The spectral plates.

The spectra which are the object of this study, have been photographed with the 3 prism spectrograph attached to the 72-inch telescope of the Dominion Astrophysical Observatory, Victoria B. C. In connection with the studies of lines in spectra of Cepheids then entered upon at our Institute, and the desirability to apply photometric methods in measuring their intensities, a request was made 1922 to Dr J. S. Plaskett, Director of the Observatory, to inquire about the possibility of taking some stellar spectra of high dispersion together with standard spectra for calibration. Dr Plaskett, with his usual obliging kindness, was willing to make some experiments in this direction. After the publication of H. H. Plaskett's Wedge Method for the photometric study of continuous spectra 1) a more precise proposal was made to make use of the same method with some modifications for our purpose. Instead of broadening the stellar spectra and photographing them through the dark wedge, the stellar spectra should be taken in the usual way, not wider than ca ½ mm ; on the same plate the continuous spectrum of a standard source (acetylene flame, tungsten ribbon lamp) should be taken through the wedge. In front of the wedge a number of equidistant narrow metal strips should be placed so that the spectrum was broken up into a series of narrow bands of regularly decreasing density. They could then be used to derive the relation between the density of the silver deposit and the intensity of the light. In this way a certain number of spectra was taken on three nights in September 1924. Each plate was kept in dark till the next day ; and then before developing the standardization spectra were put upon them by H. H. Plaskett. We are much obliged to Director J. S. Plaskett as well as to Prof. H. H. Plaskett for the kind interest they took in the problem, and the trouble they gave themselves to provide us with these spectral plates.

That such a long time has elapsed between the taking of the plates and the present publication is due to various circumstances. In the first years the resources of our Institute were not yet adequate ; not until 1927 could we procure a recording microphotometer. In 1924 the spectrophotometric methods were still in their infancy and had to be developed partly by our own work ; the Victoria plates were the very objects that served us as valuable materials to study the problems arising in the photometry of absorption lines. They induced theoretical studies, which absorbed so much time that the finishing of the plates themselves was thereby delayed. Moreover part of the work at the Institute was needed to complete other investigations already in progress. Much of what was found here in the treatment of these plates has been developed and surpassed in the meantime by numerous important investigations at different observatories. So it will not be necessary now to describe all our work in extenso. A large part of the preliminary discussions have been made by A. van Zutphen, then assistant at the Institute.

Here follow the data about the plates.

No	Data. temp.	Star	M.T. Victoria	Hour Angle beg.	Images
10606	1924 Sept. 3,	β Delphini	$7^h 45^m$— $8^h 25^m$	$2^h 16^m$ *E*	1 +
10607	„ $T = 23^\circ$	δ Cephei *m.*	8 40 —10 10	3 15 *E*	1 +
10608	„ „	δ Equulei	10 22 —11 50	0 16 *E*	1 +
10610	„ „	π Cephei	13 24 —15 00	0 51 *W*	„
10611	„ „	β Cassiop.	15 03 —16 17	1 30 *W*	„
10616	1924 Sept. 4,	ϑ Cygni	7 26 — 9 30	1 33 *E*	2 + to 1— clouds
10617	„ $T = 23.4$	δ Cephei *M.*	9 40 —10 26	2 10 *E*	1 to 2—
10618	„ „	π Cephei	10 45 —13 00	1 45 *E*	„ clouds
10619	1924 Sept. 5	ϑ Cygni	7 33 — 9 53	1 21 *E*	1 —
10620	„ „	β Delphini	9 55 —11 45	—	0 +

Plates : Seed 30 ; Slit 0.0015 inch.

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1) Publ. Victoria, Vol II. No 12.

It was found afterwards that the spectra of β Cas and β Del have rather broad lines, so that they were not so well suited as the other ones for comparison with δ Cephei. The spectra have been taken with the 3 prism spectrograph described in Vol I N^0 1 of the Victoria Publications. Between the collimator $f = 1143$ mm, ap. 63 mm, and the camera $f = 711$ mm, ap. 76 mm, there are 3 light flint prisms (glass O 118) with 63° refracting angle. The spectra have a length of circa 9 cm, a width (by trailing) of 0.4 mm ; they extend, except in the case of too short exposure, from 4050 A to 4950 A. Several of these plates were measured with the Hilger measuring machine of the Intitute to derive formulas and tables for conversion of the linear scale into wave lengths. The scale of the spectra is given by Table 1, an extract from one of these tables.

Table 1. Scale of wave length.

λ	*mm*	*mm* per *AU.*	λ	*mm*	*mm* per *AU.*	λ	*mm*	*mm* per *AU.*
4050	5.872	0.160	4400	49.272	0.097	4750	77.054	0.065
4100	13.546	.147	4450	53.951	.091	4800	80.248	.062
4150	20.630	.136	4500	58.358	.085	4850	83.289	.059
4200	27.193	.127	4550	62.515	.081	4900	86.177	.057
4250	33.292	.118	4600	66.445	.076	4950	88.949	0.54
4300	38.976	.110	4650	70.167	.072	5000	91.600	.052
4350	44.290	.103	4700	73.699	.069			

The recording microphotometer.

A photometric study of stellar spectra is not well possible without a recording microphotometer. In the first years we could make records now and then in the Physical Laboratory at Utrecht. In 1927 the Astronomical Institute was able, by the aid of considerable grants from the „Universiteitsfonds" and from "Het Natuur- en Geneeskundig Congres" to procure a Moll recording microphotometer from the P. J. Kipp firm at Delft.

Since instruments of this kind are in use now at many observatories, it is not necessary to describe it in detail; it will suffice to indicate the different changes and improvements brought about in consequence of our experiences. As to the general construction it has a lamp with a vertical glowing spiral, an image of which is formed by a condenser upon the stellar spectrum situated 2 mm behind it. After traversing the negative, the light passes an objective, by which the spectrum, magnified 8 times, is focussed upon the frontplate of the thermocouple; here a narrow slit, usually 0.15 to 0.10 mm wide, cuts out a corresponding narrow strip of the spectrum 0.018 to 0.012 mm wide. Only the light passing through this part of the spectrum, the virtual image of the slit, falls upon the thermocouple and produces the thermocurrent and the deviation of the galvanometer. By the slow motion of the negative the strip moves over the lines and background parts of the spectrum. The variations of density of the silver deposit are indicated by the varying deviations of the galvanometer, which through the horizontal slit of the camera box are recorded on the bromide paper on the revolving drum. The absorption lines appear then as tops rising above the continuous curve of the background. The axis of the drum is coupled by worm gear with the main shaft, wihich by a micrometer screw of 1 mm pitch moves the plateholder carrying the spectrum negative. One mm of the spectrum corresponds, through two different gears, with 50 and with 7 mm on the bromide paper sheet.

To control the exact correspondence of the linear scale on the spectrum and on the recording sheet, which may be influenced by distortions of the paper in developing and washing, a contact disc fitted on the main shaft was provided by the constructors. It produced light flashes at every 0.1 revolution which were recorded as a system of parallel lines 5 mm apart on the sheet. This device did not prove satisfactory, because the ebonite of the disc between the metal strips making the contacts, was worn down more rapidly than the strips themselves. We have replaced them by another time disc fitted on the same shaft, a double metal disc provided with ten equidistant radial slits. They are illuminated from behind ; when one of the slits passes before the lamp the light, by a system of mirrors, is thrown upon the horizontal slit of the camera box. By turning the two discs a small angle relative to one another, the slits are closed with the exception of two of them which, being wider to mark by stronger lines the full and the half revolutions, now remain open, so that only half revolutions are recorded (for the 7 times enlarging gear).

When first in use the records of these flash lines showed a marked periodicity. The screws and gears were of the highest precision and no periodical error could arise from this source. The cause of the periodicity was found in the connection of the axis of the drum with the wormwheel of the gear ; when the ideal rotation axes are not exactly in line there must arise a periodical error in the rotation of the drum. After the constructors had made a new and careful connection of both axes, the error had disappeared. The sharp and regular figure of the tops, representing the centres of the absorption lines on the record of the spectrum afford the possibility of measuring the place, i.e. the wave length of the line, more accurately than can be done by visual measures on the spectrum itself. This, of course, is only possible if the flash lines used as reference in measuring the tops are exactly parallel and perpendicular to the direction of the rotation. If the slit of the camera box is not exactly parallel to the axis of the drum, the flash lines will have a constant inclination. What we found in the beginning was a combination of a continuous and a periodical change in the inclination of the flash lines, which amounted to 0.7 and 0.4 mm over a height of 10 cm (corresponding to 0.014 and 0.008 mm on the plate). The periodic change may be due to a lack of exact parallelism of the rotation axis and the figure axis of the drum, the continuous change to a conical instead of a cylindrical figure of the drum, or at least of the bromide paper wrapped around it. After careful readjustments and remodelling by the constructers and after better methods were devised to have the paper tightly fitted to the drum, the deviations had diminished to 0.15 mm, corresponding to 0.003 mm on the plate, which is certainly negligible compared to the ordinary errors in spectral wave lengths.

A number of other small changes, sometimes involving notable gains in efficiency, were made after the instrument was first put in use. The glowing spiral of the lamp was usually not entirely straight, and from a large number of lamps some few with straight spirals had to be selected. Afterwards it was noted that the curvature of the spiral was always in a plane perpendicular to the axis of the lamp. By using the lamp not end on but turning it 90° in its case, so that the light passed through the side of the lamp, where moreover the glass is more regular, the difficulty was removed.

In the original device the light of the lamp was concentrated upon the spectrum by a condenser. A broader part of the spectrum than was acting on the thermocouple was illuminated in this way by the image of the spiral. Into the narrow strip of which the transmission was measured, light from the illuminated parts beside it could be diffused. So afterwards a lens and a slit were introduced between lamp and condenser ; now the illuminated part of the spectrum is hardly broader than the strip pictured upon the slit of the thermocouple.

This was only possible because the sensitivity and the rapidity of the instrument had been considerably increased by the substitution (1930) of a Moll vacuum thermocouple combined with a rapid galvanometer for the old non-vacuum instrument. With the old thermocouple one revolution of the drum took 30—40 minutes ; if we ran it faster, the tops of narrow lines were depressed, an indication that the sensitive apparatus did not respond so quickly as to follow the minutest fluctuations of density. During this time the current usually decreased and the deviation for clear plate at the end was some percentages less than at the beginning, so that clumsy interpolations were needed. Now with the vacuum thermocouple each sheet takes 10 minutes or even less. Moreover the constancy of the light is secured by an increase of the capacity of the storage battery.

Now and then irregular jumps and deviations occurred in the zero line (for no light falling on the thermocouple) and the full light line (for clear plate), which made it necessary to repeat the sheets. After many experiments it was found that the sparking of the motor produced induction currents in the wires. After the motor had been replaced by a non-sparking short-circuit motor the trouble was over.

The plateholder of the instrument had a rectangular clear space of 8 × 1.5 cm; the spectral plates were clamped on it by two heavy springs. The exact horizontal placing of the spectrum, parallel to the motion of the plateholder, had to be done by hand, by unclamping and moving it under the springs, at the risk of damaging the film. Hence an intermediate plate holder was attached to the existing one (the clear space of which was enlarged to 8 × 5 cm, while the range of vertical motion at the same time was increased from 0.5 tot 1.5 cm.) in such a way that a small rotation about an axis in one of the corners could be given to it by a screw. So the spectrum can be brought easily and accurately in a horizontal position.

In order to be warned when a revolution of the drum is completed and a new sheet has to be inserted, a contrivance was designed and constructed by D. Koelbloed, computer of the Institute. It automatically stops the motor when the sheet is ready and at the same time operates an alarm bell. Fig. 1. gives a schematical representation. At the fixed basis of the plateholder an ebonite plate A can be clamped, which carries a contact consisting of a watch-spring B pressed against a metal pin C, forming part of the current circuit for the motor. In a shunt a transformer produces the current for the galvanometer lamp and the flash lamp. By the slow motion of the plateholder a metal point D approaches the spring; at the moment that it makes contact with the spring the alarmbell sounds ; and then it pushes the spring, breaking its contact with the pin, so that the motor is stopped and the lamps illuminating the bromide paper are extinguished. The operator can come at leisure to insert a new sheet for the next part of the spectrum, to clamp the ebonite plate in the next position and to start the motor. The contact place of the spring must be kept clean from oxide to prevent sparks.

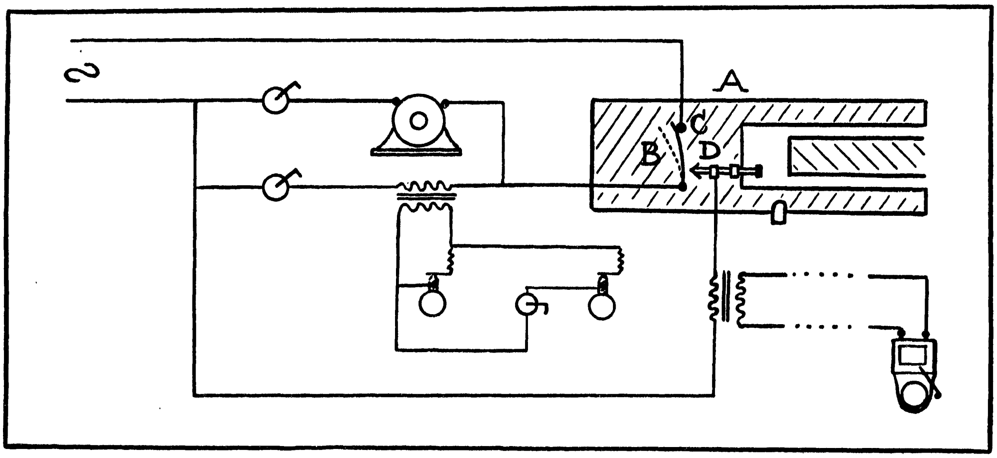

Fig. 1.

When the apparatus is recording, only a narrow strip of the spectrum is intensely illuminated, and an image of only this part is visible upon the slit of the thermocouple. In order to find and to recognize the part of the spectrum to be recorded, a small lens is set for a moment before the condenser ; then a larger area of the spectrum is visible in diffuse illumination on the white frontplate of the thermocouple. Moreover, by moving it to and fro transversally this image can be used to detect by the parallax test whether it is exactly in focus. When it is in focus for visual light this is not exactly the case for the infra-red heat rays, that chiefly produce the thermoelectric current. By determining the position of the objective where a test plate with narrow lines gives the maximum deviation, the difference with the position for visual focus was found to be 1.2 mm. This correction was always applied after the best visual focus had been found.

The stellar spectra are not sharply cut off in width. To exclude the fainter rim at both sides and to use only the equally blackened central band a flag-shaped screen with a wedge-shaped incision was placed before the frontdisc of the thermocouple. By turning it about an axis at the bottom piece and clamping it in different positions the free part of the slit can be given any desirable height.

On each paper sheet of 42 cm length and 12 cm breadth 8 mm of the spectrum could be recorded; so a dozen sheets were wanted per spectrum. Before and after making the tracing a part of the clear plate beside the part of the spectrum treated was brought into the lightpencil to mark the transmission of 100 % ; in the same way, by entirely covering the light, the line for complete darkness, 0 % transmission was recorded. In this way each vertical distance to the zero-line could be reduced to percentages of transmission.

The standardization spectra.

For the reduction of silver densities (transmissions) to intensities we have on each plate a series of continuous spectra, forming separate bands of a spectrum decreasing linearly in intensity. The distances of the central lines of the consecutive spectra are 0.429, 0.433, 0.438, 0.440, 0.432, 0.437 mm, hence so nearly equal that — provided the wedge itself had a constant gradient — we may assume that the logarithms of the intensities corresponding to the midst of the spectra form a linear series. So the "bandnumber" 1, 2, 3.... may be used as a linear scale of log. intensity. The distance of two thin lines in the bandspectrum, produced bij the sharp edge and the thick end of the wedge, was measured on the plates 3.815 mm, whereas the height of the wedge in reality is 5.915 mm ; hence the magnification of the optical system was 0.6450 and the distance between two consecutive free spaces in front of the wedge was 0.675 mm. The wedge constant σ_λ per half millimeter is given p. 228 of H. H. PLASKETT's memoir; from 0.170 for 3900 A it decreases to 0.110 for 5100 *A*. The logarithm of the intensity ratio per unit bandnumber $\beta(\lambda) = 2 \times 0.675 \times \sigma_\lambda$ is then found to be :

for $\lambda =$ 4100	4200	4300	4400	4500	4600	4700	4800	4900 *A*
$\beta =$ 0.202	0.192	0.182	0.174	0.167	0.162	0.158	0.154	0.151.

The longitudinal tracings of the bands were made with a velocity ratio 7 ; the zero of the wave length scale was secured by the impressions of mercury emission lines superposed upon the continuous spectrum. At every 5 cm of the horizontal scale the height of each curve above the zero line was measured, as well as the height for clear plate. So the transmission for each band was found, and with the bandnumber as abscis a characteristic curve could be constructed for each wave length.

The characteristic curves for different wave lengths show the same figure, with a slightly curved part with a point of flexure (not a straight part) in the medium transmissions ; the slope is greatest about 4600 *A*. If the intensity of light I, passing through the wedge and producing a silver deposit with transmission s, is indicated by the bandnumber n, so that $\log I = -\beta n$, then the characteristic curve as found above is given by $s = f(n)$. It appears that the curves for different wave lengths can be brought into coincidence by a horizontal displacement, if at the same time (for the differences in slope) the abscissae n are reduced in a certain ratio. So we put $(n-a)b = -n_0$, where a is found from the horizontal distances of the points with transmission 0.50, b is found from the points with transmission 0.35 and 0.70, and the negative sign is given to n_0 in order to have n_0 (which is zero for transmission 0.50) increase with increasing intensity. In Fig. 2 (taken from the discussion of plate 10616 as an instance) the variations of a and b

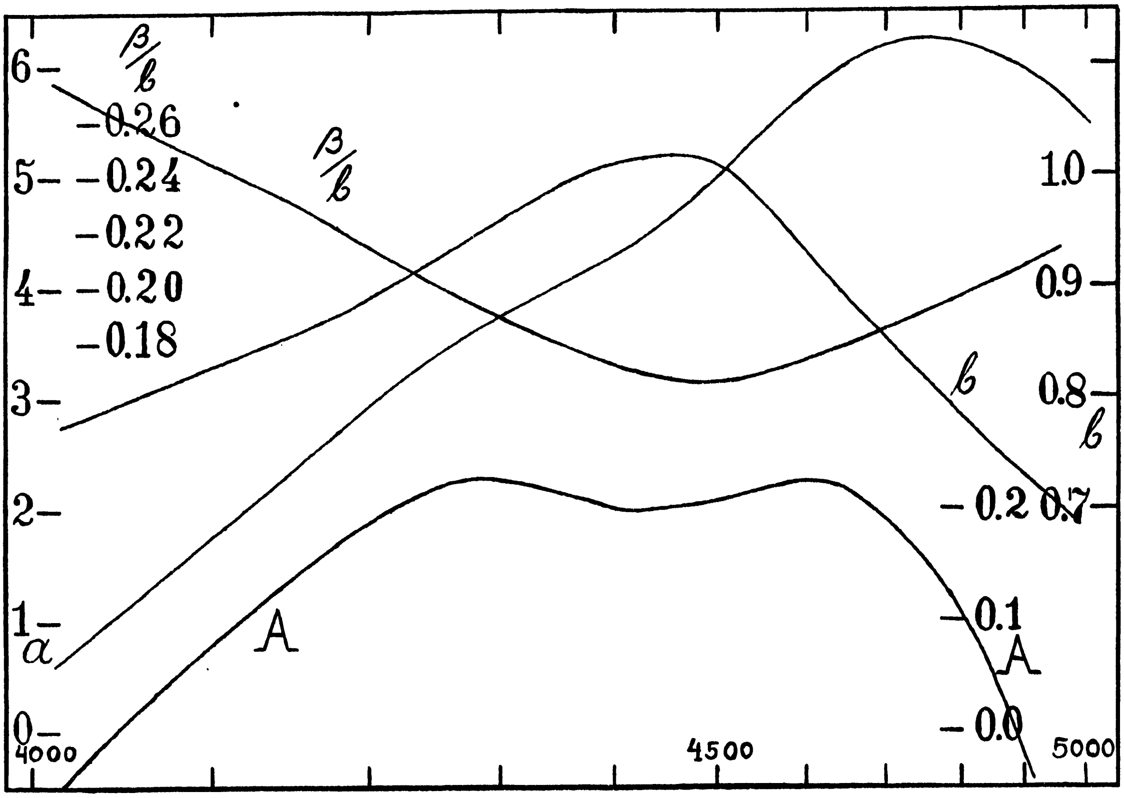

Fig. 2.

along the spectrum may be seen. The variation of the gamma of the characteristic curve with wave length is not given by b but by β/b. By this reduction and displacement all the curves can be superposed and combined ; every measured value $s = f(n)$ of any wave length is now plotted as a function of n_0. So we find a normal characteristic curve $s = f(n_0)$, determined by a large number of points (Fig. 3), which is used for all reductions of recorded transmissions to intensities. For each measured s the curve gives n_0 ; then $n = a - n_0/b$ and $\log I = -\beta a + n_0 \beta/b$.

In the derivation of intensities in stellar spectra by means of this formula the unit of intensity for each wave length is the radiation of the standard light source (an acetylene flame of 2350° *K*) without the wedge. Since the stellar spectra correspond to temperatures about 6000° this has the drawback that the continuons background of the stellar spectra is represented by values of log I

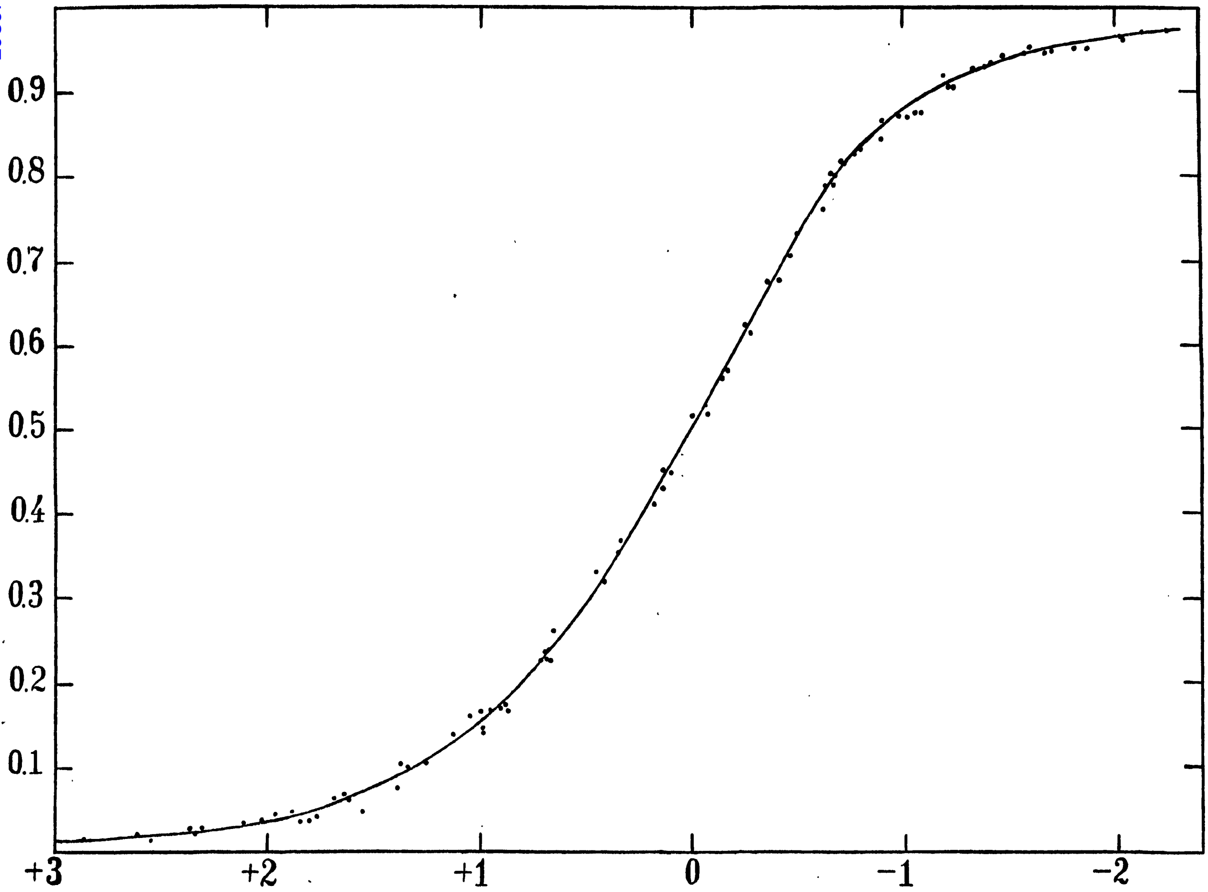

Fig. 3.

strongly varying with wave length. To compensate this difference a term log B (6000)/B (2350) = τ where B represents the black body radiation, is added to the formula. Putting then

$$\log I = \text{Const.} - \tau - \beta a + n_0 \beta / b = A + B n_0$$

the unit of intensity for different wave lengths corresponds to a temperature of nearly 6000°.

There is a curious irregularity in the curve for the constant a, which of course reappears in A ; it presents itself in all the plates in the same way. It shows that besides the regular change of the intensity blackening the plate, by change of dispersion and of sensitivity, there is a broad depression about 4400 A, (from 4250 to 4600 A). Probably it must be ascribed to the absorption of the glass of the prisms. At their base the prisms are nearly 13 cm, hence for 3 prisms the mean path through the glass is 20 cm, enough to produce a visible effect of even a faint absorption band. An analogous faint absorption band was perceived in the crown glass prisms used by the Dutch eclipse expeditions. ^{1})

Reduction of the stellar spectra.

The tracing of a stellar spectrum of advanced type presents itself as a continuous curve, where the stronger absorption lines stand out as peaks merging into one another at their feet, so that the real continuous background is not or seldom reached. So it is not sufficient to measure

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1) A. Pannekoek and M. G. J. Minnaert: Results of observations of the total solar eclipse of June 29. 1927. I p. 26.

separate lines; the whole curve must be treated as a combined effect of all the lines and transformed into a real intensity curve by means of the normal characteristic curve and the formula. A great amount of work is of course involved in measuring and reducing a spectrum in this way.

Partly the tracings were measured in such a way that for each mm on the sheets (corresponding to 20 μ on the plate) the vertical coordinate in the curve was read to 0.1 mm (the vertical distance between the zero line and the line for clear plate, corresponding to 100 per cent transmission usually was 8—10 cm). The small irregularities in the curve due to silvergrain, had to be smoothed before or during the reading. At first only the tops and the valleys between them were read in two coordinates to find wave length and central intensity in each line. But this was not sufficient to give the different shapes of the line contours, and so they were completed afterwards by intermediate points. The vertical readings were first reduced to percentages of transmission, for which a careful correction for the variation of transparency (fog) along the spectrum was necessary. From the transmission s the intensity of each point was found by means of the curve $s = f(n_0)$ and the formula $\log I = A + Bn_0$.

Afterwards a shorter method was followed. For a limited number of horizontal readings 4 mm apart, falling at the beginning, the middle and the end of each sheet the reverse process of reduction was followed. For certain round values of $\log I$ the value of n_0, of s and of the vertical coordinate were computed. So for each of them 3 points were found and indicated on the sheet and a thin nearly straight pencil line was drawn through them. A system of isophotic lines was thus drawn on each sheet, between which the intensity of each point of the curve could be directly read by interpolation. Now intervals of 0.1 in $\log I$ gave too large distances between the isophotic lines for reliable interpolation; moreover the use of only two figures in $\log I$ is somewhat too rough in further computations. Intervals of 0.01 in $\log I$ gave a too dense network of lines, and the use of 3 figures means an illusionary timeconsuming accuracy. So intervals of 0.04 in $\log I$ were chosen. Though in general the use of "magnitudes" as units in spectral photometry is more apt to impede than to further an immediate grasping of intensity relations, here we had to use them as a name for the unit chosen for technical reasons. All readings and computations were now made in 2 decimals of a magnitude. By multiplying the coefficients A and B by 2.5, $\log I$ is given in magnitudes. The scale lines are computed and drawn for every 0.1 magnitude and the points of the stellar curve can be read to 0.01 magnitude; in the highest and lowest parts of the sheet the accuracy of course is less. Since the sheets have vertical lines at 5 mm distance, a glass millimeter scale suffices to read the curve for every full or half millimeter. Usually for the intersection points of the stellar curve with the scale lines the horizontal coordinate was read.

The next step is the determination of the background of the continuous spectrum. It is the most difficult and uncertain part in the reduction, because in spectra of advanced type the lines stand so close that there is no place between them where the real background appears without absorption. We have read in each sheet the deepest valley points; plotting them in a small scale diagram we could draw, as a first approximation, a line through the highest values of $\log I$, leaving all the others below the line, perhaps neglecting some isolated points where plate errors might be suspected, and giving to the line no more sinuosities than may be really present (e.g. a shallow depression between 4300 and 4500 A). Of course it is probable that the real background is situated at somewhat higher values; this, however, must be made out afterwards in discussing the line profiles.

Taking $\log I_0$ from this background line, slowly varying with λ, we derive for each point of the stellar curve $\log I - \log I_0$; then I/I_0 is the fraction of the background light present in that point, i.e. the residual intensity. Plotted against the linear scale of the spectrum these values form the intensity curve of the spectrum. It is the basis of the further study of the spectrum.

The instrumental curve.

The observed contour of an absorption line in a stellar spectrum is determined by two causes : the real distribution of intensity over the line in the light of the star as it enters the telescope, and the broadening influences of the instrument. Such influences are the finite slit-width, the diffraction of light by finite apertures, the scattering of light in the optical parts, the defects of focus through imperfect achromatism and curved field of the camera, and moreover photographic effects. For the recorded contour the finite width of the slit before the thermocouple is added to them. The real distribution free from the instrumental influences is given by *the true profile* of the spectral line. The broadening influences are given by *the instrumental curve,* which is the intensity distribution produced in the case of an infinitely narrow line. By combining these two curves we get the observed distribution of intensity.

In astrophysics we have the inverse problem : to deduce the true profile from the observed curve. For this it is necessary first to derive the instrumental curve. In our case this curve had to be determined from the given spectra themselves. Here all the spectral lines are combinations of the two curves. Their qualitative character can be described in this way : for faint lines, where the resonance wings have not yet developed and the true profile is a narrow Doppler contour the observed curve is nearly identical with the instrumental curve ; for stronger lines with resonance wings the result is a broadened instrumental curve ; with increasing breadth of the wings the true profile begins to dominate, and at last the observed curve is the true profile broadened by the instrumental curve. Weak lines cannot be used in these spectra to derive the instrumental curve, because they are obliterated or strongly disturbed by adjacent stronger lines. We have to use lines of moderate strength and correct their observed width for the influence of the true profile. By the crowding of the lines they will, though we may be careful to select practically single ones, as a rule still have faint blends, by which they are broadened. In every case the extreme wings will be covered by other lines, so that it will not be possible to derive the complete curve.

In the tracings of the spectra 10607 (δ Cep) and 10610 (π Cep) a number of lines were selected which appeared to be single and little distorted. From their intensity curves the width at the points where the decrease of continuous light is 0.75 and 0.50 of the central depth, was read and expressed in 0.001 mm on the plate. By means of a preliminary curve the amount of broadening by fainter companions (for which the Rowland list and the Rowland intensity was used) was deduced, as well as the broadening by the true profile, which was found as a function of the central depth. For both influences corrections were applied. The results are

for λ	4186	4272	4451	4641	4875 *A*
width at 0.75	25.9(11)	30.0(15)	31.0(17)	30.6(15)	40.0(12) μ,
„ „ 0.50	43.9(11)	49.2(14)	49.8(15)	53.1(14)	65.4(10) μ.

Both stars showed concordantly the increase of width with λ. This increase must be chiefly ascribed to all the scattering and diffracting effcets increasing with λ. The optical image of the slit on the plate has a breadth of 22 μ. Part of the variation may also be due to focus and curvature of the field. Since at the Victoria telescope as a rule focus was determined and corrected at the beginning of each night's work, and sometimes the dip of the plateholder was corrected at the same time, we are not sure that the same variation with λ holds for different nights. It has to be determined separately for each of the three nights.

The difficulty of finding a sufficient number of appropriate lines in the spectra of each night then led to the use of the iron arc comparison spectrum for the study of the instrumental curve. For these emission lines the intensity of the resonance wings is entirely negligible compared with the central Doppler core ; the width of this core is of the order of 2.5 μ, hence practically insignificant. Iron arc lines of moderate strength and free from companions were taken, and their width at 0.75 and 0.50 of the central intensity was measured. When it appeared that the results were practically identical with those of the stellar lines, these more easily accessible and manageable data were used to derive the variation of the breadth with wave length for each separate night and to find the figure of the instrumental curve. Still there were difficulties here too ; only a limited part of the curve is represented by moderate values of transmission in the same line. In Fig. 4 *A*—*F* are reproduced apparent contours as they appear on the sheets, in percentages of transmission, computed by means of the $s = f(n_0)$ curve Fig. 3, with the width at 0.75, 0.50, 0.25 of the central intensity indicated by horizontal lines. Moreover also for lines of moderate strength the breadth at 0.75 and 0.50 was somewhat smaller for stronger lines, larger for fainter lines, so that a reduction to the case of 50 % central transmission had to be made before the variation with wave length could be derived—probably a photographic effect, as if the characteristic curve for isolated emission lines is different from that for continuous bands.

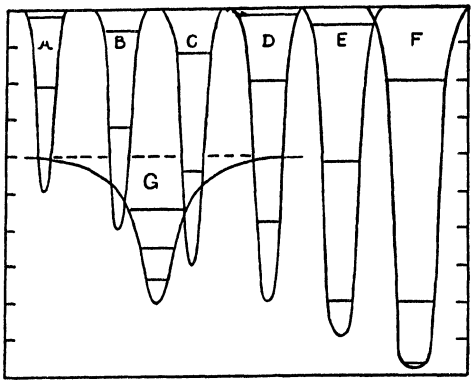


Fig. 4.

The results for the breadth of the lines at 0.75 and 0.50 of the central intensity are given in Table 2.

Table 2. Width of lines at 0.75 and 0.50 in μ.

Sept. 3 (10607. 608. 610. 611)							Sept. 4 (10616. 617)						
λ	width 0.75	n	λ	width 0.50	n	Scale factors	λ	width 0.75	n	λ	width 0.50	n	Scale factors
4092	25.2	17	4090	45.9	8	0.84 0.87	4059	32.0	19	4056	52.4	18	1.07 0.99
4179	26.9	32	4178	47.1	27	0.90 0.89	4140	31.4	30	4142	56.4	28	1.05 1.07
4239	26.9	30	4239	47.3	24	0.90 0.89	4242	33.8	37	4241	59.2	30	1.13 1.12
4355	28.1	23	4350	50.5	14	0.94 0.95	4344	34.2	17	4346	61.0	14	1.14 1.15
4455	30.9	26	4457	56.1	13	1.03 1.06	4483	38.3	19	4486	69.8	18	1.28 1.32
4621	35.6	9	4670	59.8	2	1.19 1.13	4639	43.9	23	4646	77.9	19	1.47 1.47
4853	40.6	8	4890	64.2	2	1.36 1.21	4902	46.1	23	4921	79.7	12	1.54 1.51

Sept. 5 (10620)						
λ	width 0.75	n	λ	width 0.50	n	Scale factors
4052	29.1	16	4049	49.6	14	0.97 0.94
4150	30.4	20	4150	51.2	15	1.02 0.97
4241	31.0	23	4243	58.2	19	1.04 1.10
4406	33.1	19	4404	63.1	13	1.11 1.19
4626	44.6	12	4610	79.8	6	1.49 1.51
4945	49.7	7	4931	92.0	5	1.66 1.74

The increase of the breadth of the instrumental curve with increasing wave length has nearly the same character for each of these nights.

To find the shape of the instrumental curve only those parts of the measured profiles of the iron arc lines (between 4100 and 4400 *A*) were used where the transmission is between 20 and 80 per cent, the straightest part of the characteristic curve. Since it comprises an intensity range of 1 : 2 only, the curve must be built up in parts : from the centre to ± 16 μ (Intensity 1—0.7) lines with central transmission 25—50 % were used, from ± 16 μ to ± 24 μ (Int. 0.8—0.5) lines with c.tr. 10—30 %, etc. In this way we found, as a mean of the 6 plates mentioned above, at distances from the centre

	0	4	8	12	16	20	24	32	40 μ
Int	1.	.966	.889	.791	.688	.578	.489	.350	.271.

An attempt was made to reach the outer parts of the curve by the use of strong lines, totally blackened in a broad central part, with borders showing a zone of gradual decrease. This, however, proved to be impossible ; at the borders of such strong lines photographic effects spoil the regular relation between intensity and blackness. The Eberhard effect increases the density at the extreme faint border parts relative to the stronger inward border parts and produces too slow a decrease in the resulting curve.

