ASTRONOMY & ASTROPHYSICS
SUPPLEMENT SERIES

Astron. Astrophys. Suppl. Ser. **51**, 161-178 (1983)

A study of visual double stars with early type primaries. II. Photometric results (*)

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Received July 7, accepted July 27, 1982

Summary. — Visual double or multiple stars with early type primaries have been observed photometrically at visual and infrared wavelengths and photometric data have been collected from the literature. *uvbyβ* indices for the members of 248 systems and *JHKL* magnitudes for the members of 45 systems are presented.

Key words : visual double stars — photometry.

1. **Introduction.** — This is the second in a series of articles dealing with young visual double stars and early stellar evolution. In the first article, Gahm *et al.* (1983), paper I, the scientific background for this investigation is laid out in more detail and here we will only mention that the primary motive has been to detect and study low mass stars which are still in their early phases of evolution, i.e. stars which are still above the zero-age-main-sequence or which have just reached it.

The first steps in this investigation has been to collect basic data such as spectral types, magnitudes and colours for a large number of components of visual double stars which most likely are younger than the contraction time for solar type stars. The stars were selected from the Index Catalogue of Visual Double Stars by Jeffers *et al.* (1963) in a magnetic tape version provided by Charles Worley at the U.S. Naval Observatory. The criteria used for selecting the stars were that the primary should be of spectral type O or B and that the separation between the components should be larger than 2″. To avoid the inclusion of likely optical pairs very few secondaries with separations larger than 60″ were included. The distribution over separation is shown in figure 1 and it can be seen that most of the systems have separations less than 30″. The main purpose has been to study solar type stars close to the main-sequence and therefore systems in which the secondary is two or more magnitudes fainter than the primary were favored compared to systems with more equally bright components. Figure 2 shows the distribution over the magnitude difference between the components and it is seen that the majority of the included secondaries are from 2 to 7 magnitudes fainter than their primaries.

Since most of the observations were conducted at ESO, Chile, few stars north of declination + 20° are included. This is also evident in figure 3 which shows the galactic coordinates of the stars. The positions of the stars also reflect the Gould's Belt distribution of early type stars.

The selected stars, both primaries and secondaries have been observed photometrically and/or spectroscopically or the data has been compiled from the literature. The total number of systems studied is 254 and the number of secondaries is 292. In this article photometric data for 248 primary and 233 secondary components is presented. The results of the spectroscopic observations are presented in paper I and a thorough analysis of the results of the investigation is to be presented later. A first analysis has been presented as a thesis (Lindroos, 1981), which is summarized by Lindroos (1982).

2. **The *uvbyβ* observations and data reduction.** — Because of their importance for astronomy in general visual double stars have been extensively observed in the past. Most of this work is naturally concentrated to the measurements of separations and position angles which are essential for the determination of orbits and masses but which also can reveal if a pair is optical. The individual brightness of the components is a crucial parameter and especially the measurement of the magnitude difference between the components has been the concern of many observers and special techniques and instrumentation have been developed for this purpose. A large contribution in this field has come from Wallenquist who also compiled a catalogue (Wallenquist, 1954). For later works we refer to Wierzbinsky (1969), Worley (1969) and Ferrer (1980).

UBV observations of visual double stars have been reported by e.g. : Eggen (1963), Tolbert (1964), Lutz (1971), Lutz and Lutz (1977), Burnichon and Garnier (1976), Andrews and Thackeray (1973) and Landolt (1968a, 1968b, 1971). Recently a compilation of *UBV* data for visual double stars has been published by Wallenquist (1981).

(*) Based on observations collected at the European Southern Observatory, La Silla, Chile.

Measurements in the $uvby\beta$ systems have been published among others by Mechler (1976), Mechler and McGinnis (1978), Oblak (1978), Oblak and Chareton (1980) and Olsen (1971, 1982). Several double stars are also included in the catalogues by Grønbech and Olsen (1976, 1977).

The new photometric data for this investigation was collected at the ESO facilities in Chile at several periods from 1977 to 1981 and with four different telescopes. The instruments and dates were : the Danish 50 cm (February 1977 and December 1978) ; the ESO 50 cm (May 1979 and December 1979) ; the ESO 1 m (May 1978, December 1979 and March 1981) ; the Danish 1.5 m (June 1981). Unfortunately the observation run in May 1978 was almost entirely lost due to bad weather. On the Danish telescopes we used the simultaneous four colour photometers and the likewise simultaneous Hβ photometer. On the ESO telescopes the ESO single channel photometers were used.

2.1 DATA REDUCTION. — For the reduction of the $uvby\beta$ observations a number of computer programmes in Fortran were developed (Lindroos, 1980). The reduction closely follows the technique given by Grønbech *et al.* (1976) in which one instrumental system is defined for each observing period. The extinction coefficients were for each night in the best cases determined from four extinction stars of which two were rising and two were setting and two were early type stars and two were late type stars. For the determination of the nightly zero-points about 20 standard stars were observed each night in such a way that a large overlap existed for stars observed on other nights. The determination of these zero-points is a least square analysis in which the standard stars indices in the instrumental system are obtained simultaneously. To derive the coefficients in the transformation equations between the instrumental and the standard *uvby* or Hβ system the standard stars and their indices were taken from Grønbech *et al.* (1976) and Grønbech and Olsen (1977). Updated values for the indices were provided by Lodén (1978). The total number of standard stars in each observing period were typically 35 and they were selected to cover the largest possible range in spectral type. In the reduction programmes the nightly values for the extinction coefficients were used except for the observations in February 1977. In that period no reliable extinction star measurements could be secured at large enough airmasses. The reason for this was probably the combination of a small diaphragm and a mechanical instability or tracking error of the telescope, which caused the star to move in and out of the diaphragm. Similar problems with this telescopes have been reported by Heck and Manfroid (1980). Therefore the mean values for the extinction coefficients given by Grønbech *et al.* (1976) were used. The rms values for the difference between our transformed V and c_1 indices and the standard values are rather high for this period, 0.030 and 0.016 respectively. For c_1 the major cause is probably a bad extinction coefficient while for V the small diaphragm is also contributing. It should be pointed out that most of the stars observed in February 1977 were re-observed later. In the table of final magnitudes the result rely entirely on observations from this period for only a few stars.

More details about the reduction of the observations are given by Lindroos (1980, 1981).

2.2 PROGRAMME STAR OBSERVATIONS. — The spectral types of the programme stars reach from O to M and their visual magnitudes range from 3 to 14. Our aim was to collect at least 10,000 photo electrons in each filter to reach a 1 % precision. This met with no problem for the primaries and brighter secondaries for which millions of photo electrons normally were registered but for the faint and/or red secondaries sometimes only a few thousand photo electrons could be counted with a reasonable integration time. This is particularly the case for the u, v and narrow Hβ filters for which in a few cases no measurements were feasible. A 1 % accuracy corresponds to an error of 0.010 in y, 0.015 in $(b\text{-}y)$ and 0.022 in m_1 and c_1. In practice the errors will be larger than this because of the sky background which for the fainter stars can contribute with 50 % of the signal. With few exceptions all stars were observed at airmasses less than 1.6 and most stars were observed on at least two different nights.

The difficulty in making photometric observations of double stars, compared to single stars, is to take into account the stray light that fall into the diaphragm from the other component(s). In most cases the secondaries are so faint and the separations so large that the primary component can be measured as a single star. For the faint companions special techniques must be used, however. For very close systems it is possible to use e.g. an area scanner, Rakos (1965), which is quite time consuming, however. For systems with separations larger than say 5″ ordinary photometry is still possible provided that small diaphragms are used. One method, used by Andrews and Thackeray (1973) is to let the secondary drift across the aperture which require that the telescope has a trailing facility. An other approach, Tolbert (1964), is to determine the amount of light that is scattered into the diaphragm from a star at different distances from the center of the diaphragm. This is basically to determine the point spread function. To be useful it must be determined with great care which takes time and furthermore one can expect it to be seeing dependent. The simplest method is to measure the « sky background + scattered light » at the diametrically opposite position of the primary, this was used e.g. by Oblak (1978) and Olsen (1982). The difficulty here is to point the telescope at the correct position which requires the telescope to have an off-set capability.

Depending on the telescope, either of the last two methods were used. For the Danish 50 cm which is not equipped with any off-set facility the point-spread function was determined by observing the amount of light scattered into the diaphragm from a star at different distances from the center. The function was established for each filter and each of the diaphragms and it was determined on two different nights. However, the seeing was about the same on both nights and no differences became apparent. In figure 4 the result for *uvby* is presented as $\Delta m(r) = 2.5 \log \left(N(r=0)/N(r)\right)$ where $N(r)$ is the number of photo electrons at angular distance r (seconds of arc) from the diaphragm center. Within the errors no colour dependence was evident for these functions and a mean curve was adopted for all filters.

