappears when the star is examined with spectroscopes of considerable dispersion. I am therefore at present of opinion that, excluding the new stars and perhaps $\eta$ Argûs, which seems to belong to the same category, we have no reason to believe that great and rapid changes take place in the stellar spectra, although it must be confessed that the observations of certain stars, especially DM. + 36° 2772, are such as to render such changes very probable.

(*To be continued.*)

[1] M. Vogel has as a matter of fact seen feeble bands in the spectrum of one of them − 60 Schj., while in the case of ten stars his observations confirm my own; in the spectrum of another star M. Pechülé has not seen any bands.

[2] "Trovata cercando 124 Schj." The position of this star differs by 27m. and 40′ from that of the star in question.

[3] In his observations at Vienna with the great refractor, M. Vogel was able to see the lines of hydrogen either C or F in the spectra of all three stars; they were, however, feeble in comparison with the other bright lines.