So it seems that emission lines, too, cannot afford the instrumental curve in its outer parts. This is due to the fact that small quantities of light, as in the outer parts of the emission line, do not produce any perceptible, and when increasing, only a very small silver deposit. The same quantity of light, however, when added to a moderate intensity which already gives a moderate silver deposit, increases its density with an amount proportional to the increase of light. This consequence of the characteristic curve is illustrated by the computed apparent contour G in Fig. 4, where a background with transmission 60 % was assumed. The same emission line that stands sharply cut on a clear background shows itself, when photographed upon the background of a continuous spectrum, with broad gradually decreasing wings. In such a case the instrumental curve may be easily determined up to where its outer parts decrease to zero. Whereas for the exact determination of wave lengths it is necessary that the comparison spectrum consists of lines with sharp borders, it is better for spectrophotometric purposes that the iron arc is taken together with a continuous light source, so that the lines stand on a continuous background.

Among the spectra taken 1929 in Victoria with the same instrument we have one, where at the moment of taking the comparison spectrum by chance a drop of molten iron produced a continuous spectrum together with the arc lines. Here the arc lines show broad wings. Reduction of a number of these lines gave a complete curve with

intensity	1.0	0.40	0.10	0.03
at distance	0	20	40	60 μ.

from the centre. This curve is narrower than the 1924 curve, also in its central parts, which was confirmed by other plates of the same night with sharp iron arc lines. So we cannot simply take over its results for our plates. We may use it, however, as a model how to complete, tentatively, the central parts of the instrumental curve as found above, down to its outer limit. So we get the normal instrumental curve, as given in Table 3.

Table 3. Instrumental curve.

Dist.	Int.	Dist.	Int.	Dist.	Int.
0 μ	1.0	40 μ	0.26	90 μ	0.06
5	0.95	45	0.22	100	0.045
10	0.84	50	0.19	120	0.026
15	0.72	55	0.16	140	0.018
20	0.58	60	0.14	160	0.011
25	0.47	65	0.12	180	0.006
30	0.38	70	0.10	200	0.003
35	0.31	80	0.08		

Here the intensities 0.75 and 0.50 correspond to 13.4 and 23.4 μ, hence to a width of 26.8 and 46.8 μ. We assume that for different wave length on different days the instrumental curve has always the shape of Table 3, with only the distances multiplied by a scale-factor. Possibly the variations of scale hold only for the central parts ; but on our assumption of one factor for the whole curve the outer parts will have little influence. Because in the derivation of the values in Table 2 reduction to an arbitrary zero point was made, we cannot find the scale factors by simply taking the ratios of Table 2 to the above values of the normal curve. So we assume that for identical lines the results deduced in the way of Table 2 and Table 3 must represent the same curve ; the breadth at 0.75 and 0.50 derived in the way of Table 2 from the lines between 4100 and 4400 A only, for which we now find 29.9 μ and 52.9 μ, belongs to the normal curve of Table 3. Hence for every wave length on each day the scale factor is found by dividing the values of Table 2 by 29.9 and 52.9. The results are given in Table 2 in the last columns. They were smoothad to the values given in Table 4.

Table 4. Scale factors.

λ	4000	4100	4200	4300	4400	4500	4600	4700	4800	4900
Sept. 3	0.83	0.85	0.88	0.92	0.97	1.02	1.08	1.14	1.21	1.28
Sept. 4	1.01	1.05	1.09	1.15	1.22	1.31	1.40	1.47	1.51	1.54
Sept. 5	0.94	0.98	1.03	1.11	1.20	1.31	1.42	1.52	1.61	1.67

The instrumental curve of Table 3 was used to derive the intensity distribution, the apparent curve for stellar absorption lines of different strength. In an absorption line we will consider, instead of the residual intensity r, the depression $1-r$ as the intensity curve ; it may be treated entirely as a curve of positive intensities. The true profile for weak lines consists chiefly in the Doppler core with variable depth and a width of the order of 10 μ, which gives a small general broadening of the instrumental curve. For stronger lines the resonance wings form the most important part. The profiles for the resonance wings are similar for lines of any strength and only different in their horizontal scale. If we denote their figure by $f(a)da$ — we may take this figure $f(a)$ from Monthl. Not. **91**, p. 139 — the scale unit is related to the wave length differences and to the linear scale of the spectrum x by the linear relation $a = nx$. Expressed in this scale we have $f(a)da = W(x)dx$. The instrumental curve is given by $A(x)dx$, where $A(x)$ must be normalized so as to make the total surface $\int A(x)dx = 1$. Since the total surface of the curve defined by Table 3 is 66.3, the values of this table must be divided by 66.3 to give $A(x)$. Then the intensity at distance x from the centre in the apparent curve is

$$F(x) = \int A(y) W(x-y)dy = \int W(y) A(x-y)dy.$$

The curve $F(x)$ has been computed for different values of n, the scale ratio. For weak lines the computation could not be made in such a general way ; for the Doppler core special values of the constants had to be assumed as instances. The total surface $\int F(x)dx = \int W(x)dx$, the same for the observed and for the true profile, denotes the equivalent width expressed in μ instead of in $A.U.$ The central intensity of the apparent curve $F(0) = \int A(y)W(y)dy$ increases for increasing strength and equivalent width of the line. A number of curves $F(x)$ for lines of different strength is given in the left hand part of Fig. 6 The relation between central intensity, equivalent width in μ, and width at 0.75 and 0.50 times the central intensity is given in Table 5.

Table 5. Apparent intensity curves.

Central intensity $1-r$	0.10	0.20	0.30	0.40	0.50	0.60	0.70
Equivalent width.	7.0	15.6	28.1	44.6	65.4	92.9	134 μ
Width at 0.75	34.2	36.0	37.8	43.3	51.7	60.5	71.4 μ
Width at 0.50	55.8	60.0	66.9	77.8	90.0	105	122 μ

It must be remarked that in these results true profiles are used as computed by theory, with a central intensity $r = 0$ for strong lines. If the lines, by collisions or fluorescence, have a higher residual intensity in the centre, the apparent curve will show a less deep centre too, a somewhat smaller *EW* and the same wings. Hence for a given c.i. the width at 0.75 and 0.50, as well as the *EW* will be larger than is indicated in Table 5. The same takes place with a small rotation velocity which does not appreciably broaden the wings, but only depresses the central intensity.

The use of iron arc lines for the instrumental curve was suggested by their concordance with the stellar lines shown in the beginning of our work in a limited amount of data. Afterwards, however, differences were found in other cases. Of course we cannot be certain a priori that photographic effects will not produce differences between the width of emission and of absorption lines. So it was necessary to make a new investigation of the stellar lines themselves, and a larger number of them in the spectra of δ Cephei, π Cephei and ϑ Cygni were selected. We have not made use now of the width at 0.50 of the c.i., firstly because the influence of an error in the adopted continuus background is stronger here, and moreover the influence of adjacent lines too may be felt. So only their width at 0.75 was read, and corrected for the broadening by weak blends within 30 μ distance. They were compared with the apparent curves of Table 5 for the same central intensity ; the ratio of the widths at 0.75 supplies the scale factor. The results are averaged in Table 6.

Table 6. Scale factors from stellar lines.

Sept. 3. 10607 δ Cephei	Sept. 3. 10610 π Cephei	Sept. 4. 10616 ϑ Cygni	Sept. 4. 10617 δ Cephei	Sept. 4. 10618 π Cephei	Sept. 5. 10619 ϑ Cygni
4189 0.78 (6)	4191 0.85 (9)	4056 0.75 (17)	4175 0.87 (13)	4502 1.09 (15)	4174 0.85 (15)
4252 0.80 (6)	4237 0.84 (12)	4170 0.82 (12)	4270 0.76 (19)	4611 0.97 (13)	4228 0.77 (17)
4370 0.88 (6)	4277 0.90 (15)	4216 0.79 (16)	4385 0.83 (16)	4840 1.13 (7)	4278 0.79 (15)
4478 0.84 (6)	4384 1.11 (13)	4264 0.76 (18)	4521 0.83 (11)		4372 0.81 (16)
4662 0.82 (6)	4485 1.25 (17)	4347 0.69 (14)	4647 0.78 (7)		4445 0.88 (20)
4880 1.10 (6)	4556 1.00 (16)	4444 0.79 (23)	4809 1.08 (7)		4520 0.93 (18)
	4676 1.01 (20)	4518 0.78 (17)			4604 0.95 (17)
	4878 1.13 (14)	4625 0.83 (15)			4692 1.18 (9)
		4805 0.92 (19)			4803 1.25 (12)

The values for π Cep are on the average somewhat larger than for other stars on the same days ; this may be due to a small rotation. Moreover the values for 4500 A on both π Cep plates are strongly deviating. It seems to be connected with the predominance of many strong lines in this region. Since the origin of the deviation could not be entirely cleared up and as accordingly we have no means to correct it, it was excluded. The other values show everywhere smaller scale factors, hence narrower lines than were found from the iron arc lines. The difference is least on the first night, which procured our preliminary values, and much larger at the other dates. The values are smoothed in Table 7.

Table 7. Adopted scale factors.

o	4100	4200	4300	4400	4500	4600	4700	4800	4900
Sept. 3	0.82	0.83	0.85	0.88	0.91	0.95	1.00	1.05	1.11
Sept. 4	0.78	0.79	0.80	0.82	0.85	0.89	0.94	1.01	1.09
Sept. 5	0.78	0.80	0.83	0.88	0.93	1.00	1.09	1.20	1.31

For the further reductions scale factors rounded to one decimal were used for large intervals of wave length. The values 0.8, 0.9, 1.0, 1.1.... etc. were used on:

Sept. 3 for λ beginning — 4280 — 4620 — 4800 — the end
Sept. 4 „ „ — 4500 — 4720 — 4850 — „ „
Sept. 5 „ „ — 4350 — 4540 — 4650 — 4750 — 4850 — the end.

Derivation of equivalent widths.

Theoretically it is possible, if the instrumental curve is well known, to derive, by a series of approximations, the true profile from the apparent distribution of intensity in the observed spectral line. Practically it is extremely difficult and uncertain where the true profile is narrower than the instrumental curve. In our case of spectra where the distance of consecutive lines is less than the breadth of the instrumental curve, it is not possible to derive true profiles. A spectrophotometric investigation in this case can only aim at the determination of equivalent widths; and even then many difficulties stand in our way.

In the intensity curve of the stellar spectrum no line is entirely free from its neighbours. Not only their wings combine in the deepest valley-points between them, but also at the place of each top part of the intensity is due to the extreme wings of adjacent lines. Hence the total intensity curve must be analysed and dissected into curves for separate lines by a process of successive approximations; only by subtracting the wing-intensities of adjacent lines the real top intensity of each line can be found. The background line of 100 % light, which forms the zero line for the curve, moreover, is only preliminary. By its drawing through the deepest valley points, where there is probably still some absorption, the extreme wings of the lines are cut off. Now that an estimate of the wing-intensities in the deepest valley-points can be made, we can find how much the real continuous background light is above the assumed 100 %, i.e. how much the zero line has to be lowered; here also the final result may be got only by successive approximations. Then we have still to consider that the large number of very weak lines, not clearly distinguishable between the stronger ones, cannot be separated from the background, and change it into an irregular mixture of shallow sinuosities. So the separation of lines and background is an indeterminate problem; fixing the background line at a certain height means at the same time a choice, what depressions are ascribed to absorption lines.

The difficulty arising from the blending of close lines cannot be solved. If two nearly equal lines are not more distant than 30 μ they look like a single line, only broadened. At a distance of 40 μ the top begins to be flattened, at 50 μ two tops are seen, or with a greater inequality the weaker line appears as a hump on the side of the stronger one. In the former case only the combined equivalent width of the two lines can be determined. In the latter case the curve can be decomposed into two curves and each *EW* can be measured, though the ratio in this division and each single value is less certain than their sum total. In the many cases of more lines and groups of lines blending into one broad figure, this separation into a number of single curves is difficult and often rather arbitrary.

In our treatment of the Victoria spectra we have first tried to follow this way. For each separate line a curve, as given by the theoretically computed apparent intensity curves, was assumed. Its wing intensity at the place of adjacent lines was used as a negative correction for their central intensities; reversely their wing-intensities (dependent on that central intensity) at the place of the first line served as negative corrections for its central intensity. So by a few approximations the central intensities were found, and the observed intensity curve was represented by the superpositions of all these single curves, the *EW* of which was a known function of the c.i. Where a number of close lines were blending, the combined curve had to be decomposed into single curves. This could be done only by assuming, that at every wave length in Rowland's Table with strength 1 or more (sometimes, for enhanced lines, also with strength 0) a line of unknown intensity was present, for each of which the c.i. with corresponding curve had to be assumed so as to represent the total curve. For narrow blends the separation, of course, was impossible and arbitrary; then the wing corrections in the vicinity were unknown, because one strong and one weak line combined give stronger wings, than two equal moderate lines with the same c.i. of the combined curve. After a part had been treated in this way, the method was abandoned as being too cumbersome, especially by the wide extension of the single curves.

Then the method of contracting the profiles of the lines was devised. It has been described in B. A. N. 301 (Vol 8, p. 179). From the intensities $S(x)$ the reduced intensities $S'(x) = 3\,S(x) - S(x-c) - S(x+c)$ are computed, where c, proportional to the breadth of the instrumental curve, is taken 30 μ for the normal curve of Table 3. If we apply this procedure to the instrumental curve its figure is contracted, the intensity in the centre is increased, it falls rapidly to nearly zero at distance 40—50 μ and remains nearly zero for larger distances; its wings have disappeared.

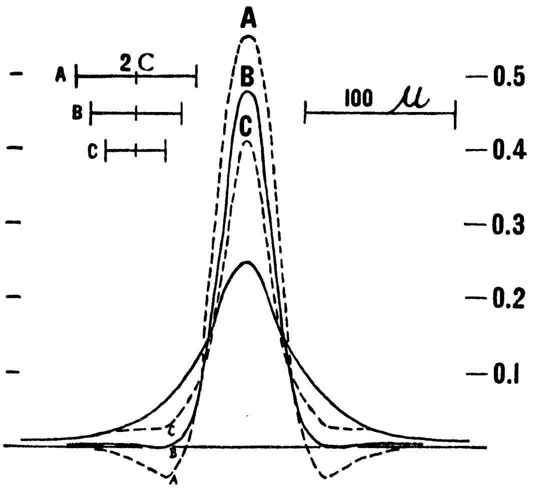


Fig. 5.

Fig. 5 shows besides this contracted curve (B) two other curves obtained by taking $c = 40\,\mu$ (A) and $c = 20\,\mu$ (C). In the first case the wings are over-corrected and the curve falls to negative values next to the core; in the other case the wings are under-corrected and the curve does not fall off te zero. If the same procedure is applied to the apparent profile of a spectral line

$$F'(x) = 3\,F(x) - F(x-c) - F(x+c),$$

then by

$$F(x) = \int W(y)\,A(x-y)dy$$

we have

$$F'(x) = \int W(y)\,A'(x-y)dy,$$

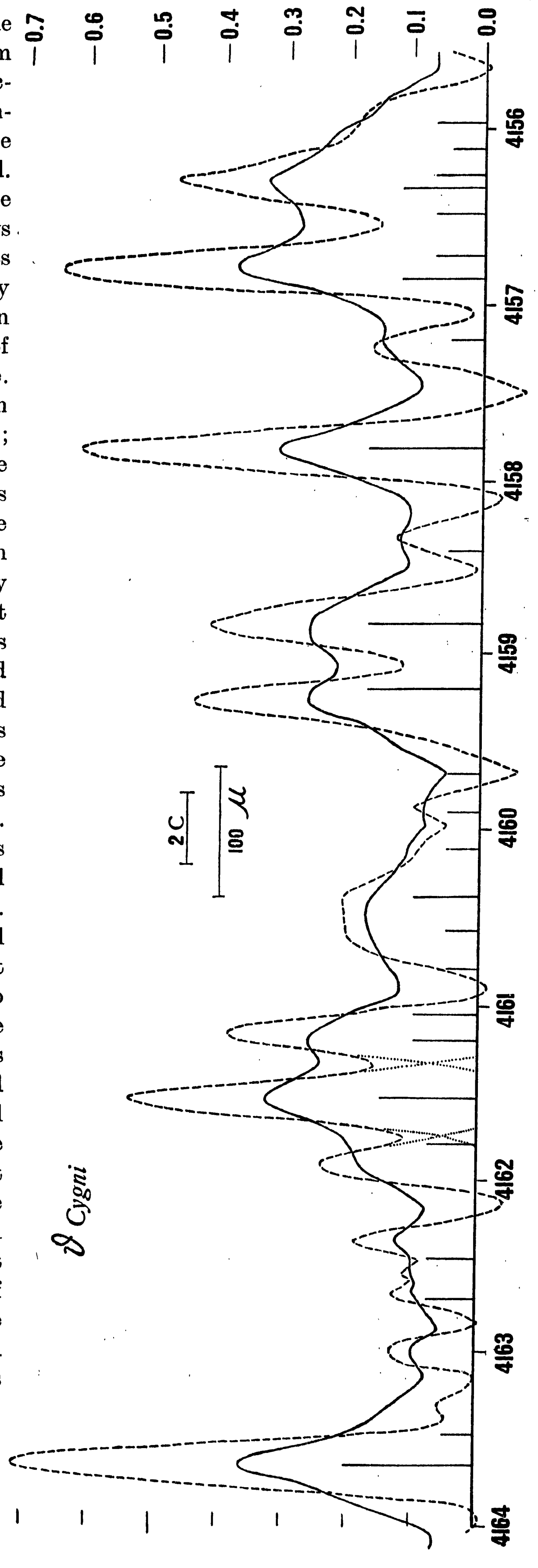
where

$$A'(x) = 3\,A(x) - A(x-c) - A(x+c).$$

Hence the contracted apparent curve of a spectral line is found by combining the contracted instrumental curve with the true profile of the spectral line. This implies that for strong lines the central parts are narrowed; the central depression approaches nearer to 1.0. The resonance wings, however, are not affected; they remain as they were before the contracting proces. In Fig. 6 the effect is shown; for each of the lines of different intensity the contracted curve is seen to the right of the original curve. It appears that the faintest lines are somewhat overcorrected; the constant c was adapted to somewhat stronger lines with a c.i. of nearly 0.2 — 0.3.

By applying the contracting method to the observed intensity curve of the stellar spectrum this is changed into such a shape as if each spectral line was broadened with the contracted instrumental curve only. Hence it looks as if the resolving power of the apparatus has been increased. The lines are better separated, their tops are higher, their contours are narrower, the valleys between them are deeper; where first the top was only flattened, it is now doubled. The effect may be seen in the diagram taken from the publication quoted above, a part of the intensity curve of ϑ Cygni before and after the contracting procedure. Of course the gain of this increase in resolution of the spectrum must be redeemed somewhere; the price is the strongly reduced accuracy of the contracted curve. The weight of each of its points is only 1/11 of the weight of a point of the original curve; its mean error is 3 times the mean error of the measured and computed intensity values. The weight of the total surface is not diminished, but the reliability of each feature is easily overestimated, and it had better be judged after the original curve. Only by the contracted curve, however, the task of separating the lines and determining their equivalent width is made possible. If the distance of the components is below 30 μ, they remain, of course, inseparable.

The surface belonging to each line was now measured by means of a planimeter; reduced from μ to A.U. it gives the equivalent width. Each line or line group that is well separated now from adjacent ones is measured; it is not necessary to know from other sources where to assume lines. Usually the valleys between the lines do not reach the new zero line; so it is necessary to continue the contour-lines downward to zero in such a way that the intensity around the valley points is represented. The resonance wings are cut off in this way; but they are lost in every case, because also in the original curve they disappear below the adjacent lines and can only be found by theory. Hence corrections must be applied to the measured EW. In the case of single contracted curves they are cut off where the steepness of the contour ceases, as is indicated in Fig. 6 by dotted lines. Then on these figures



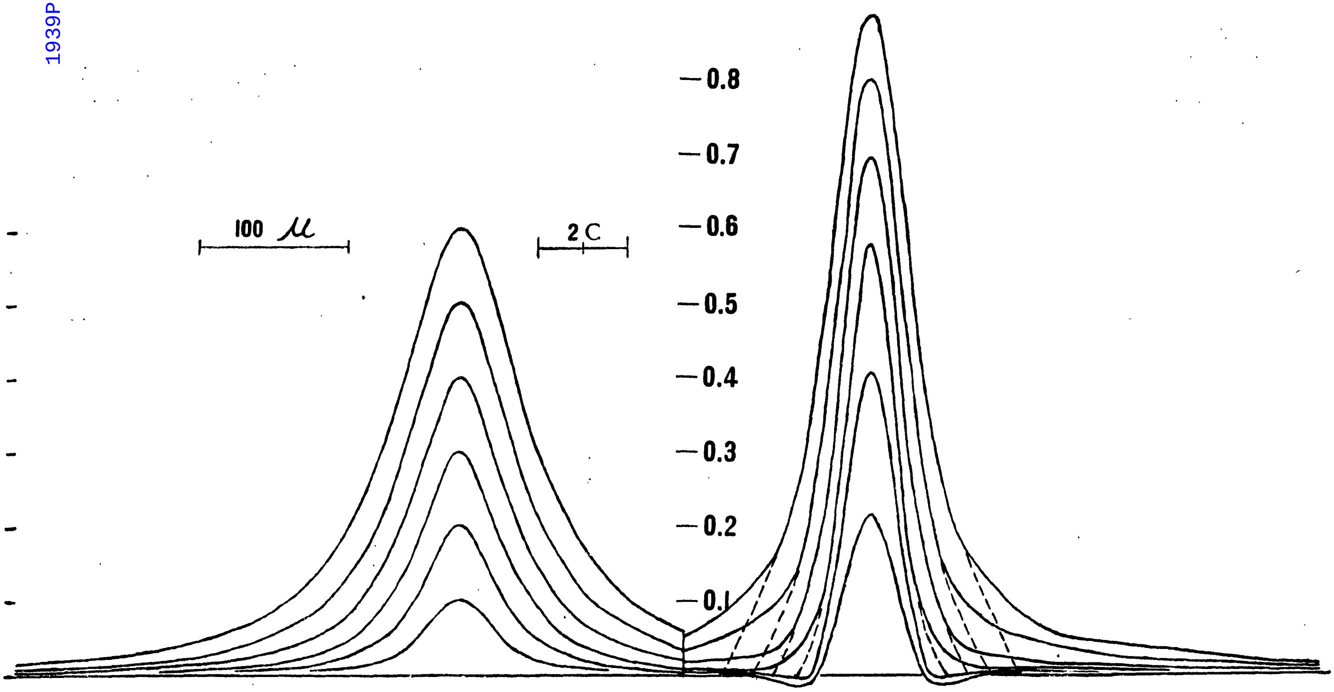


Fig. 6.

we can measure what fraction of the total surface is cut off in each case; in this way corrections are found that must be added to the logarithm of the *EW* if measured between the steep sides down to zero. They are given in Table 8. Because there is a certain arbitrariness in the prolongation of the steep contours downward, Table 8 also gives the breath at the bottom of the contour as it has been used in the measurement. It must be remarked that often just beside the contracted contour of a strong line, we find a depression instead of the first part of the wing. Probably it is produced by the Eberhard effect; clipping the wings and replacing them by theoretical corrections sets right this disturbance at the same time.

Table 8. Wing-correction to measured equivalent width.

Log *EW* meas. in μ	Corr. to log *EW*	Centr. depth	Bottom breadth
0.8	—0.012	0.16	65 μ
0.9	— .007	.21	69
1.0	+ .003	.27	73
1.1	+ .017	.34	78
1.2	+ .032	.41	84
1.3	+ .048	.49	92
1.4	+ .064	.58	104
1.5	+ .080	.67	120
1.6	+ .095	.74	138
1.7	+ .109	.81	160
1.8	+ .123	.87	187
1.9	+ .138	.92	222

As a compensation we have to subtract from the measured *EW* that part of the wings of adjacent lines that is coinciding with the measured line. Since, moreover, the bottom breadth of the measured „lines", because they really are blends, usually is larger than the last column of

Table 8 indicates, we computed both corrections together by means of Table 9. This table contains, for different line intensities (indicated in the first column) the total wing surface beyond the limits of distance given at the top. The negative correction to each neighbour line then is the difference of the table values holding for its inner and outer distance. The positive correction due to its own wings is found by adding the table values holding for the bottom distance of the measured surface to the rigth and to the left hand side. The table holds for scale factor 1 ; for other scale factors, as given p. 14, all the values in table 9 must be multiplied by them.

Table 9. Wing surface beyond distance *d* (in 0.1 μ).

d in μ / meas. *EW*	50	60	70	80	90	100	120	140	160	180	200
27 μ	17	14	12	11	9	8	7	6	5	5	4
34	30	26	22	19	17	15	13	11	10	9	8
42	48	40	34	30	26	24	20	17	15	13	12
49	67	57	49	43	38	34	29	24	21	19	17
57	91	77	67	59	52	47	39	33	29	26	24
64	117	100	87	76	68	61	51	44	38	34	31
70	152	123	107	95	85	76	64	54	47	42	38

Some more computations are still necessary. The zero line had to be drawn, before the line contours could be analyzed and contracted, and the real background could be deduced only afterwards in a second approximation. If the zero line is too high or too low, all the areas measured are too small or too large ; so we must be able to apply corrections afterwards. On the other hand the curves were contracted and partly measured with preliminary values of the scale factors, before the definite values of Table 7 were available. So it is necessary to know also the influence of the constant *c* upon the result. For this purpose the same computations as for Table 8 have been made for deviating values of *c* (20 μ and 40 μ) and for variations of the zero line of + 0.04 and — 0.04. The results are given in Table 10, in the form of corrections to log *EW* for the two cases that for *c* $^2/_3$ times and $^4/_3$ times the true value has been used, and for the two cases, that the real background is situated 0.04 below and 0.04 above the adopted zero line. The argument is the log of the measured *EW*.

Table 10. Corrections to equivalent width.

Log *EW* meas. in μ	Corr. $^2/_3$ *c*	Corr. $^4/_3$ *c*	Corr. zero — 0.04	Corr. zero + 0.04
0.7	+ 0.12	— 0.10	+ 0.18	—
0.8	.11	.10	.16	—
0.9	.11	.10	.14	— 0.16
1.0	.10	.094	.12	.14
1.1	.095	.091	.10	.12
1.2	.084	.088	.085	.10
1.3	.072	.084	.075	.083
1.4	.059	.080	.068	.074
1.5	.044	.074	.062	.068
1.6	.029	.063	.058	.063
1.7	.020	.051	.055	.058
1.8	.015	.034	.053	.054
1.9	.009	.019	.052	.051
2.0	.006	.012	for $^2/_3$ *c* abs. val. 0.005 larger for $^4/_3$ *c* abs. val. 0.005 smaller	

The tables of line intensities (equivalent widths).

In the following tables the results for equivalent width are given, first for the two spectra of δ Cephei, min. and max., then for the other stars. The 1st column gives the wave length to one decimal only, as read from the curves.

The 2d column represents the original intensity curve of the spectrum, as derived from the plates; it gives the central depth $1-r$ as a fraction of the continuous background. Where the line does not produce a separate top but only appears as a hump on the curve of a stronger neighbour, the height $1-r$ at this hump is indicated by a number in parenthesis. Where instead of a hump there is only a wave in that curve no number is given. Where two lines, separated in the contracted curve, form a single broad top in the original curve, the values are connected by a brace. Where the centre of the line shows clear plate the real intensity could not be derived and (100) is put down in this column. A broadened line is indicated by *b*, asymmetrical broadening to the violet or to the red side only, by b_1 or b_2; the letter *e* indicates a plate error.

The 3d column gives the equivalent width in 0.001 A, as measured on the contracted intensity curve, already corrected if in the construction or measurement not the definite *c* or background had been used. Where the curves of two adjacent lines are strongly connected the values given are connected by an arch; where the curves are separated only at the top, so that the part of the total surface attributed here to each component is rather uncertain, the values are connected by a brace. In the case of strong lines with central depth (100) the measured surface is somewhat uncertain and the result is put in parenthesis.

The values of column 3 must be corrected for the wings by means of Table 9. In order to compute this correction we must, in the case of blends, know what part of the measured intensity must be ascribed to each of the components. This can be estimated only roughly, in such a way that for arc lines the relative intensities in the solar spectrum (after MULDERS' calibration) were assumed, whereas for spark lines the solar intensity for supergiants was increased by 2, for giants and *F* type stars by 1. Then the effects for the components were added together. For strong lines the negative corrections to their neighbours as wel as the positive corrections for themselves were derived; for weaker lines only the latter were significant; all corrections below 5 were neglected. By applying these corrections, after reduction from μ to AU, the corrected equivalent widths of the 4th column were found. Where over large extents no corrections were needed, the values of the 3d column have not been repeated in the 4th (indicated by no corr.). The 3d decimal has no real significance and was only kept to avoid an accumulation of small uncertainties.

Some lines appear against the background of the extensive wings of the hydrogen lines. Here the surface below the depressed background is given as equivalent width. In a separate table at the end the values $1-r$ for the hydrogen wings are given, as well as the reduced equivalent width $EW/(1-r)$ of the lines affected in this way. Asterisks in column 3 indicate the beginning and the end of the series of these lines.

The last column for δ Cephei contains the identifications. Each identification consists of: two figures, giving the decimals of an Angstrom for the wave length, then the atom to which it is attributed, then the Rowland intensity; if the atom is not known, the solar occurrence is indicated by ⊙. All the solar lines down to intensity 0 are given; for spark lines lower intensities are sometimes included. In the table for the other stars the identifications are not repeated.

1939PUAms...6....1P

Line intensities for δ Cephei.

δ Cephei *m* (10607)				δ Cephei *M* (10617)				Elements
λ	C.d.	*EW* meas.	*EW* corr.	λ	C.d.	*EW* meas.	*EW* corr.	
4049.8	25	72	60					73 Ni 1, 87 Fe Gd$^+$ 00.
50.4	44	219 ⎞	269					32 Zr$^+$ 0.
50.7	36	86 ⎠	70					68 Fe 2.
51.0	31b	53 ⎫	52					06 V$^+$ 00.
51.3	—	100 ⎭	96					19 Ni Nd$^+$ 00, 34 Cr V 0.
51.7	(29)	50	47					
51.9	49	188 ⎞	191					93 Fe 3, 03 Cr$^+$ 0.
52.3	41 ⎫	90 ⎠⎞	86					31 Fe 2.
52.6	41 ⎭	155 ⎠	150					47 Fe Mn 2, 50 ⊙ 3, 66 Fe 1,
52.9	—	17	12					94 Co Ti 0. [72 Fe 1.
53.3	—	81 ⎫	69					27 Fe 2.
53.5	(45)	83 ⎭⎞	58					43 Cr$^+$ 0, 49 Ce$^+$ 00.
53.8	(100)	(485) ⎠	(575)					83 Ti$^+$ Fe 3, 08 Cr$^+$ 0, 19 Fe 1.
54.9	57	363	323					44 Zr Fe 0, 72 ⊙ 0, 83 Fe 2,
55.6	45	189	225					55 Mn 6. [88 Fe 3, 04 Zr Ti Fe 3.
56.3	50	226 ⎞	217					99 Fe 0, 07 Cr 0, 20 Ti$^+$ 0, 35 Fe 1,
56.6	—	56 ⎠	53					56 Pr$^+$ Fe 00. [46 ⊙ 0.
56.9	21	48	44					
57.5	55	266	291					19 Co 1, 36 Fe Ni 3, 52 Mg 7,
57.8	(31)	77 ⎞	64					89 ⊙ 0, 97 Mn 0. [67 ⊙ 0.
58.2	39	113 ⎠⎫	110					22 Co Fe 4.
58.4	(35)	57 ⎭	56					
58.8	50	145 ⎞	145					60 Co 0, 77 Fe Cr 3.
59.0	(40)	106 ⎠	106					94 Mn 3, 23 ⊙ 0.
59.5	24b_1	58	58					39 Mn 1, 51 ⊙ 0.
59.7	34	96 ⎫	95					73 Fe 2.
59.9	30	50 ⎭	48					
60.3	18	45	42					27 Ti 1.
60.6	17b	44	38					50 ⊙ 0.
60.8	—	20 ⎞	8					78 Fe 0.
61.1	36	169 ⎠	196					10 Nd$^+$ Fe 3.
61.6	—	33 ⎞	27					73 Mn 2.
61.9	28b	103 ⎠	78					96 Fe 2.
62.5	50	252	285					24 Ce$^+$ 00, 45 Fe 5, 75 Cu 0.
63.0	—	69	27					
63.6	(100)	(500)	(630)					30 Fe 4, 43 ⊙ 0, 60 Fe 20, 79 ⊙ 1,
64.2	34	68	39					05 Cr$^+$ 1, 21 Ti 1. [94 V 0.
64.4	39	140	123					37 Ti$^+$ Ni 1, 46 Fe 2, 58 Sa$^+$ 00.
65.0	(24)b_1	45 ⎞	35					
65.2	32	84 ⎠	82					09 Ti Mn 2, 24 ⊙ 0.
65.5	29	88	86					40 Fe 3, 59 Ti 0.
65.9	^{e}10	(22)	(21)					
66.2	(21)	39	35					12 ⊙ 1, 23 Mn 1.
66.5	40b_1	149 ⎞	141					39 Co 2, 60 Fe 2.
66.9	51b	186 ⎠⎫	194					72 ⊙ 0, 83 ⊙ 0, 98 Fe 5.
67.3	55b_1	244 ⎭	245					28 Fe 3, 49 ⊙ 0, 60 ⊙ 0.
68.0	43	238	267					77 ⊙ 0, 99 Fe 6.
68.6	19	52	44					55 Co 0.
69.0	25	102 ⎞	96					85 Ce$^+$ 00, 07 Fe 2.
69.2	(18)	22 ⎠	20					27 Nd$^+$ 0.
69.5	(13)b	57	52					61 ⊙ 1.
70.1	29b_2	141	128					05 Fe 0, 28 Fe Mn 3.
70.8	46	221	237					78 Fe 4, 99 Cr$^+$ 00, 10 Zr$^+$ 0.

4071.6	53	295	389					54 VFe 1, 64 ⊙ 0, 74 Fe 15.
72.0	(39)	93	33					91 ⊙ 0.
72.5	32*b*	163	157					36 ⊙ 0, 52 Fe 2.
73.0	(22)*b*	94	88					14 ⊙ 0.
73.5	(33)	99	85					49 Ce$^+$ 0.
73.8	45	159	193					77 Fe Ce$^+$ 4.
74.4	—	14	13					37 W 0.
74.8	42	229	222					69 ⊙ 2, 79 Fe 3, 91 Ni Zr 0.
75.2	(30)	73	69					11 Nd$^+$ Fe 2, 32 ⊙ 0.
75.9	47b_1	281	312					71 Ce$^+$ 0, 85 Ce$^+$ Sa$^+$ 00, 94 Fe 3.
76.2	—	54	27					23 Fe Ce$^+$ 1.
76.7	(100)	(315)	(290)					50 Fe 2, 64 Fe 4, 81 Fe 2,
77.0	(44)	87	74					07 Zr$^+$ Cr 0. [88 Fe Cr$^+$ 1.
77.7	(100)	(630)	(750)					35 La$^+$ Y1, 48 Ti Ce$^+$ 0, 58 Cr$^+$ 0,
								[71 Sr$^+$ 8, 84 ⊙ 0, 98 Dy$^+$ 0.
78.4	49	209	171					36 Fe 4, 48 Ti 3.
79.3	50	282	255					19 Mn Fe 2, 24 Mn Fe 3, 42 Mn 3.
79.8	40b_1	188	193					85 Fe 3.
80.3	40	156	181					22 Cr Fe Nd$^+$ 3.
80.8	22b_1	58	53					89 Fe 2.
81.2	24*b*	129	124					24 Ce$^+$ Zr 0, 27 Fe 1.
81.9	(25)	64	64					
82.2	33	112	112					12 Fe 2, 28 ⊙ 0.
82.5	26	48	48					44 Ti Sc Fe 3, 60 Co 0.
82.9	(35)	99	98					95 Mn V 4.
83.2	38b_1	128	130					23 Mn Ce$^+$ 0.
83.7	44	247	239					55 Fe 2, 64 Mn 4, 76 Y Fe 1,
84.5	31	219	239					33 ⊙ 0, 50 Fe 5. [00 ⊙ 0.
85.0	49	144	155					02 Fe Cr 4.
85.3	50	174	164					26 Ce$^+$ Fe 1, 31 Fe 4.
85.6	(29)	47	44					59 Gd$^+$ 00, 73 Zr$^+$ 00.
86.0	32 b_1	102	96					98 Fe 1, 13 Ni Cr Cr$^+$ 0.
86.2	33	89	77					32 Co 3.
86.7	41*b*	219	251					71 La$^+$ 1.
87.3	37b_1	176	179					10 Fe 3, 28 Fe$^+$ 00.
87.6	(24)	68	63					61 Cr$^+$ 00, 80 Cr$^+$ 00.
88.1	9	11	10					
88.3	(10)	17	16					
88.6	29	116	115					57 Fe 3, 73 Fe$^+$ 00, 85 Cr Ce$^+$ 00.
89.1	31	125	127					22 Fe 3.
89.4	(19)	34	33					
89.8	(20)	51	51					
90.0	26b_1	69	69					96 Mn Cr$^+$ 0, 08 Fe 2.
90.5	38	193	193					33 Cr Fe 0, 51 Zr$^+$ 0, 58 V 1.
91.0	24	75	75					98 Ce$^+$ Fe 3.
91.5	20*b*	103	103					56 Fe 3.
92.4	50	370	370					29 Fe 2, 40 Co Mn V 3, 51 Fe 1,
93.3	15b_1	62	62					[67 Ca V 3.
93.6	11	29	29					
94.0	16*b*	65	65					
94.4	23	57	57					42 ⊙ 2.
94.8	(31)b_1	100	100					70 ⊙ 0, 98 Ca 4.
95.1	33b_2	108	108					27 Mn 0.
95.4	(27)	57 *	57					36 ⊙ 0, 49 V 0.
96.0	46	266	266					98 Fe 3, 12 Fe 2, 22 Fe 1.
96.7	(35)	108	104					64 Zr$^+$ 00, 70 ⊙ 0.
97.0	39b_1	156	168					10 Fe 3.
97.7	(24)*b*	63	55					66 Cr 0.
98.2	46	182	198					96 Cr 0, 18 Cr Fe 5.