These curves were then used for correcting the signal from each component for stray light from the other component. In the case of multiple systems the primary was corrected for all the secondaries but the secondaries only for stray light from the primary. In no case did the correction of the primary exceed 1 %, generally it was negligible. For many of the secondaries the correction was of the order of 10 to 30 %. In cases where the magnitude difference is large and the secondary is very red it often happens that the signals in the u and v filters are entirely lost due to the contamination from the primary which is very strong at these wavelengths. This explains the empty columns found in table I for some faint secondaries. Measurements were rejected if the correction for stray light exceeded 50 % of the number of photo electrons that remained after subtracting the true sky background.

With the ESO 50 cm and 1 m telescopes which have built in off-set facilities the stray light from the primary was in each case measured at the same distance from the primary as the secondary but in the opposite direction. This technique was also used with the Danish 1.5 m telescope which were used for measuring some faint secondaries with small separations.

3. **The $uvby\beta$ catalogue.** — The catalogue of $uvby\beta$ photometry of one or more components in 248 systems is given in table I which is described below. Included are systems for which some data (spectroscopic or photometric) exist for the secondary or there the primary has been measured by us. Often the data is collected from the literature.

3.1 DESCRIPTION OF TABLE I.

Column 1 : HD number for the primary and occasionally for the secondary.
Column 2 : BD number.
Column 3 : HR number.
Column 4 : Number in Aitkens Double Star Catalogue (Aitken, 1932).
Column 5 : Component designation. Composite measurements are indicated as AB or ABC.
Column 6 : For the secondaries, their separation from A, expressed in seconds of arc.
Column 7 : Number of nights on which the star was observed in *uvby*, i.e. the number of single observations.
Column 8 : The V magnitude of the UBV system derived from the y filter. The values given for our own observations are the mean of the N single observations. All observations were given the same weight. Values taken from the literature are reproduced as they were given in the referred source.
Column 9 : The mean error of one observation defined as

$$= \left(\sum_{i=1}^{i=N} (V_i - \overline{V})^2 \Big/ (N-1) \right)^{1/2}$$

where N is the number of observations and $\overline{V}$ and V_i are the mean value and single values respectively. For observations taken from the literature the errors are reproduced from the referred source.
Column 10 : The (b-y) index. Calculated as for column 8.
Column 11 : The same as in column 9 but for (b-y).
Column 12 : The m_1 index. Calculated as for column 8.
Column 13 : The same as in column 9 but for m_1.
Column 14 : The c_1 index. Calculated as for column 8.
Column 15 : The same as in column 9 but for c_1.
Column 16 : The number of nights on which the star was observed in Hβ.
Column 17 : The Hβ index. Calculated as for column 8.
Column 18 : The same as in column 9 but for Hβ.
Column 19 : Number code for the source from which the observation is taken. The references to these sources are given in the section of notes to table I.
Column 20 : An asterisk (*) signifies that there is a note to the star after the table. The symbol IR means that *JHKL* data are given in table V.

3.2 THE ERRORS IN THE INDICES. — The rms values of the errors in the mean values of each index as given in table I are presented in table II for different intervals of the visual magnitude. The error in the mean value is obtained from the error of one observation by dividing with $N^{1/2}$, N = number of observations. It is seen from the table that, except for V, there is a 1 % precision down to the 10th magnitude but that for still fainter stars the errors increase. However, even at 13th magnitude (b-y) is quite good.

4. **Comparisons with other investigations.** — Several of the stars selected for this project had already been observed by others in $uvby\beta$, particularly by Grønbech and Olsen (1976, 1977), referred to as G & O below, and by Oblak (1978). Some of these stars were re-observed to check the consistency of the results and also to detect possible light variations. However, the differences at hand seem more appropriate to ascribe to the photometry than to variability. The comparison was made to the indices given in the notes to table I. Cases where G & O measured two stars in the diaphragm were excluded from the comparison if the magnitude difference between the stars is less than 4.0. Also excluded were stars suspected of variability and for which we do get different results. Two emission line objects were also excluded in c_1 (see below). The stars were divided into two groups with $V < 7.0$ and $V > 7.0$. The faint group then contains only secondaries. The result is summarized in table III. The agreement between the results is quite good for the bright stars but for the secondaries the differences are rather large. No systematic deviation is otherwise apparent, however.

For a few bright stars the difference Lindroos-G & O was larger than the average and these are listed below.

HD 29227 A : $\Delta\beta = -0.022$. G & O : s value corresponds to B8V-IV while our give B8III which better matches the MK classification B7III.
HD 36960 A : $\Delta V = 0.087$. Suspected variable star.

HD 52437 AP : $\Delta V = -0.054$, $\Delta c_1 = 0.018$. G & O measured APB but the B component is 7.7 magnitudes fainter than A and this cannot explain the difference.
HD 83953 A : $\Delta c_1 = 0.062$. Emission line object.
HD 91355 A : $\Delta V = 0.034$. $\Delta c_1 = -0.032$.
HD 112091 B : $\Delta c_1 = 0.045$. Emission line object.
HD 114911 A : $\Delta V = -0.056$.
HD 159176 AB : $\Delta c_1 = 0.031$. Suspected variable. G & O measured ABC but C is 5.2 magnitudes fainter than A.

A similar comparison was also made to the indices given by Oblak and the result is presented in table IV. For stars brighter than $V = 7.0$ there might be a systematic difference in the sense that Oblak's c_1 indices are larger. For the fainter stars the mean differences are smaller than in the comparison with G & O. Again, the differences for individual stars are often large, however.

Ferrer (1980) presents precise measurements of the difference of magnitudes for components in close double stars. For HD 36408, separation 9.″6, he gives $\Delta m = 0.40$ which agrees well with our $\Delta V = 0.42$.

5. **The infrared observations.** — A number of systems which were regarded to be specially interesting e.g. because the secondary was found to be contracting, were selected for photometry in the *JHKL* bands. The prime motive of these observations was to investigate if some of the stars had infrared excess emission which is common for T Tauri stars. The observation were conducted in March 1981 with the ESO 1 m telescope and the InSb photometer. The standards were taken from Wamstecker (1981). Because the diaphragm has a fixed sized (12″) and the chop throw and beam switch also are fixed (13″) some closer systems could not be measured. The fainter secondaries were often only measured in one filter, normally *K*, and only the brighter were measured in *L*.

For the reduction of the infrared observations a number of Fortran programmes, similar to the *uvby* programmes, were developed (Lindroos, 1983).

Three of the primaries have also been observed in *JHKL* by Whittet and van Breda (1981), HD 112244, HD 124471 and HD 135591. The rms values for the differences in our results are, in the order *JHKL*, 0.02, 0.01, 0.02 and 0.03 so the agreement is good.

6. **The *JHKL* table.** — The results of the *JHKL* observations are presented in table V which is described below.

Column 1 : The HD number.
Column 2 : The component designation.
Column 3 : Number of nights on which the star was observed i.e. the number of observations.
Column 4 : The *J* magnitude.
Column 5 : The error in the *J* magnitude in units of 0.01. For only one observation this is the error in the mean value of the signal determined from several beam switches. For *N* observations it is the mean error of one observation (see description of table I) or the error in the mean value calculated from the errors of the *N* individual observations if this is larger than the former.
Column 6 : The *H* magnitude.
Column 7 : Same as column 5 but for *H*.
Column 8 : The *K* magnitude.
Column 9 : Same as column 5 but for *K*.
Column 10 : The *L* magnitude.
Column 11 : Same as column 5 but for *L*.

Acknowledgements. — The author wishes to express his thanks to the following persons for help and support during the progress of this project. Mr. Urban Frisk, Dr. Gösta Gahm, Dr. Erik Olsen and Mr. Tor Westin.

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Notes to table I.

For the compilation of photometric data from the literature the sources below were used. The number codes correspond to the ones given in column 19 of table I.

Sources for the photometric data.

1. CRAWFORD *et al.* : 1970.
2. CRAWFORD *et al.* : 1971.
3. CRAWFORD *et al.* : 1972.
4. CRAWFORD *et al.* : 1973.
5. GRØNBECH and OLSEN : 1976.
6. GRØNBECH *et al.* : 1976.
7. GRØNBECH and OLSEN : 1977.
8. JOHNSON *et al.* : 1966.
9. JOHNSON and MITCHELL : 1975.
10. LINDEMANN and HAUCK : 1973.
11. OBLAK : 1978.
12. OBLAK and CHARETON : 1980.
13. HOFFLEIT : 1964.

Notes to individual stars.

Stars with an asterisk (*) in column 20 of table I are commented upon below. Sources 5 and 7 are referred to as G & O and source 11 as Oblak. The indices below are given in the order V, b-y, m_1, c_1 and Hβ.

HD 560 B : Wallenquist (1981) lists $V = 9.44$, B-$V = 0.34$, U-$B = -0.14$. This is not reconcilable with the MK classification G5V. However, the star is peculiar and variability is possible.