4098.6	44	123	117					58 Ca 4, 60 ☉ 2.
99.0	31	56	55					06 ☉ 0.
99.2	(29)*b*	44	44					
99.6	(31)	43	42					
4100.1	(39)*b*	141	135					80 V 2, 00 Fe 0, 17 Fe 2, 35 Fe 0.
00.8	54	151	170					75 Fe 4, 92 Cb 0.
01.0	(49)	22	17					09 ☉ 0. [17 V 0, 38 Y 0.
01.7	(100)	—	—					27 Fe 2, 49 ☉ 0, 68 Fe 3, 74 H,
03.0	49	152	163					94 Si Mn 5, 32 Dy^+ 0.
03.6	35b_1	60	58					62 ☉ 0.
04.0	42	98	98					14 Fe 5.
04.3	40	78	78					47 ☉ 0.
04.6	(30)	33	33					
05.0	33*b*	128	128					95 Fe 1, 17 V 2.
05.4	(26)	43	43					
05.8	(20)	31	30					
06.4	42	264	225					27 Fe 2, 44 Fe 2, 74 ☉ 0.
07.5	51	277	349					49 Fe 5.
08.2	(26)*b*	80	69					14 ☉ 1.
08.5	28*b*	111	104					54 Ca 2.
09.1	40	156	139					91 ☉ 0, 07 Fe 3.
09.5	48*b*	188	212					47 Nd^+ 1, 58 Cr 0, 78 V 2.
09.9	50	218	206					81 Fe 3, 04 Zr^+ 00.
10.6	37b_1	163*	185					54 Co 4.
11.0	44	188	180					87 Cr 1, 00 Cr^+ 1.
11.5	(27)	77	69					36 Cr 1.
11.8	31	150	166					79 V 4.
12.3	26*b*	80	77					35 Fe 2.
12.7	—	119	119					57 Cr^+ 00, 72 Ti 1.
13.1	38*b*	228	224					92 ☉ 1, 98 Fe 3, 23 Mn Cr^+ 1.
13.9	21	69	63					87 Nd^+ Mn 00.
14.1	(20)	17	11					
14.5	36	200	236					45 Fe 4.
15.0	31	89	80					96 Fe 2.
15.2	30	91	87					18 V 3, 38 Ce^+ 00.
15.5	(18)	33	32					
15.9	(11)	19	19					
16.1	13*b*	37	37					99 Ni 0.
16.4	(18)	38	38					48 V 1.
16.7	21	54	54					56 ☉ 0, 70 V 1, 77 Nd^+ 00.
17.0	21b_2	87	86					96 Fe 0.
17.5	(18)	54	52					
17.9	(30)*b*	111	105					87 Fe 2. [90 Fe 2.
18.6	55b_1	472	491					15 Ce^+ 0, 55 Fe 5, 78 Co 4,
19.6	35b_2	202	184					40 Fe 1, 53 ☉ 0, 67 Fe 0, 80 Ce^+
20.2	40b_1	191	220					21 Fe 4. [0, 89 Ce^+ 0.
20.7	—	23	16					62 Cr 0.
20.9	22*b*	65	50					84 Ce^+ 00.
21.3	41	178	205					33 Co 6.
21.8	38b_1	153	162					81 Fe Cr 3.
22.1	—	38	27					15 Cr Ti 1.
22.7	48	279	278					52 Fe 3, 67 Fe^+ 1.
23.3	42b_2	190	173					23 La^+ 1, 39 Cr 0, 55 V 1.
23.8	43b_1	244	277					74 Fe 5, 88 Ce^+ 00, 95 Sa^+ 00.
24.8	43	272	267	4124.9	40	233	232	50 ☉ 0, 79 Ce^+ 0, 93 Y^+ 0.
25.6	(25)	107	107	—	—	—	—	63 Fe 3, 70 ☉ 1.
25.9	40*b*	123	119	25.8	32*b*	176	172	89 Fe 3.
26.2	38	142	150	26.2	35	129	137	19 Fe 4.

4126.7	20*b*	85	79	4126.5	28	93	88	52 Cr 2, 86 Fe 1.
—	—	—	—	27.1	—	58	55	
—	—	—	—	27.3	—	59	55	28 Cr 0, 38 Ce$^+$ 1.
27.6	(50) *b*	335	321	27.7	52	210	183	62 Fe 4, 81 Fe 4.
28.0	52	264	299	28.2	43	221	268	07 V 6.
28.8	41	199	221	28.8	37	158	171	74 Fe$^+$ 2.
29.2	39	126	115	29.3	36	128	118	19 Cr Fe 3.
29.7	44	276	259	29.7	35	180	186	47 ⊙ 2, 72 Eu$^+$ 1, 96 Cr 0, 05 Fe 2.
30.8	40*b*	264	278	30.8	39	193	201	45 Cr Gd$^+$ 0, 68 Ba$^+$ 2.
—	—	—	—	31.0	39	125	117	86 ⊙ 0.
31.1	(27)	85	71	31.2	(24)	88	70	12 Ce$^+$ Mn 1, 36 Cr 0.
32.1	(100)	(410)	(470)	32.1	50*d*	232	271	76 ⊙ 0, 96 Fe V 2, 06 Fe 10, 28
—	—	—	—	32.5	47	218	197	41 Ti Cr$^+$ 0, 54 ⊙ 3. [Gd$^+$ Mn$^+$ 0.
32.8	48*b*$_1$	268	251	33.0	35	143	163	71 ⊙ 1, 90 Fe 4.
33.2	(20)	20	18	33.4	(18)	35	28	37 Nd$^+$ 00.
33.8	41	220	214	33.9	34	197	195	61 Fe 2, 82 Ce$^+$ 0, 87 Fe 3, 01 ⊙ 0.
34.4	51	201	164	34.6	43	289	288	20 ⊙ 0, 34 Fe 3, 44 Fe V 3, 53 ⊙ 1.
34.7	51	167	217	—	—	—	—	68 Fe 5, 04 Mn 0.
35.4	24	110	104	35.4	25*b*$_1$	115	114	30 Fe Nd$^+$ 0, 46 ⊙ 0.
35.9	—	26	24	35.8	18	66	64	80 Os 0.
36.6	26	105	91	36.6	25	124	115	53 Fe 4.
37.0	41	184	220	37.1	34	183	204	00 Fe 6, 28 Mn Ti 0.
37.5	38	226	213	37.7	33	186	174	42 ⊙ 2, 64 Ce$^+$ 1.
—	—	—	—	38.0	(23)	43	37	98 Fe 0.
38.3	26	141	142	38.4	29*b*	177	200	36 Fe$^+$ 0.
39.1	11	42	41	39.1	(17)*b*	97	88	86 Fe 0.
39.9	24*b*$_1$	132	132	40.0	26	149	163	93 Fe 6.
40.4	20*b*	100	99	40.6	22	106	101	28 Sc 0, 44 Fe 3.
—	—	—	—	40.9	(18)	37	36	76 ⊙ 0.
41.0	11*b*	45	44	41.2	21	86	84	08 Mn 0.
41.3	(13)	7	6	41.5	18	26	25	54 ⊙ 0.
41.8	31	148	146	41.9	33	135	140	75 La$^+$ 0, 86 Fe 4.
42.3	40*b*$_1$	258	248	42.5	36	222	209	18 Ni Cr 2, 31 Ni 2, 51 Ce$^+$ 00,
43.0	—	66	58	—	—	—	—	95 ⊙ 0. [52 Ti 2, 63 Fe 2.
43.4	57	278	263	43.4	49	292	281	42 Fe 4, 51 Fe 2.
43.8	57	316	398	43.9	(100)	(255)	(320)	87 Fe 15, 08 ⊙ 1.
44.4	(22)	74	54	44.6	26*b*$_1$	115	95	52 Ce$^+$ 0.
45.0	24	120	112	45.0	28	159	155	01 Ce$^+$ Ti 0, 21 Fe 1.
45.8	(31)	114	112	45.8	33	157	155	56 ⊙ 0, 76 Ru 1.
46.1	33	168	166	46.2	33	126	126	98 ⊙ 0, 07 Fe 3, 14 ⊙ 0.
46.6	—	22	22	46.5	24	56	55	50 Cr$^+$ 00, 70 Cr 0.
46.9	(18)	34	34	47.0	21	63	61	99 ⊙ 2.
47.2	(25)	48	48	47.3	(25)	60	53	
47.7	42	261	261	47.7	39	218	239	35 ⊙ 2, 49 ⊙ 1, 68 Fe 4.
48.3	(10)	39	38	48.3	19*b*	83	70	50 ⊙ 0.
—	—	—	—	48.8	—	47	37	81 Mn 0.
49.2	58	372	381	49.3	56	340	367	20 Zr$^+$ 2, 37 Fe 4, 50 ⊙ 0.
49.9	37	153	149	50.0	33	104	97	77 Fe 2, 90 Ce$^+$ 00, 98 Ce$^+$ 00,
50.3	35	132	125	50.3	32*b*$_2$	129	121	28 Fe 4, 45 Co 1. [10 V$^+$ 00.
50.9	32	181	204	51.0	31	159	178	97 Ti Zr$^+$ 1.
—	—	—	—	51.3	(20)	33	27	
52.0	52	371	383	52.2	48*d*	315	328	77 ⊙ 0, 95 Fe La$^+$ Ce$^+$ 2, 08 ⊙ 1,
52.5	(20)	19	13	52.6	(23)*b*	56	52	[19 Fe Sa$^+$ 3.
52.8	—	50	46	52.9	(19)*b*	40	38	77 Cr La$^+$ 0.
53.2	—	69	66	53.3	22*b*$_1$	89	87	39 Fe 1.
—	—	—	—	53.5	(21)	40	38	62 ⊙ 0.
53.8	50	273	266	53.9	38	166	160	81 Cr 1, 91 Fe 4, 11 Fe 2.
—	—	—	—	54.3	(39)*b*$_1$	111	103	29 Cr$^+$ 0.

4154.5	51	179	156	4154.5	48	86	65	50 Fe 4.
54.7	53	225	289	54.8	46	204	263	82 Fe 4.
55.2	(16)	19	7	—	—	—	—	20 Sa$^+$ 00.
55.5	14	29	23	55.4	19	62	52	[46 Fe 1.
56.2	58b_2	356	342	56.2	48b_2	312	295	91 ⊙ 1, 08 ⊙ 0, 23 Zr$^+$ 1, 31 ⊙ 3,
56.7	51	250	260	56.8	49	276	278	67 Fe 1, 80 Fe 3, 20 ⊙ 0.
57.7	41	249	293	57.8	38	222	259	79 Fe 5.
58.3	(18)	29	19	58.4	(23)b_1	79	62	38 V 0.
58.8	41	174	188	58.8	37	132	118	81 Fe 5.
59.1	41	180	188	59.1	40	188	221	19 ⊙ 5.
59.6	(9)	7	3	59.8	(16)b	46	34	64 Ti 0.
59.9	(12)	17	13	60.0	(16)	15	14	87 ⊙ 0.
60.3	29	134	129	60.3	32	125	121	10 ⊙ 0, 39 Ti$^+$ 2.
60.6	27	75	69	60.6	33	131	125	56 Fe 0, 78 ⊙ 0.
61.2	53	251	255	61.2	—	203	135	08 Fe 2, 21 Zr$^+$ 2.
61.6	53	300	308	61.6	55b	183	282	52 Ti$^+$ Fe 4.
—	—	—	—	61.9	—	119	100	80 Sr$^+$ 1.
62.5	11	41	37	62.3	(17)b	45	38	
—	—	—	—	62.7	19	72	62	
63.0	(10)	25	11	63.1	(18)	44	3	
63.6	50	332	394	63.7	(100)	(330)	(460)	66 Ti$^+$ Cr Fe 4, 02 V$^+$ 00.
64.3	19	54	46	64.2	—	101	57	26 ⊙ 0, 34 ⊙ 0.
64.8	14	38	35	64.9	21	88	80	65 Ni 0, 79 ⊙ 0.
65.2	—	53	51	—	—	—	—	
65.6	35	169	167	65.5	34b	211	203	42 Fe 3, 61 Ce$^+$ 2.
66.0	(18)	50	50	66.0	26	97	94	04 Ba$^+$ 0.
66.3	12	28	27	—	—	—	—	33 Ti 0.
66.9	—	78	74	66.9	26	125	108	86 Ce$^+$ 00, 97 Ni 0.
67.3	44	246	258	67.3	42	237	272	28 Mg 8, 36 Zr$^+$ 00, 52 Y 1.
67.9	33	167	164	68.0	32	195	185	86 Fe 2, 96 Fe 2.
68.6	23	85	85	68.6	26	108	106	62 Fe 2.
68.9	23	84	84	69.1	26	121	120	94 Fe 2.
69.5	—	47	47	69.5	(19)	36	19	47 Sa$^+$ 00, 62 ⊙ 1.
69.8	30b	149	148	69.9	30b	200	213	78 Fe 2, 85 Cr Ce$^+$ 00.
70.9	45	303	301	71.0	46	290	290	64 Cr$^+$ 00, 91 Fe Co 4, 04 Ti 4.
71.8	59	445	453	71.8	54	219	224	56 Sa$^+$ 00, 70 Cr Fe 2, 91 Fe Ti$^+$ 2.
—	—	—	—	72.1	(100)	(210)	(210)	05 Cr Ga 1, 13 Fe 2.
72.6	51	284	289	72.7	48	246	250	48 ⊙ 0, 59 Cr$^+$ 00, 64 Fe 2, 76 Fe [Cr$^+$ 4, 98 ⊙ 1.
73.5	58	379	385	73.4	(100)	(325)	(325)	32 Fe 2, 48 Fe$^+$ 3, 55 Ti$^+$ 3.
74.1	51b_1	226	225	74.1	45	184	167	93 Fe 3, 12 Ti$^+$ 0.
74.4	—	75	70	74.4	41b	160	187	41 ⊙ 0.
74.9	40	209	185	75.0	39	189	171	80 Cr 0, 92 Fe 4, 13 ⊙ 1.
75.7	47	282	298	75.7	40	256	271	64 Fe 5, 91 Fe 1.
76.6	41	229	256	76.6	35b_2	215	210	58 Fe Mn 5, 88 ⊙ 0.
77.5	60	493	479	77.7	56	416	439	08 Fe V 0, 34 Nd$^+$ Ti 0, 52 Y$^+$ 3,
78.1	(33)	56	47	78.3	(32)	124	89	05 Fe 2, 39 V$^+$ 0. [60 Fe 3, 70 ⊙ 1.
78.8	58b_1	378	453	78.9	53	305	410	87 Fe$^+$ 3.
79.3	49b_2	322	290	79.4	41	183	139	25 Co Cr 0, 38 V Cr$^+$ 3, 58 Nd$^+$ 00.
—	—	—	—	79.8	30b_2	137	129	81 Zr$^+$ 0.
80.3	13b	72	62	80.4	19	67	63	40 Fe 1.
81.0	18b	73	64	81.0	21b	140	123	19 ⊙ 0.
81.7	55	376	401	81.7	50b_2	317	325	55 ⊙ 1, 76 Fe 5, 98 ⊙ 2.
82.3	38	147	142	82.4	34b_2	165	182	38 Fe 3.
82.7	27	96	91	82.9	(26)b	90	78	79 Fe 2, 02 Fe 1.
83.4	36b_1	199	191	83.5	39	216	225	32 Zr Ti 1, 44 V$^+$ 2.
84.0	46	173	200	84.0	43	128	85	00 ⊙ 4.
84.3	46	168	143	84.4	47	204	242	31 Lu$^+$ Gd$^+$ Ti$^+$ 2.
84.9	41	214	258	84.9	38	179	207	90 Fe Cr 4.

4185.3	—	33	11	4185.5	(21)	60	51	
—	—	—	—	85.7	19	59	52	78 ⊙ 0.
85.9	(14)b	66	55	86.1	19b	63	51	12 Ti 1, 35 Cr 0.
86.6	(44)	185	170	86.7	40	168	165	60 Ce$^+$ 2.
87.0	53	265	333	87.0	50	244	292	05 Fe 6, 34 Ce$^+$ 00.
87.7	56	385	358	87.7	51	292	274	59 Fe 2, 72 ⊙ 0, 79 Fe 5, 86 Fe 3,
—	—	—	—	88.3	(20)	44	29	[11 Sa$^+$ 00.
88.7	35	207	230	88.8	35	181	216	74 ⊙ 4.
89.5	25	130	115	89.6	23b_1	136	123	11 ⊙ 1, 57 CN 2.
90.3	33	209	204	90.2	27b_2	186	182	99 Mn 0, 13 Cr 0, 24 Ti$^+$ 0, 40
90.8	(21)	59	54	90.9	24	66	61	71 Co 1, 90 V$^+$ Cb 00. [V$^+$ 00.
91.4	56	382	397	91.4	50	344	366	27 Cr 0, 44 Fe 6, 68 Fe 3.
92.0	—	83	79	92.1	(29)	73	68	02 Ni$^+$ 0.
92.4	(11)	27	26	92.4	(19)	46	44	
—	—	—	—	92.8	16	43	42	
93.1	21b	121	119	93.3	21	95	94	12 Ce$^+$ 00, 28 Ce$^+$ 00.
93.6	20b_2	98	97	93.8	17	58	57	66 Cr 0, 88 Ce$^+$ 00.
94.3	10b	34	32	94.2	17b	74	72	49 Fe 0.
94.8	—	67	62	94.8	(25)	96	85	85 Dy$^+$ 1, 95 Cr 0.
95.3	49	347	355	95.4	46	314	277	34 Fe 5, 53 Ni 1, 62 Fe 2.
96.2	45	220	242	96.2	43b_2	176	167	22 Fe 4, 36 Ce$^+$ 00.
96.6	(37)	136	124	96.6	—	161	155	55 Fe La$^+$ 2, 67 Fe 1.
97.2	18	68	64	97.2	(24)	173	166	10 Fe 2, 23 Cr 0.
97.6	(19)	40	36	—	—	—	—	
98.2	60b_2	438	434	98.3	55	355	346	06 Fe 2, 14 ⊙ 0, 27 Fe 4, 32 Fe 4.
98.7	—	102	81	98.7	(45)	126	98	64 V Fe 3.
99.1	52	298	356	99.2	50	285	348	10 Fe 5, 29 Y$^+$ 00.
99.9	27	137	126	4200.0	27	147	132	91 Ru 1, 98 Fe 2.
4200.4	—	28	25	00.4	(20)	29	27	46 Ni 1.
00.8	35	212	199	00.9	35	205	196	74 Ti 1, 92 Fe 3.
01.2	—	24	12	01.2	(25)	60	36	24 Ce$^+$ 00.
02.0	59	502	577	02.1	62	373	494	71 Ni Fe 1, 03 Fe 8.
—	—	—	—	02.4	—	100	66	36 V$^+$ 0.
02.9	30	141	120	03.0	31b	184	166	75 Fe 2, 94 Ce$^+$ 0, 13 ⊙ 1.
03.5	—	60	50	03.7	—	134	130	57 Fe Cr 2.
04.0	44	269	276	04.1	38b_1	171	168	99 Fe 3, 01 Fe La$^+$ 4, 20 V$^+$ Cr 0.
—	—	—	—	04.6	—	116	114	46 Cr 0, 70 Y$^+$ 1.
04.9	51	314	308	05.0	52b	219	212	03 Eu$^+$ 1, 07 V$^+$ 1.
05.4	49	278	280	05.4	—	269	278	39 Cb 1, 54 Fe 2.
06.2	(20)	43	40	06.2	(25)	80	74	30 ⊙ 0, 37 Mn$^+$ 00.
06.7	40	188	174	06.8	38b_1	201	166	56 ⊙ 1, 70 Fe 3.
07.1	38	200	231	07.3	37	228	288	13 Fe 3.
07.8	(10)b	23	18	07.8	(16)	62	50	82 ⊙ 0.
08.6	40	192	183	08.5	(34)	146	128	35 Cr 0, 61 Fe 2.
08.9	40	187	212	09.0	41b_1	249	284	98 Zr$^+$ 1.
09.7	26b	132	121	09.7	32	164	154	35 Cr 0, 60 ⊙ 0, 76 Cr 0, 83 V$^+$ V 1.
10.3	44	270	267	10.3	42	237	232	34 FeSa$^+$ 4, 40 Fe Sa$^+$ 3, 63 Zr$^+$ 00.
11.3	17b_1	76	70	11.2	(22)b	112	102	35 Cr 0.
11.9	36	243	254	11.8	42	246	270	74 Ti Mn 0, 89 Zr$^+$ Os 2, 04 Gd$^+$
12.6	(9)b	37	33	12.3	—	74	64	64 Cr 3. [Fe 00.
13.1	(13)	25	22	13.1	20b	113	109	17 Cr 0.
13.6	32	206	210	13.6	32	185	181	65 Fe 3, 86 Zr 0.
14.4	—	42	32	14.1	(19)	79	72	04 Ce$^+$ 00.
14.8	—	43	28	14.9	(24)b_1	106	76	
15.6	66b_2	462	555	15.4	63	431	536	42 Fe 2, 52 Sr$^+$ 5, 77 Zr$^+$ 00.
16.1	(49)	268	229	16.2	42	241	194	97 Fe 1, 19 Fe 3, 36 Cr 0.
17.2	(30)	94	81	17.1	26	106	80	06 Cr$^+$ 00, 26 ⊙ 1.
17.4	37b_1	191	216	17.6	44	244	295	56 Fe La$^+$ Cr 5.

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4218.1	16	64	56	4218.2	24	116	102	23 Sc 1, 40 ⊙ 1.
18.6	(7)*b*	12	11	18.7	(16)	40	36	73 CH 3.
19.3	42	257	255	19.3	46	281	277	20 Fe 1, 36 Fe 4, 42 Fe 3.
20.2	35	281	275	20.3	$38b_1$	246	242	05 V$^+$ 1, 35 Fe 3.
—	—	—	—	20.7	23	51	49	66 Sa$^+$ 00.
21.1	11	36	31	21.0	18	78	72	
21.5	12	32	25	21.5	—	56	46	48 ⊙ 1, 56 Cr 0.
22.2	$46b_2$	317	394	22.3	$45b_2$	307	357	22 Fe 5.
22.7	—	71	52	22.7	(30)	54	48	62 Ce$^+$ 0, 74 Cr 0.
23.1	(22)	101	86	23.0	$26b_2$	146	136	10 ⊙ 1, 24 ⊙ 0.
23.5	—	41	35	23.6	(18)	40	37	58 ⊙ 1, 73 ⊙ 0.
24.2	46	351	345	24.2	$41b_2$	329	322	18 Fe 4, 30 ⊙ 0, 46 ⊙ 0, 52 F eCr 3.
24.8	—	47	42	24.8	(32)	55	47	
25.3	$49b_2$	312	349	25.3	49	312	343	22 V$^+$ 0 46 Fe 3.
25.8	—	162	105	25.9	36	131	93	72 ⊙ 1, 96 Fe 2.
26.7	62	519	665	26.8	59	426	544	35 ⊙ 0, 43 Fe 2, 56 Ge 0, 73 Ca.
27.3	53	364	294	27.4	54	324	286	32 Ti$^+$ 1, 44 Fe 4. [20, 97 ⊙ 1.
—	—	—	—	27.8	—	54	40	76 Ce$^+$ Zr 0, 95 ⊙ 1.
28.2	$(17)b_2$	78	69	—	—	—	—	
28.7	—	22	17	28.5	21*b*	191	176	72 Fe 1.
29.6	35	263	259	29.7	31*b*	262	256	41 ⊙ 0, 52 Fe 2, 75 Fe 3, 92 ⊙ 1.
30.3	14	54	51	30.4	(18)*b*	86	84	48 Cr 0, 58 ⊙ 0.
31.0	19	90	88	31.1	19*b*	98	95	03 Ni 4.
31.7	23	113	109	31.7	$24b_1$	109	105	61 Zr$^+$ 1, 70 Fe 1.
32.0	(21)*b*	66	63	32.0	27	105	103	96 Sc 1.
32.4	$(26)b_1$	71	64	32.3	25*b*	77	67	40 Nd$^+$ 00.
—	—	—	—	32.7	—	48	31	72 Fe 2.
33.2	61	445	490	33.2	(100)	337	394	93 V 1, 16 Fe$^+$ 4, 25 Cr$^+$ 00.
33.6	—	174	169	33.6	50	218	241	61 Fe 6.
34.2	21	123	104	34.3	26 *b*	128	103	02 V Co 0, 23 Nd$^+$ V$^+$ 0.
—	—	—	—	34.6	24	66	59	55 V Sa$^+$ 0.
35.1	33	184	158	35.2	32	167	147	15 Mn 2, 29 Mn 3.
35.9	56	409	492	35.9	55	340	417	71 Y$^+$ 0, 84 ⊙ 0, 95 Fe 8.
36.4	—	53	31	—	—	—	—	56 Zr$^+$ 00.
36.8	—	59	49	36.6	(25)*b*	131	92	81 V$^+$ 1.
37.1	29*b*	158	147	37.1	27	132	122	96 ⊙ 0, 08 Fe 1, 16 Fe 3, 26 ⊙ 1.
38.0	38	197	190	38.1	34*d*	241	218	68 ⊙ 0, 03 Fe Sc 3.
38.4	(40)	108	94	—	—	—	—	39 La$^+$ 1.
38.8	$45b_1$	260	294	38.9	43	281	332	76 ⊙ 0, 85 Fe 5.
39.3	—	40	29	39.4	(26)	72	55	37 ⊙ 2.
39.8	45	283	298	39.9	48	267	269	73 Mn 3, 85 Fe Nd$^+$ 3, 96 ⊙ 1.
40.4	30	139	131	40.4	30	138	133	20 Cr 0, 37 Fe 2, 44 Ca 1.
40.8	—	31	30	40.6	(22)	49	49	71 Cr 1.
41.1	19	73	72	41.2	21	148	148	11 Fe 2.
42.4	45	390	393	42.3	42*b*	248	248	16 ⊙ 2, 28 Cr 0, 38 Cr$^+$ Mn$^+$ 2.
—	—	—	—	42.9	(25)	54	54	[59 Fe 2, 73 Fe 2.
43.3	$26b_2$	163	162	43.6	25	106	105	21 ⊙ 1, 37 Fe 1, 45 ⊙ 3, 55 ⊙ 1.
43.8	—	69	69	43.8	(22)	116	114	79 Fe 2, 25 Mn$^+$ 0.
44.6	(16)	56	54	44.6	20*b*	115	112	71 Sa$^+$ 00, 81 Ni$^+$ 00.
45.3	40	247	242	45.3	36	222	216	09 ⊙ 0, 26 Fe 4, 36 ⊙ 2.
46.0	33	180	160	46.0	30	165	140	02 ⊙ 0, 09 Fe 2.
46.8	58	367	461	46.9	54	329	436	42 Cr 0, 85 Sc$^+$ 5.
47.4	48	263	221	47.4	43	241	203	32 ⊙ 1, 44 Fe 4, 57 ⊙ 0, 73 ⊙ 0.
48.2	33	176	168	48.3	$30b_2$	150	142	06 ⊙ 0, 22 Fe 2, 42 Fe 1.
48.8	$(26)b_1$	137	129	48.7	27	105	99	54 ⊙ 0, 73 Cr 2.
—	—	—	—	49.0	(20)	52	45	
49.4	(13)	31	19	49.4	(16)*b*	50	29	
50.0	49	303	347	50.1	44	273	317	13 Fe 8.

4250.8	51	335	349	4250.8	54	307	268	68 Mo$^+$ 0, 79 Fe 8, 92 ⊙ 1.
51.7	21*b*	91	80	51.7	25	171	152	34 Cr 0, 75 Gd$^+$ Ti 00.
52.1	(22)*b*	71	67	—	—	—	—	
52.5	33	206	198	52.6	38	267	260	30 Co 0, 45 Nd$^+$ 00, 63 Cr$^+$0, 76 ⊙ 1.
53.4	(18)*b*	100	86	53.3	23	155	133	01 Mn$^+$1, 21 ⊙ 1, 37 Ce$^+$ 00.
53.9	—	39	20	—	—	—	—	73 ⊙ 0, 91 ⊙ 1.
54.3	51	343	431	54.4	50	350	421	34 Cr 8.
55.0	—	58	33	55.0	—	43	24	94 Fe 2.
55.5	24	89	83	55.6	25b_2	153	143	51 Cr Fe 1.
55.8	26	99	96	—	—	—	—	85 Fe 2.
56.3	29	156	153	56.4	28b_1	241	237	14 ⊙ 0, 21 Fe 1, 33 Dy$^+$ 00, 40 Sa$^+$ 00,
56.8	17	71	69	57.2	17	93	91	81 ⊙ 0. [61 ⊙ 0.
57.7	—	66	63	57.7	—	51	50	66 Mn 2.
58.2	54	352	349	58.2	41	410	407	04 Zr$^+$ 0, 16 Fe$^+$ 1, 38 Fe 2.
58.6	—	77	76	—	—	—	—	61 Fe 2.
59.0	24	114	109	59.0	26b_2	173	162	95 Fe 2, 15 Cr 0, 31 V Mn 1.
59.8	—	67	60	—	—	—	—	77 ⊙ 0.
60.2	—	220	151	60.1	(45)	181	129	99 Fe 2, 13 Fe 3.
60.5	58b_1	317	421	60.5	52	333	415	34 ⊙ 0, 48 Fe 10, 62 ⊙ 0, 74 Fe Ti 1,
61.3	—	41	32	61.2	19	52	37	37 Cr. 0. [84 ⊙ 0.
61.9	41	301	310	61.9	44	291	325	90 Cr$^+$ 1, 14 Cr V Gd$^+$ 00, 35 Cr 0.
62.6	(13)	49	45	62.7	19	83	68	68 Sa$^+$ 0.
63.2	20	102	99	63.2	23	95	92	14 Ti Cr 2, 27 ⊙ 0.
63.6	(19)	38	37	63.6	22*b*	98	97	59 La$^+$ 0.
63.8	(21)	63	63	—	—	—	—	98 ⊙ 1.
64.3	26	133	133	64.2	28	141	139	21 Fe 3.
—	—	—	—	64.6	(20)	65	65	47 ⊙ 1.
64.8	(20)*b*	90	90	65.0	(21)	70	70	74 Fe 2, 93 Zr$^+$ 00.
65.2	21	93	92	65.3	24	128	128	27 Fe Ti 2, 54 ⊙ 0.
65.8	17b_2	103	102	66.0	20	76	76	73 Ti 0, 92 Mn 2.
—	—	—	—	66.3	18	52	52	
66.9	31	210	208	67.0	29	186	186	62 ⊙ 0, 74 ⊙ 0, 97 Fe 3.
—	—	—	—	67.5	21	50	50	
67.8	35	216	214	67.9	30	164	162	83 Fe 3, 98 Zr 0, 11 ⊙ 1.
68.7	29	178	174	68.7	30	120	116	64 V 0, 75 Fe 2.
69.3	33	173	169	69.3	38	235	232	27 Cr$^+$ 0, 49 La$^+$ 0.
69.6	(26)	73	69	69.7	(25)	55	53	74 V 2, 86 Fe 2.
70.1	22	109	96	70.2	20*b*	101	92	17 Ti Ce$^+$ 1.
70.6	—	52	37	70.7	21	49	34	73 Ce$^+$ 00.
71.1	51	307	315	71.0	45	256	256	06 Cr 0, 17 Fe 6, 38 ⊙ 0.
71.8	59	449	532	71.8	56	357	448	64 Fe 0, 76 Fe 15, 96 Fe 1.
—	—	—	—	72.5	19	45	26	55 ⊙ 1.
72.7	(19)	64	43	72.9	21	53	41	92 Cr 1.
73.4	45	302	294	73.4	46	291	294	33 Ti Fe$^+$ 3, 49 Zr$^+$ 2.
73.9	(21)	85	69	73.8	—	52	48	89 Fe 1, 94 ⊙ 1.
—	—	—	—	74.1	19	42	33	
74.8	53	357	401	74.9	47	294	343	59 Ti 2, 80 Cr 7.
75.6	41	252	235	75.6	39	227	216	39 ⊙ 0, 56 Cr$^+$ 0, 64 La$^+$ 0, 72 ⊙ 0.
76.2	—	13	11	76.3	(15)	28	27	11 Co 0, 28 ⊙ 0.
76.6	21	140	136	76.7	20*b*	127	125	44 Ti 0, 68 Fe Ti 2, 96 V 1.
77.4	22	114	112	77.4	22	104	102	24 ⊙ 1, 39 Fe Zr$^+$ 0.
78.1	34	232	231	78.2	38	231	235	13 Fe$^+$ 0, 24 Fe Ti 3.
78.9	18	90	89	79.0	19*b*	116	114	86 Ti V$^+$ 1, 03 Mo$^+$ 1.
79.5	(25)	63	62	79.6	26b_2	136	135	48 Fe 2.
79.8	30*b*	209	207	80.0	(24)	71	70	88 Fe Sc$^+$ 1, 09 Ti 1, 22 Fe 1.
80.5	30	124	121	80.6	(26)*b*	149	148	41 Cr 1, 55 ⊙ 0, 64 ⊙ 0.
81.0	29	211	205	81.1	28b_1	135	133	80 Sa$^+$ 1, 10 Mn 2, 38 Ti 0.
81.9	(17)	28	12	81.7	—	64	50	

4282.4	50	343	393	4282.4	45	279	296	22 Zr Zr$^+$ 00, 41 Fe 5, 71 Ti 0.
83.1	42	259	279	83.0	39	234	256	80 ⊙ 0, 10 Ca 4.
84.2	37b_2	296	302	84.2	37b_2	236	248	07 V Mn 0, 20 Cr$^+$ 2, 41 ⊙ 0.
84.7	—	65	57	84.5	—	67	57	50 Nd$^+$ 00, 69 Ni 1.
—	—	—	—	85.0	18	33	30	01 Ti 2.
85.4	34	205	201	85.5	29	178	174	37 Ce$^+$ 1, 45 Fe 3, 82 Co Fe 1.
85.9	29b_2	154	151	86.1	21b_2	85	83	01 Ti 2.
86.5	26	85	84	86.5	23	82	81	44 Fe 3.
87.0	30	168	162	87.0	29	128	124	89 Fe 1, 01 Fe La$^+$ 2, 05 ⊙ 0.
87.4	—	29	21	87.3	(19)	59	48	42 Ti 1.
87.9	52	406	438	87.9	50	335	367	88 Ti$^+$ 2, 00 Ni 1, 16 Fe Ti 1.
89.0	—	160	138	88.9	—	86	69	74 ⊙ 2, 96 Fe 1, 08 Ti 2.
89.4	—	196	221	89.4	(44)	190	204	36 Ca 4.
89.9	64 b_1	316	258	89.7	(52)	207	245	73 Cr 5, 92 Ti Ce$^+$ 1.
90.3	63	348	423	90.2	58b_1	366	357	23 Ti$^+$ 2, 38 Fe 1.
91.0	32	137	115	91.0	20	104	90	87 Fe 1, 94 Ti 3, 14 Ti 2.
91.5	35	203	220	91.5	27	174	182	22 Ti 1, 47 Fe 2.
92.3	29	176	166	92.2	23b_2	153	147	98 Cr. 0, 14 Fe 2, 29 Fe 2.
93.1	20	121	109	93.2	18	92	83	04 ⊙ 2.
94.1	57	408	443	94.1	50	328	359	80 ⊙ 0, 05 Ti$^+$ Fe 2, 15 Ti$^+$ Fe 5.
94.8	41	262	292	94.8	38	227	271	78 Zr Sc$^+$ 2.
95.9	34	225	207	95.9	30	163	144	76 Ti Cr 2, 90 Ni 1, 08 Ce$^+$ La$^+$ V 0.
96.7	50	394	403	96.6	47	345	373	56 Fe$^+$ 3, 68 Ce$^+$ 1, 78 Zr$^+$ Ce$^+$ 0, 06 Cr 1.
97.5	—	19	16	97.6	—	62	51	29 ⊙ 2.
98.0	33	234	229	98.0	29	163	161	75 Cr Pr$^+$ V 0, 98 Co 1, 04 Fe 2, 20 ⊙ 1.
99.2	60	576	554	99.1	56	452	446	68 Ti 2, 82 Ni 2, 99 Ca 3, 14 Ti 1, 25 Ti
4300.1	59	583	614	4300.1	59	421	436	64 Ti 2, 98 Cr 0, 06 Ti$^+$ 3. [Fe 4, 37 Ce$^+$ 0.
—	—	—	—	00.5	—	80	77	56 Ti 2, 74 ⊙ 0. [22 Mn$^+$ 0, 32 Ce$^+$ 1.
01.1	(37)	205	195	01.1	31	174	167	83 Fe 1, 00 Co 2, 08 Ti 4, 18 Cr V$^+$ 1,
02.0	56	358	383	02.0	52	324	338	81 Zr$^+$ 0, 93 Ti$^+$ 2, 19 Fe 2. [29 ⊙ 0.
02.5	53	268	255	02.5	44	203	189	30 Y 2, 54 Ca 4, 79 Cr 2.
03.1	52	242	253	03.2	50	326	352	88 Zr 1, 18 Fe$^+$ 2, 43 ⊙ 1.
03.5	—	242	233	03.7	—	76	70	61 Nd$^+$ 1, 72 ⊙ 0, 84 ⊙ 2.
—	—	—	—	04.3	—	46	44	26 ⊙ 1.
04.5	29	198	193	04.6	21b_1	95	93	55 Fe 2, 72 ⊙ 0, 86 Fe 0.
—	—	—	—	05.1	—	48	46	11 Ce$^+$ 1, 22 ⊙ 0.
05.4	—	278	274	05.4	—	140	133	46 Fe Cr Sr$^+$ 3.
05.8	54	306	301	05.7	52	297	303	71 Sc$^+$ 2, 92 Ti 4.
06.8	29	175	154	06.8	25	152	138	60 Fe 0, 73 Ce$^+$ 2, 86 ⊙ 2.
08.0	62	541	628	07.9	56	416	515	74 Ca 3, 91 Fe Ti$^+$ 6.
—	—	—	—	09.0	(33)	159	135	60 ⊙ 2, 91 ⊙ 1, 04 Fe 2, 21 Fe 0.
09.6	54b_1	601	566	09.6	48	347	341	38 Fe 3, 46 ⊙ 1, 62 Y$^+$ 1, 72 Ce$^+$ 1, 80 V 0.
10.3	26b	75	74	—	—	—	—	11 Co 2, 23 ⊙ 1, 38 Ti 2, 47 ⊙ 1. [91 ⊙ 0.
10.6	(24)b_2	95	93	10.6	19b	112	110	71 V$^+$ 2.
11.0	—	35	34	10.9	(16)	30	29	90 ⊙ 1.
11.3	18b	63	61	11.2	15	43	40	45 Fe 2.
11.6	18	86	84	11.7	15	56	48	53 Fe 2.
e				12.1	15	44	34	
				12.9	47	339	394	55 Mn 1, 88 Ti$^+$ 3, 04 Fe 1.
14.1	59	416	431	14.1	51	412	416	12 Sc$^+$ 3, 22 ⊙ 1, 35 Ti 1, 50 Nd$^+$ 0.
15.0	58	443	467	15.0	54	367	385	81 Ti 1, 98 Ti$^+$ 3, 09 Fe 4.
15.7	(14)	22	16	—	—	—	—	
16.2	(12)	34	30	16.0	16	70	59	96 La$^+$ 00.
16.8	37	268	265	16.9	36	239	237	80 Ti$^+$ 1, 97 ⊙ 0, 07 ⊙ 0.
17.3	26	87	84	17.4	(23)	90	85	31 Zr$^+$ 0.
18.0	—	23	9	18.0	14	45	38	07 ⊙ 0.
18.7	44	338	369	18.8	37	277	298	36 ⊙ 0, 65 Ca Ti 4, 95 Sa$^+$ 00.
19.7	12	58	47	19.6	16	90	78	46 Fe 0, 65 Cr 0.

—	—	—	—	4320.1	(14)	28	18	
4320.8	59	530	560	20.9	59	440	500	38 Co Fe 0, 50 Fe 0, 75 Sc$^+$ Ce$^+$ 3, 96 Ti$^+$ 2.
—	—	—	—	21.4	—	35	23	42 ⊙ 0.
21.8	21	134	126	21.9	20	86	81	67 Ti 0, 80 Fe 2, 04 ⊙ 0.
22.5	19	87	83	22.5	21b_1	139	134	52 La$^+$ 0.
23.3	21*b*	142	138	23.2	16	52	50	06 ⊙ 0, 37 Fe 0.
23.7	—	123	112	23.5	16	59	56	54 Cr 1, 61 ⊙ 0.
—	—	—	—	24.0	18*b*	85	77	98 ⊙ 1, 18 ⊙ 0.
—	—	—	—	24.4	(20)	61	47	41 ⊙ 2.
25.0	55	435	439	25.0	51	301	325	82 ⊙ 0, 00 Fe Sc$^+$ 4, 15 Ti 1.
25.8	61	458	505	25.8	58	401	445	62 Ni 1, 77 Fe 8, 96 ⊙ 1, 05 ○ 0.
26.8	37	152	141	26.6	27	95	83	76 Fe 2.
27.1	37	169	165	27.1	30*b*	182	174	92 ⊙ 0, 10 Fe 3, 11 Gd$^+$ 00.
27.9	28	181	179	28.0	23b_2	192*	201	92 Fe 2.
28.6	(16)	34	32	28.7	18	49	47	61 ⊙ 0.
29.0	20*b*	148	144	29.1	20	90	89	03 Sa $^+$ 00, 29 ⊙ 0, 40 ⊙ 0.
29.8	—	23	20	29.6	18	52	51	
30.2	—	174	161	30.3	(42)	230	230	03 V 0, 25 Ti$^+$ 1, 41 ⊙ 0, 45 Ce$^+$ 0.
30.7	49b_1	303	343	30.8	45	199	199	71 Ti$^+$ Ni 2, 96 Fe 1.
31.6	28	206*	192	31.6	29b_2	161	161	45 ⊙ 0, 64 Ni 2.
32.6	28*b*	154	152	32.6	25	91	91	58 Cr 0, 83 V 0.
33.2	(24)*b*	69	65	33.2	27	102	102	92 ⊙ 0, 21 Zr$^+$ 0.
33.8	40	300	306	33.9	39	233	232	80 La$^+$ 1, 98 Pr$^+$ 00, 17 Sa$^+$ 00.
34.7	(12)*b*	30	27	—	—	—	—	67 ⊙ 0, 81 V$^+$ Ti 0, 94 La$^+$ 0.
35.2	22*b*	90	88	34.9	27	85	84	28 ⊙ 1.
35.6	(19)	30	28	35.6	27*b*	79	76	
36.2	24b_1	80	68	36.3	33	101	87	14 Ce$^+$ 00.
37.1	53	287	303	37.2	54	242	263	05 Fe 5, 26 Ti$^+$ Cr 0.
37.9	62	360	384	38.0	63	315	329	57 Cr 3, 76 Ce$^+$ 00, 92 Ti$^+$ 4, 27 Fe 1.
38.7	44	84	74	38.8	47*b*	79	73	71 Nd$^+$ 0, 84 Mn Fe 0.
39.5	53	117	114	39.4	53	44	42	14 ⊙ 0, 26 Fe 0, 45 Cr 4, 72 Cr 3.
40.5	(100)	—	—	40.4	(100)	—	—	14 Cr 0, 48 H 20, 02 V 0.
41.4	(54)	113	113	41.4	56	78	78	25 Fe Gd$^+$ 00, 39 Ti$^+$ 2, 72 ⊙ 0, 83 ⊙ 0.
42.2	(34)	69	69	42.3	42*b*	133	133	93 ⊙ 0, 19 Gd$^+$ V 0.
43.2	36*b*	118	118	43.2	42*b*	112	112	18 Cr 2, 28 Fe 2.
43.8	(37)	70	68	43.6	(40)	61	61	50 ⊙ 0, 70 Fe 2.
44.4	55	356	359	44.5	54	330	330	97 Mn$^+$ 1, 31 Ti$^+$ 2, 51 Cr 4.
45.0	—	35	35	44.9	—	40	40	89 ⊙ 0.
45.6	(17)	42	42	45.6	(29)*b*	135	135	
46.1	—	53	53	—	—	—	—	91 ⊙ 0.
46.5	32*b*	248	248	46.5	33*b*	118	118	30 Mn 1, 56 Fe Ti 2.
—	—	—	—	46.9	—	68	68	83 Cr 1.
47.5	—	60	60	47.4	(27)	68	68	24 Fe 1, 55 ⊙ 1.
47.9	26b_1	130	130	48.0	29*b*	134	134	85 Fe 2.
48.2	(20)	30	30	48.4	(25)	62	61	34 Fe 1.
48.7	(19)	48	48	—	—	—	—	49 Mn$^+$ 00, 64 Zr$^+$ 00.
49.0	23	108	107	49.1	28	134	133	95 Fe 2.
49.8	21	137	134	49.8	25*b*	159	156	79 Ce$^+$ 00, 96 V$^+$ 00, 16 ⊙ 0, 25 ⊙ 0.
50.9	45	347*	333	50.9	43	295	279	59 Fe 0, 84 V Ti$^+$ 1, 06 Cr 3.
51.8	59	503	529	51.8	59	467	501	23 Nd$^+$ 00, 39 Fe$^+$ 00, 55 Fe 2, 77 Cr Fe$^+$
52.7	43	332	346	52.8	42	268*	285	56 ⊙ 0, 74 Fe 4, 88 V 0. [5, 92 Mg 5.
53.5	(14)	42	37	53.5	21	97	91	
—	—	—	—	54.0	—	70	67	98 Cr 0.
54.5	42	305	300	54.6	40	267	276	27 ⊙ 0, 39 La$^+$ 00, 62 Sc$^+$ 1, 77 Fe 0.
55.0	—	147	145	55.1	29	85	82	10 Ca 2.
—	—	—	—	55.5	(21)	90	89	35 Ti 0.
55.9	19	123	123	56.0	20b_2	109	108	90 Ni V 0.
56.7	11*b*	78	78	56.6	19	83	83	37 ⊙ 0, 61 Mn 0.

—	—	—	—	4357.0	17	81	81	91 Co 0.
4357.4	17b_2	95	95	57.6	24	107	106	52 Cr 0.
—	—	—	—	58.0	24	66	65	88 Ni 0.
58.6	44	453	448	58.5	(34)	160	148	20 Nd$^+$ 0, 51 Fe 2.
—	—	—	—	58.9	38	177	190	72 Zr Y$^+$ 0.
59.7	41	322	335	59.7	37	307	313	63 Ni Cr 3, 74 Zr$^+$ 0.
60.7	20b	160	156	60.8	20	94	93	50 Ti 1, 80 Zr Fe 1.
61.3	(15)	60	60	61.3	20b	115	115	
62.0	25	147	147	62.1	27	141	141	10 Ni$^+$ 0.
62.4	—	71	71	62.5	21	54	54	54 ⊙ 1.
62.9	20	117	117	63.0	20b	118	118	75 ⊙ 0, 13 Cr 1.
63.6	(11)b	41	41	63.6	16	60	60	47 ⊙ 0, 65 Mo$^+$ 0.
64.1	15b	64	64	64.1	19b	123	123	19 ⊙ 1.
64.7	20b_1	138	138	64.7	22	110	110	66 Ce$^+$ La$^+$ 00.
65.5	—	31	31	65.2	18	79	79	29 Mn$^+$ 00, 54 ⊙ 0.
65.9	18b_1	81	81	66.0	20b	157	157	90 Fe 2.
66.4	16b	120	118	66.7	(17)	60	60	41 Nd$^+$ Zr 00.
—	—	—	—	67.0	19b_1	62	61	91 V$^+$ 00.
67.7	50	548	552	67.7	45b_2	408	404	58 Fe 5, 66 Ti$^+$ 2, 91 Fe 2, 13 ⊙ 0.
68.7	19	56	54	68.5	—	105	94	30 Cr Ni 0, 63 Nd$^+$ 0.
69.4	—	211	231	69.4	40	253	318	41 Fe$^+$ 1.
69.8	44	266	254	69.9	—	180	152	68 Ti 0, 78 Fe 4, 16 ⊙ 0, 30 Cr 0.
—	—	—	—	71.0	30	138	136	95 Zr$^+$ 0, 06 ⊙ 1.
71.2	37	372	369	71.4	32	160	159	28 Cr 2, 43 ⊙ 0.
72.5	17b_1	119	115	72.4	19b_1	133	130	80 ⊙ 0, 34 ⊙ 0.
72.8	(16)	26	24	72.9	(17)	66	64	85 ⊙ 0, 99 Fe 0.
73.5	29	239	220	73.6	26b_1	186	171	27 V Cr 1, 57 Fe 2, 79 ⊙ 0, 90 ⊙ 0.
74.4	59	400	490	74.4	(53)	286	309	17 Cr 1, 50 Sc$^+$ Fe 3.
75.0	—	321	264	74.9	56	352	366	82 Ti$^+$ Rh 0, 95 Mn CoY$^+$ 2, 20⊙0, 34Cr 0.
76.0	40	298	330	76.0	39	233	246	58 ⊙ 0, 93 Fe 6.
76.7	20	109	97	76.8	21b_1	116	107	57 ⊙ 0, 78 Fe Cr 1.
77.2	13b_2	45	42	77.2	17	38	37	38 Fe 0.
77.6	(11)b	55	53	77.6	19	85	84	54 Cr 0, 80 Fe 1.
78.2	10b	38	38	78.2	17b	107	106	
78.5	(9)b	21	20	78.7	(15)	48	48	52 ⊙ 0.
79.2	29	172	170	79.3	(25)	129	128	24 V 4.
79.8	30	203	200	79.8	30b_1	182	181	77 Zr$^+$ Cr 0, 07 Co 2.
80.7	(19)b_2	113	109	80.6	21b	137	134	50 ⊙ 0.
81.1	(12)	40	39	81.2	16	68	66	12 Cr 0.
81.5	11b	35	32	81.7	(17)	55	52	
82.0	22	135	125	82.1	23b_1	128	120	17 Ce$^+$ 00, 32 V$^+$ 00.
82.7	29	163	126	82.8	27	106	83	52 ⊙ 0, 69 ⊙ 0, 78 Fe 2.
83.5	57	456	594	83.5	52	354	470	55 Fe 15.
84.3	—	220	167	84.4	42	185	158	13 ⊙ 0, 32 ⊙ 1.
84.8	51b_1	245	214	84.8	45	243	231	54 Ni 0, 73 V 3, 81 Sc$^+$ 0, 98 Cr 2.
85.4	51	376	419	85.4	47	342	342	26 La$^+$ Fe 1, 39 Fe$^+$ 2, 68 Nd$^+$ 00.
86.8	40	333	358	86.8	38	324	347	46 Ni 0, 84 Ti$^+$ 1.
87.9	31 b_1	244	227	87.9	29	156	148	40 Cr 0, 47 Cr 0, 61 ⊙ 0, 90 Fe 2.
88.4	35	199	194	88.4	31	199	197	42 Fe 3, 73 ⊙ 0.
89.3	24	138	135	89.2	22	108	107	25 Fe 2, 51 ⊙ 0.
—	—	—	—	89.7	21	65	65	74 Mn 0.
90.0	28	163	161	90.0	22	64	64	99 V 2.
—	—	—	—	90.3	27	77	77	46 Fe 1.
91.0	42	369	367	90.9	39	319	318	54 ⊙ 0, 63 ⊙ 0, 96 Fe 2, 02 Ti$^+$ 1.
91.7	30	195	194	91.6	28	175	174	66 Ce$^+$ 0, 76 Cr 1, 88 Co 0, 07 V 1.
92.4	(13)b	49	48	92.6	17b	99	98	59 Fe 1.
93.3	20b	138	132	93.3	19b	111	106	04 ⊙ 0, 28 ⊙ 0, 53 Cr 1.
94.0	42	315	310	94.0	41	273	271	70 ⊙ 0, 82 V 0, 93 Ti 0, 06 Ti$^+$ 2.

4395.0	56	460	504	4395.0	53	401	456	04 Ti$^+$ 3, 24 V 2.
95.9	41	300	303	95.9	38	268	269	51 Fe 0, 85 Ti$^+$ 1, 31 $\odot$ 0.
—	—	—	—	96.7	16	84	74	96 $\odot$ 1.
97.3	—	51	38	97.3	16	47	40	
98.0	42	380	379	98.1	39	372	378	03 Y$^+$ 1, 31 Ti$^+$ 0, 50 $\odot$ 0.
—	—	—	—	98.8	(19)	37	30	
99.2	(24)	75	50	99.2	(24)	45	36	22 Ce$^+$ 00, 30 $\odot$ 0.
99.8	50	348	406	99.8	46	330	362	60 Ni 0, 78 Ti$^+$ 3.
4400.5	51	370	364	4400.4	47	331	353	19 $\odot$ 0, 42 Sc$^+$ 3, 59 V 1, 86 Nd$^+$ Ni 0.
01.4	44	362	350	01.4	41	358	339	03 $\odot$ 1, 30 Fe 2, 45 Fe 1, 55 Ni 2.
—	—	—	—	02.4	(12)	38	34	
02.7	—	49	45	02.8	(16)	46	45	
03.3	26	184	175	03.4	30	202	195	19 $\odot$ 1, 38 Zr $^+$ Cr 0.
04.1	—	42	18	04.2	—	80	58	98 $\odot$ 0.
04.8	53	494	585	04.7	49	405	469	28 Ti 1, 75 Fe 10, 04 V Fe 1.
05.7	—	42	26	05.7	16b_2	85	74	67 Ti 0.
06.6	16b	112	106	06.5	19	123	119	16 Fe V 0, 65 V 2.
07.7	40	289	285	07.6	35	303	299	28 Fe Ce$^+$ 0, 65 V Ti$^+$ 2, 72 Fe 4.
08.4	42	310	308	08.6	36	225	222	21 V 2, 42 Fe 3, 52 V 2, 83 Pr$^+$ 00.
09.5	42	391	388	09.4	40	341	338	12 Fe 1, 23 Ti$^+$ 0, 37 Sa$^+$ 00, 53 Ti$^+$ 1.
10.5	—	102	94	10.4	(22)	96	85	01 $\odot$ 0, 49 Ni 2.
11.1	35	237	261	11.0	34	262	302	08 Ti$^+$ Nd$^+$ Cr 1.
12.0	30	263	258	11.9	33	262	251	93 Ti$^+$ 0, 26 Cr Ca 0.
—	—	—	—	13.0	16	51	48	
13.6	27	263	243	13.7	29	211	204	60 $\odot$ 1, 86 Cr 0.
—	—	—	—	14.5	—	87	72	56 VZr$^+$ 00.
15.2	58	730	773	15.0	48	278	289	87 Mn 2, 13 Fe 8.
—	—	—	—	15.4	(46)	260	288	58 Sc$^+$ 3.
16.8	44	361	366	16.8	42	308	334	48 V Ti 0, 81 Fe$^+$ 2.
17.7	50	372	433	17.7	45	315	339	29 Ti 0, 73 Ti$^+$ 3.
18.4	(41)	248	219	18.3	39	252	276	33 Ti$^+$ 1.
18.9	—	75	69	19.0	(22)	102	80	78 Ce$^+$ 00.
19.5	—	36	32	19.4	17	41	36	
20.1	—	49	47	19.8	19	76	72	77 Mn$^+$ 00.
20.6	24	169	167	20.5	26b	214	211	29 $\odot$ 0, 54 Sa$^+$ 00, 66 Sc$^+$ 00.
21.1	(15)	27	26	21.2	18	52	49	14 Sa$^+$ 00.
21.9	34	232	222	21.9	35	233	221	59 V 0, 95 Ti$^+$ 1, 07 $\odot$ 0.
22.7	40	284	312	22.6	35	228	256	58 Fe Y$^+$ 3, 83 Ti 0.
23.2	29	135	128	23.2	30	147	136	98 Ni 0, 14 Fe 1, 27 Ti$^+$ Cr 0.
23.7	(20)	52	48	23.9	20b	120	116	86 Fe 2.
24.3	25b_1	208	200	24.5	22b_1	114	106	07 Cr 0, 30 Cr 0, 37 Sa$^+$ Ti 00, 59 V 0.
25.4	35	280	320	25.5	33	254	301	44 Ca 4.
26.0	—	34	21	26.0	(18)	49	31	04 V Ti 0.
—	—	—	—	26.3	17	51	41	
27.3	45	409	448	27.3	41	341	366	11 Ti 2, 31 Fe 5.
27.9	(22)	56	44	27.9	—	87	77	92 Ti$^+$ Ce$^+$ 00.
28.4	18	111	105	28.3	(21)b	110	106	55 V Fe 1.
29.3	22	109	105	29.1	23b_1	148	145	27 Ce$^+$ 00.
29.9	—	248	240	29.9	33	222	220	91 La$^+$ Cr 00, 20 Fe 1.
30.7	41b_1	272	286	30.6	36b_1	242	246	62 Fe 3, 77 $\odot$ 0.
31.4	27	154	150	31.3	28	181	180	14 Ni 0, 35 Sc$^+$ 0.
32.1	24b_1	167	164	32.1	30	222	221	85 $\odot$ 0, 09 Ti$^+$ 00, 18 Cr 0.
32.6	(20)	44	41	32.7	23	68	68	58 Fe 1.
33.3	31	228	242	33.2	32	187	187	22 Fe 3.
33.8	29	135	124	33.9	31	186	184	81 Fe 1, 00 Ti 0.
34.3	(24)	75	64	34.3	(26)	80	77	34 Sa$^+$ Ti 00, 44 $\odot$ 0.
35.0	47	377	393	35.0	42	299	301	96 Ca 5, 15 Fe 2.
35.6	(40)	246	269	35.7	38	209	225	68 Ca 4.

4436.4	(21)*b*	111	101	4436.3	(24)	128	120	14 V 0, 36 Mn 2.
36.9	(20)*b*	96	93	37.0	22*b*	156	156	95 Fe Ni 2.
37.5	—	88	86	37.7	18	80	80	57 Ni 0, 84 V 0.
38.2	14*b*	118	118	38.4	22	141	140	35 Fe 1.
—	—	—	—	39.0	18	70	70	17 ⊙ 0.
39.2	—	56	55	39.3	19	54	54	
39.8	—	97	96	39.8	(20)	82	80	64 Fe 0, 89 Fe 1.
40.4	24	166	162	40.4	28*b*	189	186	48 Zr$^+$ Fe 1.
41.0	(22)	75	70	40.9	(24)	80	68	84 Fe 1, 97 Fe 0, 09 ⊙ 0.
41.8	38	224	219	41.6	37	268	312	72 V Ti$^+$ 3.
42.4	42	250	278	42.3	37	208	194	35 Fe 6.
43.1	45	312	266	43.0	43	278	222	84 Fe 1, 99 Zr$^+$ 0, 20 Fe 3.
43.9	53	367	457	43.8	50	367	464	81 Ti$^+$ 5.
44.6	(42)	299	268	44.6	41	317	314	22 V 0, 40 Ce$^+$ 00, 57 Ti$^+$ 2, 70 Ce$^+$ 00.
45.4	—	38	35	—	—	—	—	43 Fe 1.
45.8	(11)	25	21	45.7	17	62	52	
46.3	22	111	108	46.2	21	79	75	
—	—	—	—	46.5	23*b*	81	75	37 Nd$^+$ 00.
46.9	28*b*	187	168	46.9	24*b*	127	111	85 Fe 2, 14 Fe Mn 2.
47.7	35	283	326	47.7	33	264	309	72 Fe 6.
—	—	—	—	48.3	(14)	41	19	
49.3	26	233	221	49.2	26	199	180	15 Ti 2, 33 Ce$^+$ 00.
49.8	—	30	24	49.7	(22)	66	41	72 Dy$^+$ 00.
50.5	49	476	494	50.4	45	391	480	32 Fe 1, 49 Ti$^+$2, 76 Ce$^+$Fe 00, 91 Ti 1.
51.5	29	260	261	51.5	28	180	158	59 Mn Nd $^+$ 3.
—	—	—	—	52.1	(16)	65	59	04 V 0.
52.7	21*b*	145	138	52.7	(20)	106	103	62 ⊙ 0, 75 Sa$^+$ 00.
53.3	20*b*	144	136	53.3	23*b*	152	146	01 Mn 1, 32 Ti 2, 71 Ti 1.
54.6	52	626	668	54.7	47b_2	601	612	39 Fe 3, 67 Sa$^+$ Fe 00, 79 Zr$^+$ Ca 5, 03 Mn
55.8	39	275	261	55.9	33	228	225	82 Mn 2, 88 Ca 3. [Fe 1, 32 Mn Ti 2.
56.5	31	201	197	56.7	28*b*	195	193	33 Fe 1, 62 Ca 2, 04 Mn 0.
57.5	29	197	195	57.5	29	168	168	44 Ti Zr$^+$ V 2, 55 Mn 2.
58.2	23	221	220	58.2	27	178	178	10 Fe 2, 26 Mn 2, 53 Cr Sa$^+$ 0.
59.1	46	402	401	59.1	40	346	346	05 Ni 2, 12 Fe 3, 36 Cr 1, 76 Cr V 1.
60.2	25	181	181	60.3	27	172	172	20 Ce$^+$ 0, 31 V 1, 40 Mn 0.
61.7	51	765	761	61.5	44*b*	571	571	09 Mn 1, 21 Fe Zr$^+$ 1, 38 Fe 0, 66 Fe 4,
—	—	—	—	62.5	(20)	93	92	46 Ni 1. [01 Fe Mn 3, 20 ⊙ 0.
63.0	25	204	197	63.1	22	108	107	96 Nd$^+$ 00.
—	—	—	—	63.4	19	57	55	41 Ti Ni 0.
64.6	47	465	481	64.5	44	418	434	48 Ti$^+$ 2, 68 Mn Cr 2, 77 Fe V 1.
65.4	(16)	46	40	65.5	—	76	70	35 Cr 0.
65.8	(17)	46	38	65.9	—	42	37	82 Ti 1.
66.6	42	360	366	66.6	36	299	305	39 Ni 0, 56 Fe 5, 94 Fe 1.
67.5	(20)	128	98	67.5	23	148	132	34 Sa$^+$ 00.
68.5	53	445	565	68.5	49	297	368	50 Ti$^+$ 5.
69.3	47	362	306	69.3	42	325	298	15 Ti$^+$ 1, 39 Fe 4, 57 Co 0.
70.7	42*b*	566	574	70.8	39b_2	492	487	14 Mn 1, 49 Ni 2, 87 Ti$^+$ 1, 25 Ce$^+$ Ti 0.
71.7	—	26	22	71.8	17	67	66	68 Fe 0.
72.8	37	369	365	72.8	37	328	328	42 Sa$^+$ 00, 71 Ce$^+$ Fe 1, 80 Mn 0,93 Fe$^+$0.
—	—	—	—	73.6	16	48	48	
73.9	8	24	22	74.0	(14)	69	69	
74.4	15*b*	159	157	74.7	18*b*	143	143	86 Ti 0.
76.0	38	361	360	76.0	36	341	341	02 Fe 4, 09 Fe 3.
77.4	12*b*	102	102	77.2	16*b*	154	154	
78.0	(11)	28	28	78.0	18	91	91	03 ⊙ 0.
78.7	18b_1	125	125	78.7	22b_1	155	155	
79.5	29	206	206	79.7	27*b*	183	183	37 Ce$^+$ Mn 0, 61 Fe 1.
80.0	29	151	151	80.1	(26)	111	111	97 ⊙ 0, 14 Fe 1.

4481.2	44	498	497	4481.2	53	545	545	59 Ni Ti 0, 83 ⊙ 0, 14 Mg$^+$ 0, 27 Ti 1,
82.2	43	350	352	82.2	39	309	309	17 Fe 5, 26 Fe 3. [34 Mg$^+$ 0, 62 Fe 1.
82.8	—	97	96	82.9	(21)	86	86	74 Ti Fe 1.
—	—	—	—	83.5	15	30	30	
84.2	31	316	316	84.1	29	253	253	78 ⊙ 0, 92 Ce$^+$ Co 0, 23 Fe 4.
84.9	—	42	42	84.8	14	43	43	
85.6	26	222	222	85.5	23	204	204	67 Fe 3, 98 ⊙ 0.
—	—	—	—	86.4	13	33	33	
87.0	21	164	163	86.9	22	131	131	89 Ce$^+$ 0.
—	—	—	—	87.3	(14)	47	46	
88.3	36	313	311	88.2	35	268	267	75 ⊙ 0, 05 Cr 0, 13 Fe 1, 32 Ti$^+$ 1.
89.1	44	343	342	89.2	40	309	308	91 V Fe 1, 10 Ti 0, 21 Fe$^+$ 2, 47 Cr 0.
90.0	(35)	240	234	89.9	$30b$	243	236	75 Fe 4, 09 Fe Mn 3.
90.8	(26)	102	85	90.9	(25)	91	75	54 Ni Cr 0, 77 Fe 2, 81 V 0.
91.4	41	369	421	91.4	41	315	366	41 Fe$^+$ 2, 66 Mn Cr 0.
92.4	(13)	119	104	92.4	$16b$	115	101	32 Cr 0, 69 Fe 1.
93.6	30	211	199	93.5	29	224	222	53 Ti$^+$ 1.
94.5	42	417	445	94.6	38	349	392	96 ⊙ 0, 06 Fe 1, 39 Zr$^+$ 00, 57 Fe 6.
95.5	$21b$	132	121	95.3	22	120	107	43 Fe Zr$^+$ Ti$^+$ 0, 59 Fe 0.
96.0	$(23)b$	96	91	96.0	23	115	110	96 Fe 1, 15 Ti 1.
96.9	40	349	354	96.9	34	284	282	86 Cr 3, 97 Zr$^+$ 0.
98.0	(14)	101	95	97.9	18	138	134	68 Na Ti 0.
99.0	23	239	231	99.0	$22b_1$	201	195	71 Cr 0, 90 Mn 1, 14 ⊙ 1.
4500.0	13	22	16	99.7	16	55	50	
00.3	21	132	102	4500.3	$25b$	185	146	28 Cr 0.
01.2	52	492	593	01.3	48	450	542	10 Cr 0, 28 Ti$^+$ 5, 77 Cr 0.
02.4	—	154	122	02.3	20	96	83	22 Mn 2.
—	—	—	—	02.8	18	64	60	59 Fe 0.
—	—	—	—	03.3	16	66	61	
03.8	9	98	89	03.8	13	68	66	
04.9	16	132	127	04.9	$19b_1$	188	183	85 Fe 1.
05.6	—	26	24	05.5	12	60	57	
06.7	22	224	202	06.8	$22b_1$	272	243	74 Ti$^+$ 00, 23 Cr$^+$ 0.
08.3	47	462	549	08.2	43	405	510	29 Fe$^+$ 4, 69 ⊙ 0.
09.3	17	75	64	09.1	16	55	36	29 V 0..
09.9	(14)	100	93	09.9	$18b$	148	135	45 Ca 0, 74 ⊙ 1.
10.5	12	58	54	10.5	17	94	92	84 Fe 0.
11.0	10	46	44	11.1	14	52	48	
11.9	$19b_1$	159	154	11.8	18	150	146	92 Cr 1, 28 Ca 0.
12.9	20	171	166	12.7	$21b_1$	143	140	74 Ti 3, 00 Ni 0.
13.7	—	41	36	13.5	$16b$	106	102	44 ⊙ 0.
14.3	24	187	166	14.4	22	166	147	19 Fe Co V 1, 43 ⊙ 1, 51 Cr 0.
15.3	46	434	500	15.3	42	385	442	18 Fe 0, 33 Fe$^+$ 3.
16.3	$(16)b$	52	41	16.3	18	65	52	27 Fe 0.
16.7	$(15)b$	58	51	16.9	(19)	95	93	66 Co 0.
17.4	26	164	159	17.4	$22b$	107	103	16 Co 0, 53 Fe 3.
18.3	38	379	370	18.3	35	338	333	03 Ti 3, 34 ⊙ 1, 59 Cr 0, 66 Ti 0.
19.3	(15)	41	30	19.2	$15b$	53	45	
20.2	44	469	515	20.1	41	397	429	64 Sa$^+$ 00, 99 Ni 0, 24 Fe$^+$ 3, 54 V$^+$ 00.
—	—	—	—	21.1	16	81	68	14 Cr 0.
21.6	(8)	26	14	21.7	(15)	26	19	
22.7	54	623	656	22.5	40	548	569	37 La$^+$ 00, 53 Fe 0, 64 Fe$^+$ 3, 81 Ti 2,
23.6	—	71	55	23.9	$17b$	85	72	93 Sa$^+$ 00. [09 Ce$^+$ Sa$^+$ 0, 40 Fe 1.
25.1	32	475	500	25.0	38	458	482	69 Ti$^+$ Co 0, 94 Sa$^+$ Ba$^+$ 0, 15 Fe 5.
26.5	$36b_2$	367	354	26.4	$31b_2$	242	228	87 Fe 0, 11 Cr La$^+$ 0, 36 Ti 1, 48 Cr 2,
27.1	$(31)b_2$	133	127	27.2	$27b_1$	224	213	98 Ca 3. [57 Fe 1.
27.5	—	98	93	—	—	—	—	33 Ti Cr 3, 46 Cr Ti 0.
27.9	—	21	14	—	—	—	—	79 Fe Y 0.

4528.6	49	420	471	4528.6	44	416	474	47 Ce$^+$ 0, 62 Fe 8, 76 ⊙ 0, 81 ⊙ 0.
29.5	43	348	325	29.5	39	317	287	46 Ti$^+$ 1, 56 Fe 1, 68 Fe 1, 86 Cr 0.
31.0	44	469	474	31.0	36	350	340	70 Cr 0, 74 Cr 1, 97 Co 2, 15 Fe 5.
31.7	—	98	87	31.6	(22)	116	110	64 Fe 2.
33.2	38	317	267	33.1	32	279	237	97 ⊙ 1, 05 ⊙ 0, 25 Ti 4.
34.1	57	531	637	34.0	55	513	619	97 Ti$^+$ Co 6, 17 Fe$^+$ 1.
34.8	(34)	150	128	34.8	27	125	101	78 Ti 4, 15 Cr 0.
35.9	42	460	448	35.8	35	385	374	58 Ti 3, 72 Cr 1, 74 Zr 0, 92 Ti 2, 05 Ti 2.
—	—	—	—	36.5	—	67	66	51 Sa$^+$ Cr 00.
37.1	(11)*b*	52	50	37.0	14	39	38	
37.9	(14)*b*	144	139	38.0	17*b*	183	180	68 V Fe 0, 97 Sa$^+$ 00.
38.8	(20)	122	116	38.9	22	135	135	76 Fe 0, 85 Fe 0, 96 Cs$^+$ 00.
39.8	30	281	308	39.7	31	255	250	78 Ce$^+$ Cr 0.
40.6	27	192	176	40.4	25	175	163	49 Cr Ti 2, 71 Cr 2.
41.4	44	381	392	41.5	39	391	431	07 Cr 0, 33 Fe$^+$ 0, 52 Cr Fe$^+$ 2.
42.5	21	185	180	42.6	—	87	80	22 Zr 0, 42 Fe Mn 1, 61 Cr 0, 72 Fe 0.
43.3	—	17	17	43.0	21	78	76	
44.0	34	274	273	44.0	31	263	259	82 Co 0, 02 Ti$^+$ 1.
44.7	(37)	130	129	44.8	—	112	111	62 Cr 1, 70 Ti 3.
45.2	39	285	282	45.1	35b_1	239	237	98 Ce$^+$ 00, 15 Ti$^+$ 1, 33 Cr 0.
46.0	26	160	159	45.9	23	150	148	96 Cr 3.
47.1	29	225	221	47.0	25	193	188	94 Ni 1, 03 Fe 2, 24 Ni 0.
—	—	—	—	47.3	23	71	69	
47.9	28	204	192	48.0	25	161	150	85 Fe Ti 3.
48.8	—	121	95	48.7	—	76	48	77 Ti 2.
49.6	63	705	806	49.6	62	741	863	48 Fe$^+$ 2, 63 Ti$^+$ 6, 82 ⊙ 2, 12 ⊙ 0.
50.8	23	136	110	50.8	24	107	86	82 Fe 2.
51.3	18	41	35	51.1	23	92	82	23 Ni 0.
51.8	—	39	33	51.7	18	40	34	66 Fe 0.
52.4	39	364	338	52.4	34	326	309	14 ⊙ 0, 29 Ti$^+$ 0, 46 Ti 2, 55 Fe 1.
54.0	54	529	647	54.0	47	443	509	04 Ba$^+$ 8, 47 Fe 1.
55.0	35	213	171	55.0	35	233	206	99 Cr$^+$ 2.
55.9	53	558	555	56.0	49	476	467	49 Ti 3, 90 Fe$^+$ 3, 13 Fe 4.
57.0	(13)*b*	83	73	57.0	18	69	62	94 Fe 0, 29 ⊙ 0.
57.4	(11)	29	15	57.5	18	74	65	
58.7	46	497	556	58.7	43	414	481	11 Fe Ti 0, 46 La$^+$ 00, 67 Cr$^+$ 3.
—	—	—	—	59.6	18	62	51	
60.1	22b_2	243	228	60.3	24b_1	186	177	92 Ni Ti 0, 11 Fe 2, 27 Ce$^+$ 00, 42 Sa$^+$00.
61.0	20*b*	155	147	61.0	21	107	103	
—	—	—	—	61.6	20	115	110	42 ⊙ 1.
62.2	24	207	167	62.4	24	176	158	35 Ce$^+$ 0.
63.7	51	551	685	63.8	46	458	530	77 Ti$^+$ 4.
64.6	29	135	98	64.6	26	147	122	58 V$^+$ N$^+$ 00, 72 V$^+$ Fe 0, 83 Fe 0.
65.6	38	376	359	65.8	34	339	331	32 Fe 0, 53 Cr 3, 68 Co Fe 2.
66.5	19*b*	106	101	—	—	—	—	21 Sa$^+$ 00, 52 Fe 1.
67.0	16	60	59	66.9	21b_1	166	163	88 Fe 1.
67.4	(9)	27	24	67.6	(15)	46	46	
68.3	28b_2	299	291	68.3	28	251	246	30 Ti$^+$ 0, 79 Fe 1, 84 Fe 0.
69.3	—	88	83	69.3	(19)b_2	134	130	62 Cr 0.
70.0	(9)b_2	33	28	69.9	(15)	80	76	
71.0	28	207	174	71.1	25	186	147	12 Mg 5.
72.0	57	633	749	71.9	50	510	612	45 Fe 0, 68 Cr 1, 98 Ti$^+$ 6, 28 Ce$^+$ 00.
73.0	(14)	42	25	73.0	(15)	52	31	87 Fe Cr$^+$ 00.
—	—	—	—	73.6	13	76	67	
74.2	(19)	127	110	—	—	—	—	24 Fe 1.
74.8	25	228	218	74.9	23b_1	300	267	49 Zr$^+$ 00, 73 Fe 2, 86 La$^+$ 00.
76.3	40	385	452	76.4	35	333	389	79 ⊙ 0, 31 Fe$^+$ 2.
77.4	11*b*	79	51	77.3	16	73	61	17 V 0.