HD 8803 : Wallenquist lists for B : $V = 9.38$, B-$V = -0.19$, U-$B = 0.00$. This is clearly in conflict with the MK classification F6V.
G & O give
AB : 6.595, − 0.015, 0.124, 0.860, 2.821.

HD 24388 : G & O give
AB : 5.493, − 0.041, 0.104, 0.609, 2.743.

HD 25330 : G & O give
A : 5.680, 0.049, 0.070, 0.485, 2.726.

HD 29227 : G & O give
A : 6.357, − 0.034, 0.093, 0.633, 2.737.

HD 34797/8 : G & O give
A : 6.372, − 0.075, 0.115, 0.356, 2.710.
B : 6.526, − 0.053, 0.131, 0.503, 2.755.
Oblak gives
A : 6.359, − 0.065, 0.104, 0.386, 2.723.
B : 6.512, − 0.050, 0.129, 0.531, 2.755.

HD 35149 : Oblak gives
A : 4.975, − 0.041, 0.069, 0.069, 2.624.
B : 7.163, − 0.034, 0.096, 0.329, 2.680.

HD 35172/3 : Oblak gives
A : 7.274, 0.059, 0.096, 0.431, 2.657.
B : 8.276, 0.085, 0.082, 0.510, 2.798.

HD 36151 X : The X component is not listed in the IDS catalogue. The position angle is about 315° and the separation is somewhat less than for B. It was observed both in December 1978, December 1979 and March 1981.

HD 36779 : G & O give
A : 6.228, − 0.075, 0.091, 0.144, 2.658.

HD 36960/59 : G & O give
A : 4.808, − 0.110, 0.070, − 0.057, 2.601.
B : 5.695, − 0.099, 0.086, 0.036, 2.631.
Oblak gives
A : 4.770, − 0.100, 0.068, − 0.059, 2.601.
B : 5.661, − 0.087, 0.079, 0.047, 2.632.

HD 44996 : G & O give
A : 6.126, − 0.012, 0.079, 0.335, 2.649.
B : 10.438, 0.265, 0.121, 0.618.
Oblak gives
A : 6.107, − 0.006, 0.101, 0.361, 2.667.
B : 10.486, 0.258, 0.176, 0.639, 2.789.

HD 46064 : G & O give
A : 6.159, − 0.049, 0.077, 0.156, 2.638.
B : 11.004, 0.353, 0.150, 0.354.

HD 47116 : Oblak gives
A : 7.705, − 0.012, 0.177, 0.700, 2.774.
B : 9.282, 0.355, 0.184, 0.362, 2.638.

HD 47247 A : β may be variable. In February 1977 we measured 2.704 + − 0.003, in December 1979 we measured 2.728 + − 0.004.
G & O give
AB : 6.343, − 0.052, 0.120, 0.427, 2.728.

HD 47851 BC : The separation between B and C is 0.″6 and the magnitude difference is 0.2.

HD 48383 : G & O give
A : 6.153, − 0.075, 0.105, 0.384, 2.688.
B : 9.567, 0.107, 0.183, 0.853, 2.837.
Oblak gives
A : 6.175, − 0.050, 0.102, 0.392, 2.678.
B : 9.550, 0.157, 0.169, 0.833, 2.905.

HD 48857 : Oblak gives
A : 7.014, − 0.056, 0.105, 0.343, 2.667.
B : 9.091, − 0.013, 0.125, 0.801, 2.852.

HD 48917 : G & O give
A : 5.307, − 0.030, 0.047, − 0.022, 2.480.

HD 52437 : X is not identical to the C component in the IDS catalogue. The separation and position angle are estimated to be about 40″ and 225° respectively.
G & O give
ABP : 6.579, − 0.085, 0.094, 0.146, 2.631.

HD 69144 : G & O give
A : 5.140, − 0.058, 0.084, 0.373, 2.652.

HD 71833 : G & O give
A : 6.702, − 0.010, 0.085, 0.630, 2.697.

HD 83953 : G & O give
A : 4.764, − 0.049, 0.088, 0.379, 2.605.
B : 10.900, 0.640, 0.333, 0.117.

HD 86523 : G & O give
B : 10.337, 0.046, 0.141, 0.868.

HD 87901 BC : The C component is 4 magnitudes fainter than B.

HD 91355/6 : G & O give
A : 5.747, − 0.087, 0.107, 0.298, 2.669.
B : 6.108, − 0.040, 0.102, 0.566, 2.700.

HD 112092/1 : G & O give
A : 4.020, − 0.081, 0.095, 0.180, 2.667.
B : 5.134, − 0.019, 0.089, 0.326, 2.608.

HD 114911 : G & O give
A : 4.814, − 0.047, 0.127, 0.632, 2.795.
B : 7.327, 0.078, 0.306, 0.646, 2.877.

HD 120955 : G & O give
B : 8.424, 0.159, 0.186, 0.698, 2.793.
Oblak gives
A : 4.758, − 0.033, 0.093, 0.484, 2.680.
B : 8.479, 0.187, 0.157, 0.778, 2.740.

HD 138800 : The X component is not listed in the IDS catalogue. The separation and position angle are about 34″ and 120° respectively. Y is not listed in the IDS catalogue. The separation and position angle are about 27″ and 0° respectively.

HD 141318 : X is not listed in the IDS catalogue. The separation is about 50″.
Oblak gives
A : 5.783, 0.091, 0.045, 0.098, 2.603.
B : 9.148, 0.829, 0.354, 0.269, 2.527.

HD 143118 : Oblak gives
A : 3.447, − 0.099, 0.086, 0.106, 2.635.
B : 7.830, 0.077, 0.159, 0.777, 2.857.

HD 153613 : D has a one magnitude fainter companion. The separation and position angle are about 4″ and 50° respectively.

HD 159176 : X is not listed in the IDS catalogue. The separation and position angle are about 25″ and 180° respectively.
G & O give
ABC : 5.729, 0.087, 0.007, − 0.105, 2.580.

HD 170740 : Oblak gives
A : 5.757, 0.231, 0.038, 0.180, 2.629.
B : 9.388, 0.342, 0.105, 0.975, 2.840.

HD 174152 : Oblak gives
A : 6.517, − 0.020, 0.102, 0.487, 2.712.
B : 9.350, − 0.003, 0.107, 0.836, 2.839.

HD 181558 : G & O give
A : 6.244, − 0.033, 0.099, 0.441, 2.715.

HD 193924 : X is not listed in the IDS catalogue. The separation and position angle are about 65″ and 260° respectively.

HD 211924 : G & O give
AB : 5.369, 0.028, 0.067, 0.495, 2.665.