—	—	—	—	4577.9	16	62	59	70 Sa$^+$ 00.
4578.4	26	228	222	78.4	24	188	185	57 Ca 3.
79.3	(23)	88	85	79.1	(18)	28	28	34 Fe 0.
80.0	37	407	399	80.1	34*b*	437	433	83 Fe 0, 06 Cr 3, 40 V 1, 60 Fe Ni 1.
81.4	35	325	312	81.4	33	293	288	20 ⊙ 0, 45 Ca 4, 53 Fe 4.
82.8	40	355	340	82.8	36	280	252	31 ⊙ 0, 84 Fe$^+$ 1.
83.9	54	620	729	83.9	52	570	666	44 Ti$^+$ 0, 84 Fe$^+$ 4.
84.9	(21)	102	66	84.9	20	110	82	73 Fe 1, 83 Fe 2.
86.0	32	345	327	86.0	29	299	283	88 Ca 4, 98 ⊙ 0, 24 ⊙ 1, 37 V 1.
87.1	14	76	61	87.2	18*b*	122	103	14 Fe 2.
88.1	40	428	482	88.3	38	400	424	22 Cr$^+$ 3, 30 Cr$^+$ 00.
89.9	40	410	492	90.0	38	375	408	96 Cr$^+$ Ti$^+$ 3.
—	—	—	—	90.9	18	48	31	79 ⊙ 0.
91.2	(24)	145	136	91.4	(24)	108	100	41 Cr 2, 52 ⊙ 1.
92.1	38 *b*	247	253	92.2	35*b*	280	276	07 Cr$^+$ 1.
92.7	40	308	295	92.7	—	215	214	53 Ni 2, 66 Fe 4.
93.8	29	272	268	94.0	28	257	256	54 ⊙ 1, 83 Cr 0, 93 Ce$^+$ 0, 10 V 2.
—	—	—	—	94.7	17	39	38	89 Ni 0.
95.3	(29)	251	251	95.4	27	191	191	37 Fe 2, 59 Cr 0.
95.9	32*b*	199	199	96.0	28	215	215	96 Ni 0, 06 Fe 2, 42 Cr Fe 1.
96.6	—	56	56	96.9	17*b*	73	73	90 Co 0.
97.3	18	82	82	97.3	19	73	73	26 ⊙ 0, 39 ⊙ 0.
98.0	30	332	332	98.0	26*b*	281	281	76 ⊙ 1, 88 ⊙ 1, 14 Fe 3.
—	—	—	—	98.7	19	37	37	74 Fe 0.
—	—	—	—	90.0	16	54	54	
4600.2	36b_2	352	352	4600.3	30*b*	373	373	90 Fe 2, 11 Cr 1, 21 V$^+$ 00, 37 Ni 2.
00.8	(33)	231	230	01.1	(26)	126	126	75 Cr 3, 94 Fe 0, 03 Cr 0.
01.5	(19)	62	61	01.4	(24)	116	115	38 Fe$^+$ 00.
02.0	18	82	77	02.2	19	95	91	01 Fe 3.
03.0	33	320	348	03.0	29	282	293	95 Fe 6, 35 ⊙ 0.
04.1	—	13	9	04.0	16	89	88	73 Cs$^+$ 00, 86 ⊙ 0, 96 Fe 0.
04.7	—	119	118	—	—	—	—	60 Fe 2.
05.1	24*b*	123	122	05.0	25b_2	193	192	99 Ni 3.
05.6	(21)	112	112	05.5	(24)	147	147	37 Mn 0, 60 ⊙ 2.
06.4	17	133	133	06.4	18*b*	170	170	23 Ni 2.
07.6	28	278	278	07.6	22	245	245	34 Sr 1, 66 Fe 4.
09.3	15*b*	144	144	09.3	21	188	188	27 Ti$^+$ 0.
10.0	—	67	67	10.2	14	99	99	91 Cr 0, 19 ⊙ 0.
11.3	31	267	267	11.3	27	282	282	19 Fe Cr 0, 29 Fe 5.
—	—	—	—	12.2	12	45	45	
13.3	31	368	368	13.4	27	283	283	21 Fe 3, 37 Cr La$^+$ 3, 92 V Zr$^+$ 1.
14.3	—	61	61	14.2	(17)	86	86	21 Fe 1.
—	—	—	—	14.9	11*b*	60	60	
15.6	—	93	92	15.7	(22)	101	101	57 Fe 1, 71 Sa$^+$ 00.
16.2	33	231	230	—	—	—	—	94 W$^+$ Fe 00, 13 Cr 4.
16.6	31	167	166	16.6	30*b*	367	367	70 Cr$^+$ 1.
17.3	(14)	108	101	17.7	14	65	65	28 Ti 3.
18.8	40	338	400	18.9	34	382	382	79 Fe Cr$^+$ 4.
19.4	—	169	135	19.7	—	57	57	30 Fe 3, 54 Ti Cr 1.
20.5	30	323	352	20.6	29	274	274	52 Fe$^+$ 1.
21.5	(10)	42	38	21.4	12	35	35	48 Cr$^+$ 00.
22.2	(13)*b*	57	56	22.0	17b_2	123	123	89 Cr 0, 96 Cr 1.
22.7	14*b*	94	94	22.6	(15)	60	60	47 Cr 1, 76 Cr 0.
23.3	14	92	91	23.3	12b_1	88	88	11 Ti 2, 59 ⊙ 0.
24.0	8	20	20	24.1	14*b*	96	96	
25.0	26	254	251	25.0	24	194	194	57 Co Cr$^+$ 00, 90 Ce$^+$ 00, 06 Fe 5.
26.1	26	251	247	26.2	22b_2	222	219	92 Cr 0, 19 Cr 5, 54 Mn 0.
27.3	—	15	12	27.3	14	77	73	37 ⊙ 0, 55 ⊙ 0.

4628.0	21	201	186	4628.2	19b_1	142	127	15 Ce$^+$ 0.
29.3	42	425	501	29.3	40	442	506	08 Zr$^+$ 00, 34 Ti Fe$^+$ Co 6.
30.2	—	158	132	30.1	19	56	42	13 Fe 4.
—	—	—	—	30.8	16b	124	112	57 ⊙ 0, 04 Fe 0.
31.1	9b	68	57	31.6	11	54	51	49 Fe 0.
—	—	—	—	32.3	(12)	41	40	20 Cr 0.
32.9	29	265	256	32.9	23	198	197	82 Fe 1, 92 Fe 4, 28 Cr 0.
34.0	33	378	410	34.1	32	302	301	78 Fe 0, 11 Cr$^+$ 2.
35.3	21	144	130	35.4	24	198	198	73 Fe 1, 32 Fe$^+$ 0.
35.9	21 b	93	89	35.9	(20)	52	52	63 Fe 0, 85 Fe 2.
36.3	21 b	156	156	36.4	22b_1	147	147	34 Ti$^+$ 0.
37.7	31	249	249	37.4	24	133	133	18 Cr Ti 0, 52 Fe 5.
38.1	—	172	172	38.0	27	216	216	77 Cr 0, 02 Fe 4.
39.0	(14)	34	34	39.1	17	100	100	71 Nd$^+$ 00, 96 ⊙ 0.
39.5	20b	191	191	39.5	17 b	58	58	37 Ti 2, 51 Cr 0, 67 Ti 2.
—	—	—	—	39.9	15	58	58	95 Ti 1.
40.5	19b_1	128	128	40.5	17	103	103	29 ⊙ 1.
41.2	16	103	103	41.4	17	141	141	22 ⊙ 0.
42.2	16	150	150	42.4	16	101	101	25 Sa$^+$ 00.
43.7	22	256	256	43.6	22	219	219	47 Fe 4.
44.4	—	59	59	44.4	17	110	110	
45.0	20	116	116	45.3	(16)	58	58	20 Ti 0, 50 ⊙ 0.
46.1	33	384	384	46.3	27b	319	319	79 Nd$^+$ 00, 17 Cr 5, 40 V 0, 64 ⊙ 1,
47.5	33	314	314	47.5	27	227	227	28 ⊙ 0, 44 Fe 4. [81 Cr 0.
48.9	31	342	342	48.9	27b_1	321	321	96 ⊙ 1, 12 Cr 0, 66 Ni 4.
49.9	14b	99	99	50.0	17	122	122	46 Cr 0, 65 ⊙ 0, 82 ⊙ 0, 02 Ti 0.
50.4	10	20	20	50.6	12	30	30	32 ⊙ 0.
51.3	23	201	201	51.3	21	183	183	30 Cr 4.
52.3	24	224	224	52.4	20	186	186	17 Cr 5.
53.1	7	15	15	53.1	10	38	38	
—	—	—	—	53.7	13	55	55	
54.6	37	449	449	54.7	30	333	333	16 ⊙ 0, 28 Ce$^+$ 00, 50 Fe 4, 63 Fe 5.
55.7	23	229	229	55.9	24	214	214	69 Ni Ti 0, 80 Ti 0, 03 Ti 0, 20 Cr 0.
57.1	42	512	512	57.2	38	454	454	46 Ti 3, 98 Fe$^+$ 1, 20 Ti$^+$ 2, 60 Fe 1.
—	—	—	—	58.3	11	34	34	30 Y 0.
58.8	9	91	91	59.0	12	78	78	
59.7	8	59	59	59.8	10	62	62	
60.6	11	109	109	60.5	16b_2	130	130	43 ⊙ 0, 91 ⊙ 0.
61.6	(16)	82	82	—	—	—	—	54 Fe 1.
62.1	(20)b	114	114	61.8	18b_1	153	153	79 Zr$^+$ 00, 98 Fe 1.
62.7	(23)	195	195	62.8	22	160	160	51 La$^+$ 0, 76 Ti$^+$ 0.
63.7	29	303	303	63.7	27	310	310	19 Fe 0, 35 Cr 1, 41 Co 0, 71 Fe$^+$ 0,
65.0	18b_1	142	142	64.8	20	137	137	81 Cr Na 3. [86 Cr 1, 97 ⊙ 0.
66.0	(22)	115	115	66.0	(19)	133	133	92 Cr 1, 11 ⊙ 0, 22 Cr 0.
66.8	40	385	385	66.8	36	359	359	54 Cr 1, 61 ⊙ 0, 75 Fe$^+$ 1, 99 Ni 1.
67.6	40	296	296	67.7	33b_2	221	221	25 ⊙ 0, 46 Fe 4, 59 Ti 3, 77 Ni 1.
68.2	34	220	220	68.3	(26)	176	175	07 ⊙ 2, 15 Fe 4, 57 Na 1.
69.4	27b_1	255	251	69.4	23b	216	205	18 Fe 3, 34 Cr 1, 65 Sa$^+$ Cr 00.
70.4	41	444	458	70.5	38	417	444	18 ⊙ 1, 42 Sc$^+$ 2, 50 V Nd$^+$ 00.
71.4	10	32	29	71.5	12	26	22	42 ⊙ 1, 69 Mn 0.
72.3	(16)	140	139	72.3	18	114	112	34 ⊙ 3.
—	—	—	—	72.9	19	98	98	84 Fe 1.
73.1	25	228	228	73.3	19	126	126	17 Fe 4, 28 Fe 1.
74.1	—	41	41	74.2	16	107	107	10 ⊙ 1, 31 ⊙ 0.
74.7	20	188	188	74.9	17	95	95	66 Fe 0, 76 ⊙ 0.
—	—	—	—	75.2	15	49	49	12 Ti 1.
—	—	—	—	75.6	(14)b_2	48	48	61 Ni 0.
76.0	11	107	107	75.9	(12)	45	45	

—	—	—	—	4676.5	12	70	70	
4677.0	8*b*	59	59	77.1	12	54	54	92 Sa$^+$ Ti 00.
77.7	(12)	48	48	77.7	(13)	51	51	60 ⊙ 0.
78.3	(22)	75	75	78.1	(17)	79	79	18 ⊙ 3.
78.9	29	329	329	78.9	25b_1	281	281	86 Fe 6, 23 Fe 2.
80.4	25	286	286	80.4	21	247	247	14 Zn Ce$^+$ 1, 30 Fe 1, 49 Fe Cr 0, 52 W 0,
81.5	(17)	34	34	—	—	—	—	46 Fe 1. [75 Nd$^+$ 00, 92 Cr 0.
82.2	31	367	367	82.3	25	329	329	91 Ti 3, 11 Fe 1, 35 Y$^+$ Co 1, 57 Fe 0.
83.7	14	132	.132	83.6	15	161	161	57 Fe 3.
84.9	18	87	87	84.9	(15)	73	73	61 Cr Ce$^+$ 0, 04 Ti 0.
85.3	20	138	138	85.5	16*b*	121	121	28 Ca 2.
86.2	17	157	157	86.3	18	142	142	22 Ni 3.
87.3	16	123	123	87.3	13	67	67	20 Sa$^+$ 00, 31 Fe 0, 39 Fe 2.
88.2	15*b*	141	141	87.9	13	55	55	80 Zr 0, 21 Fe 2, 37 Fe Ti 0.
89.1	16	84	84	88.6	16	122	122	69 ⊙ 0.
89.6	15	80	80	89.5	15b_2	113	113	39 Cr 2, 50 Fe 1.
90.2	15*b*	113	113	90.2	13	64	64	15 Fe 4, 38 Fe 0.
90.9	—	47	47	90.9	(12)	24	24	
91.5	28	289	289	91.5	24	269	269	34 Ti 1, 42 Fe 5, 60 ⊙ 1.
92.6	14*b*	107	107	92.5	15	70	70	49 La$^+$ 00, 66 ⊙ 0.
—	—	—	—	93.1	(12)	57	57	20 Co 0.
93.6	13	77	77	93.6	15	35	35	68 Ti 0.
94.1	15b_2	112	112	94.0	16b_2	110	110	96 Cr 1, 12 ⊙ 0.
94.6	—	43	43	94.5	(15)	84	84	87 Fe 1.
95.4	16b_2	149	149	95.5	16*b*	130	130	17 Cr 0, 45 ⊙ 0.
95.9	—	33	33	96.1	14*b*	70	70	
96.4	10	45	45	96.7	14	85	85	
97.4	—	76	76	97.6	14b_1	90	90	07 Cr 1, 40 Cr 0.
98.4	27*b*	326	325	98.7	28	272	272	28 Sc$^+$ 00, 39 Co Ni 0, 49 Cr 1, 62 Cr 1,
99.3	(26)	159	158	99.4	(21)	145	144	34 ⊙ 4. [77 Ti 1.
4700.0	19	97	96	—	—	—	—	20 Fe 4.
00.5	(17)	65	64	4700.4	19	162	159	62 Cr 0.
01.5	21b_1	260	248	01.4	18	153	143	05 Fe 1, 36 Ni 1, 54 Ni 1, 91 Fe 0.
—	—	—	—	02.2	15	36	24	30 ⊙ 0.
03.0	39	439	510	03.0	32	345	394	61 ⊙ 0, 07 Mg 10.
03.7	(22)	81	59	04.0	16	68	59	80 Ni 3.
05.0	21*b*	309	296	05.0	17	164	158	40 Sa$^+$ 00, 48 ⊙ 0, 96 Fe 4.
06.0	(12)	32	32	05.8	13	59	58	46 Fe 0.
06.7	—	121	120	06.5	16	100	100	56 Nd$^+$ V 0.
07.5	33	313	312	07.4	23	225	225	28 Fe 5, 49 Fe 2.
07.9	—	49	49	08.0	(20)	48	48	04 Cr 2.
08.7	33	200	200	08.8	30	346	346	65 Ti$^+$ 2.
09.2	33	232	232	—	—	—	—	98 Fe Ti 1, 09 Fe 3.
10.2	26	293	293	10.3	19*b*	260	260	70 Mn 2, 29 Fe 3.
11.3	10*b*	51	51	11.1	11	21	21	48 Fe 0.
12.2	16	120	120	11.9	15	115	115	10 Ni Fe 0.
13.1	16*b*	154	154	13.0	16b_1	156	156	
14.4	30	385	385	14.4	28	327	327	07 Fe 0, 37 Fe 1, 42 Ni 6.
15.9	22	228	228	16.0	18*b*	219	219	76 Ni 4.
16.5	(13)	45	45	—	—	—	—	
17.1	13	67	67	17.0	12	27	27	
17.7	16	93	93	17.6	(13)*b*	102	102	58 ⊙ 0.
18.4	19	163	163	18.5	16*b*	142	142	45 Cr 3.
19.9	20	260	260	19.6	19b_2	193	193	51 Ti$^+$ 0.
—	—	—	—	20.3	(12)	63	63	
21.0	13*b*	135	135	21.0	13	66	66	00 Fe 2.
22.3	21	211	211	22.2	16	152	152	16 Zn 3, 63 Ti 0.
22.9	16	45	45	23.1	13b_2	117	117	

4723.5	13	90	90	—	—	—	—	
24.6	15*b*	138	138	4724.2	(10)	59	59	42 Cr 0.
25.1	12	44	44	24.9	12*b*	111	111	
25.9	11	69	69	25.6	9	30	30	
26.5	(11)	28	28	26.3	11	80	80	16 Fe 0.
27.6	25	309	309	27.5	23	217	217	15 Cr 0, 41 Fe 3, 46 Mn 2.
28.6	26	221	221	28.8	19*b*	205	202	17 ⊙ 0, 55 Fe 4.
29.2	(21)	108	108	—	—	—	—	02 Fe 1.
29.8	18	100	99	29.9	18*b*	188	180	70 Fe 1, 04 Mg 2.
30.8	(24)	154	151	—	—	—	—	72 Cr 1.
31.5	35	402	414	31.6	30	381	403	00 ⊙ 0, 49 Fe$^+$ 4, 81 Ni 1.
32.6	15	90	87	32.8	(13)*b*	89	85	47 Ni 1.
33.7	24	261	259	33.7	20	175	173	60 Fe 4, 11 Fe Sc 1.
34.3	(17)	72	72	34.4	15	114	114	
35.0	10	33	33	—	—	—	—	
35.8	20	128	128	35.6	12	94	94	84 Fe 3.
37.0	33	464	464	36.9	29	377	377	78 Fe 6, 34 Cr 2, 64 Fe Sc 1.
38.0	—	45	45	—	—	—	—	
38.9	11	34	34	—	—	—	—	
39.3	16	134	134	39.0	14*b*	205	205	00 Mn 3.
40.4	22	230	230	40.5	16*b*	184	184	27 Ni La$^+$ 00, 34 Fe 1, 49 ⊙ 0.
41.1	18	52	52	—	—	—	—	95 ⊙ 1, 08 Sc Fe 1.
41.8	18	147	147	41.6	17*b*	211	211	53 Fe 3.
42.8	11*b*	96	96	43.0	13b_2	144	144	80 Ti 1.
43.5	10*b*	71	71	—	—	—	—	
44.6	16	136	136	44.6	13*b*	150	150	39 Fe 3.
45.8	21	256	256	45.8	16	188	188	81 Fe 4.
47.1	10	66	66	47.3	(12)	82	82	
48.2	20	233	233	48.2	15*b*	118	118	14 ⊙ 4.
—	—	—	—	48.8	(14)	93	93	
49.4	13*b*	150	150	50.0	15	117	117	69 Co 0, 93 Fe 1.
50.2	11	47	47	—	—	—	—	
51.0	11	95	95	50.7	12	65	65	10 Fe 0.
52.1	19	178	176	51.8	15 b_1	137	137	11 Cr Ni 2.
52.5	19	106	104	52.4	15 b_2	90	90	43 Ni 3.
—	—	—	—	53.3	(13)	66	66	
54.1	25	368	376	54.1	23	232	232	05 Mn 7, 75 Cr Ni 1.
—	—	—	—	55.0	15	45	45	
55.7	—	122	120	55.8	(19)	146	146	71 Mn$^+$ 00.
56.3	27	299	299	56.7	20	205	205	12 Fe Cr 2, 52 Ni 3.
57.7	19	196	196	57.9	15	150	150	58 Fe 2, 13 Ti 1.
59.2	13	157	157	59.2	11	94	94	28 Ti 2.
60.2	9	45	45	60.3	12*b*	109	109	
61.3	18	145	143	61.4	15b_1	126	126	53 Mn 3.
62.6	36	443	434	62.7	30	357	357	38 Mn 5, 63 Ni 1, 78 Ti$^+$ Zr 0.
64.0	33	339	383	64.0	27b_2	252	252	92 Ni Ti$^+$ 4.
64.6	(31)	189	170	64.8	(24)	145	145	53 Ti$^+$ 0.
65.7	26*b*	230	224	65.7	(19)	99	99	48 Fe 2, 86 Mn 3.
—	—	—	—	66.3	21*b*	106	106	42 Mn 4.
66.6	28b_1	294	297	66.9	(18)	160	160	
68.5	20	267	264	68.5	17*b*	232	232	33 Fe 3, 40 Fe 2, 70 ⊙ 0.
69.7	11	99	99	70.0	15	143	143	
71.7	23	312	312	71.8	23b_1	185	185	47 ⊙ 3, 71 Fe 2.
72.9	19	188	188	73.1	17	150	150	82 Fe 4.
74.0	(13)	113	113	74.3	10*b*	111	111	
75.6	—	142	142	75.8	15*b*	167	167	
76.3	18	125	125	76.6	14b_2	110	108	36 Co V Fe 0.
77.1	10	30	28	—	—	—	—	

4778.2	10*b*	121	118	4777.9	11	91	89	
79.3	—	83	66	79.0	(9)	47	41	44 Fe 1.
80.0	31	357	400	80.0	26	314	330	99 Ti^+ Co 2.
81.3	8	38	33	—	—	—	—	
82.2	11	86	76	82.0	(11)*b*	122	119	
83.5	27	433	476	83.5	23	359	362	43 Mn 6, 00 $\odot$ 0.
85.7	(11)	70	65	85.3	11	69	67	
86.7	34	530	541	86.9	26b_1	363	363	96 Fe 0, 29 Ni 0, 54 Ni V Y^+ 3, 81 Fe 2.
—	—	—	—	88.0	12	70	70	84 Fe 1.
88.6	(16)	147	143	88.8	(15)	79	79	76 Fe 3.
89.6	28	387	386	89.7	21b_2	263	263	35 Cr 2, 66 Fe 3.
91.3	15	150	150	91.3	14	155	155	14 $\odot$ 0, 25 Fe 1.
92.5	20	258	258	92.6	17*b*	205	205	53 Ti Cr 2, 87 Co 1.
93.8	9*b*	62	62	—	—	—	—	
94.5	10	41	41	94.1	10b_2	55	55	
95.1	10	78	78	95.9	9	74	74	
96.4	8*b*	92	92	96.6	10	82	82	
97.4	14	116	116	97.7	(11)	25	25	
98.5	26	310	310	98.6	22	279	279	27 Fe 1, 52 Ti^+ 1, 74 Fe 0.
99.6	18	122	122	99.8	18*b*	179	179	41 Fe Nd^+ 1, 80 V Ti 1.
4800.9	20	306	306	4801.1	17*b*	199	199	65 Fe 2, 03 Fe Cr 1.
02.9	16	208	206	03.2	13*b*	183	183	89 Fe 2.
03.7	13	22	20	04.1	(12)	50	50	
05.1	31	484	498	05.1	27	438	438	53 Fe 0, 01 $\odot$ 0, 11 Ti^+ 3, 43 Ti 0.
07.0	19*b*	239	235	07.3	17*b*	174	174	00 Ni 2.
07.9	17	101	99	07.7	(13)	48	48	73 Fe 1, 16 Fe 0.
08.7	17	187	185	08.9	14b_2	161	161	69 Fe 0.
10.6	21	319	322	10.5	18	216	216	53 Zn 3.
12.1	20*b*	338	336	12.2	18b_1	232	232	37 Cr^+ 0.
13.8	13*b*	136	136	13.5	(12)	89	89	11 Fe 0, 49 Co 1.
14.9	10b_2	97	97	14.5	13	121	121	
16.0	14	189	189	15.8	10	113	113	
—	—	—	—	16.7	11	84	84	
17.6	14	190	190	17.9	13*b*	153	153	78 Fe Ni 2.
18.5	(10)	53	53	—	—	—	—	
19.3	8	55	55	19.1	11*b*	114	114	
20.4	12	174	173	20.5	12b_2	150	148	42 Ti 1, 13 Fe Ni 0.
21.6	8	26	25	21.5	11	82	80	
23.4	35*b*	726	757	23.6	29b_2	565	570	52 Mn 5, 14 Cr^+ Fe 3.
25.5	18	201	190	25.6	17	184	184	
26.2	(11)	34	31	—	—	—	—	
27.2	12	131	129	27.7	13	158	158	
28.9	24	321	319	29.3	18*b*	272	272	03 Ni 3, 36 Cr 2.
29.7	(13)	54	52	—	—	—	—	
31.1	17	212	212	31.2	17*b*	221	221	19 Ni 3.
32.7	20	240	240	32.8	(14)*b*	219	219	73 Ni Fe 3.
33.5	16	146	146	33.9	15*b*	115	115	
34.8	(9)	40	40	35.0	13	86	86	51 Fe 1.
36.1	24	344	344	36.2	21	273	273	87 Fe 2, 23 Cr^+ Ni 0.
37.2	9	17	17	37.2	13	81	81	
38.7	18	217	217	38.4	16*b*	163	163	52 Fe 2, 65 Ni 1.
39.9	24*b*	230	230	39.5	(18)	145	145	55 Fe 3.
40.3	—	118	118	40.3	20*b*	218	218	28 Co 2, 33 Fe 3.
41.1	(14)	98	98	—	—	—	—	88 Ti 3.
41.5	(12)	48	48	41.8	13	124	124	79 Fe 0.
43.0	20	309	309	42.8	18*b*	174	174	78 Fe 1, 16 Fe Ni 3.
—	—	—	—	43.5	17	76	76	
44.2	15	130	130	44.2	16	146	144	02 Fe Ti 1.

4845.9	11b	198	193	4845.6	(14)	119	117	66 Fe 1.
47.0	(15)	87	77	46.5	16b	142	134	
48.3	31b	419	475	48.3	$28b_2$	424	466	31 Ca 0, 26 Cr$^+$ 2.
49.0	(28)	133	114	49.2	$(24)b_2$	211	192	90 Fe 1, 17 Ti$^+$ 0.
49.5	(24)	173	166	—	—	—	—	
51.0	—	122*	117	50.6	17	161*	158	
51.9	14	108	108	51.9	17b	144	144	50 V 1.
52.8	—	83	83	52.7	(18)	92	92	56 Ni 2.
54.2	(22)	139	139	53.5	19	92	92	
54.9	—	197	197	55.3	35	273	273	88 Y$^+$ Fe 1.
55.7	39b	410	410	56.0	35	263	263	42 Ni 3, 69 Fe 2, 02 Ti 1, 20 Cr$^+$ 00.
56.8	(22)	37	37	—	—	—	—	
57.5	22	69	69	57.8	(25)	80	80	40 Ni 1.
58.3	—	50	50	—	—	—	—	
59.2	—	120	120	59.1	(36)	106	106	14 Fe 0.
59.8	(41)	253	253	59.8	(42)	97	97	75 Fe 4, 22 Cr$^+$ 00.
61.4	60	—	—	61.2	58	—	—	99 Fe 0, 34 H 30, 84 Cr 0, 60 Fe V 0.
63.9	33	169	169	—	—	—	—	66 Fe 2, 94 Ni 0.
64.4	33	205	205	64.3	$35b_1$	254	254	32 Ni Cr$^+$ 1, 75 V 0.
65.7	29	149	149	65.6	$29b_1$	126	126	62 Ti$^+$ 1.
66.2	(26)	173	173	66.3	27	145	145	28 Ni 2.
68.1	21	146	146	67.7	21b	109	109	88 Co 1, 26 Ti 0.
68.9	(17)	99	99	68.8	(17)b	119	119	47 ⊙ 0.
71.4	38	497	497	71.1	30b	347	347	05 Cs$^+$ 00, 14 Ti 1, 80 Cr Ni 3, 33 Fe 5.
72.0	(31)	262	262	72.3	28	285	285	94 ⊙ 1, 15 Fe 4.
73.8	25	415*	415	73.9	$23b_2$	354*	354	26 Ni 0, 45 Ni 2, 95 Ti$^+$ 0, 36 ⊙ 0, 80 Ni 0.
76.3	29	497	497	76.5	26	420	420	48 V 1, 88 Fe 2, 42 Cr$^+$ 1, 49 Cr$^+$ 00.
78.1	29	424	424	78.1	24	331	331	59 Fe 0, 17 Ca Sc 3, 22 Fe 4.
79.8	10	90	90	79.6	$10b_2$	104	104	
80.7	(10)	30	28	80.6	12	88	88	
81.9	22	346	344	81.9	19b	294	294	57 V 1, 72 Fe 2, 17 Fe 3.
83.7	26	350	364	83.6	$25b_2$	300	300	69 Y$^+$ 2.
84.6	24	82	79	84.5	21	88	88	60 Cr$^+$ 0.
85.1	24	197	195	85.3	20	170	170	09 Ti 2, 44 Fe 3.
86.1	23	232	230	86.4	$20b_2$	185	185	83 Cr 0, 34 Fe 3.
87.1	21	217	217	87.1	(16)	143	143	02 Cr Ni 2, 20 Fe 2.
88.7	23	160	160	88.7	20	281	281	65 Fe 2.
89.1	23	212	209	—	—	—	—	01 Fe 3, 11 Fe 2.
90.9	35	338	350	90.7	$29b_2$	259	259	77 Fe 6.
91.4	35	343	343	91.4	(26)	253	253	50 Fe 8.
92.6	(13)	50	50	92.9	13	106	106	87 Fe 1.
93.4	14	136	136	—	—	—	—	
94.4	13	154	154	94.1	16	204	204	
—	—	—	—	95.3	$10b_2$	75	75	
96.2	10	122	122	96.6	(10)	136	136	44 Fe 1.
97.0	8	58	58	—	—	—	—	
98.0	9	82	82	97.7	14b	155	155	
4900.0	29	493	493	4900.1	29	443	443	91 Ti La$^+$ 2, 11 Y$^+$ 2.
02.0	12	110	110	02.0	14	114	114	
03.3	21	286	286	03.3	21	238	238	26 Cr 0, 32 Fe 5.
04.4	19	228	228	04.6	17	149	149	42 Ni V 3, 14 Fe 0.
06.0	8b	69	69	05.9	11	143	143	
07.3	12	81	81	07.2	13	103	103	
07.9	14	136	136	08.1	16	139	139	74 Fe 2, 03 Fe 0.
09.3	—	126	126	09.1	$16b_2$	109	109	40 Fe 2.
10.2	26b	340	340	10.3	26	321	321	03 Fe 3, 32 Fe 2, 57 Fe 2.
11.2	25b	231	231	11.4	$25b_2$	313	313	20 Ti$^+$ 1, 54 Fe 0, 78 Fe 1.
11.9	(17)	95	95	12.5	—	109	109	03 Ni 1.

4913.4	14	102	102	—	—	—	—	
14.0	14	119	119	4913.8	16	194	194	62 Ti 2, 98 Ni 2.
15.0	10	82	82	14.9	11	95	95	
15.8	7	8	6	15.9	11	90	90	
16.5	(10)	95	92	16.8	13	67	67	
17.4	(16)	82	76	17.3	(18)	151	146	24 Fe 2.
18.8	31	478	456	18.9	26	358	342	02 Fe 1, 37 Ni 2, 71 Ni 0, 00 Fe 6.
20.5	35	520	594	20.5	30	454	528	51 Fe 10, 97 La$^+$ 0.
22.0	21	216	178	22.0	21	310	252	79 La$^+$ Ti 1, 26 Cr 2.
24.0	40	716	788	23.9	37	560	623	92 Fe$^+$ 5, 78 Fe 3.
25.4	—	96	76	25.5	—	150	130	58 Ni 1.
27.0	(15)	102	98	26.9	(16)	95	91	
—	—	—	—	27.4	(16)	71	71	43 Fe 1.
27.8	18b_1	227	223	27.8	17*b*	83	83	88 Fe 2.
—	—	—	—	28.1	17	119	119	34 Ti 0.
29.1	9	60	58	29.4	15	125	125	
30.3	12	172	170	30.4	17	160	160	33 Fe 2.
32.0	14	152	150	32.0	18b_1	231	231	07 V 0.
—	—	—	—	33.2	(24)	146	146	19 Fe 0, 35 Fe 2.
34.0	33	622	622	34.0	35	457	457	88 Fe 0, 04 Fe Ba$^+$ 3, 10 Ba$^+$ 4.
35.6	15b_2	181	181	35.8	17	163	163	84 Ni 2, 33 Cr 1.
37.1	(18)	162	162	37.1	20	194	194	28 Ni 3.
38.1	(24)	182	182	37.9	(21)	93	93	18 Fe 2.
39.2	26*b*	436	436	38.8	26*b*	321	321	82 Fe 4, 25 Fe 2.
—	—	—	—	39.5	(24)	205	205	69 Fe 3.
41.3	8	26	26	41.0	16	89	89	
42.2	13	204	204	42.2	18	156	156	49 Cr 2.
—	—	—	—	42.8	16	132	132	
43.7	10	117	117	43.8	16	123	123	
—	—	—	—	44.6	15	92	92	
45.6	(16)	178	178	45.5	(17)	97	97	45 Ni 1, 64 Fe 1.
46.2	20*b*	209	209	46.2	21	236	236	04 Ni 0, 40 Fe 3.
47.5	10	88	88	47.4	18b_2	183	183	
48.6	12	132	132	49.0	16b_1	173	173	
50.0	15	188	188	50.1	21	211	211	12 Fe 2.
50.9	10	76	76	51.2	17	117	117	
51.9	11	67	67	—	—	—	—	
52.8	16*b*	165	165	52.5	23	291	289	29 Fe 1, 65 Fe 2, 21 Ni 2.
53.5	(15)	73	73	53.4	16	114	114	
				54.6	17b_2	150	146	61 Fe 1, 80 Cr 2.
				55.9	16	143	132	
				57.3	35	620	696	31 Fe 5, 60 Fe 8.
				59.6	15*b*	186	166	
				61.0	16	177	175	
				62.5	18	199	197	92 ⊙ 0, 58 Fe 2.
				63.9	(13)	124	124	
				64.5	15*b*	92	92	
				65.1	15	50	50	94 Cr 1, 18 Ni 0.
				66.0	21b_2	285	285	10 Fe 4.
				68.0	21b_1	218	218	89 Fe 3.
				68.5	24	151	151	60 Ti 0, 71 Fe 1.
				69.0	19	62	62	
				70.0	19	163	163	94 Fe 3.
				70.7	20	121	121	50 Fe 1, 65 ⊙ 0.
				71.3	15	53	53	35 Ni 1.
				71.9	15*b*	115	115	
				73.2	19b_2	215	215	11 Ti Fe 4.
				74.5	15	157	157	

				4976.0	16	189	189	14 Ni 0, 34 Ni 1.
				76.9	15	41	41	
				77.5	17	83	83	66 Fe 0.
				78.4	21	255	255	56 Na 0, 61 Fe 3.
				80.2	25	330	330	17 Ni 4.
				81.3	26	149	149	
				82.0	32	199	199	73 Ti 4.
				82.7	38	225	225	52 Fe 4.
				83.1	37	256	256	83 Na 2, 27 Fe 3.
				83.8	32	129	129	86 Fe 3.
				84.2	28	179	179	12 Ni 2.
				85.2	32	298	298	27 Fe 3, 56 Fe 3.
				86.5	22	210	210	23 Fe 1.
				87.8	15	30	30	
				88.8	29	257	257	97 Fe 2.
				89.4	23	210	210	
				90.8	22	83	83	46 Fe 0.
				91.3	24	246	246	07 Ti 3, 29 La$^+$ Fe 2.
				92.8	20	115	115	
				93.3	24	161	161	36 ⊙ 0.
				93.8	21	113	113	69 Fe 0.
				94.3	(16)	83	83	13 Fe 3.
				94.9	(15)	88	88	
				96.0	19	110	110	
				96.4	18	119	119	
				97.0	—	59	59	85 Ni 1, 10 Ti 0.
				97.5	16	78	78	
				99.1	(22)	144	144	12 Fe 0.
				99.5	28	228	228	51 Ti 3.
				5000.3	29	161	161	34 Ni 2.
				00.8	26	154	154	01 Ti 0.
				01.3	28	155	155	
				02.0	26	158	158	87 Fe 5.
				02.7	25	161	161	80 Fe 2.
				04.3	(23)	297	297	75 Ni 0, 05 Fe 0.
				05.6	33	487	487	17 Ti$^+$ 0, 72 Fe 4, 13 Fe 5.
				07.3	32	298	298	21 Ti 3, 29 Fe 2.

Lines in the wings of the hydrogen lines.

10607			10607			10617			10607			10617		
λ	1 — r	E/r	λ	1 — r	E/r	λ	1 — r	E/r	λ	1 — r	E/r	λ	1 — r	E/r
4095.4	01	58	—	—	—	4328.0	01	203	4851.0	01	118	4850.6	01	160
96.0	02	271	—	—	—	28.7	02	48	51.9	02	110	51.9	04	150
96.7	04	108	—	—	—	29.1	02	91	52.8	03	86	52.7	05	97
97.0	05	177	—	—	—	29.6	02	52	54.2	04	145	53.5	06	98
97.7	07	59	—	—	—	30.3	03	237	54.9	06	210	55.3	12	310
98.2	08	215	—	—	—	30.8	04	207	55.7	08	446	56.0	13	302
98.6	09	129	4331.6	01	194	31.6	05	169	56.8	11	42	—	—	—
99.0	11	62	32.6	02	155	32.6	08	99	57.5	12	78	57.8	17	96
99.2	13	51	33.2	03	67	33.2	09	112	58.3	13	57	—	—	—
99.6	16	50	33.8	04	319	33.9	10	258	59.2	14	140	59.1	23	138
4100.1	17	163	34.7	04	28	—	—	—	59.8	15	298	59.8	27	133
00.8	22	218	35.2	05	93	34.9	12	95	63.9	14	197	—	—	—
01.0	30	24	35.6	07	30	35.6	12	86	64.4	13	236	64.3	18	310
03.0	19	201	36.2	09	75	36.3	16	104	65.7	11	167	65.6	15	148
03.6	17	70	37.1	14	352	37.2	19	325	66.2	10	192	66.3	13	167
04.0	15	115	37.9	19	474	38.0	22	422	68.1	07	157	67.7	10	121
04.3	13	90	38.7	25	99	38.8	29	103	68.9	05	104	68.8	07	128
04.6	12	38	39.5	39	187	39.4	40	70	71.4	03	512	71.1	03	358
05.0	10	142	41.4	37	179	41.4	41	132	72.0	01	265	72.3	01	288
05.4	08	47	42.2	25	92	42.3	25	177						
05.8	07	32	43.2	18	144	43.2	21	142						
06.4	06	239	43.8	15	80	43.6	19	75						
07.5	04	364	44.4	12	408	44.5	17	398						
08.2	03	71	45.0	08	38	44.9	14	47						
08.5	03	107	45.6	06	45	45.6	12	153						
09.1	02	142	46.1	05	56	—	—	—						
09.5	01	214	46.5	04	258	46.5	11	133						
09.9	01	208	—	—	—	46.9	09	75						
			47.5	03	62	47.4	09	75						
			47.9	03	134	48.0	08	146						
			48.2	02	31	48.4	08	66						
			48.7	01	48	—	—	—						
			49.0	01	108	49.1	07	143						
			49.8	01	135	49.8	04	163						
						50.9	03	288						
						51.8	02	511						
						52.8	01	288						

Line intensities for ϑ Cygni, π Cephei, δ Equulei.

ϑ Cygni						π Cephei						δ Equulei (10608)			
λ	C.d.	*E.W.* meas.		*E.W.* corr.		λ	C.d.	*E.W.* meas.		*E.W.* corr.		λ	C.d.	*E.W.* meas.	*E.W.* corr.
		10616	10619	10616	10619			10610	10618	10610	10618				
4012.8	12	27		27											
13.0	(10)	22		22											
13.3	(10)	18		18											
13.7	26	114		114											
14.0	(17)	44		44											
e	—	—		—											
14.8	16	62		62											
15.2	(10)	12		12											
15.6	29	122		122											
16.0	—	14		14											
16.4	21	107		107											
17.1	32	128		128											
17.6	29b_1	112		112											
18.1	38	192		192											
18.7	—	32		32											
19.1	15	68		68											
19.5	—	19		19											
20.3	27	147		147											
20.8	14	42		42											
21.2	12	34		34											
21.8	29	129		129											
22.2	(12)	29		29											
22.7	13	67		67											
23.4	26	115		115											
23.9	15	62		62											
24.3	8	28		28											
e	—	—		—											
24.7	9	36		36											
25.0	(8)	19		19											
25.3	(10)	44		44											
25.7	19	73		73											
26.2	14	53		53											
26.5	12	36		36											
26.9	(10)	20		19											
27.1	15	69		68											
27.6	12	35		33											
27.8	(14)	35		31											
28.3	35	156		197											
28.7	15	42		35											
29.1	(14)	36		33											
29.6	28	132		132											
30.1	(29)	81		63											
30.5	65	243		302											
30.7	55	132		112											
31.2	19	41		38											
31.5	(17)	23		22											
31.8	33	162		160											
32.5	38	146		144											
33.1	35	145		161											
33.7	12b_2	46		43											
33.9	(15)b	47		44											
34.4	43	200		214											
4034.9	(9)	13		11											

4035.3	—	23		22											
35.6	43	183		182											
36.1	12	24		23											
36.6	19	73		73											
36.8	(16)	19		19											
37.1	21	64		64											
37.3	18	44		44											
37.6	—	30		30											
38.1	13	26		26											
38.3	14	38		38											
38.8	22	116		116											
39.4	13	49		49											
40.4	28	115		115											
40.6	33	143		142											
41.4	43	200		212											
41.7	28	68		62											
42.0	14	38		37											
42.5	$14b_1$	41		40											
42.8	21	71		70											
43.1	(12)	20		19											
43.5	(17)	54		52											
43.9	41	176		172											
44.4	39	164		156											
45.1	32	108		89											
45.7	73	506		622											
46.4	20	44		17											
46.8	18	59		45											
47.1	14	24		20											
47.4	20	89		82											
47.9	15	50		39											
48.2	16	36		30											
48.8	41	211		232											
49.2	(21)	28		22											
49.4	25	96		92											
49.9	16	60		59											
50.4	24	74		73											
50.7	(20)	65		65											
51.1	21	48		48											
51.3	21	75		75											
51.9	34	134		134											
52.4	34	141		141											
52.7	34	90		90											
52.9	—	40		40											
53.3	25	87		86											
53.9	34	108		107											
54.2	32	109		108											
54.9	48	258		251											
55.6	42	161		202											
56.0	18	44		38											
56.3	22	85		79											
56.7	18	36		34											
56.9	$21b_1$	58		53											
57.4	68	371		399											
58.2	40	157		161											
58.8	41	187		182											
59.4	23	58		57											
59.7	27	88		88											
4060.2	(15)	25		25											

4060.4	19	56		56											
60.7	18	34		33											
61.1	25	112		109											
61.6	19	36		34											
61.9	30	114		104											
62.5	48	183		235											
62.9	—	32		13											
63.3	46	120		71											
63.6	(100)	(299)		413											
64.1	27	51		29											
64.3	29	75		67											
64.5	24	39		36											
64.8	17	33		30											
65.1	—	37		36											
65.4	$26b_1$	104		102											
65.8	16	22		21											
66.1	24	73		71											
66.3	—	29		27											
66.7	27	81		66											
67.1	42	87		110											
67.4	(40)	103		93											
68.0	50	194		243											
68.4	(17)	31		20											
68.6	13	25		22											
69.1	19	71		68											
69.4	13	29		27											
69.8	17	59		56											
70.2	19	80		74											
70.8	38	140		157											
71.2	17	25		3											
71.7	66	318		411											
72.5	26	113		91											
73.1	11	42		35											
73.3	(11)	23		13											
73.7	33	157		182											
74.4	13	29		26											
74.7	40	162		161											
75.1	(19)	43		43											
75.4	(16)	40		39											
75.8	28	111		108											
76.2	26	53		51											
76.5	(39)	50		47											
76.7	58	246		247											
77.3	26	53		37											
77.7	61	288		353											
78.4	29	124		112											
78.9	15	18		16											
79.2	35	109		107											
79.4	35	97		92											
79.9	37	131		146											
80.2	(22)	79		74											
80.9	22	78		77											
81.2	22	62		62											
81.5	(11)	20		20											
81.9	23	59		59											
82.1	24	64		64											
82.4	22	57		56											
4082.9	33	126		138											

4083.2	18	12		10
83.6	43	231		228
84.1	16	19		16
84.5	38	145		171
85.0	38	131		138
85.3	32	106		101
85.9	28	108		107
86.3	24	75		75
86.7	21	69		69
87.1	26	104		104
87.4	(18)	38		38
87.8	17	67		67
88.2	16	34		34
88.6	24	83		83
88.9	17	58		58
89.2	24	88		88
89.8	24	73		73
90.1	28	93		93*
90.5	26	90		90
90.9	24	68		68
91.2	24	42		42
91.4	28	70		70
91.6	25	46		46
92.0	29	61		61
92.4	42	92		92
92.6	45	135		135
93.0	(22)	42		42
93.3	22	63		62
93.7	23	48		47
94.0	23	51		48
94.4	35	135		140
95.0	41	135		142
95.4	36	99		96
96.0	58	233		232
96.6	27	30		30
96.8	(34)	47		47
97.1	39	113		112
97.5	41	103		99
97.9	40	96		65
98.2	51	183		237
98.7	41	103		96
99.1	40	67		65
99.4	45	109		105
99.8	60	136		148
4100.0	59	165		159
01.7	(100)	—		—
03.0	59	218		276
03.5	46	88		76
03.8	53	59		53
03.9	57	53		43
04.1	63	154		198
04.4	52	135		132
04.8	(34)	69		66
05.4	$36b_1$	119		117
05.7	32	89		88
06.3	41	145		144
06.6	34	55		54
4107.0	30	66		59

4105.3	31	97	no corr.
05.5	26	55	
05.8	28	68	
06.3	33	185	
07.0	32	136	
4107.4	36	124	

4107.6	42	153		177	
08.1	29	82	114	77	114
08.6	32	105	79	104	79
09.1	36	89	137	89	137
09.5	26	47	35	47	35
09.8	39	111	158	111	158
10.1	24	40	30	40	30
10.5	30	75	82	75	82
10.8	28	38	73	38	73
11.0	30	96	75	96	75
11.4	23	59	45	59	45
11.9	25	85	^{e}96	85	96
12.3	24	82	86	82	86
12.9	36	131	166	131	166
13.3	(22)	72	42	72	42*
13.7	18	36	95	36	93
14.4	31	149	154	152	162
15.0	24*b*	52	118	51	115
15.3	22	68	45	68	44
15.6	(16)	39	47	39	47
16.0	18	48	88	48	88
16.5	(16)	61	77	61	77
17.0	18	78	60	78	60
17.4	14*b*	31	50	31	50
18.0	22*b*	77	125	77	125
18.6	41	109	118	109	118
18.9	(39)	143	179	143	179
19.5	22	79	78	79	78
19.9	16	23	53	23	53
20.3	24	88	122	88	122
20.8	13	23	63	23	63
21.3	28	114	114	114	114
21.8	27	115	126	115	126
22.6	36	189	187	189	187
23.2	21*b*	75	87	75	87
23.8	28	136	143	136	143
24.5	13*b*	27	54	27	54
24.8	19	67	79	67	79
25.3	(12)	17	22	17	22
25.6	23b_2	81	95	81	95
25.9	24*b*	60	45	60	45
26.2	26b_1	105	80	105	80
26.5	(17)	32	41	32	41
26.9	14	28	48	28	48
27.2	(16)	36	20	36	20
27.7	34*b*	173	179	173	179
28.1	30	107	105	107	105
28.8	22	70	95	70	95
29.2	22	71	77	71	77
29.6	19*b*	76	86	76	86
30.0	(16)	48	77	48	76
4130.8	23b_1	139	137	138	135

4107.8	29	110	no corr.
08.2	26	60	
08.6	29	110	
09.0	31	129	
09.5	37	122	
09.8	27	72	
10.1	23	49	
10.5	33	130	
10.9	25b_2	88	
11.3	27	80	
11.7	27	84	
12.0	21	47	
12.4	28	86	
12.9	32	184	
13.6	15	52	
14.1	20	63	
14.5	32	98	
14.8	23	68	
15.1	17	40	
15.4	11	26	
15.7	14	35	
16.0	14	44	
16.5	16	76	
16.9	17	48	
17.5	19	66	
17.8	18	45	
18.1	(27)	74	
18.4	40	112	
18.8	37	154	
19.5	25	84	
19.9	24	76	
20.2	20	64	
20.6	16	32	
21.0	23	73	
21.4	23	102	
21.8	17	39	
22.2	24	74	
22.6	28	91	
22.9	(17)	37	
23.4	28	112	
23.8	21	60	
24.1	13	26	
24.5	17	60	
24.9	14	37	
25.4	24	74	
25.8	31	102	
26.2	25	56	
26.4	23	44	
26.7	15	28	
27.2	(20)	59	
27.7	40b_1	200	
28.2	20	72	
28.7	30	70	
29.2	23	77	
29.6	17	67	
30.0	13	44	
30.4	17	53	
4130.7	15	47	

4131.2	(16)	61	43	56	39
32.0	51	199	267	237	309
32.6	24	66	55	54	48
32.9	28	108	111	105	108
33.8	$24b_1$	127	152	124	151
34.4	(25)	60	79	54	78
34.7	36	145	157	162	157
35.3	10	27	47	25	47
35.8	12	48	48	48	48
36.1	9	5	22	5	22
36.5	18	72	69	72	69
37.0	26	106	107	106	107
37.5	20	59	59	59	59
37.7	$16b_2$	32	26	32	26
38.0	15	41	38	41	38
38.4	$15b_1$	63	62	63	62
38.8	11	29	18	29	18
39.2	13	46	31	46	31
39.4	11	20	22	20	22
40.0	$18b_1$	78	81	78	81
40.4	20	68	60	68	60
40.6	(14)	29	30	29	30
41.2	$12b_1$	51	40	50	39
41.5	12	19	11	19	11
41.9	(18)	44	76	43	75
42.1	20	50	62	49	61
42.5	22	129	81	126	78
43.0	(14)	15	25	12	22
43.4	37	e 130	167	110	135
43.9	50	e 209	232	264	293
44.6	11		28		23
45.0	15		37		35
45.3	15		38		37
45.8	$22b_2$		96		95
46.2	(17)		46		46
46.5	—	e	16		16
46.7	12		30		30
47.1	17		50		50
47.4	(18)		31		31
47.7	$28b_1$		130		130
48.4	10	47	20	47	20
48.8	(14)	33	40	33	40
49.3	36	200	216	200	216
49.9	(16)	32	44	32	44
50.3	25	111	138	111	138
51.0	15	75	54	75	54
51.4	(12)	18	24	18	24
51.8	(17)	26	16	26	16
52.1	38	188	220	188	220
52.7	12	24	61	24	61
53.1	12	60	45	60	45
53.9	$34b_2$	177	180	177	178
54.5	36	114	141	114	150
54.8	34	128	123	128	120
55.4	(10)	17	20	17	20
4155.9	(21)	62	50	62	50

4131.2	13	27	no corr.
31.7	36	150	
32.1	44	160	
32.6	26	116	
33.0	$18b_2$	57	
33.5	22	55	
33.8	22	68	
34.3	33	138	
34.6	27	62	
35.0	(14)	46	
35.3	10	30	
35.6	8	22	
36.0	12	43	
36.6	19	74	
37.0	23	90	
37.5	18	62	
37.9	10	29	
38.3	11	33	
38.7	12	42	
39.2	12	42	
39.5	11	26	
39.8	11	20	
40.1	15	51	
40.5	12	42	
40.9	9	26	
41.5	14	60	
41.9	19	52	
42.2	19	65	
42.6	17	68	
43.1	(19)	58	
43.5	42	200	
43.9	29	95	
44.6	9	44	
45.4	14	78	
45.7	18	67	
46.1	13	45	
46.6	11	44	
47.0	14	30	
47.3	19	79	
47.8	14	60	
48.3	9	24	
49.0	22	111	
49.4	25	122	
49.9	20	80	
50.3	17	44	
50.9	15	e87	
51.4	(11)	13	
51.9	30	180	
52.2	(21)	38	
52.6	8	14	
53.0	11	33	
53.5	20	56	
53.7	23	47	
54.1	31	132	
54.5	19	103	
54.9	20	66	
55.7	14	38	
4156.1	17	84	

4156.3	32	121	158	121	158
56.8	38	177	173	176	173
57.3	(16)	33	38	30	38
57.8	31	143	143	153	143
58.3	15	33	28	32	28
58.8	28	116	128	115	128
59.2	28	104	118	104	118
59.8	10	21	17	21	17
60.4	19*b*$_1$	122	122	122	122
		e			
61.2	26	102	91	102	91
61.5	31	131	135	131	134
61.9	(17)	48	54	48	54
62.3	12	30	34	29	33
62.6	10	32	30	30	28
63.0	10	30	23	26	19
63.6	34	168	180	200	201
64.3	10	49	47	34	39
64.7	12	51	27	48	26
65.1	16	42	33	41	31
65.5	21*b*	102	131	100	128
66.0	12	36	20	34	19
66.4	11	27	20	24	18
66.7	(15)	36	47	26	33
67.3	42	230	234	270	281
67.9	26	119	123	107	108
68.7	17*b*	72	59	70	57
69.0	16	46	69	45	67
69.7	18	95	49	94	48
70.0	18	58	70	58	69
70.3	11	12	19	12	19
71.0	38	203	203	203	203
72.0	40	256	254	256	254
72.7	38	194	201	194	201
73.5	44	204	191	204	191
74.0	26	122	98	122	98
74.4	(18)	52	49	51	49
74.9	29	144	136	141	136
75.7	30	152	167	162	165
76.1	—	18	22	14	19
76.6	28	148	151	156	161
77.0	—	41	20	39	18
77.6	44	231	236	230	234
78.1	(20)	61	36	60	35
78.4	16	39	31	37	29
78.8	32	152	156	161	168
79.4	34	167	152	163	147
79.8	(15)	45	34	44	33
80.2	12	32	46	32	45
80.6	14	61	45	61	45
81.0	14	52	50	51	50
4181.8	40	259	253	263	252

4171.8	39*b*	174		173	
72.2	47	171		169	
72.7	61	233		246	
73.0	46	104		98	
73.3	37	48		47	
73.5	50	192		191	
74.1	39*b*	149		149	
74.4	(33)	111		111	
74.9	38	127		127	
75.1	38	69		68	
75.3	31	64		63	
75.7	34	95		94	
75.9	29	92		89	
76.2	22	13		9	
76.5	37	172		201	
77.0	32	132		119	
77.6	50	174		172	
77.8	56	151		150	
78.0	49	118		118	
78.5	38	149		147	
78.9	32	113		108	
79.4	41	183		193	
79.8	32	75		71	
80.1	(26)	54		46	
80.4	42	156		174	
80.7	35	101		98	
81.0	32	79		77	
81.5	(37)	88		84	
81.8	52	216		222	
4182.3	39	150		158	

4156.4	33	130	no
56.9	23	88	corr.
57.5	19	74	
57.8	18	61	
58.1	12	16	
58.5	18	50	
58.8	25	95	
59.2	20	62	
59.9	14*b*$_1$	68	
60.3	14	36	
60.5	16	36	
60.8	18*b*$_1$	46	
61.2	27	112	
61.6	21	62	
61.9	14	50	
62.5	10	38	
62.7	8	18	
63.3	19*b*	90	
63.8	20*b*$_1$	97	
64.4	14	56	
65.0	(13)	54	
65.5	19*b*$_1$	107	
66.0	11	28	
66.5	12	37	
67.0	28*b*$_1$	144	
67.5	29*b*$_2$	169	
68.1	(17)	59	
68.6	27	76	
69.0	14	38	
69.4	17	45	
69.6	16	36	
69.9	16	38	
70.1	15	34	
70.7	24*b*$_1$	88	
71.1	25	122	
71.8	27	156	
72.4	32	144	
72.8	30	101	
73.2	29	116	
73.7	32	146	
74.1	22	72	
74.5	21	110	
75.0	20*b*$_1$	68	
75.4	19	62	
75.9	19	92	
76.3	17	54	
76.7	23	98	
77.3	28	132	
77.8	33	146	
78.2	(18)	53	
78.6	23	76	
79.1	28	134	
79.6	22*b*$_1$	106	
80.1	11	23	
80.4	12	54	
80.9	17	52	
81.7	31*b*	213	
4182.1	27	73	

4182.4	26	99	81	97	81							4182.5	22	78	no
82.8	$20b$	102	93	101	91	4182.8	33	152		146		82.8	20	45	corr.
83.4	$18b$	82	70	82	64	83.4	31	101		100		83.1	20	61	
						83.7	27	71		71		83.6	25	113	
84.0	$32b$	155	182	154	210	84.1	39	*e*132		131		84.0	25	109	
84.3	—	80	55	78	45	84.3	(37)	*e*111		109		84.4	20	60	
84.9	30	146	138	154	137	84.9	32	*e*148		156		84.9	17	89	
85.4	(14)	44	12	42	10	85.4	15	*e* 33		32		85.3	8	20	
85.7	12	55	33	53	32	85.7	20	*e* 81		78		85.6	7	16	
86.2	14	55	47	53	45	86.2	22	*e* 52		50		85.9	10	20	
86.6	$18b_1$	54	72	49	68	86.6	$34b_1$	*e*164		127		86.3	(14)	59	
87.0	34	155	157	167	171	87.1	54	*e*260		319		86.8	28	104	
87.8	37	243	241	232	237	87.8	53	*e*221		215		87.1	27	114	
						88.0	—	*e* 84		82		87.6	28	98	
						88.3	—	*e* 33		31		88.0	26	105	
88.7	32	185	201	220	199	88.8	38	*e*132		130		88.5	19	56	
						89.0	(32)	*e* 94		93		88.7	22	46	
89.6	$18b_1$	103	85	90	84	89.6	25	*e* 79		78		89.0	20	54	
90.1	$17b$	65	34	63	33	90.1	33	*e*183		181		89.3	15	35	
90.4	$16b$	58	60	58	59	90.7	31	*e*142		137		89.7	13	41	
90.7	(11)	42	22	41	20	91.4	49	*e*227		275		89.9	12	20	
91.4	42	*e*	296	—	310	91.7	(40)	*e*126		103		90.2	9	27	
						92.0	(28)	*e* 62		57		90.7	13	42	
92.2	$14b$	54	54	54	51	92.4	22	94		92		91.1	(19)	75	
92.7	11	33	46	33	44	93.0	22	82		81		91.5	32	172	
93.2	10	36	53	36	53	93.2	21	33		33		92.2	12	44	
						93.4	(21)	34		33		92.7	12	49	
93.8	15	104	78	104	77	93.8	37	166		166		93.3	10	52	
94.4	$14b_1$	32	58	32	58	94.4	23	44		44		93.7	11	22	
94.8	15	45	41	45	41	94.9	$38b$	239		239		94.0	11	30	
95.3	34	224	213	224	213	95.3	(42)	92		92		94.6	14	61	
						95.5	44	144		143		95.1	24	84	
						95.9	—	56		54		95.5	26	124	
96.2	28	117	142	116	141	96.2	44	146		152		95.9	19	51	
96.5	(22)	65	66	65	66	96.6	50	173		171		96.4	23	86	
						96.8	46	86		86		96.8	15	55	
97.1	13	70	61	69	60	97.1	40	145		143		97.1	11	18	
97.6	14	30	4	29	4	97.6	24	80		78		97.4	14	31	
98.3	46	258	312	254	307	98.3	61	304		271		97.8	31	108	
98.6	(32)	80	50	73	46	98.6	60	204		247		98.3	42	218	
99.1	36	183	183	221	210	99.1	43	228		248		98.8	31	110	
4200.0	20	92	118	87	111	99.9	39	200		194		99.2	24	93	
00.4	(16)	22	36	21	34	4200.8	42	263		259		99.7	12	31	
00.9	22	151	174	145	169	01.2	26	64		59		4200.1	15	68	
02.0	43	233	261	269	301	01.8	(46)	125		107		00.6	$22b_2$	116	
02.4	—	57	47	40	33	02.0	60	171		192		01.1	20	60	
02.8	$18b$	70	86	65	80	02.2	56	201		237		01.8	33	164	
03.2	(12)	26	22	24	20	02.8	36	179		158		02.3	$31b_2$	177	
03.5	16	41	40	40	38	03.6	31	145		141		02.9	14	42	
04.0	33	159	163	58	162	04.1	36	213		213		03.3	12	24	
04.7	$19b_1$	77	83	77	83	04.7	(35)	121		120		03.7	25	84	
05.1	$22b$	96	90	95	90	05.0	$43b_1$	161		160		04.1	23	78	
05.6	24	116	124	116	124	05.5	43	186		186		04.5	16	46	
						05.9	20	38		38		04.9	24	66	
06.2	(10)	38	35	38	35	06.2	21	43		43		05.1	23	80	
06.7	24	114	111	114	111	06.7	38	184		184		05.6	(16)	94	
4207.2	$24b_2$	127	121	127	121	07.1	32	93		93		06.4	19	74	
						4207.4	29	93		93		4206.8	26	89	

4207.7	$16b_2$	60	40	60	40
08.2	(11)	16	32	16	32
08.6	25	112	114	112	114
09.0	22	72	101	72	101
09.5	15	42	28	42	28
09.8	18	60	73	60	73
10.4	33	172	172	172	172
11.1	13*b*	74	61	74	61
11.9	20	98	114	98	114
12.6	11*b*	61	52	60	52
13.0	11	34	35	34	35
13.6	24	137	116	136	116
14.3	10	28	43	26	41
14.8	(11)	37	22	31	20
15.5	49	274	281	310	297
16.2	28	127	130	120	123
16.7	(10)	18	24	16	22
17.1	(11)	38	21	38	19
17.6	28	143	153	142	161
18.2	14	81	68	81	66
18.7	(12)	35	26	35	26
19.4	34	197	179	197	179
20.3	24*b*	151	152	151	151
20.7	(9)	34	21	34	21
21.2	11	34	21	33	20
21.6	12	52	54	48	52
22.2	32	165	157	185	168
22.7	(15)	46	42	39	38
23.1	14	52	39	50	38
23.6	14*b*	43	62	41	60
24.2	$32b_2$	127	163	125	161
24.6	27	104	61	102	59
24.9	(17)	44	27	42	25
25.5	29	170	169	162	161
25.9	27	92	101	78	90
26.7	58	387	386	480	513
27.4	43	235	231	227	211
28.3	14*b*	70	81	58	70
28.7	15	56	27	53	25
29.5	$21b_1$	106	91	104	89
29.8	21	79	76	78	74
30.6	13	95*d*	48	95	47
31.0	15	64	83	64	64
31.7	$14b_1$	47	41	47	47
32.0	$15b_1$	62	62	62	62
32.4	12	36	27	36	26
32.8	—	23	27	23	26
33.2	40	208	168	203	161
33.6	36	158	175	166	194
4234.3	11	44	32	42	27

4207.7	19	51		51	
08.2	27	80		80	
08.6	33	129		129	
08.9	30	130		130	
09.6	32*b*	179		179	
10.1	34	73		73	
10.4	44	166		166	
10.7	32	64		64	
10.9	(28)	70		70	
11.3	27	96		96	
11.9	32	164		164	
12.2	—	53		53	
12.7	$26b_1$	110		109	
13.2	$26b_1$	109		105	
13.6	38	153		142	
13.9	32	92		89	
14.5	33*b*	160		158	
15.0	43	175		171	
15.5	59	225		213	
15.8	71	278		432	
16.1	56	246		125	
17.2	(25)	101		91	
17.6	34	163		174	
18.3	22	104		102	
18.7	19	67		66	
19.3	35	207		207	
20.1	28	84		84	
20.3	31	114		114	
20.7	19	44		44	
21.1	12	23		22	
21.5	24	129		125	
22.2	37	177		201	
22.7	27	98		88	
23.0	27	81		79	
23.3	29	67		65	
23.6	32	125		123	
24.2	43	156		154	
24.5	$40b_2$	150		146	
24.8	(32)	73		66	
25.5	45	235		251	
25.9	$46b_1$	215		176	
26.4	(60)	216		72	
26.7	(100)	438		751	
27.4	54	282		252	
27.7	—	164		116	
28.2	(25)	76		67	
28.6	23	93		85	
29.5	35	138		136	
29.8	37	163		161	
30.4	23	112		110	
31.0	19	77		75	
31.6	$26b_2$	117		117	
32.0	(23)	60		60	
32.3	24	55		55	
32.8	37	188		187	
33.2	43	146		145	
33.6	47	198		197	
4234.0	32	117		115	

4207.2	19	74	74
07.5	13	29	29
07.9	8	14	14
08.4	16	62	62
08.8	20	79	79
09.2	13	26	26
09.6	15	66	66
10.1	23	93	93
10.6	22	98	98
11.1	12	37	37
11.7	12	43	43
12.1	15	41	41
12.4	13	38	38
12.7	14	49	49
13.4	17	56	56
13.7	19	92	92
14.1	8	10	10
14.4	8	19	19
14.7	12	26	26
15.4	32*b*	236	236
15.9	31	101	101
16.3	20	82	82
16.9	13	31	31
17.4	23	101	101
17.7	17	52	52
18.0	13	25	25
18.4	$13b_2$	70	70
19.1	23	135	135
19.7	21	58	58
20.1	17	66	66
20.4	14	46	46
21.0	9	38	38
21.4	11	31	31
21.9	20	82	82
22.3	24	111	111
22.8	13	27	26
23.3	19	97	95
23.9	23	96	94
24.3	$27b_2$	184	182
25.2	26	112	106
25.7	30	170	153
26.6	58*b*	420	565
27.2	(50)	214	138
27.7	35	148	132
28.2	13	36	33
28.6	10	26	24
29.0	8	8	7
29.3	(13)	29	27
29.7	21	114	112
30.1	14	45	45
30.6	12	48	48
31.2	12	76	76
32.0	10	61	61
32.5	13	28	28
33.0	25	110	108
33.5	36	171	186
4234.0	(23)	94	84

4234.7	12	26	30	25	28
35.2	$25b$	151	129	139	122
36.0	40	241	224	278	263
36.6	—	23	20	18	13
36.8	(13)	37	32	35	29
37.2	$20b_1$	96	86	94	84
38.0	25	177	155	174	154
38.8	32	178	160	184	159
39.3	(18)	32	34	31	34
39.8	37	207	192	207	192
40.4	25	114	120	114	120
40.8	—	41	9	41	9
41.1	14	39	47	39	47
41.5	12	47	35	47	35
41.9	(13)	26	36	26	36
42.3	$28b_2$	162	129	162	129
42.7	(22)	76	70	76	70
43.3	20	78	103	78	103
43.7	16	73	53	72	53
44.3	11	50	34	50	34
44.8	(14)	42	29	41	29
45.3	30	173	161	171	160
46.0	24	130	123	123	117
46.8	40	218	190	270	230
47.4	34	191	158	177	150
47.9	—	2	14	1	11
48.3	25	146	119	144	117
48.7	(14)	47	41	45	39
49.1	13	51	30	47	27
49.6	15	45	48	36	43
50.1	39	210	199	254	244
50.8	40	223	202	245	217
51.4	14	30	28	26	26
51.7	14	43	27	40	25
52.2	$13b_1$	59	36	56	36
52.7	18	108	96	107	94
53.3	13	57	45	54	41
53.8	18	81	26	71	14
54.4	38	189	206	218	248
54.9	16	48	55	43	47
55.4	15	38	54	36	52
55.7	17	63	24	62	23
56.2	$17b$	113	71	113	71
56.7	$14b$	73	60	73	59
57.1	12	32	12	32	32
57.6	14	48	34	48	48
58.2	30	187	171	186	170
58.7	(18)	46	33	46	33
59.0	$18b_2$	62	78	61	77
59.3	(13)	44	41	41	39
60.0	35	142	127	126	113
60.5	45	277	273	314	312
61.4	$15b_1$	64	50	60	45
61.9	26	146	126	144	124
62.4	13	14	24	14	24
62.7	13	45	36	44	35
4263.2	17	90	82	90	82

4234.5	20	88		85	
35.2	37	180		162	
36.0	51	404		450	
36.7	(25)	66		59	
37.1	38	202		198	
37.6	26	66		64	
38.0	35	148		146	
38.4	(31)	84		78	
38.8	43	214		225	
39.3	30	*e* 86		84	
39.8	50	238		237	
40.4	37	*e* 153		153	
40.7	(28)	81		81	
41.1	22	97		97	
41.7	18	55		55	
42.0	22	43		43	
42.4	41	175		175	
42.7	37	128		128	
43.4	39	215		215	
43.8	(23)	88		87	
44.3	12	36		36	
44.8	13	40		39	
45.3	37	200		199	
46.0	30	149		139	
46.8	40	218		257	
47.4	45	200		241	
48.3	40	236		231	
48.7	(30)	50		48	
48.9	(27)	91		85	
49.6	31	132		102	
50.1	53	274		327	
50.8	56	351		386	
51.3	—	41		27	
51.7	26	111		98	
52.3	32	177		170	
52.7	25	104		98	
53.3	22	66		61	
53.8	(33)	152		125	
54.3	55	310		401	
54.8	33	120		91	
55.2	26	50		45	
55.5	33	104		101	
55.8	33	90		88	
56.3	31	175		172	
56.7	(20)	83		80	
57.6	20	102		100	
58.2	41	211		209	
58.5	39	121		119	
58.9	31	86		84	
59.2	29	116		111	
60.1	54	244		184	
60.5	60	393		492	
61.5	(33)	146		135	
61.8	$36b$	144		141	
62.1	(32)	125		122	
62.7	15	*e* 42		41	
63.1	21	98		97	
4263.5	20	52		51	

4234.6	8	14	14
35.0	(14)	56	55
35.6	28	138	132
36.1	36	226	235
37.0	22	114	113
37.4	16	46	46
37.9	19	64	64
38.3	21	66	66
38.7	24	94	94
39.1	20	85	85
39.7	26	129	129
40.2	24	118	118
40.7	20	66	66
41.0	12	22	22
41.4	9	30	30
41.7	5	12	12
42.6	$25b_1$	198	198
43.4	19	88	88
43.8	22	96	96
44.3	10	34	34
44.7	8	14	14
45.2	16	81	81
45.6	19	68	68
46.0	16	82	82
46.8	21	80	80
47.2	29	134	134
47.7	26	120	120
48.3	19	58	58
48.6	$21b$	122	122
49.5	15	70	70
50.0	27	122	122
50.4	27	85	85
50.8	30	115	115
51.2	26	106	106
52.0	8	40	40
52.5	13	61	61
53.0	13	50	50
53.7	14	46	46
54.2	26	124	124
54.7	$25b$	126	126
55.4	18	96	96
56.0	19	104	104
56.6	(10)	46	46
57.1	$7b$	34	34
57.6	9	30	30
58.1	(18)	70	69
58.6	$26b$	132	132
59.0	(21)	82	80
59.5	14	54	50
60.0	(22)	66	51
60.5	$43b_2$	254	297
61.0	(34)	144	132
61.9	$22b$	128	125
62.3	18	65	64
63.1	11	31	31
63.5	10	45	45
4264.0	13	56	56

4263.8	12	44	45	43	45
64.2	18b_1	96	76	96	76
64.7	15	74	57	74	57
65.2	16	67	80	67	80
65.9	16	93	94	93	94
66.5	9	10	11	10	11
66.9	23	113	106	113	106
67.4	(14)	18	26	18	26
67.8	26	138	143	138	143
68.7	20*b*	129	116	129	115
69.2	19	23	76	23	76
69.6	18	67	69	66	68
70.1	(14)	92	49	90	46
70.6	(11)	15	19	13	16
71.1	36	175	191	167	189
71.8	43	262	257	314	316
72.6	12*b*	54	76	43	59
73.3	26	136	149	133	142
73.9	17	82	60	81	58
74.3	(14)	16	27	15	25
74.8	38	209	207	213	210
75.6	24	138	131	137	130
76.1	11	17	23	17	23
76.6	16	80	89	80	89
77.2	(14)	43	21	43	21
77.5	16*b*	80	72	80	72
78.2	22	117	126	117	126
78.9	(11)	71	54	71	54
79.5	(16)	51	72	51	72
79.9	18*b*	110	79	110	79
80.5	14*b*	87	84	87	84
81.0	18	105	107	105	107
81.9	14	37	40	36	40
82.4	31	157	153	159	153
83.0	30	148	149	147	149
83.6	(12)	27	29	27	29
84.2	20*b*	122	137	122	137
84.8	15	97	50	97	50
85.4	22	121	109	121	109
86.0	19	73	89	73	89
86.5	18	65	60	65	60
87.0	20	99	98	99	98
87.4	16	32	31	32	31
87.9	32	203	212	203	212
89.0	(22)	97	88	97	88
89.4	33b_1	112	117	112	117
89.8	39	162	170	162	170
90.3	39	193	205	193	205
91.0	25	120	123	120	123
91.5	20	81	96	81	96
92.2	18	113	107	113	107
93.1	16	69	100	69	100
93.6	(12)	15	16	15	16
94.1	38	225	223	225	223
94.8	22	96	90	96	90
4295.2	(15)	42	50	42	50