TABLE I. — *uvbyβ indices and V magnitudes for double stars.*

HD	BD	HR	ADS	COMP	SEP	N	V	ERR	B-Y	ERR	M1	ERR	C1	ERR	N	HB	ERR	NOTES
480	S50 20			A		2	7.065	10	-.055	3	.110	4	.594	0	2	2.716	4	IR
				B	25.0	1	13.06		.60		.52		.37					IR
560	N10 8	26	122	A		2	5.529	4	-.042	4	.148	10	.820	13	2	2.837	7	
				B	8.0	1	10.37		.50		.36		.42					*
1438	N42 48	70	254	A		4	6.06		-.033		.118		.677		6	2.751		13,3
3369	N32 101	154	513	A		3	4.367	8	-.071	1	.122	6	.433	14	3	2.677	11	11
				B	35.9	4	8.606	6	.107	7	.197	10	.899	19	4	2.860	17	11
4180	N47 183	193	622	A			4.62		.007		.076		.479					2
8803	N02 211	419	1148	A		2	6.643	27	-.006	3	.094	6	.885	3	2	2.821	11	*
				B	6.0	1	9.67		.31		.26		.73					
10161	S25 670	474	1298	A		3	6.692	5	-.031	3	.108	5	.870	3	4	2.792	6	5,7
				B	20.3	2	12.320	38	.410	41	.226	42	.305	49	3	2.524	125	
10293	N57 370	482	1334	A		3	6.36		.024		.078		.474		3	2.669		4
16046	S28 819	749	1954	A		3	4.968	7	-.026	2	.125	2	.967	2	4	2.843	5	5,7
16047				B	10.8	3	7.790	8	.082	2	.227	4	.894	18	3	2.872	8	5,7
17543	N16 355	836	2151	AB	3.2	4	5.280	12	-.013	16	.090	24	.485	12	4	2.703	4	
				C	25.2	3	10.727	52	.395	24	.149	33	.309	33	2	2.565	13	
23793	N10 486	1174	2778	A		2	5.097	10	-.057	13	.100	14	.356	27	2	2.705	0	
				B	9.0	2	9.408	175	.293	55	.302	86			2	2.660	16	
23990	N08 574		2796	A		2	6.774	1	-.004	6	.123	13	.916	13	2	2.828	0	
				B	30.7	2	13.211	17	.657	0	.319	48	.436	74	2	2.568	41	
24388	S05 769	1202	2832	A		2	5.498	3	-.033	8	.092	8	.604	7	2	2.743	7	*
				B	8.2	2	10.346	139	.304	18	.110	66	.398	62	2	2.626	11	
25330	N09 528	1243	2938	A		2	5.689	16	.037	1	.080	3	.480	10	2	2.717	6	*
				B	12.0	2	11.211	38	.553	16	.050	74	.285	57	2	2.575	47	
27638	N25 707	1369	3161	A		2	5.406	19	-.028	0	.143	1	.957	26	2	2.832	7	12
				B	19.4	2	8.430	31	.378	3	.212	3	.319	4	2	2.623	16	12
28107	S40 1372			A		2	7.360	11	-.042	7	.109	0	.525	8	2	2.742	4	
29227	S03 830	1462	3328	A		2	6.371	8	-.032	4	.102	3	.623	10	2	2.715	7	*
				B	17.8	2	10.719	11	.219	10	.124	27	.714	69	2	2.711	21	
				C	45.1	2	13.644	37	.547	201	-.014	218	.505	58	2	2.580	92	
31065	S54 719			AB	2.5	2	7.794	7	.000	7	.139	6	1.062	18	2	2.869	1	
32202	N11 702			A		2	7.262	41	.067	6	.092	0	.874	20	2	2.744	4	
				B	32.8	2	10.293	40	.204	6	.171	10	.886	20	2	2.908	10	
32964	S04 1044	1657	3698	A		2	5.109	3	-.031	3	.137	8	.864	4	3	2.845	10	IR
				B	52.8	3	10.835	9	.733	10	.586	50	.688	140	3	2.569	38	IR
33224	S08 1037	1671	3722	A		2	5.822	5	-.033	3	.099	0	.648	3	3	2.750	9	5,7
				B	21.6	2	8.992	6	.665	3	.462	6	.406	4	2	2.569	10	
33802	S12 1095	1696	3778	A		2	4.473	3	-.044	0	.114	6	.604	16	2	2.752	6	IR
				B	12.7	2	9.923	3	.491	25	.259	8	.285	57	2	2.575	47	IR
33949	S13 1092	1705	3800	AB	2.6	2	4.365	1	-.037	3	.102	3	.706	7	3	2.708	0	
34503	S07 1028	1735	3877	A		2	3.609	17	-.034	8	.080	4	.566	6	2	2.677	6	
				D	36.0	2	10.974	23	.494	41	.037	86	.373	47	2	2.631	54	
34527	S15 1001		3883	A		2	6.976	0	-.017	14	.111	21	.868	1	2	2.811	1	
				B	20.6	2	8.718	3	.020	6	.160	7	.955	4	2	2.899	14	
34798	S18 1055	1753	3910	A		2	6.375	0	-.071	1	.113	6	.356	21	2	2.714	1	*
34797				B	39.4	2	6.535	21	-.046	6	.122	7	.526	17	2	2.754	11	
35007	S00 929	1764	3941	A		4	5.676	7	-.048	3	.092	6	.293	5	3	2.677	9	5,7 IR
				B	32.7	2	13.050	8	.458	16	.176	31	.339	10	2	2.594	23	
				C	37.6	2	11.882	16	.435	21	.205	49	.372	71	2	2.625	3	IR
35149	N03 871	1770	3962	A		3	5.004	7	-.050	9	.074	9	.065	26	4	2.634	12	*
35148				B	32.1	3	7.257	52	-.041	0	.094	9	.327	5	3	2.676	35	
35173	N15 805		3969	A		2	7.271	3	.065	1	.064	7	.442	11	2	2.699	3	*
35172				B	26.0	2	8.288	1	.065	14	.086	25	.558	7	2	2.732	0	
35715	N02 962	1811	4039	AB	3.0	2	4.577	5	-.090	2	.076	6	.031	1	3	2.614	2	5,7
				C	83.4	2	13.877	49	.402	59	.255	81	.291	57	2	2.672	10	
36013	N01 1026			A		2	6.885	3	-.069	0	.091	3	.335	6	2	2.668	7	IR
				B	25.0	2	12.486	14	.372	4	.149	8	.334	37	2	2.600	10	IR

TABLE I *(continued)*.

HD	BD	HR	ADS	COMP	SEP	N	V	ERR	B-Y	ERR	M1	ERR	C1	ERR	N	HB	ERR	NOTES
36151	S07 1092			A		2	6.692	10	-.054	4	.115	6	.380	4	2	2.721	4	IR
				B	48.6	2	10.597	11	.411	10	.180	25	.362	14	2	2.565	8	IR
				X	45	2	11.988	14	.467	33	.106	64	.353	41	2	2.600	3	* IR
36408	N16 794	1847	4131	A		3	6.091	19	.040	12	.081	7	.743	21	2	2.722	4	
	N16 784			B	9.6	3	6.510	23	.047	16	.085	9	.871	14	2	2.705	4	
36779	S01 949	1873	4159	A		2	6.240	6	-.076	1	.096	3	.156	3	2	2.652	10	* IR
				B	27.5	2	11.195	23	.890	28	.440	113	.398	78	2	2.568	30	IR
36861	N09 879	1879	4179	AB	4.4	2	3.469	11	-.040	3	.052	7	-.068	14	2	2.583	8	IR
				C	28.6	2	10.721	24	.521	44	.068	1	.300	11	2	2.621	13	IR
36898	S00 1005		4180	A		2	7.162	3	-.048	3	.121	4	.556	6	2	2.757	13	
				B	10.0	2	10.087	55	.103	52	.244	1	.936	16	2	2.907	54	
36960	S06 1234	1887	4182	A		2	4.895	4	-.126	14	.071	10	-.045	8	2	2.608	17	*
36959				B	35.7	2	5.729	8	-.111	7	.093	1	.041	7	2	2.636	17	
38426	S21 1252		4339	A		3	6.785	2	-.089	7	.101	10	.224	9	3	2.679	3	IR
				B	19.4	3	11.580	21	.693	12	.461	104	1.199	288	3	2.544	31	IR
38622	N13 979	1993	4381	A		2	5.274	8	-.070	10	.094	6	.323	30	3	2.658	10	IR
				B	17.8	2	12.167	106	.922	20					2	2.611	4	
				C	24.9	2	12.011	24	.406	0	.194	6	.325	47	2	2.635	13	IR
38672	N12 902		4386	A		2	6.701	13	-.033	7	.112	8	.636	6	2	2.743	14	
				B	19.3	2	12.974	38	1.089	37	.641	51						
40494	S35 2612	2106		A		2	4.361	2	-.075	3	.092	4	.307	3	6	2.641	2	6,7 IR
				B	33.8	2	12.664	24	.458	10	.227	49	.280	79	1	2.57		IR
43112	N13 1173	2222		A		2	5.935	41	-.102	4	.093	0	-.010	13	2	2.612	10	
				B	21.3	2	12.703	11	.392	1	.162	27	.335	35	2	2.563	62	
43286	N03 1180		4863	A		2	6.992	10	-.055	3	.105	1	.421	10	2	2.680	6	
				B	18.3	2	12.381	27	.423	25	.258	4	.248	42	2	2.592	34	
				C	58.8	2	10.111	3	.186	1	.178	8	.763	24	2	2.787	0	
43983	N12 1110		4939	A		2	7.674	14	-.050	8	.123	16	.610	16	2	2.719	4	
				B	21.9	2	11.299	30	.346	18	.191	33	.374	21	2	2.611	17	
44458	S11 1460	2284	4978	AB	4.2	2	5.552	87	.076	10	.007	9	-.046	20	3	2.456	10	5,7
				C	56.5	2	11.623	25	.414	24	-.069	61	1.215	49	2	2.871	10	
44944	N10 1128		5035	A		2	7.836	23	.116	4	.220	7	.858	17	2	2.840	6	
				B	20.0	2	10.376	16	.082	17	.090	18	.894	21	2	2.783	41	
44996	S12 1470	2309	5030	A		3	6.106	5	-.016	3	.083	7	.338	29	2	2.651	8	*
				B	23.2	3	10.497	26	.287	9	.136	5	.624	21	3	2.755	47	
45995	N11 1204	2370	5153	A		3	6.105	21	.017	9	.029	16	.014	12	3	2.461	3	
				B	16.3	3	9.161	29	.019	9	.098	31	.745	23	2	2.766	13	
46035	S14 1476		5144	A		4	6.776	32	.017	10	.112	16	.677	14	4	2.764	8	
				B	21.6	3	10.983	43	.156	19	.160	36	1.021	26	2	2.864	6	
46064	S13 1519	2373	5148	A		3	6.160	3	-.055	5	.080	7	.150	2	3	2.642	5	*
				B	36.6	2	11.080	4	.354	17	.154	21	.422	33	3	2.662	24	
46547	S31 3407	2397		A		2	5.744	10	-.088	1	.096	5	.139	5	3	2.605	7	5,7
				B	24.9	2	8.665	0	-.019	3	.094	10	.558	26	3	2.771	3	5,7
47116	S24 4209			A		3	7.706	14	-.009	10	.199	16	.667	47	2	2.761	3	*
				B	37.9	4	9.285	18	.345	12	.175	8	.409	40	2	2.588	10	
47247	S22 1472	2433	5260	A		3	6.410	12	-.063	5	.112	5	.417	14	4	2.716	28	*
				B	9.1	3	9.319	57	.061	29	.206	17	1.085	152	3	2.906	14	
47732	N09 1331		5316	A		2	8.465	10	-.057	8	.114	8	.321	3	2	2.721	3	
				B	21.4	2	10.908	24	.518	33	-.163	24	.069	38	2	2.660	52	
				C	25.8	2	12.462	13	.595	28	-.085	40	.276	132	2	2.807	137	
47851	S31 3520			A		2	7.672	7	-.093	10	.107	11	.194	34	2	2.639	3	
				BC	23.8	2	10.153	4	.272	0	.144	17	.494	11	2	2.703	54	*
47887	N09 1344		5327	A		2	7.185	10	-.099	1	.084	7	-.015	14	2	2.631	6	
				B	12.8	2	10.228	23	.114	10	.142	1	.705	24	2	2.789	0	
48383	S40 2625	2475		A		4	6.161	40	-.076	10	.108	24	.374	12	6	2.693	12	*
				B	15.4	5	9.601	54	.120	18	.193	18	.910	65	2	2.841	3	
48425	S23 4239		5371	A		3	7.140	3	-.081	5	.104	7	.319	7	3	2.701	2	IR
				C	34.9	3	12.829	7	.437	23	.193	43	.377	33	3	2.572	9	IR
48857	S50 2357			A		2	7.028	52	-.060	3	.093	3	.336	3	2	2.671	10	*
				B	42.3	2	9.163	98	-.018	4	.118	16	.813	24	2	2.819	14	
48917	S30 3484	2492		A		3	5.216	16	-.015	10	.041	12	-.031	12	3	2.499	3	*
				B	36.3	2	12.583	65	.280	52	.199	18	.791	17	2	2.663	33	

TABLE I *(continued)*.

HD	BD	HR	ADS	COMP	SEP	N	V	ERR	B-Y	ERR	M1	ERR	C1	ERR	N	HB	ERR	NOTES
52140	S30 3757	2621		A		3	6.308	10	-.076	7	.110	10	.371	5	4	2.709	7	5,7
				B	35.0	1	10.095	10	1.172	4	.183	7	.511	10	2	2.620	18	5
				C	70.0	2	11.370	3	.322	6	.131	14	.453	4	2	2.655	28	
52437	S21 1695	2628	5687	AP		2	6.525	4	-.088	14	.098	14	.118	10	2	2.613	6	
				X	40	2	11.074	4	1.079	10	.767	33	.327	24	2	2.569	1	*
53191	S60 742			A		2	7.742	13	-.023	11	.135	8	.876	10	2	2.840	0	IR
				B	17.0	2	11.754	16	.425	4	.198	1	.304	3	2	2.598	1	IR
53755	S10 1861	2670	5782	AB	6.2	3	6.498	24	.029	2	.022	3	-.008	10	3	2.587	12	
54764	S16 1802	2699	5837	A		3	6.051	1	.101	4	.005	7	.008	3	3	2.573	6	5,7
				B	29.5	4	11.671	34	.312	36	.091	48	.549	14	2	2.685	4	
55856	S22 1761	2733	5912	A		3	6.375	2	-.090	3	.093	7	.119	11	3	2.617	5	5,7
				B	19.7	1	9.092	10	.506	4	.249	7	.418	10	3	2.579	15	5,7
56456	S48 2807	2762		A		2	4.761	0	-.036	3	.110	3	.785	1	3	2.782	3	5,7
				B	18.5	1	13.04		.37		.29		.47					
56504	S29 4141			A		2	9.081	7	-.025	3	.117	7	.715	1	2	2.727	18	IR
				B	31.1	2	9.920	27	.566	1	.332	13	.413	21	2	2.587	4	IR
58420	S35 3569	2829		A		2	6.324	1	-.067	2	.109	5	.432	6	3	2.719	3	5,7
				B	25.0	2	11.781	18	.333	10	.149	7	.461	18	2	2.668	6	
60102	S84 132			A		2	7.537	16	.020	0	.119	3	.916	13	2	2.819	8	
				B	16.4	2	11.862	38	.519	6	.217	25	.208	1	2	2.704	30	
60575	S48 1206			A		3	8.705	17	.023	7	.075	28	.383	35	3	2.685	19	IR
				B	15.4	4	10.051	68	.040	52	.105	42	.671	58	2	2.785	14	IR
				C	26.4	2	12.795	179	1.311	48	-.272	4			2	2.715	8	IR
60624	S13 2104			AB	5.7	2	7.592	21	.036	13	.064	18	.559	13	3	2.709	7	
60855	S14 1999	2921	6208	AB	5.2	2	5.719	11	-.027	3	.058	5	.229	6	3	2.616	5	5,7
				C	19.6	1	9.766	10	.057	4	.130	5	.978	8				5
60863	S28 4566	2922	6205	A		2	4.650	2	-.055	2	.121	3	.594	3	3	2.760	8	5,7
				B	38.4	2	9.154	8	.199	2	.153	8	.640	7	3	2.740	12	5,7
				C	79	1	10.445	10	.641	4	.345	7	.541	10	2	2.560	3	5
61555	S26 4707	2948	6255	A		2	4.532	33	-.099	10	.105	3	.301	4	2	2.688	1	
61556				B	9.9	2	4.778	7	-.072	10	.139	0	.569	20	2	2.750	1	
63065	N00 2079		6366	A		2	8.380	11	.004	1	.129	1	.942	11	2	2.831	3	
				B	17.5	2	9.301	10	.061	30	.172	25	1.003	13	2	2.877	13	
				C	26.5	2	12.433	48	.239	74	.164	74	.663	17				
63425	S41 3384			A		2	6.933	4	-.055	0	.054	3	-.042	1	2	2.606	4	IR
				B	49.6	4	7.647	20	1.062	18	.518	40	.563	76	2	2.561	1	IR
63465	S38 3650	3035		A		2	5.079	6	-.026	1	.068	1	.308	0	3	2.630	3	5,7
				B	10.9	2	11.132	66	.317	51	.225	65	.525	86	2	2.665	25	
63922	S46 3458	3055		A		2	4.092	3	-.055	1	.043	8	-.082	11	4	2.595	34	
				B	59.2	2	8.931	3	-.003	10	.120	6	.743	8	2	2.766	10	
64755	S26 5171			AB	4.2	2	8.673	21	.340	7	-.060	1	.697	7	2	2.640	4	
65162	S35 4030			AB		2	8.127	0	.007	13	.077	27	.372	13	2	2.686	11	
				C	15.7	2	10.157	25	.041	7	.090	25	.568	45	2	2.761	7	
66005	S49 3243	3142		A		2	6.346	3	-.068	11	.094	14	.128	5	3	2.652	6	5,7
66006				B	16.4	2	6.356	13	-.045	10	.075	18	.167	11	3	2.656	9	5,7
66230	S34 4213			A		2	8.172	6	-.008	1	.090	3	.540	13	2	2.729	7	
				B	9.7	2	12.231	7	.195	4	.178	18	.793	7	2	2.792	34	
66539	S30 5500			A		2	7.669	11	.000	1	.064	14	.291	21	2	2.640	14	
66546	S54 1470	3157		A		2	6.122	4	.023	2	.065	8	.222	9	3	2.639	10	5,7
				B	40.4	2	8.178	9	.035	8	.078	21	.338	19	3	2.716	16	5,7
66624	S40 3776	3162		A		2	5.518	11	-.081	1	.143	2	.549	9	3	2.727	5	5,7
				B	27.0	2	8.306	15	1.487	31	-1.123	35	2.032	117	2	2.730	48	5
67059	S42 3852			AB	4.2	2	7.431	3	-.013	1	.069	6	.247	3	2	2.611	6	
67880	S15 2280	3194	6632	AB	5.2	2	5.661	1	-.065	0	.089	2	.200	1	3	2.645	5	5,7
69144	S46 3929	3244		A		2	5.135	10	-.058	4	.079	14	.380	16	2	2.654	3	*
				B	35.0	2	9.495	13	.933	16	.592	11	.194	72	2	2.592	8	
70309	S47 3799			A		2	6.453	6	-.055	1	.100	4	.315	10	2	2.686	10	IR
				B	42.5	2	11.282	18	.700	27	.387	1	.263	180	2	2.604	71	IR
70556	S36 4513	3283		AB	6.8	2	5.178	1	-.089	3	.092	2	.154	0	4	2.631	3	5,7

TABLE I *(continued)*.