4263.9	(21)	48		48
64.2	30	133		132
64.7	26	95		95
64.9	17	14		14
65.3	24	121		121
65.9	10	95		95
66.9	26	141		141
67.3	22	66		66
67.9	36	247		246
68.8	32	158		155
69.4	32	153		150
69.8	36	136		134
70.2	30	111		102
70.7	(27)	79		57
71.2	56	234		273
71.7	57b_2	443		530
72.2	(44)	141		100
72.8	26	93		80
73.5	34	126		117
73.8	36	210		199
74.8	49	323		353
75.3	36	84		73
75.6	38	220		212
76.4	(19)	37		36
76.7	29	117		117
77.0	23	52		51
77.5	27	157		157
78.2	24	115		115
78.8	20	109		109
79.8	35*b*	238		237
80.4	38	228		228
81.0	31	132		130
81.3	(19)	39		37
81.7	—	21		17
82.0	(19)	47		33
82.5	42	227		277
82.9	36	197		189
84.2	31	220		217
84.8	28	165		164
85.4	31	128		127
86.0	36	219		219
86.5	29	84		84
87.0	31	140		140
87.4	21	61		60
88.0	37	234		233
88.7	—	61		59
89.0	38	143		139
89.3	(46)	120		108
89.7	53	275		317
90.2	47	222		208
91.0	39	204		201
91.4	34	144		143
92.1	37	250		248
93.0	20	87		84
93.5	(14)	14		10
94.1	48	341		370
94.8	31	66		61
4295.1	31	170		166

4264.7	16*b*	108	108
65.2	14	47	47
65.8	14	82	82
66.3	7	20	20
66.9	15	70	70
67.4	16	58	58
67.8	20	82	82
68.2	22	98	98
68.8	12	24	24
69.2	17	92	91
69.8	17	74	74
70.2	18	77	75
70.7	12	20	18
71.1	(27)	98	92
71.6	42b_2	214	298
72.2	(40)	222	172
72.9	13	41	39
73.3	15	40	39
73.8	22	114	114
74.3	18	60	60
74.8	24b_1	112	112
75.2	27	98	98
75.8	23*b*	118	118
76.2	13	32	32
76.7	11	36	36
77.1	12	74	74
77.8	10	38	38
78.2	14	62	62
78.7	12	46	46
79.2	11	32	32
79.7	18	92	92
80.2	20	96	96
80.7	18	62	62
81.0	18	98	98
81.7	9	17	17
82.3	21	84	84
82.9	26	158	158
83.3	17	46	46
84.1	15	64	64
84.6	16	60	60
85.4	20	114	114
85.9	23	99	99
86.4	21	90	90
87.0	21	88	88
87.4	16	54	54
87.9	21	87	87
88.3	22	113	113
89.1	28b_1	146	146
89.7	35	176	176
90.2	33	152	152
90.8	24	129	129
91.4	27	131	131
92.0	17	74	74
92.4	16	82	82
93.1	13	41	41
93.5	15	52	52
94.1	25	123	123
4294.5	25	105	105

4295.8	18	94	108	94	108
96.7	29	160	174	160	174
97.2	(16)	62	35	62	35
97.6	(12)	16	48	16	48
98.1	22	116	130	116	130
99.2	42	329	347	329	347
4300.1	38	223	220	223	220
00.7	25*b*	82	93	82	93
01.2	26	141	140	141	140
02.0	34	179	194	179	194
02.6	36	193	198	193	198
03.2	29	136	154	136	154
03.9	18	102	103	102	102
04.6	18*b*	80	133	79	132
05.1	(17)	40	33	40	32
05.5	32	137	167	136	166
05.9	32	160	170	160	167
06.8	19*b*	108	123	102	117
07.9	54	357	419	393	462
08.6	(13)	20	33	13	23
09.1	(26)	83	119	80	113
09.6	32b_1	218	223	216	219
10.5	19b_1	101	230	100	128
10.8	(15)	33	46	33	46
11.2	17	53	81	52	80
11.5	15	50	79	50	79
12.2	15b_1	51	85	51	85
12.8	32	187	229	187	229
13.5	(13)	11	32	11	32
14.1	34	*e*209	254	209	254
15.0	41	*e*267	286	267	286
16.0	12	38	101	38	101
16.8	19	92	138	92	138
17.3	15	28	49	28	49
17.7	12	37	47	37	46
18.1	(10)	23	22	23	20
18.7	30	165	206	165	213
19.4	12	31	48	31	47
19.6	12	21	35	21	35
20.0	12	23	52	23	52
20.8	36	242	303	242	303
21.8	16b_1	65	145	65	145
22.5	(13)	47	75	47	74
23.0	(18)	37	52	37	52*
23.3	19b_1	62	97	62	96
23.9	17*b*	81	142	81	141
24.4	(16)	26	64	25	61
25.0	34	166	202	161	189
25.8	48	281	349	304	390
26.6	(17)	28	43	24	38
27.0	24b_1	148	174	143	170
27.9	20*b*	81	145	81	144
28.6	18b_2	33	65	33	65
4329.0	16	39	39	39	39

4295.8	30	140		139	
96.1	(24)	66		66	
96.7	36	154		153	
97.0	36	167		167	
97.4	25	55		55	
97.7	(26)	49		49	
98.0	32	172		172	
98.7	—	121		121	
99.1	55b_2	323		323	
99.5	—	175		175	
4300.1	52	244		244	
00.5	45	208		208	
01.0	37	181		181	
01.9	41b_2	306		306	
02.6	47	235		235	
03.1	41	213		213	
03.7	36	244		243	
04.5	34	198		197	
05.2	41b_2	306		303	
06.0	44b_1	302		298	
06.7	34	209		199	
07.5	(48)	182		125	
07.9	(100)	503		715	
08.3	(46)	237		174	
08.9	43	177		168	
09.4	45	246		241	
10.0	(36)	172		170	
10.4	35	175		173	
10.9	32	159		157	
11.6	34	194		193	
12.2	32	133		133	
12.8	41b_1	296		296	
13.6	18	66		66	
14.2	41	264		264	
15.0	43	297		297	
15.6	—	20		20	
16.1	—	22		22	
16.8	21	120		120	
17.3	16	65		65	
18.2	—	24		24	
18.7	28	210		210	
19.5	14	80		80	
20.6	(35)	126		126	
20.8	37	192		192	
21.2	—	29		29	
21.7	21	132		131	
22.6	12	34		33	
23.0	—	114		113	
23.4	36*b*	193		192	
23.9	30*b*	96		94	
24.2	(28)	115		111	
25.1	48	325		313	
25.8	58b_1	479		537	
26.4	—	67		53	
26.9	30	234		225	
27.9	24	165		163	
28.7	10	36		36	
4329.1	14	44		44	

4295.1	20	95	95
95.7	13	75	75
96.5	(15)	73	73
97.1	25	120	120
97.5	23	96	96
98.1	19	92	92
98.6	(18)	62	62
99.2	38b_2	235	235
99.7	(33)	117	117
4300.0	33	128	128
00.5	33	157	157
01.2	32	236	236
02.1	(30)	168	168
02.7	35	152	152
03.2	33	182	182
03.9	25	148	148
04.4	23	104	104
04.9	19*b*	88	88
05.4	(23)	89	89
06.0	33	233	233
06.6	19*b*	73	72
07.0	22	86	82
08.0	45	474	491
08.8	28	106	102
09.3	25	144	142
09.7	31	110	109
10.2	24	166	165
10.8	23	112	112
11.4	25	155	155
12.0	21	83	83
12.5	(23)	72	72
13.0	27	212	212
14.2	24b_2	202	202
15.2	27	217	217
16.6	9b_1	45	45
17.2	13	72	72
18.3	15b_1	96	96
18.8	16	73	73
19.5	7	45	45
20.7	24b_1	218	218
21.6	21	66	66
22.2	11	56	56
23.0	21	82	82
23.6	25	208	207
24.2	(18)	64	62
24.8	22	74	71
25.2	(31)	140	124
25.9	40	342	383
26.9	22	124	115
27.5	14	96	94
28.2	14	93	92
4328.9	11	56	55

1939PUAms...6....1P

4329.6	15	28	103	no corr.	no corr.
30.3	25*b*	111	125		
30.8	28	106	139		
31.6	22*b*	70	127		
32.1	(18)	30	59		
32.7	20	29	78		
33.1	22	38	81		
33.8	24*b*	72	160		
34.8	(22)	26	85		
35.4	24	41	52		
36.1	(28)	41	90		
37.0	$40b_2$	108	135		
37.9	44	107	151		
38.6	36	18	52		
39.0	36	8	25		
39.5	46	41	85		
40.5	76				
41.3	47	49	53		
41.8	(40)	18	40		
42.3	36	40	46		
43.3	34*b*	54	94		
43.8	(32)	32	48		
44.5	$38b_1$	152	160		
45.4	23	28	30		
46.0	24*b*	20	91		
46.7	28*b*	100	119		
47.1	(22)	28	64		
47.9	22*b*	104	141		
49.0	20*b*	82	116		
49.6	18	42	57		
50.1	18*b*	71	85		
50.9	27	168	167		
51.9	46	298	331		
52.8	30	161	166		
53.3	(18)	44	70		
53.8	16*b*	67	95		
54.6	22*b*	118	151		
55.1	22*b*	101	138		
55.7	17	45	84*		
56.1	16*b*	49	40		
56.5	(15)	65	81		
56.9	14*b*	45	65		
57.5	15	89	90		
58.6	24*b*	183	248		
59.6	26	181	183		
60.3	(14)	79	41		
60.9	16	30	101		
61.4	(12)	31	55		
61.7	(12)	28	50		
62.2	14*b*	49	72		
62.6	16	85	69		
63.2	16	99	72		
64.0	13	73	75		
4364.7	13	60	99		

4329.3	15	69		no corr.
30.2	$25b_1$	143		
30.6	30	65		
30.8	30	164		
31.6	23	155		
32.6	24	*e* 81		
32.8	27	156		
33.8	27	209		
34.9	19	110		
35.4	14	67*		
36.3	14	67		
37.0	44	229		
37.5	43	148		
37.9	42	154		
38.3	(35)	98		
38.7	32	101		
39.7	49	276		
40.4	66			
41.4	41	122		
42.0	$27b_2$	147		
43.3	$35b_2$	220		
43.8	(30)	94		
44.5	37	232		
45.0	(22)	79		
46.0	19	88*		
46.3	—	70		
46.7	$28b_1$	166		
47.3	21	92		
47.9	27	176		
48.4	18	64		
49.0	20	111		
49.8	12	46		
50.2	18	73		
50.7	(29)	71		
51.0	35	192		
51.9	48	411		
52.8	39	271		
53.6	18	78		
54.0	19	57		
54.5	27*b*	194		
55.1	25	113		
55.9	$23b_1$	147		
56.4	19	58		
56.8	17	81		
57.2	13	15		
57.6	15	70		
58.0	21	71		
58.8	36	273		
59.7	36	244		
60.3	20	80		
60.8	21	116		
61.3	(12)	50		
62.1	15*b*	101		
62.6	18	68		
63.1	23	129		
63.5	(20)	66		
64.1	19	101		
4364.7	11	44		

4329.4	11*b*	46	46
29.9	$14b_1$	68	68
30.5	19	91	91
30.9	19	82	82
31.8	14	114	114
32.5	14	64	64
33.1	15	92	92
33.9	16	149	149
34.9	17	132	132
35.8	17*b*	130	129
37.0	$31b_1$	210	216*
37.7	32	96	94
38.2	33	122	121
39.4	(37)	25	25
40.4	58		
41.1	(46)	32	32
41.6	(34)	34	34
42.2	26	48	48
43.1	26	72	72
43.6	27	104	104
44.5	28	211	221
45.5	16	105	105*
46.3	19	126	126
46.9	(15)	107	107
47.7	17	71	71
48.1	17	67	67
48.5	14	48	48
48.9	13	52	52
49.3	12	42	42
50.0	14	84	84
50.9	21	154	154
51.9	36	342	342
52.6	24	91	91
53.0	21	81	81
53.6	13	59	59
54.4	17	94	94
54.9	19	88	88
55.3	17	62	62
55.9	$15b_2$	80	80
56.6	(12)	94	94
57.5	(13)	90	90
58.7	$19b_1$	192	192
59.8	23	188	188
61.0	12	158	158
61.9	(8)	30	30
62.4	15	80	80
63.3	$14b_1$	151	151
64.3	14	49	49
4364.6	11	46	46

4365.3	(10)	31	51	31	51
66.1	15		111		111
66.8	(11)		71		71
67.7	$31b_2$		254		254
68.2	—	*e*	30		30
68.7	(11)		42		42
69.4	(20)		58		58
69.8	26		154		154
70.2	(13)		41		41
71.3	20	149	157	149	157
72.0	9	34	27	34	27
72.6	11	52	43	52	43
73.0	10	47	36	47	36
73.7	$15b_1$	89	74	89	74
74.5	30	179	163	179	163
75.0	30	182	165	182	165
75.9	24	169	144	169	144
76.6	$12b_2$	50	50	50	50
77.1	11	46	54	46	54
77.8	10	67	42	67	42
78.4	9	54	39	54	39
79.2	$16b_1$	116	90	116	90
79.7	14	65	50	65	49
80.2	12	52	37	52	37
80.7	13	85	48	84	47
81.4	10	61	85	58	81
82.2	10	44	34	39	30
82.7	18	91	90	71	70
83.6	44	331	333	403	402
84.4	—	81	35	58	18
84.8	27*b*	133	176	129	170
85.3	28	166	154	162	150
86.1	8	32	22	32	21
86.8	18	140	112	139	111
87.8	$17b_1$	116	109	115	108
88.4	21	124	139	124	139
88.8	(13)	23	12	23	12
89.3	12	72	62	72	62
90.0	14*b*	82	84	82	84
90.6	17	64	61	64	61
91.0	24	134	137	134	137
91.7	$13b_1$	74	65	74	65
92.2	(10)	39	36	39	36
92.7	10	47	43	47	43
93.3	12	57	71	57	71
94.0	20	140	123	140	123
95.0	30	253	250	253	250
95.9	18	104	81	104	81
96.3	(10)	38	20	38	20
97.0	8	54	45	54	45
97.5	10	38	6	38	6
98.1	17	121	136	121	136
98.9	8	37	22	37	22
99.7	26	184	173	184	173
4400.5	24	151	126	151	126

4365.5	12*b*	62		62
65.9	(15)	60		60
66.5	21	151		151
67.2	—	32		32
67.7	38	194		194
68.0	38	*e* 189		189
68.4	—	37		37
68.7	(17)	75		75
69.4	—	67		67
69.8	34	194		194
70.2	(20)	78		78
71.2	23	307		307
72.4	19*b*	94		94
72.9	24	*e* 110		110
73.2	(23)	74		74
73.7	26*b*	133		133
74.3	$36b_2$	238		237
75.0	$40b_2$	197		195
75.4	—	111		104
76.0	$36b_1$	259		279
76.9	18	92		88
77.4	24	170		169
78.0	(14)	20		20
78.3	18	84		84
79.3	26	200		198
80.1	21*b*	114		111
80.7	27*b*	178		175
81.1	—	93		89
82.1	(24)	160		150
82.9	(45)	309		248
83.6	58	444		674
84.2	—	168		126
84.8	47	269		252
85.3	(42)	246		239
85.9	—	102		96
87.0	$28b_1$	237		234
87.5	27	105		103
88.1	$30b_1$	141		140
88.6	30	208		207
89.3	26	115		115
90.0	34	210		210
90.5	30	144		144
91.0	31	156		156
91.8	36	276		276
92.6	20*b*	88		88
93.0	—	56		56
93.4	28	*e* 154		154
94.0	30	195		194
95.1	46	502		508
96.0	25*b*	69		68
96.2	—	81		81
96.6	—	35		35
97.2	18	132		132
98.1	24*b*	182		182
98.8	22	94		94
99.2	22	65		65
99.8	35	194		194
4400.6	36	232		232

4365.3	8	50	50
65.9	11	52	52
66.7	$13b_1$	104	104
67.9	$23b_1$	268	268
69.0	9	32	32
69.8	22*b*	160	160
70.3	(16)	71	71
71.3	21*b*	96	196
72.3	10	30	30
72.8	13	57	57
73.4	14*b*	102	102
74.0	(17)	78	78
74.4	(22)	67	67
74.9	25*b*	160	160
75.4	21	71	71
75.9	22	138	138
76.5	(14)	60	60
77.2	12	66	66
77.6	11	44	44
78.2	12	62	62
78.7	11	34	34
79.3	12	64	64
79.7	15	51	49
80.1	11*b*	34	33
80.8	13*b*	143	137
82.1	9	37	26
82.7	16	62	42
83.6	$41b_1$	485	582
85.0	28*b*	370	341
86.3	10	32	30
86.8	14	57	55
87.2	17	104	102
88.2	17	132	131
88.7	17	94	94
89.2	13	42	42
89.6	17	78	78
90.1	$17b_1$	112	112
91.0	20	162	162
91.7	21	80	80
92.2	16	91	91
93.4	14	80	80
94.0	$18b_2$	152	152
95.0	24	116	116
95.5	$25b_2$	168	168
96.2	14	56	56
96.7	10	39	39
97.2	10	52	52
97.8	13	54	54
98.3	16	72	72
98.7	15	58	58
99.6	17	88	88
4400.1	$22b_1$	104	104
00.6	21*b*	118	118

4401.5	27	271	219	269	218	4401.0	—	107		106		4401.5	16	261	259
02.7	10	67	21	66	21	01.5	39	280		279		02.8	10	24	22
03.3	$13b_1$	90	98	86	94	02.6	$13b_1$	58		56		03.4	16	112	106
04.1	(12)	49	36	35	22	03.3	$28b$	176		172		04.0	14	26	15
04.8	38	291	288	343	334	03.6	(25)	50		48		04.8	37	412	458
05.6	(8)	37	31	28	24	04.1	—	194		174		05.8	12	24	20
06.4	$10b_1$	60	55	57	53	04.8	$52b_1$	509		571		06.2	12	49	45
06.9	10	52	7	51	7	05.6	26	88		77		06.7	12	64	62
07.6	20	121	115	120	114	06.0	23	103		99		07.4	20	116	114
08.4	23	157	152	156	151	06.7	28	194		190		07.8	$22b_2$	116	116
09.1	16	80	48	80	48	07.3	(22)	64		63		08.5	$20b_2$	149	149
09.4	14	61	79	61	79	07.8	33	210		209		09.2	13	50	50
10.4	$12b_1$	78	65	78	65	08.5	42	282		281		09.6	13	31	31
11.2	17	112	93	112	93	09.3	$27b$	234		233		10.2	15	64	64
12.0	14	64	78	64	78	10.2	20	85		85		10.6	16	54	54
12.7	8	45	50	45	50	10.7	22	115		115		11.0	15	60	60
13.7	$12b$	120	65	119	65	11.1	22	131		130		11.7	14	108	108
14.2	11	19	14	18	14	12.1	25	204		203		12.3	12	48	47
15.1	34	268	220	281	220	12.8	8	21		19		12.9	9	46	46
15.6	(24)	121	94	115	94	13.3	(15)	67		64		13.7	12	93	90
16.3	(10)	15	14	15	14	13.9	$25b$	154		148		15.1	$32b_1$	362	384
16.8	24	165	137	165	137	14.3	—	72		63		16.4	18	120	115
17.7	25	158	150	158	150	15.0	50	555		600		16.9	16	62	61
18.3	19	124	83	124	83	16.4	26	116		110		17.3	19	70	70
18.9	(10)	32	29	32	29	16.9	28	142		139		17.8	19	105	104
19.3	9	44	37	44	37	17.7	$28b$	248		246		18.5	15	97	97
20.1	$11b$	93	72	93	72	18.4	26	160		159		19.0	11	30	30
20.8	10	39	30	39	30	19.0	22	117		116		19.9	8	36	36
21.3	$10b$	48	39	48	39	19.9	(16)	99		98		20.3	8	47	47
21.9	$16b$	114	87	114	87	20.7	$19b$	142		142		20.8	7	30	30
22.7	22	153	128	153	128	21.6	$27b$	278		275		21.7	$14b_1$	99	99
23.2	14	59	41	59	41	22.6	$34b$	245		244		22.3	$19b$	106	106
23.6	10	22	42	22	42	23.2	33	178		178		22.9	(18)	112	112
24.2	$12b$	90	61	90	61	24.3	27	274		267		24.0	$12b$	153	153
24.8	(11)	36	6	36	6										
25.5	24	181	142	181	142	25.6	33	365		391		25.4	18	165	165
26.1	(9)	26	27	26	27	26.6	—	13		6		26.1	11	61	61
26.4	(7)	36	13	36	13	27.3	37	370		383		27.2	21	225	225
27.3	26	208	192	208	192	28.7	$21b_1$	156		151		28.2	7	27	27
28.0	9	18	23	18	23	29.2	17	72		71		28.6	6	18	18
28.5	10	62	44	62	44	29.6	—	21		21		29.1	7	34	34
29.1	(9)	46	43	46	43	30.1	$38b_2$	265		265		29.9	(16)	55	55
29.9	(16)	104	60	104	60	30.7	37	215		215		30.4	$22b$	138	138
30.6	$23b_1$	155	178	155	178	31.5	21	105		105		30.9	(17)	85	85
31.5	$12b$	75	52	75	52	32.2	$23b$	157		157		31.7	14	84	84
32.0	13	73	80	73	80	32.7	18	63		63		32.3	13	70	70
32.7	(14)	64	35	64	35	33.3	28	159		159		32.9	(15)	97	97
33.2	18	133	90	133	90	34.0	$31b$	219		219		33.6	17	102	102
33.8	18	119	120	119	120	34.6	(26)	67		67		34.1	13	47	47
35.0	28	209	202	209	202	35.0	42	305		305		35.0	$24b$	270	270
35.7	23	133	125	133	125	35.7	(33)	188		188		35.9	(18)	100	100
36.4	$13b$	77	55	77	55	36.3	$29b_2$	181		181		36.6	15	77	77
37.0	14	79	64	79	64	37.0	22	105		105		37.1	12	65	65
37.8	$10b_1$	65	40	65	40	37.8	25	168		168		37.8	10	30	30
38.3	14	94	96	94	96	38.4	22	144		144		38.2	11	52	52
39.2	8	41	31	41	31	39.2	12	51		51		38.8	10	40	40
39.8	11	70	38	70	38	39.9	19	121		121		39.8	$10b_1$	93	93
4440.4	$12b$	79	55	79	55	4440.5	23	131		130		4440.7	13	92	92

4441.0	12	57	59	no corr.	no corr.	4441.1	27	153		150		4441.4	13	52	no corr.
41.7	16	95	109			41.8	31	148		138		42.0	20	104	
42.3	22	137	138			42.5	36	251		286		42.6	22	131	
43.1	22	134	125			43.3	$33b_1$	234		224		43.4	22	207	
43.8	29	180	175			43.9	33	175		173		44.1	17	68	
44.6	17	130	66			44.3	30	222		221		44.6	(14)	70	
45.2	—	22	18			45.5	19	131		130		45.4	7	49	
45.8	9	42	45			46.3	17	61		60		46.0	7	30	
46.3	8	34	19			47.0	28	186		182		46.8	(15)	103	
46.8	12*b*	95	47			47.7	32	254		267		47.6	19	184	
47.1	16	35	66			48.5	—	14		13					
47.8	22	170	137			49.3	22*b*	222		220		49.1	13	107	
48.6	(8)	27	35			50.5	33*b*	*e*385		385		50.5	19*b*	214	
49.2	12*b*	115	60			51.7	24	127		127		51.4	14	67	
50.4	25	236	205			52.1	20	81		81		51.9	12	59	
51.6	16	110	138			52.8	25	132		132		52.8	13	110	
52.5	11	52	55			53.2	$27b_2$	169		169		53.5	12	48	
53.2	14*b*	122	82			53.8	—	63		63					
53.8	10	30	27			54.9	44	395		395		54.8	$31b_1$	411	
54.9	33*b*	362	351			55.3	—	137		137					
55.9	22	132	130			56.0	29	154	126	154	126	56.0	$21b_1$	173	
56.6	16*b*	98	78			56.5	$26b_2$	234	166	234	166	56.6	17	57	
57.2	12	27	28			57.5	28	200	170	200	170	57.2	16	86	
57.5	16	74	77			58.2	28*b*	255	204	255	204	57.9	18	160	
58.2	20	138	129			59.2	36	285	235	285	235	59.2	25	303	
59.1	28	234	220			59.8	(25)	110	58	110	58				
60.2	12	78	88			60.3	28	193	135	193	135	60.4	14	76	
61.2	(23)	103	131			61.2	$37b_1$	179	79	179	79				
61.7	28*b*	152	142			61.7	38*b*	282	202	282	202	61.5	26*b*	292	
62.0	(24)	86	76			62.3	(33)	279	295	279	295	62.3	23	104	
62.5	(16)	63	60			63.4	$23b_1$	227	169	227	169	52.8	11	37	
63.2	12*b*	83	79			64.8	32	379	255	379	255	63.3	10	41	
63.8	—	11	27			65.2	(26)	*e*	84	*e*	84	63.7	9	13	
64.5	25	230	240			65.8	(23)	*e*	86	*e*	86	64.5	23	233	
65.5	(9)	69	63			66.7	32	*e*	208	*e*	208	65.5	9	36	
66.6	23	192	215			67.1	—	*e*	78	*e*	78	66.3	(19)	98	
67.8	(11)	34	43			67.6	(20)	38	57	38	57	66.8	20	157	
68.5	28	197	201			67.9	(18)	72	42	72	42				
69.3	26	175	173			68.5	30	225	177	225	177	68.3	22	131	
70.4	(17)	102	96			69.4	34	342	251	342	251	68.8	22	94	
70.9	$19b_1$	105	135			70.1	23	48	65	48	65	69.4	20	144	
71.5	(10)	30	23			70.6	24*b*	138	132	138	132	70.3	16	71	
72.0	9	31	23			71.1	22*b*	89	70	89	70	71.0	18	153	
72.5	(12)	33	33			71.7	$24b_1$	220	144	220	144	71.8	10	39	
72.9	$18b_1$	130	142			72.9	28	291	215	291	215	72.8	16	159	
73.6	9	74	34			73.8	14	92	69	92	69	73.6	9	18	
74.5	10	62	64			74.7	22*b*	184	193	184	193	74.4	8	61	
75.0	10	30	77			75.3	(17)	57	28	57	28	75.0	9	36	
75.4	—	23	13			76.0	28	273	197	273	197	76.1	21	203	
76.1	26	209	230			76.9	(15)	27	53	27	53	77.0	6	31	
77.2	10	78	57			77.3	(14)	52	47	52	47	77.6	6	32	
77.8	10	43	73			78.0	14	104	77	104	77	78.1	9	37	
78.6	12	92	88			78.7	15	*e* 84	78	84	78	78.6	11	39	
79.6	16	102	103			79.6	(28)	177	137	177	137	79.2	15	58	
80.1	16	88	115			80.1	$30b_1$	217	150	217	150	80.0	19	69	
						80.6	(27)	60	92	60	92				
81.2	37	356	314			81.2	31*b*	302	222	302	222	81.0	$26b_2$	280	
4482.2	27	192	206			4482.2	34	279	207	279	207	4482.2	$14b_1$	234	

4482.8	(14)	56	44	no corr.	no corr.
83.4	9	26	34		
84.3	17	147	156		
85.0	6	7	17		
85.7	14	104	125		
86.6	9	42	40		
87.1	8	30	66		
87.7	(10)	18	34		
88.3	18b_1	134	129		
89.2	22	141	165		
90.0	17b	105	125		
90.8	14	78	59		
91.4	19	126	150		
92.3	9b	41	43		
92.7	10	41	43		
93.6	12	60	98		
94.6	23	210	186		
95.4	10	32	56		
96.0	13	81	75		
96.9	16	131	146		
98.0	8	45	54		
98.8	12	48	65		
99.1	12	79	66		
99.9	9	48	12		
4500.4	10b	46	57		
01.3	28	238	218		
02.3	10b_2	38	73		
02.7	8	39	22		
03.1	—	17	28		
03.7	8	39	49		
04.4	8	29	43		
05.0	8	46	38		
05.4	6	21	24		
06.1	8	58	35		
06.8	9	54	39		
07.4	7	18	43		
08.3	21	186	178		
09.5	10	100	71		
10.5	7	22	63		
11.2	8	54	55		
12.0	10	85	61		
12.8	11	88	69		
13.6	10	38	42		
14.4	12	120	93		
15.4	22	197	173		
16.5	7	24	31		
16.9	12	66	67		
17.6	(14)	92	65		
18.2	16b_2	125	103		
18.9	10	52	44		
20.2	21	224	201		
21.1	8	19	7		
21.5	8	39	27		
22.7	27	282	252		
23.6	(11)	72	49		
24.3	—	28	20		
4525.1	22b_1	219	196		

4482.8	25	132	102	132	102
83.4	17	*e*	53	—	53
83.9	18	*e*	54	—	54
84.3	20	131	115	131	115
84.9	—	45	30	45	30
85.7	18	*e*181	153	181	153
86.9	14	*e* 92	47	92	47
87.3	16	*e* 54	109	54	109
88.2	25	234	185	234	185
89.1	29	227	195	227	195
89.9	28b	270	219	270	219
90.7	26	178	145	178	145
91.6	22	198	172	197	172
92.5	17	138	101	137	101
93.5	(21)	112	82	107	82
94.0	(27)	147	133	134	133
94.6	35b_1	329	260	363	260
95.4	22	119	87	113	87
96.1	26	200	159	198	159
96.9	24	*e*172	152	171	152
97.7	18	137	121	136	121
98.8	22	215	213	214	213
99.6	(12)	43	23	43	23
4500.3	18b_1	141	125	141	125
01.2	30b_2	268	192	268	192
01.8	(22)	125	94	125	94
02.3	(19)	111	125	110	125
02.9	10	30	38	30	38
03.8	12	114	66	114	66
04.8	16	150	145	150	145
05.9	13	82	87	82	87
06.7	16b	130	98	130	98
07.3	16	87	72	87	72
08.2	22b	255	201	255	201
09.4	16b_2	79	98	79	98
09.7	(16)	74	67	74	67
10.1	(11)	45	45	45	45
11.0	12	82	102	82	102
11.9	18b_1	140	128	140	128
12.8	20	185	146	185	146
13.6	17b	112	97	112	97
14.4	25	236	189	236	189
15.4	25	222	186	222	186
16.5	15b	107	130	107	130
17.6	22b_1	223	135	223	135
18.1	24b_1	88	106	88	106
18.5	24	229	138	229	138
20.0	24	*e*303	258	303	258
21.3	(10)	41	64	41	64
22.7	34	384	305	384	305
23.3	—	57	64	57	64
24.0	(13)	40	58	39	58
4525.1	28	313	250	312	249

4483.0	10	25	no corr.
83.7	13	70	
84.4	13	96	
85.5	13	137	
86.6	8	48	
87.2	9	24	
87.7	(12)	50	
88.3	16	107	
88.9	(18)	85	
89.8	21b_2	234	
90.9	15b	136	
91.6	14b	76	
92.1	8	5	
92.5	11	51	
93.0	10	49	
93.7	(11)	40	
94.6	20b	255	
95.7	16	62	
96.1	13	52	
96.9	16	157	
97.9	8	31	
98.5	11	49	
98.9	14	73	
99.3	12	45	
4500.0	9	46	
00.4	9	27	
01.2	21	213	
02.2	14	79	
02.8	(9)	57	
03.6	10	79	
04.5	11	53	
05.0	10	41	
05.4	8	23	
05.9	9	40	
06.8	10	91	
07.8	16	90	
08.4	15b	96	
09.1	10	46	
09.6	11	68	
10.4	9	66	
11.2	10	53	
11.7	10	41	
12.1	13	51	
12.6	14	75	
13.5	(11)	91	
14.3	17b_2	120	
15.3	19b	18	
16.3	11	58	
17.0	13b_1	76	
17.7	18	124	
18.4	19b	126	
19.3	9	27	
20.3	16b	187	
21.3	13	56	
22.7	25	291	
23.9	9	42	
24.8	22	161	
4525.4	27	65	

4526.5	20*b*	123	154	123	154	4526.5	30*b*	289	251	288	250	4526.5	22*b*	275	no
26.9	(19)	88	36	88	36	27.0	(27)	61	68	60	68				corr.
27.3	(15)	63	83	63	83	27.4	26	178	132	172	128	27.4	17	80	
28.6	28	240	232	240	232	28.0	—	44	27	33	19	27.9	13	28	
29.6	22	187	130	187	130	28.7	40	395	325	446	355	28.7	28	263	
31.1	22*b*	265	215	265	215	29.6	31	246	228	236	222	29.6	21	179	
31.8	(12)	42	63	42	63	31.0	36	424	292	423	291	31.1	24	290	
32.5	—	34	8	34	8	· 31.7	(23)	97	118	96	118	32.1	10	24	
33.1	21	172	119	172	119	33.2	28	246	223	245	123	33.0	(21)	171	
34.0	32	269	247	269	247	34.0	32	251	204	251	204	34.1	25	285	
34.9	16	81	104	81	104	34.8	26	138	160	138	160				
35.9	24	269	211	269	211	35.8	38	457	374	457	374	35.8	26	341	
37.0	10	62	52	62	52	37.3	$10b_2$	72	34	72	34	37.1	7	35	
37.7	10	38	24	38	24										
38.0	10	46	42	46	42	37.9	12	38	86	38	86	37.7	10	66	
38.7	12	82	32	82	32	38.7	21	205	180	205	180	38.8	13	127	
39.1	11	49	50	49	50	39.8	22	165	142	165	142	39.8	12*b*	98	
39.7	11	40	76	40	76	40.6	26	206	192	206	192	40.5	16	78	
40.7	16	157	114	157	114	41.1	(24)	56	85	56	85	41.4	17	180	
41.5	20	148	159	148	159	41.7	24	181	118	181	118	42.2	15	53	
42.6	12	80	86	80	86	42.5	22	197	119	197	119	42.7	13	60	
43.1	10	40	30	40	30	43.1	(10)	14	14	14	14	43.2	11	32	
43.9	14	93	69	93	69	43.9	22	142	154	142	154	43.9	14	59	
44.7	15	97	77	97	77	44.7	28	169	186	169	186	44.4	16	55	
45.1	15	103	86	102	86	45.3	(26)	165	151	165	151	44.9	18	98	
46.0	14	93	107	93	107	45.9	20	113	100	113	100	45.7	17	129	
47.0	14*b*	144	110	142	109	47.0	26	236	240	236	240	46.6	(16)	100	
47.9	16	126	109	120	107	47.9	18	107	109	106	108	47.3	19	132	
48.9	—	48	30	36	25	48.8	22	114	124	112	117	48.0	16	80	
49.6	42	435	405	487	431	49.7	44	451	411	462	433	49.5	34	381	
50.9	15	117	107	108	103	50.9	18	121	101	117	97	50.8	(14)	136	
51.6	10	19	31	17	30	51.5	(16)	65	76	65	75	52.5	19	216	
52.5	18	198	145	197	145	52.5	29	304	286	300	272	54.1	25	245	
54.0	27	237	230	238	230	53.2	(18)	46	43	41	36	54.9	(14)	51	
55.0	16	117	91	116	91	54.1	34	341	324	378	380	56.0	26	309	
56.0	27	286	246	286	246	55.1	(24)	102	152	93	140	57.1	10	57	
57.1	10	43	57	43	57	56.0	$30b_1$	383	254	379	249	57.8	10	30	
57.8	9	31	17	31	17	57.2	$16b_1$	108	132	107	131	58.4	18	114	
58.7	22	218	177	218	177	58.5	20	267	226	266	225	58.9	17	94	
59.7	10	64	23	64	23							59.7	10	28	
60.3	12	75	91	75	91	60.1	$21b_2$	194	197	194	197	60.1	14	57	
61.1	$12b_2$	56	26	56	26	61.0	18*b*	160	176	160	176	60.6	11	46	
61.4	(9)	51	44	51	44							61.2	11	76	
62.4	$11b_2$	124	72	124	72	62.5	15	95	145	95	145	61.9	10	45	
63.8	26	230	224	230	224	63.8	$28b_1$	281	*e*295	281	295	62.5	10	59	
64.8	14	92	60	92	60	64.8	$24b_1$	168	154	168	154	63.7	22	239	
65.6	18*b*	199	164	199	164	65.6	34	297	284	297	284	64.6	14	51	
66.9	12	113	82	113	82	66.6	$19b_1$	92	104	92	104	65.5	22*b*	226	
67.7	—	40	32	40	32	67.0	(18)	88	113	88	113	66.7	13*b*	141	
68.3	16	113	26	113	26			*e*				67.5	(8)	32	
68.8	12	39	67	39	67	68.7	$20b_1$	225	202	225	202	68.7	13	151	
69.4	10	72	42	72	42	69.6	16	116	131	116	131	69.7	11	64	
70.0	8	50	26	50	26							70.9	14*b*	78	
71.0	14	123	71	123	71	71.0	28	224	223	224	215	71.4	18	65	
72.0	23	275	265	275	265	71.9	$34b_1$	311	334	311	357	72.0	23	225	
73.1	8	72	34	72	34	72.9	(13)	74	67	74	62	73.5	7*b*	47	
74.2	13	78	65	78	65	74.2	(17)	72	147	72	147	74.2	12	65	
4574.8	14	95	85	95	85	4574.9	20*b*	214	135	214	134	4574.9	13	87	