HD	BD	HR	ADS	COMP	SEP	N	V	ERR	B-Y	ERR	M1	ERR	C1	ERR	N	HB	ERR	NOTES
71304	S43 4259			A		2	8.259	1	.469	4	-.124	4	-.045	8	3	2.561	16	
				B	11.8	2	11.829	225	.465	13	.152	55	.408	253	2	2.643	24	
				C	18.6	2	11.407	31	.510	42	-.121	41	.285	3	2	2.668	31	
71510	S51 3004	3330		A		2	5.186	2	-.081	2	.099	3	.289	0	3	2.666	3	5,7 IR
				B	25.5	2	9.508	5	.057	11	.089	18	.849	8	2	2.697	7	5 IR
				C	34.9	2	10.766	17	.420	24	.237	54	.383	38	2	2.600	41	IR
71833	S20 2549	3345		A		2	6.700	0	-.009	4	.089	8	.628	7	2	2.694	10	*
				B	18.9	2	11.770	23	.358	24	.104	34	.379	24	2	2.650	20	
72798	S45 4236			A		2	6.460	6	-.041	1	.090	4	.433	1	2	2.654	1	
				B	15.	2	10.899	18	.105	27	.073	47	.908	7	2	2.850	8	
74067	S39 4653	3439		AB	3.9	2	5.223	5	-.053	1	.225	2	.917	4	4	2.846	7	5,7
74115	S40 4505			A		2	8.209	21	-.005	0	.139	1	.994	1	2	2.842	11	
				B	17.0	3	13.087	14	.375	38	.093	83	.527	118	3	2.731	83	
74146	S52 1579	3442		A		2	5.195	6	-.064	0	.111	3	.405	2	3	2.715	1	5,7 IR
				B	16.6	2	8.663	1	.164	0	.188	11	.724	31	3	2.760	10	5,7 IR
74531	S47 4261			A		2	7.254	13	-.073	14	.081	0	.025	17	2	2.635	3	
				B	13.9	2	11.631	30	.345	42	.109	64	.917	122	2	2.754	68	
76323	S41 4616			A		2	7.360	3	-.055	0	.106	0	.424	3	2	2.676	10	
				B	17.5	2	10.207	3	-.006	4	.172	4	.982	3	2	2.903	1	
76566	S44 4951	3562		A		2	6.276	20	-.078	1	.105	7	.333	20	4	2.672	8	5,7 IR
				B	35.0	2	12.639	7	.419	21	.238	4	.287	10	2	2.601	35	IR
77002	S58 1301	3582		A		2	4.919	2	-.086	0	.100	1	.223	4	3	2.659	6	5,7
				B	40.4	2	6.833	6	-.053	2	.117	5	.500	2	3	2.739	8	5,7
77484	N00 2451		7159	AB	4.4	3	8.019	14	-.003	5	.147	0	.966	3	3	2.556	5	
82906	N14 2113			A		2	7.901	47	-.039	23	.121	8	.572	13	2	2.724	13	
				B	54901	2	9.075	42	.360	18	.178	7	.364	14	2	2.627	7	
82919	S56 2300			A		2	7.127	13	.016	4	.069	1	.442	14	2	2.675	10	
				B	10.8	2	11.459	24	.157	28	.072	6	1.004	274	2	2.780	137	
83953	S22 2684	3858		A		2	4.757	4	-.053	11	.095	13	.441	11	2	2.609	0	*
				B	54.7	2	10.944	17	.691	21	.442	64	.300	47	2	2.658	1	
83965	N17 2120			A		2	8.375	57	.068	11	.182	8	1.096	1	2	2.861	10	
				B	17.0	2	11.873	11	.469	37	.152	6	.356	30	2	2.704	30	
86388	S68 1002			A		2	6.872	25	-.033	10	.122	6	.827	30	2	2.822	10	
				B	9.2	2	9.980	45	.298	6	.163	23	.554	68	2	2.704	3	
86440	S53 3075	3940		A			3.543		-.016		.078		.356			2.597		9,1
				B	37.2	2	12.378	1	.919	17	.673	17	.442	238	2	2.606	14	
86523	S47 5399	3943		A		2	6.083	0	-.061	2	.098	2	.243	7	4	2.664	5	5,7
				B	14.1	2	10.509	23	.007	33	.235	45	1.027	61	2	2.905	18	*
87901	N12 2149	3982	7654	A			1.35		-.041		.102		.712			2.723		8,4
				BC	176.0	2	8.076	8	.523	6	.374	10	.266	8	3	2.556	5	* IR
90972	S29 8383	4118		A		2	5.577	4	-.026	2	.135	1	.867	3	4	2.824	7	5,7 IR
				B	11.0	2	9.654	10	.384	4	.215	5	.325	8	2	2.580	13	5 IR
91355	S44 6583	4135		A		2	5.781	25	-.093	3	.101	7	.266	13	3	2.670	2	*
91356				B	13.5	2	6.143	21	-.052	0	.104	3	.560	4	3	2.695	14	
91590	S46 6219			A		2	7.101	10	-.046	6	.119	10	.584	3	2	2.748	3	IR
				B	28.4	2	9.990	13	.118	14	.206	27	.861	7	2	2.838	6	IR
91645	S36 6485			AB	3.7	2	6.898	4	.014	3	.148	4	1.077	0	3	2.855	7	
92029	S81 449	4161		A		2	7.059	16	.000	6	.070	8	.443	1	3	2.711	5	5,7
				B	41.9	2	9.436	15	.189	9	.159	5	1.073	7	3	2.795	22	5,7
93010	S60 2203			A		2	6.633	10	.028	0	.084	0	.330	3	2	2.670	3	
				B	12.4	2	8.192	7	.078	11	.064	4	.514	0	2	2.730	6	
93632	S59 2696			A		2	8.353	44	.285	1	-.056	1	.170	3	2	2.548	6	
				B	16.8	3	10.468	14	.204	16	-.058	28	.034	38	2	2.601	16	
93873	S58 2747			A		2	7.759	8	.414	7	-.138	0	-.029	10	2	2.549	13	
				B	13.8	2	10.641	21	1.020	76	-.159	25	.474	35	2	2.635	1	
94565	S38 6818			A		2	7.055	42	-.004	4	.100	3	.703	3	2	2.761	14	
				B	25.8	2	8.547	21	.218	1	.148	7	.856	6	2	2.789	1	
94909	S56 4016			A		2	7.310	1	.402	6	-.065	4	-.025	11	2	2.546	7	
				B	23.6	2	10.602	48	.620	35	.408	72	.377	44	2	2.639	79	
95198	S34 7121			A		2	7.879	3	-.030	8	.153	1	.856	1	2	2.769	4	
				B	26.7	2	11.879	1	.902	1	.654	33	.458	119	2	2.517	33	

TABLE I *(continued)*.

HD	BD	HR	ADS	COMP	SEP	N	V	ERR	B-Y	ERR	M1	ERR	C1	ERR	N	HB	ERR	NOTES
96261	S59 3019			A		2	7.699	69	.242	7	-.071	4	.027	4	2	2.595	21	
				B	17.6	2	9.515	64	.312	23	-.125	17	-.205	20	2	2.317	42	
96264	S60 2505			A		2	7.603	0	.039	6	.016	1	-.105	7	2	2.570	4	
				B	24.0	2	10.167	52	.034	44	.056	42	.130	8	2	2.331	34	
97583	S63 1860	4355		A		2	5.234	2	-.040	0	.123	2	.800	4	3	2.806	4	5,7
				B	19.1	2	11.105	61	.286	8	.042	40	1.022	17	2	3.037	116	
99803	S41 6565	4423		A		2	5.157	2	-.013	1	.125	3	.943	2	3	2.824	5	5,7
				B	13.1	2	7.783	10	.089	8	.185	9	.934	1	3	2.877	11	5,7
100359	S73 864			A		2	6.867	27	.240	6	-.009	1	.610	0	2	2.682	11	
				B	21.0	2	10.891	82	.321	0	.045	33	1.055	57	2	2.944	20	
100841	S62 2127	4467		A			3.148		-.002		.096		1.158			2.743		9,1
				B	16.3	1	13.19								2	2.882	85	
101436	S62 2206			A		2	7.614	1	.118	1	-.015	7	-.093	3	2	2.558	40	
				B	27.8	2	8.370	14	.133	3	-.028	11	-.040	13	2	2.568	47	
102340	S57 4979			AB	2.9	3	7.735	16	-.020	10	.113	5	.519	3	3	2.714	12	
104901	S61 2933			A		2	7.361	38	.216	3	-.012	4	.785	0	2	2.643	14	IR
				B	23.0	2	7.566	54	.394	3	.019	6	1.454	91	2	2.631	6	IR
106983	S63 2235	4679		A		2	4.048	6	-.085	6	.107	3	.258	4	2	2.686	3	
				B	33.8	2	12.490	30	.931	1	.336	40	.299	48	2	2.583	34	
107348	S21 3514	4696	8517	A		2	5.218	4	-.039	4	.112	6	.710	3	3	2.738	4	5,7
108610	S61 3218			A		2	6.941	0	.014	0	.054	6	.364	4	2	2.683	17	
				B	21.8	2	11.890	7	.242	21	.144	51	.958	25	2	2.940	31	
108767	S15 3482	4757	8572	A			2.94		-.024		.142		.980			2.856		8,1 IR
				B	24.2	2	8.430	14	.534	8	.423	10	.310	21	3	2.566	3	IR
109668	S68 1702	4798		A		3	2.69		-.104		.093		.112		3	2.645		9,1
109867	S66 1861	4806		A		2	6.290	35	.118	6	-.022	6	-.050	8	3	2.542	11	5,7
				B	17.0	2	11.474	1	.100	4	.007	0	.284	18	2	2.702	37	
110956	S55 5215	4848		A		2	4.624	12	-.072	5	.105	6	.302	4	2	2.703	4	5,7
				B	52.6	1	8.716	10	.179	4	.334	5	.466	8	2	2.814	38	5
111123	S59 4451	4853		A		3	1.25		-.103		.061		-.041		3	2.597		8,1
112092	S56 5487	4898		A		2	3.996	7	-.081	6	.096	11	.195	10	2	2.655	11	*
112091				B	34.9	2	5.127	3	-.033	1	.094	1	.371	4	2	2.617	21	
112244	S56 5498	4908		A		3	5.382	6	.080	4	.013	2	-.136	1	3	2.539	6	5,7 IR
				B	29.1	2	11.768	17	.815	21	.235	4	.014	31	2	2.828	38	IR
112413	N39 2580	4915	8706	A		8	2.89		-.058		.188		.630		6	2.777		8,3
112412				B	19.6	10	5.60		.230		.152		.578		3	2.723		8,3
113703	S47 8088	4940		A		2	4.717	2	-.074	3	.118	8	.377	0	3	2.725	3	5,7
113791	S49 7644	4942		A		2	4.251	13	-.086	6	.095	10	.142	38	2	2.662	20	IR
				B	25.1	2	9.381	25	.335	7	.187	21	.312	49	2	2.620	52	IR
114911	S67 2224	4993		A		2	4.758	21	-.039	1	.122	3	.635	7	2	2.787	23	*
				B	60.0	2	7.305	17	.065	16	.284	4	.771	35	2	2.856	0	
117460	S62 3326			A		2	7.476	6	.122	1	-.002	4	.170	20	2	2.613	21	
				B	16.1	2	8.413	10	.128	4	.008	1	.062	8	2	2.591	8	
118716	S52 6655	5132		A		3	2.30		-.094		.058		.043		3	2.610		8,1
				B	36.0	1	13.56											
119423	S66 2309			AB	3.6	2	7.544	16	.018	8	.083	10	.239	3	2	2.553	7	
120324	S41 8172	5193		A			2.94		-.051		.054		-.029			2.474		8,1,10
				B	48.6	3	13.627	208	.363	97					3	2.614	61	
120642	S52 6787	5207		A		2	5.279	6	-.050	2	.123	2	.711	0	3	2.791	3	5,7
120641				B	18.0	2	7.539	13	.169	3	.180	4	.749	19	3	2.786	3	5,7
120955	S31 10729	5221		A		2	4.781	7	-.060	5	.097	3	.452	7	3	2.681	8	5,7 *
				B	14.9	2	8.413	6	.188	10	.181	6	.759	20	1	2.79		
120991	S46 8931	5223		A		2	6.131	10	-.003	24	.042	27	-.046	47	3	2.550	8	5,7
				B	21.4	2	11.515	40	.069	48	.180	81	.784	76	1	2.924		
123445	S42 2065	5294		A		2	6.187	4	-.013	6	.111	8	.741	3	3	2.815	6	5,7 IR
				B	28.6	2	12.517	79	.690	34	.471	139	.472	201	3	2.573	24	IR
123635	S43 8831			A		2	7.755	4	.000	3	.107	11	.629	17	2	2.721	1	
				B	9.2	1	11.30		.50		.06		.67		1	2.55		

TABLE I *(continued)*.

HD	BD	HR	ADS	COMP	SEP	N	V	ERR	B-Y	ERR	M1	ERR	C1	ERR	N	HB	ERR	NOTES
124367	S56 6206	5316		A		2	5.065	10	-.001	9	.070	12	.207	4	3	2.537	2	5,7
				B	33.9	2	12.288	6	1.467	48					2	2.915	171	
				C	36.	3	12.791	64	.546	19	.267	28			3	2.672	19	
124471	S66 2490	5320		A		2	5.760	7	.009	10	.044	13	-.014	2	3	2.610	2	5,7 IR
				B	23.8	2	13.482	201	.302	171	.269	393	.656	190	2	2.698	82	IR
126981	S44 9383	5412		A		3	5.517	5	-.040	2	.119	2	.823	2	3	2.780	5	
				B	10.5	1	12.45		.77									
127304	N32 2482	5422	9288	A		3	6.07		-.010		.150		1.007		8	2.879		4
127971	S40 8794	5439		A		2	5.885	6	-.031	3	.108	6	.577	0	3	2.771	12	5,7 IR
				B	26.9	2	11.215	6	.640	38	.397	81	.362	27	2	2.620	98	IR
128819	S40 8860			A		2	6.670	7	-.039	6	.131	6	.759	7	2	2.803	4	
				B	8.7	1	12.93		.90									
128919	S63 3381			AB	5.0	2	9.162	4	.192	0	.021	11	.551	54	2	2.713	20	
129791	S44 9590			A		2	6.936	18	.036	4	.139	3	.967	11	3	2.877	3	IR
				B	35.3	2	12.927	20	.790	10	.677	81			2	2.397	7	IR
130081	S74 1246			A		2	6.832	1	.031	0	.114	6	.775	4	2	2.801	10	
				B	17.7	2	11.745	1	.419	34	.184	25	.454	188	2	2.494	75	
131168	S45 9492			A		3	6.874	7	.020	2	.048	3	.133	3	3	2.567	2	
				B	17.0	2	9.607	41	.645	7	.390	4	.376	33	2	2.585	13	
135160	S60 5698	5661		ABC		2	5.736	0	.015	4	.028	7	-.053	2	3	2.606	4	5,7
				C	10.8	2	11.618	42	.181	113	.437	190			2	2.711	279	
135240	S60 5701	5664		A		2	5.065	7	.017	1	.026	1	-.115	5	3	2.585	5	5,7 IR
				B	50.	3	12.873	57	1.168	42					3	2.635	126	IR
135591	S60 5720	5680		AB	5.4	2	5.446	3	.009	6	.028	12	-.130	4	3	2.580	2	5,7 IR
				C	44.5	2	11.708	3	.268	37	.114	52	1.002	25	2	2.889	52	IR
136454	S62 4468			AB	3.7	2	9.474	3	.044	8	.115	0	.726	6	2	2.797	17	
137387	S72 1802	5730		A		2	5.471	34	.002	5	.028	8	.109	22	3	2.490	5	5,7 IR
				B	27.0	3	11.274	31	1.079	17					3	2.532	88	IR
138800	S73 1625	5782		A		2	5.650	6	.008	7	.084	6	.677	3	3	2.727	2	5,7 IR
				X	34	1	12.86		.60		.33		.46					* IR
				Y	27	1	14.09		.53		.26		.15					*
139619	S643236			A		1	8.98		.02		.10		.52		2	2.703	4	
140022	S72 1868			A		3	9.064	99	-.006	12	.077	21	.630	31	3	2.776	12	
				B	7.7	1	10.56		.07		.21		.96					
141318	S54 6711	5873		A		3	5.779	4	.078	5	.014	7	.098	4	5	2.601	8	5,7 *
				B	24.0	2	9.087	3	.825	8	.368	11	.271	88	2	2.585	4	
				X	50	1	11.76		.46		.18		.23		1	2.65		*
141468	S46 7745			A		2	8.598	7	.053	1	.085	7	.635	1	2	2.762	17	IR
				B	17.0	2	10.383	6	1.115	14	.652	95	.226	13	2	2.588	11	IR
141569	S03 3833			A	1.5	2	7.127	10	.066	8	.149	18	.960	59	2	2.908	8	
142448	S39 10237	5918		A		2	6.045	7	.145	1	.035	1	.900	3	2	2.780	3	5,7
				B	18.6	2	12.696	68							2	2.494	64	
142514	S64 3320	5920		AB		2	5.753	14	-.017	8	.100	4	.603	6	3	2.736	3	
				B	9.7	1	12.65		.38		.08		.21					
143018	S25 11228	5944	9862	A			2.91		-.068		.058		.028			2.614		8,1
				B	50.4	2	11.902	17	.355	59	.217	89	.751	173	2	2.666	52	
143118	S38 10797	5948		A		2	3.439	6	-.101	3	.083	11	.097	10	2	2.599	1	* IR
				B	15.0	2	7.858	27	.099	1	.181	11	.814	6	2	2.893	23	IR
143939	S39 10298			A		2	6.980	7	-.092	37	.229	33	.815	24	2	2.840	4	
				B	8.6	1	11.80		.64		.59		.24					
144217	S19 4307	5984	9913	ABC			2.59		.006		.046		.013			2.602		8,1
144218				C	13.6	2	4.931	6	.037	4	.047	20	.191	1	2	2.646	1	
145483	S28 11962	6029	9953	AB	4.3	3	5.671	6	.019	5	.117	8	.824	7	4	2.828	5	5,7
147049	S52 9668			A		2	7.704	10	.320	14	-.049	23	.003	28	2	2.538	0	
				B	7.	1	11.69		.13		.20		1.01					
148066	S65 3311			A		2	8.235	7	-.039	21	.118	18	.453	7	2	2.706	10	
				B	15.6	2	10.575	41	.280	17	.123	25	.954	201	2	2.837	42	
148688	S41 10695	6142		AB		2	5.287	11	.351	6	-.121	4	-.040	1	3	2.514	7	5,7
				B	8.6	1	13.06											
				C	58.0	2	9.688	0	1.039	20	.488	59	.383	8	2	2.610	18	