4575.6	14	68	20	no corr.	no corr.
76.4	18	161	156		
77.4	10*b*	92	53		
78.2	(16)	59	38		
78.7	$17b_1$	126	92		
79.3	13	42	31		
80.0	$16b_2$	102	108		
80.5	—	97	57		
81.5	24	214	202		
82.9	17	158	108		
83.9	27	299	238		
84.8	12	50	48		
86.0	21	239	226		
87.2	14	104	78		
87.8	12	30	18		
88.3	17*b*	151	151		
89.0	9	19	34		
90.0	19	186	171		
90.9	11	43	7		
91.5	14	82	101		
92.1	(21)	92	29		
92.6	$22b_1$	181	201		
93.9	10	89	56		
94.5	10	22	21		
94.9	—	33	23		
95.3	$15b_1$	98	72		
95.7	(15)	37	48		
96.0	16*b*	107	78		
96.4	(10)	10	25		
97.0	(11)	89	64		
98.0	18	171	170		
98.7	(10)	49	23		
4600.0	16	116	85		
00.4	16	69	72		
00.8	16	108	109		
01.4	(12)	37	31		
02.0	12	85	58		
03.0	18	192	171		
03.9	(8)	38	20		
04.5	11	58	46		
05.0	14	100	62		
05.6	14	102	88		
06.4	11	107	62		
07.5	14*b*	164	135		
08.6	8	73	52		
09.4	13	89	40		
10.1	10	75	49		
11.3	18	212	168		
11.8	(9)	36	15		
12.5	9	52	14		
13.3	18	182	142		
14.1	(11)	93	67		
15.4	10	77	59		
16.1	16	125	82		
16.6	16	84	69		
17.4	12	128	86		
18.9	20*b*	210	151		
4619.4	(16)	86	68		

4575.8	(15)	80	61	80	61
76.5	19	138	154	138	154
77.2	16	85	61	85	61
77.8	16	48	94	48	94
78.7	23*b*	271	215	271	215
80.2	31*b*	347	361	347	361
81.6	32	299	268	299	268
82.4	(18)	55	44	55	44
82.9	24	144	162	144	162
83.9	30	*e*290	269	290	269
84.9	22	*e*151	165	151	165
86.1	34	387	333	387	333
87.1	22	97	169	97	169
87.7	(18)	71	22	71	22
88.3	20	169	158	169	158
89.1	13	40	84	40	84
90.0	20	177	143	177	143
90.9	(18)	71	62	71	62
91.5	24	162	174	162	174
92.7	$29b_1$	317	308	317	308
94.1	26	303	248	303	248
95.4	28*b*	243	288	243	288
96.1	(24)	197	167	197	167
97.2	(22)	139	130	139	130
97.9	28*b*	324	374	324	374
4600.1	$(26)b_1$	240	211	240	211
		e			
00.9	30*b*	268	286	268	286
02.1	18	109	109	109	108
03.0	27	248	234	248	234
03.9	18*b*	75	48	75	48
04.3	(18)	83	70	83	70
05.1	$26b_1$	178	210	178	210
05.6	(24)	132	114	132	114
06.3	(22)	156	150	156	150
07.5	22*b*	256	248	256	248
09.2	11*b*	113	94	113	93
10.1	14	90	94	90	89
11.3	28	310	308	310	332
12.3	(12)	27	44	27	40
13.3	28	306	261	306	258
14.2	(20)	119	109	119	109
15.5	(14)	58	72	58	72
16.2	22*b*	240	288	240	288
17.4	16	110	135	110	135
18.2	(14)	41	49	41	49
18.9	20	124	96	124	96
4619.5	24*b*	207	237	207	237

4575.7	10	41	no corr.
76.4	13*b*	110	
77.1	8	29	
77.6	11	51	
78.6	17	193	
79.8	(14)	76	
80.4	18	117	
81.6	22	240	
82.8	15	88	
83.8	23	265	
84.9	14	71	
86.0	20*b*	232	
87.1	10	65	
88.2	15*b*	172	
89.0	10	21	
89.5	12	42	
90.2	$15b_2$	152	
91.5	16*b*	127	
92.4	23	194	
93.1	17	87	
93.9	13	81	
94.7	12	38	
95.3	18	125	
95.8	17	82	
96.3	15	83	
97.0	10	32	
97.5	15	75	
98.1	18	146	
98.5	(10)	59	
99.8	(16)	98	
4600.5	19*b*	153	
01.1	(14)	72	
01.7	11	48	
02.2	14	62	
03.0	17	175	
03.9	10	32	
04.9	18*b*	194	
05.9	14	109	
06.7	11	55	
07.6	16	166	
08.7	11	78	
09.4	11	54	
10.0	10	45	
11.3	18	235	
13.3	18	221	
14.1	13	57	
15.1	7	46	
15.9	15	107	
16.5	16	94	
17.2	14	73	
17.6	9	27	
18.4	12	57	
4619.2	21	218	

4620.5	14	147	109	no corr.	no corr.
21.4	—	41	34		
22.1	$10b_1$	66	56		
22.7	12	140	60		
23.7	10	73	62		
24.4	(7)	58	25		
25.1	$18b_1$	165	113		
26.2	13b	111	82		
26.8	9	83	47		
27.6	13	69	31		
27.9	13	35	28		
28.5	—	86	20		
29.4	21	212	157		
30.3	14	149	88		
31.5	10	74	80		
32.9	15	179	143		
34.0	16	162	116		
34.8	10	34	50		
35.5	12	150	67		
36.5	9	82	66		
37.4	16 b_1	124	108		
38.0	16	120	112		
39.1	(10)	84	40		
40.0	12	61	67		
40.5	11	67	64		
41.2	10	111	52		
42.1	9	73	82		
43.5	15	183	125		
44.9	9	64	58		
45.5	14	68	1		
46.2	16	147	141		
47.5	17	198	168		
48.7	16b	184	174		
49.9	11	90	67		
50.7	10	17	47		
51.3	12	86	85		
52.1	$16b_2$	152	138		
53.4	8	35	53		
54.7	22	229	232		
55.8	11	68	49		
56.5	(13)	68	55		
57.1	19b	204	197		
58.5	8	12	46		
59.1	8	93	26		
60.0	10	93	50		
60.8	10	51	60		
61.6	11	133	84		
62.6	10	57	53		
63.3	(13)	115	69		
64.0	$13b_1$	60	111		
64.8	10	72	53		
65.5	12	83	84		
66.8	(20)	246	151		
67.6	24b	177	202		
68.3	(20)	120	116		
69.2	16	119	134		
70.5	16	192	165		
4671.6	10	58	45		

4620.6	15	148	98	no corr.	no corr.
21.2	(8)	14	8		
21.6	13	53	2		
22.1	(16)	78	122		
22.9	20b	256	210		
24.1	(12)	35	60		
25.1	21	194	188		
26.5	20b	235	256		
27.6	16	144	92		
28.4	16	72	107		
29.4	22b	239	192		
30.3	20b	155	145		
31.1	12	58	84		
32.1	12	62	52		
32.9	25	240	238		
34.0	21	218	150		
35.0	(17)b	108	102		
35.9	19b	216	228		
37.8	24b	410	394		
39.6	26	258	146		
40.0	24	145	254		
41.0	20	112	48		
41.5	17	86	154		
42.4	16	86	76		
42.9	19	45	96		
43.7	24b	270	246		
44.5	19	93	66		
45.4	22	195	156		
46.4	30b	321	326		
47.5	28b	298	238		
48.1	(25)	102	69		
48.8	24	175	174		
49.8	21b	220	236		
51.4	$20b_1$	205	190		
52.3	20	163	174		
53.0	12	46	0		
53.5	(20)	71	71		
54.7	30	323	337		
55.9	$22b_2$	179	120		
56.6	24b	175	198		
57.3	$22b_1$	190	212		
58.7	13b	74	106		
59.9	(10)	61	72		
60.8	14b	143	78		
62.1	19b	226	291		
63.5	27	367	380		
64.8	18b	158	151		
66.1	(28)	199	286		
66.9	(32)	205	188		
67.5	36b	304	303		
68.2	(30)	274	229		
69.3	26	243	232		
70.5	22	216	204		
4671.5	16	112	134		

4620.6	14	158	no corr.
21.9	12	73	
22.9	14	161	
23.6	8	9	
24.1	7	32	
25.0	14	150	
26.2	14	115	
27.0	10	47	
27.6	10	56	
28.2	12	61	
29.3	17	185	
30.3	13	91	
30.7	10	41	
31.3	10	45	
31.9	10	56	
32.9	15	177	
34.2	14	163	
35.0	12	68	
36.0	14	130	
36.8	13	57	
37.8	19	208	
38.5	15	77	
39.7	15b	122	
40.3	11	74	
40.9	10	45	
41.6	13	101	
42.4	11	47	
43.0	11	69	
43.9	14	144	
45.1	10b	102	
46.4	21	219	
47.5	19	120	
48.0	18	86	
48.8	19	183	
49.8	13	73	
50.4	11	41	
51.2	14	121	
51.9	13	44	
52.6	13	113	
53.7	9	44	
54.8	22	242	
55.9	13	90	
57.0	18b	285	
58.5	9	53	
59.2	9	73	
60.4	10	73	
61.1	10	61	
61.9	$10b_2$	88	
63.0	(12)	116	
63.9	$14b_1$	108	
65.0	11b	113	
66.3	(21)	167	
67.6	25b	395	
69.1	14b	137	
70.3	14b	138	
71.2	9	43	
4671.9	(11)	55	

4672.4	14*b*	92	108	92	108	4672.4	18	128	60	128	60	4672.5	13	70	no corr.
72.9	(14)	81	39	81	39										
73.4	15	100	100	100	100	73.3	24	218	238	218	238	73.2	17*b*	166	
74.2	11	54	39	54	39										
74.7	9	24	60	24	60	74.6	24*b*	283	270	283	270	74.4	12	106	
75.2	10	79	55	79	55	75.2	(18)	125	144	125	144	75.4	11	101	
76.2	10	88	30	88	30	76.4	13	72	81	72	81	76.7	8	93	
76.9	8	53	54	53	54	77.2	14	67	72	67	72				
77.6	7	4	21	4	21	77.8	—	147	77	147	77	77.9	(12)	66	
78.1	(12)	104	72	104	72										
78.9	18b_1	189	202	189	202	79.0	23b_1	318	329	318	329	78.8	17*b*	234	
80.1	13	102	125	102	125	80.5	28	363	365	363	365	80.4	15	182	
81.0	10	61	51	61	51										
81.5	11	55	0	55	0										
82.1	15	140	128	140	128	82.2	28	362	342	362	342	82.2	17*b*	247	
83.6	10	102	100	102	100	83.7	18*b*	193	154	193	154	83.9	10	106	
85.1	12	153*d*	139	153	139	85.3	18*b*		238		238	85.0	11	85	
86.3	11	108	67	108	67	86.5	18		154		154	86.0	12b_2	140	
87.5	12	100	127	100	127	87.4	17b_1	*e*	162	*e*	162	87.2	11	81	
88.4	12	91	82	91	82	88.6	22		219		219	88.1	12	99	
89.4	9	79	47	79	47	89.4	16		90		90	88.8	11	53	
90.0	12	121	94	121	94	90.4	18*b*	153	174	153	174	89.6	10	84	
91.5	18	188	195	188	195	91.6	26	303	244	303	244	90.5	14	96	
92.3	9	25	38	25	38							91.7	15b_2	197	
92.8	10	53	23	53	23	92.8	20b_1	185	156	185	156	92.9	11	83	
93.2	10	39	46	39	46	93.5	20b_2	118	113	118	113	93.8	12	96	
93.9	11	87	103	87	103	94.0	(20)	84	134	84	134	94.8	11	91	
94.8	10	80	45	80	45	95.0	19	129	164	129	164	95.6	11*b*	86	
95.5	10	82	49	82	49	96.0	15	95	75	95	75	96.5	(9)	68	
96.4	9	76	124	76	124	96.9	16*b*	146	77	146	77	97.3	11	81	
97.6	12	84	52	84	52	97.3	17*b*	53	144	52	144	98.3	16	89	
98.6	15	154	103	154	103	98.6	31b_2	516	430	515	430	98.9	16	134	
99.4	14	156	114	156	114							99.7	13	73	
4700.4	11	59	76	59	76	4700.2	18	111	100	111	100	4700.5	15	111	
01.2	13	121	129	121	123	01.4	24*b*	336	363	324	348	01.6	15	165	
03.0	26	321	320	321	348	03.1	30	392	335	433	370	03.2	24	329	
04.0	(12)	30	49	30	43	03.9	(21)	94	62	74	53	04.2	(10)	29	
05.0	13	150	136	150	133	04.6	19	161	100	152	97	05.2	14	159	
05.9	8	40	47	40	47	05.5	18	102	168	99	167	06.1	11	53	
07.4	18b_1	225	190	225	190	06.1	(17)	99	122	99	122	07.3	19	226	
08.0	(13)	45	35	45	35	07.5	26	347	237	346	237	08.4	16	106	
08.9	17*b*	185	192	185	192	08.0	—	60	100	59	100	09.2	16	116	
10.3	14*b*	151	168	151	168	09.0	25b_2	255	271	255	271	10.2	16	172	
11.4	8	34	34	34	34	10.2	25b_1	315	215	315	215	11.5	9	87	
12.0	8	45	48	45	48	10.9	13	24	67	24	67	12.7	13	126	
12.7	9	56	66	56	66	12.1	18*b*	228	176	228	175	14.5	19	261	
13.5	10	46	44	46	44	12.9	18*b*	142	180	141	173	15.8	14	120	
14.5	20	203	197	203	197	14.4	29b_2	457	452	466	486	16.5	8	30	
15.7	12	120	133	120	133	15.9	(18)	167	88	164	85	17.6	11	78	
16.6	8	50	43	50	43	16.7	13	70	82	70	81	18.3	11	71	
17.6	9	73	27	73	27	17.6	17*b*	159	205	159	205	19.0	10	59	
18.4	12	81	134	81	134	18.5	16	175	140	175	140	20.0	8	66	
19.7	8	119	93	119	93	19.8	14	115	152	115	152	20.9	11	60	
21.1	10	94	99	94	99	21.1	15	166	162	166	162	21.5	11	56	
22.2	10	73	107	73	107	22.3	17	199	101	199	101	22.3	10	94	
23.1	10	51	100	51	100	23.1	17	143	217	143	217	23.2	10	48	
24.0	8	35	21	35	21							23.7	10	47	
4724.6	8*b*	92	71	92	71	4724.4	14	74	149	74	149	4724.4	7	37	

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				no corr.	no corr.
4726.1	9	97	94		
27.4	14	140	194		
28.7	13*b*	189	133		
30.0	12	85	116		
30.8	14	96	45		
31.5	16*b*	108	208		
32.4	9	53	24		
33.6	12*b*	160	154		
34.9	7	24	31		
35.8	10	62	95		
36.8	18	227	179		
37.6	(14)	24	106		
38.6	10	77	86		
39.4	11	58	54		
40.4	11b_1	103	66		
40.9	11	31	66		
41.7	12	139	101		
42.9	10	77	111		
44.4	12	113	117		
44.9	10	45	50		
45.9	13	177	122		
47.0	6	14	36		
48.0	15*b*	173	171		
48.8	(9)	46	34		
49.9	10	100	102		
50.6	(10)	20	57		
51.3	(10)	66	72		
52.2	13*b*	176	161		
54.0	16*b*	237	225		
55.9	16	86	167		
56.4	16	140	80		
57.5	12	100	110		
58.4	9	59	51		
59.2	12	102	*e* 28		
60.0	9	61	*e* 70		
61.0	(12)	48	*e* 67		
61.4	(15)	102	*e* 41		
62.5	20b_1	266	255		
63.9	16*b*	132	142		
64.4	(14)	83	79		
65.6	17*b*	182	140		
66.5	17*b*	209	169		
68.3	16	205	183		
69.3	12	58	0		
69.9	10	86	66		
71.6	16*b*	252	199		
72.8	12	147	91		
74.0	10	141	78		
75.8	10	105	66		
76.2	10	128	90		
77.5	7	19	54		
4778.3	9	100	57		

4725.1	12	100	52	no corr.	no corr.
26.2	12*b*	100	104		
27.5	29	354	317		
28.6	24*b*	204	222		
29.8	24*b*	296	342		
31.2	22*b*	388	226		
32.5	(16)	60	177		
33.7	21*b*	348	344		
35.9	18	166	150		
36.8	26*b*	216	277		
37.6	(21)	188	152		
39.2	14*b*	149	160		
40.4	19*b*	173	165		
41.1	18b_2	79	133		
41.6	(17)	128	77		
42.6	14*b*	92	32		
43.1	16*b*	110	178		
43.8	(9)	8	15		
44.7	16*b*	122	199		
45.4	19*b*	142	110		
46.1	(16)	153	178		
47.6	(12)	68	69		
48.2	16	147	197		
49.8	17	236	220		
51.2	(14)	157	97		
52.3	22	255	308		
54.1	22b_2	204	183		
54.7	(19)	124	180		
56.1	23b_2	314	401		
58.1	18*b*	189	212		
59.3	14*b*	203	190		
61.4	16b_1	213	228		
62.7	23	307	296		
64.4	22	243	312		
65.7	25	304	244		
66.7	26	261	301		
68.5	22	294	302		
70.0	12	76	148		
71.5	21*b*	316	268		
73.0	18b_2	205	201		
73.9	(13)	80	121		
74.6	7	36	15		
75.5	(12)	30	76		
76.3	19	227	266		
4778.0	10*b*	104	60		

4725.0	8	41	no corr.
25.7	10	77	
26.4	8	11	
26.7	10	8	
27.4	18	202	
28.4	14	117	
29.5	16	146	
30.4	15	104	
31.3	16	159	
32.1	15	92	
33.2	14	119	
34.2	13	110	
35.5	(12)	91	
37.0	18*b*	275	
38.0	(10)	42	
39.0	9	68	
39.7	10	59	
40.5	12	64	
41.5	13*b*	174	
42.5	11	60	
43.1	8	38	
43.5	8	24	
44.3	11	68	
45.0	11	104	
46.0	11*b*	97	
46.9	7	46	
48.0	13	153	
48.9	10b_1	46	
50.1	11	130	
51.4	9	60	
52.5	13*b*	155	
54.1	15*b*	174	
54.8	12	54	
55.4	13	65	
56.2	16	132	
56.8	16	74	
57.4	14	69	
58.0	10	52	
58.8	11	72	
59.3	13	97	
60.3	10	76	
61.2	14	90	
62.3	20*b*	275	
63.8	17*b*	199	
64.7	(14)	68	
65.4	18*b*	140	
66.5	18*b*	217	
67.5	11	45	
68.6	18	207	
70.1	11	102	
71.1	14	85	
71.8	15	158	
73.0	15	138	
74.0	9	49	
74.7	9	47	
75.7	12b_2	141	
76.5	11b_1	70	
4777.7	13	86	

4779.5	(11)	85	77	no corr.	no corr.
80.0	13*b*	147	100		
81.5	8	116	44		
83.4	15*b*	196	224		
85.1	8	124	33		
86.6	18*b*	329	224		
88.1	(10)	95	45		
88.9	13	85	71		
89.7	$14b_1$	208	134		
91.0	10	93	56		
91.6	10	16	17		
92.4	12*b*	167	109		
93.6	10	108	31		
94.8	10	122	78		
95.6	8	67	19		
96.3	8	63	62		
97.0	9	54	61		
98.5	12*b*	202	115		
99.7	11	126	92		
4800.5	12	71	30		
01.0	12*b*	125	83		
02.8	10	153	130		
03.5	8	23	20		
04.0	10	81	26		
05.0	16	176	167		
05.9	12	77	23		
07.0	12*b*	108	111		
07.6	(12)	67	50		
08.9	11	161	118		
10.6	12	187	146		
12.0	10	82	23		
12.8	10	48	75		
13.5	10	85	42		
14.9	9	104	125		
15.7	7	43	30		
16.7	8	94	64		
18.0	8	96	88		
19.0	8	39	52		
19.9	9	98	63		
20.8	9	137	30		
22.0	10	99	94		
23.6	$18b_2$	338	295		
25.4	10	79	110		
26.7	8	85	49		
27.6	10	90	44		
28.4	10	44	74		
29.0	$14b_1$	227	142		
30.4	10	40	29		
31.2	13*b*	147	118		
31.9	11	42	48		
32.7	12	175	167		
34.5	$10b_2$	144	126		
35.9	$14b_2$	211	184		
37.3	9	44	88		
38.3	12	102	130		
39.5	(11)	59	101		
4840.5	14*b*	223	173		

4778.9	10*b*	27	98	27	98
79.9	16*b*	203	252	203	250
81.5	13*b*	171	180	171	174
83.5	22*b*	372	388	375	409
85.1	(9)	25	40	25	37
86.7	$22b_1$	447	388	447	386
87.8	(14)	58	85	58	85
88.9	(18)	111	102	111	102
89.6	$22b_1$	222	254	222	254
91.0	$16b_2$	278	172	278	172
92.7	18	213	261	213	261
94.3	12	106	152	106	152
95.2	7	33	55	33	55
96.1	(12)	80	100	80	100
97.0	13*b*	166	127	166	127
98.5	20*b*	256	257	256	257
99.8	20*b*	244	138	244	138
4800.7	(20)	251	220	251	220
02.4	11	58	104	58	104
03.2	12	174	92	174	92
05.1	22*b*	355	352	355	352
06.6	(13)	56	73	56	73
07.4	18*b*	317	227	317	227
08.9	20*b*	263	272	263	272
10.8	17*b*	269	211	269	211
12.0	16	142	135	142	135
13.0	17*b*	191	226	191	226
14.2	14	99	91	99	91
14.8	14	69	64	69	64
15.9	16	188	223	188	223
16.9	7	6	38	6	38
18.0	14	255	148	255	148
19.1	9	62	106	62	106
20.7	13	146	180	146	180
21.9	10	98	76	98	76
23.6	20*b*	428	253	428	253
24.2	—	117	184	117	184
25.5	16	152	174	152	174
26.7	14	72	112	72	112
27.5	16	189	113	189	113
29.1	20	333	304	333	304
31.5	18*b*	*e*244	276	244	276
32.6	20*b*	*e*243	204	243	204
33.9	16*b*	*e*129	200	129	200
35.0	(15)	137	47	137	47
36.2	20	282	270	282	270
37.0	(12)	49	70	49	70
38.6	$18b_1$	270	226	270	226
4840.2	19*b*	337	298	337	298

4778.6	8	46	no corr.
79.8	16	201	
80.9	9	32	
81.3	8	5	
81.8	10	66	
83.5	17*b*	311	
85.3	10	41	
86.2	$18b_1$	156	
87.1	$17b_2$	132	
89.2	16	324	
91.2	11*b*	125	
92.7	12*b*	178	
94.1	8	57	
95.0	8	53	
95.8	8	67	
96.7	7	70	
97.7	11	70	
98.6	12*b*	153	
99.8	13	102	
4800.7	10	88	
01.6	9	78	
02.9	11	146	
03.7	7	9	
04.2	8	9	
05.0	15	224	
06.3	7	33	
07.1	$10b_1$	116	
08.5	11*b*	161	
09.9	11	98	
10.8	11	103	
11.9	10	93	
12.8	11	57	
13.6	11	87	
14.6	8	56	
15.2	8	27	
16.1	8*b*	93	
17.6	10	128	
19.3	8	66	
21.0	$9b_1$	143	
23.1	$17b_1$	257	
24.5	13	110	
25.5	9	65	
26.9	9*b*	120	
28.0	9	46	
29.0	$13b_1$	187	
30.9	11	106	
31.9	10	87	
32.9	11	147	
34.6	7	76	
36.3	$11b_2$	214	
38.3	13	128	
39.6	$14b_1$	164	
4840.6	13	115	

4841.6	12	113	31*	no corr.	no corr.
42.3	12	88	101		
43.3	12	71	60		
44.0	12	94	126		
45.1	(12)	97	110		
46.5	12b_1	132	77		
48.2	20	228	200		
49.4	(16)	70	29		
50.2	14	46	48		
51.4	15	33	44		
52.7	18b_1	80	42		
53.7	18	41	32		
55.7	28b_1	226	178		
57.0	(24)	62	44		
58.2	(27)	103	48		
59.4	(38)	106	18		
60.0	(39)	103	6		
61.3	58				
62.8	(36)	70	66		
63.9	32	145	74		
65.0	(28)	33	30		
65.6	26b_2	77	37		
66.2	(24)	74	22		
67.0	21	32	4		
68.2	20b	105	74		
69.4	20	85	40		
71.3	26	221	153		
72.2	24	146	161		
73.9	18b_1	178	123		
75.0	15	119	81		
75.8	15	9	39		
76.4	18	222	123		
78.2	20	308	254		
79.6	12	74	91		
80.9	14	149	81		
81.9	17	195	172		
83.7	14	211	187*		
84.9	15	185	135		
86.0	15	154	126		
87.1	16	218	168		
88.9	16b	310	184		
90.7	16 b	251	216		
91.5	16	228	187		
93.2	10	130	80		
94.0	10	105	112		
95.1	10	121	17		
96.2	8b_1	82	86		
97.0	12	110	43		
97.8	10	105	93		
99.0	10	61	67		
4900.0	14	193	180		
01.5	8	117	87		
02.5	8	44	22		
03.3	14	167	167		
04.5	13	121	140		
05.1	7	32	36		
4906.3	9	129	101		

4841.1	16	73	92	73	92
41.9	(15)	128	106	128	106
43.3	21b_1	316	222	316	222
44.2	(18)	164	174	164	174
45.8	14b	295	140	295	140
47.6	16	104	158	104	158
49.0	22b	499	457	499	457
		e		*e*	
51.6	18	324	302	324	302*
53.2	16b	160	134	160	134
54.4	(17)	115	78	115	78
56.0	28b_1	539	478	539	478
57.5	21	158	106	158	106
58.8	(24)	210	101	210	101
60.0	—	157		157	
61.4	55				
63.9	27b	276	238	276	238
65.7	21b	194	147	194	147
66.3	(19)	91	114	91	114
68.1	22b_1	314	333	314	333
69.2	16	81	45	81	45
70.0	(18)	97	69	97	69
71.4	32b	456	494	456	494
72.3	(23)	299	320	299	320*
74.3	18	*e*	146	*e*	146
75.1	19	*e*	161	*e*	161
76.2	18	*e*	211	*e*	211
77.3	15	*e*	66	*e*	66
78.2	22	344	327	344	327
79.1	(10)	57	33	57	33
80.8	(16)	117	160	117	160
81.7	21b	391	313	391	213
83.6	17b	159	240	159	240
85.2	24b	362	384	362	384
87.1	22b	371	334	371	334
89.0	23	348	316	345	316
91.4	34	661		684	
93.2	16	136	182	129	182
94.3	15	166	228	164	228
96.7	14	153	253	153	253
97.6	11	69	43	69	43
98.8	10	125	92	125	92
4900.2	19	313		313	
02.2	(12)	147		147	
03.5	19	211		211	
04.9	14	166		166	
4906.1	7	36		36	

4841.7	9	71	no corr.
43.1	13	192	
44.4	10	85	
45.4	10	100	
46.2	10	67	
47.2	13	92	
48.2	14b	175	
49.3	13	104	
50.3	12	84	
51.0	13	76*	
51.7	12	74	
52.4	13	100	
53.3	15	90	
54.1	(14)	64	
55.4	23b	335	
56.6	20	62	
57.5	(21)	133	
58.5	(23)	94	
59.7	(31)	145	
61.4	55		
62.8	(30)	45	
63.9	26	180	
65.2	22	101	
66.4	21b	219	
67.6	15	86	
68.9	14	207	
71.4	21b	536*	
74.0	12	179	
75.4	12	94	
76.5	13	161	
78.5	17b_2	255	
80.3	6	34	
81.8	13	190	
83.3	10	83	
84.1	9	66	
85.3	12	156	
86.9	14b	216	
88.3	12	69	
89.3	14	144	
91.3	21	403	
92.8	(8)	49	
93.7	(7)	70	
94.6	7	33	
95.3	7	46	
96.2	7	54	
97.5	6b	85	
98.9	6	32	
99.9	12	161	
4900.8	8	49	
01.8	7	51	
02.8	12	98	
03.8	15b_2	166	
04.9	(9)	118	
4906.4	6	36	

4907.7	11	149	149	no corr.	no corr.
09.6	(14)	137	94		
10.4	17*b*	232	218		
11.1	(12)	38	35		
11.9	11	107	108		
13.4	10	104	104		
14.3	8	102	38		
15.8	8	101	90		
17.2	10	114	63		
18.8	18*b*	360	269		
20.6	19	306	250		
22.1	10	97	94		
24.0	18	263	257		
24.9	11	49	94		
25.7	10	112	20		
27.4	12	186	128		
28.4	10	97	78		
30.0	8	106	83		
31.0	8	48	10		
31.7	11	112	22		
33.4	21*b*	207	103		
34.0	17	148	171		
35.9	8	164	37		
37.1	10	134	98		
38.2	18	151			
39.2	19	270			
41.0	10	141			
42.6	10	155			
43.6	5	38			
44.3	7	25			

4907.7	14	217		217	
10.3	25*b*	475		475	
11.8	19	253		253	
13.0	12	46		46	
14.1	15	227		225	
15.1	10	73		73	
16.3	10	77		75	
17.5	(16)	128		126	
19.1	30*b*	508		478	
20.6	34	568		629	
22.3	19	177		166	
23.5	(21)	121		117	
24.4	27*b*	390		390	
25.7	20	194		192	
26.9	(14)	69		67	
27.9	19	257		257	
28.8	(11)	56		56	
30.5	14*b*	156		156	
31.2	(12)	100		100	
32.3	(11)	63		63	
33.3	(20)	154		154	
34.2	25b_1	354		354	
36.2	25b_1	154		154	
37.3	(19)	180		180	
38.3	25*b*	224		224	
39.1	27*b*	261		261	
39.8	(24)	237		237	
41.6	10*b*	41		41	
42.4	13b_2	162		162	
43.5	12	90		90	
44.4	12	108		108	
45.4	(15)	71		71	
46.2	21	275		275	
47.2	12	93		93	
48.8	9	90		90	
50.2	14	202		200	
52.7	12	180		178	
53.5	11	67		67	
54.8	10*b*	114		110	
55.9	9	29		23	
57.6	35	698		735	
60.4	12*b*	200		193	
62.1	14	190		188	
63.5	10	96		96	
65.3	18	195		195	
66.2	17	178		178	
68.2	19	290		290	
70.2	20b_2	266		266	
71.3	(15)	176		176	
73.2	15	193		193	
75.1	(11)	105		105	
76.2	18	217		217	
78.3	22	298		298	
79.8	18b_2	273		273	
82.1	25	^{e}282		282	
83.2	25	277		277	
84.3	23	249		249	

4907.2	9	65	65
08.1	12	128	128
09.2	11	82	82
10.4	19b_1	249	249
11.5	15	122	122
12.4	10	61	61
13.3	9	49	49
14.3	11	156	156
15.7	7	50	50
16.5	9	69	69
17.3	(9)	53	53
18.1	17	134	134
19.0	18	205	205
20.4	20	293	293
21.9	(11)	133	133
23.0	(12)	83	83
24.0	20	220	220
25.3	16b_2	183	183
26.5	9	47	47
28.0	13	218	218
30.2	11	185	185
32.2	11	102	102
33.4	18b_1	235	235
34.5	18	143	143
35.5	12	80	80
36.3	12	103	103
37.7	16	250	250
39.5	17*b*	308	308
41.1	10	84	84
42.6	11	147	147
44.4	19b_1	88	88
45.5	11b_2	109	109
46.4	14	140	140
47.7	9	84	84
48.5	9	54	54
49.8	10	127	127
51.4	9	88	88
52.7	11	134	134
53.9	11	93	93
55.2	10	96	94
57.4	28*b*	584	593

Lines in the wings of the hydrogen lines.

ϑ Cygni				ϑ Cygni				π Cephei 10610			δ Equulei 10608		
λ	$1-r$	10616 E/r	10619 E/r	λ	$1-r$	10616 E/r	10619 E/r	λ	$1-r$	E/r	λ	$1-r$	E/r
4090.1	1	94		4323.0	1	37	53						
90.5	1	91		23.3	1	63	97						
90.9	2	69		23.9	1	82	142						
91.2	2	43		24.4	1	25	62						
91.4	2	71		25.0	1	163	191						
91.6	2	47		25.8	1	307	394						
92.0	3	63		26.6	1	24	38						
92.4	3	95		27.0	2	146	173						
92.6	3	139		27.9	2	83	147						
93.0	4	44		28.6	3	34	67						
93.3	4	65		29.0	3	40	40						
93.7	4	49		29.6	3	29	106						
94.0	5	51		30.3	4	116	130						
94.4	5	147		30.8	5	112	146						
95.0	6	151		31.6	6	74	135						
95.4	6	102		32.1	7	32	63						
96.0	7	249		32.7	8	32	85						
96.6	8	33		33.1	9	42	89						
96.8	8	51		33.8	10	80	178	4335.4	1	68			
97.1	8	122		34.8	11	29	96	36.3	2	68			
97.5	8	108		35.4	13	47	60	37.0	4	239			
97.9	8	71		36.1	14	48	105	37.5	5	156			
98.2	9	260		37.0	20	135	169	37.9	6	164	4337.0	6	230
98.7	9	105		37.9	23	139	196	38.3	7	105	37.7	11	106
99.1	10	72		38.6	26	24	70	38.7	8	110	38.2	15	142
99.4	10	117		39.0	29	11	35	39.7	11	310	39.4	31	36
99.8	11	166		39.5	32	60	125	41.4	11	137	41.1	37	59
4100.0	11	179		41.3	35	75	82	42.0	9	162	41.6	26	46
03.0	11	310		41.8	31	26	58	43.3	6	234	42.2	20	60
03.5	11	85		42.3	27	55	63	43.8	5	99	43.1	13	83
03.8	11	60		43.3	22	69	121	44.5	3	239	43.6	9	114
03.9	10	48		43.8	20	40	60	4345.0	2	81	44.5	4	235
04.1	10	220		44.5	18	186	195						
04.4	10	147		45.4	13	32	34						
04.8	9	73		46.0	12	23	103						
05.4	9	129		46.7	11	112	134						
05.7	8	96		47.1	10	31	71						
06.3	8	157		47.9	9	114	155						
06.6	8	59		49.0	7	88	125						
07.0	8	64		49.6	6	45	61						
07.6	7	190		50.1	5	75	89						
08.1	7	83	123	50.9	4	175	174						
08.6	6	111	84	51.9	3	307	341						
09.1	6	95	146	52.8	2	164	169						
09.5	5	49	37	53.3	1	44	71						
09.8	5	117	166	53.8	1	68	96						
10.1	4	42	31	54.6	1	119	153						
10.5	4	78	85	4355.1	1	102	139						
10.8	4	40	76										
11.0	3	99	77										
11.4	3	61	46										
11.9	2	87	98										
12.3	2	84	88										
4112.9	1	132	168										

Lines in the wings of H_β.

ϑ Cygni				π Cephei				δ Equulei		
λ	1 — *r*	10616 *E*/*r*	10619 *E*/*r*	λ	1 — *r*	10610 *E*/*r*	10618 *E*/*r*	λ	1 — *r*	10608 *E*/*r*
4841.6	1	114	32							
42.3	2	90	103							
43.3	2	72	61							
44.0	2	96	129							
45.1	2	99	112							
46.5	3	136	79							
48.2	5	240	211							
49.4	7	75	31							
50.2	9	51	53							
51.4	10	37	49	4851.6	0	324	302	4851.7	1	75
52.7	12	91	48	53.2	1	162	135	52.4	1	101
53.7	13	47	37	54.4	2	117	80	53.3	1	91
55.7	16	269	212	56.0	4	561	498	54.1	3	66
57.0	18	76	54	57.5	7	171	114	55.4	4	349
58.2	21	130	61	58.8	8	228	110	56.6	5	65
59.4	25	141	24	60.0	14	183		57.5	8	145
60.0	28	143	8					58.5	11	106
				63.9	9	303	262	59.7	19	179
62.8	25	93	88	65.7	6	206	156			
63.9	22	186	95	66.3	5	96	120	62.8	22	58
65.0	20	41	38	68.1	3	324	343	63.9	13	207
65.6	18	94	45	69.2	2	83	46	65.2	7	109
66.2	17	89	27	70.0	1	98	70	66.4	5	231
67.0	16	38	5	71.4	0	456	494	67.6	4	90
68.2	14	122	86					68.9	2	211
69.4	12	97	45							
71.3	10	246	170							
72.2	9	160	177							
73.9	6	189	131							
75.0	4	124	84							
75.8	4	9	41							
76.4	3	229	127							
78.2	2	314	259							
79.6	2	76	93							
80.9	1	151	82							
4881.9	1	197	174							