TABLE I *(continued)*.

HD	BD	HR	ADS	COMP	SEP	N	V	ERR	B-Y	ERR	M1	ERR	C1	ERR	N	HB	ERR	NOTES
149249	S50 10678			AB	2.7	2	7.372	0	.030	10	.063	8	.363	4	2	2.632	8	IR
				C	22.9	2	12.921	45	.556	59	-.119	30	1.196	81	2	2.892	65	IR
150742	S40 10661	6214		AB		2	5.641	3	-.026	8	.085	10	.293	3	4	2.684	5	5,7
				B	8.0	1	12.78		.65		.22		.39					
151158	S42 11540			AB	2.8	2	8.185	38	.242	7	-.028	10	.117	3	2	2.523	79	
152408	S40 10919	6272		AB	5.4	2	5.796	4	.132	0	.107	6	-.177	3	4	2.405	4	5,7
152723	S40 10986			A		2	7.241	21	.176	8	-.041	11	-.117	17	2	2.574	13	
				D	15.7	2	10.299	41	.208	21	-.040	8	.009	6	2	2.609	68	
152901	S37 11118			A		2	7.506	235	.145	3	.002	3	.228	6	2	2.645	4	
				B	9.1	1	12.60		.32		.22		1.58					
153519	S41 11188			AB	3.2	2	8.255	11	.140	3	.012	11	.540	1	2	2.703	6	
153613	S31 13473	6316		A		2	5.038	7	-.049	1	.124	5	.656	6	3	2.767	5	5,7
				B	27.1	1	12.61		.49		.11		1.01					
				C	43.0	1	13.78		1.30									
				D	48.0	1	14.35		.97		.20		.77					*
156247	N01 3408	6414	10428	A		2	5.909	3	.081	2	.041	6	.400	0	2	2.693	1	5,7
				B	20.4	2	12.258	64	.661	14					2	2.598	8	
156325	S32 12573	6422		A		2	6.377	44	.165	5	.000	9	.508	29	3	2.643	12	5,7
				B	19.5	2	11.906	20	.478	10	-.017	17	.581	7	3	2.737	9	
157042	S47 11484	6451		A		2	5.238	5	-.016	4	.049	4	.038	10	3	2.481	12	5,7
				B	42.8	3	12.079	9	.873	42	.615	90	.737	462	3	2.544	59	
157246	S56 8225	6462		A			3.31		-.023		.034		-.040			2.560		9,1 IR
				B	17.9	1	10.53		.20						2	2.826	21	
				C	41.6	1	12.17		.38		.17		.74		2	2.697	20	IR
157736	S27 11652		10538	AB		2	7.478	3	.073	4	.108	6	.958	6	2	2.895	1	
				B	5.5	1	12.01		.52		.30		.34					
157741	N15 3179	6482	10528	AB	3.9	2	6.356	3	.007	3	.111	4	.899	0	2	2.810	0	
158094	S60 6842	6500		A			3.75		-.041		.098		.783			2.772		9,1 IR
				B	47.4	1	10.98		.93		.67		.13		4	2.601	46	IR
158427	S49 11511	6510		A			2.95		-.061		.074		.267			2.505		8,1
				B	55.6	2	10.988	1	.776	54	.469	82	.983	44	2	2.548	1	
159091	S35 11704			A		2	7.609	13	.151	1	.040	1	.627	6	2	2.717	0	
				B	9.2	1	13.32		.68		.15		.44					
159176	S32 12235	6535		AB	5.4	2	5.720	6	.101	6	-.010	16	-.136	13	2	2.570	8	
				C	13.3	2	10.912	395	.408	48	.039	296	.027	416	2	2.674	30	
				X	25	1	10.76		.18		.01		.23		1	2.69		*
159574	S40 11641			A		2	7.775	14	.201	10	-.022	11	.676	3	2	2.652	14	
				B	12.7	2	11.028	27	.187	4	-.006	6	.534	18	2	2.706	4	
160281	S32 13121			A		2	8.313	20	.069	74	.048	49	.235	72	2	2.622	16	
				B	5.6	1	10.61		.10		.18		.97					
160974	S34 12008			AB	4.7	3	8.726	3	.343	5	-.069	9	.088	9	2	2.623	7	
161004	S27 11866		10739	A		2	8.735	40	.234	4	-.033	16	.651	10	3	2.644	12	
				B	7.3	2	10.879	40	.793	147	.257	75			2	2.638	119	
162082	S26 12407		10817	A		3	8.159	10	.084	2	.055	3	.500	12	3	2.738	3	
				B	10.7	2	11.054	115	.374	23	.124	51	.625	34	2	2.772	1	
				D	27.2	2	12.124	16	.394	59	-.038	143	.928	88	2	2.927	24	
163181	S32 13517			A		2	6.633	69	.444	1	-.137	1	-.014	0	2	2.528	7	
				B	13.5	1	13.51		.25		.40		1.19					
164492	S23 13804		10991	A		2	7.593	13	.085	8	-.008	4	-.130	41	2	2.602	16	
				CD	10.8	2	8.671	10	.107	13	.038	6	.028	0	2	2.587	7	
165493	S45 12215	6759		AB	3.9	2	6.139	4	-.022	7	.096	11	.489	12	3	2.704	2	5,7
165530	S25 12748		11069	A		2	6.623	14	.039	1	.073	1	.386	1	2	2.658	0	
				B	13.3	2	8.919	13	.049	6	.101	4	.639	8	2	2.765	4	
166182	N20 3674	6787	11102	A		2	4.344	7	-.057	6	.064	11	.176	10	2	2.614	7	
				B	23.4	1	12.78		1.18									
166563	S05 4586		11135	A		2	6.750	13	.039	10	.112	6	1.078	3	2	2.854	3	
				B	17.4	2	12.639	102	.682	33	-.043	68	.518	134	2	2.701	23	
166566	S15 4856		11140	AB	3.3	2	7.925	1	.237	3	-.047	8	-.024	6	2	2.545	0	
166937	S21 4908	6812	11169	A		2	3.846	17	.230	3	-.030	8	.259	6	2	2.508	0	
				B	16.9	2	10.481	38	.082	64	.111	95	.317	103	2	2.686	27	
				D	48.5	2	9.694	3	.119	3	.032	10	.198	6	2	2.677	4	
				E	50.0	2	9.254	3	.101	1	.019	13	.181	21	2	2.652	11	

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TABLE I *(continued)*.

HD	BD	HR	ADS	COMP	SEP	N	V	ERR	B-Y	ERR	M1	ERR	C1	ERR	N	HB	ERR	NOTES
167263	S20 5055	6823	11191	AB		4	5.963	5	.088	1	-.004	3	-.106	3	3	2.577	6	5,7
				B	6.0	1	13.24											
167771	S18 4886	6841		A		2	6.528	9	.136	2	-.022	3	-.107	2	3	2.566	3	5,7
				B	8.4	1	12.55		.04									
169337	S30 15667			AB		3	7.473	7	.709	5	-.033	10	.585	3	3	2.670	7	
				B	4.9	1	12.41		.21		.22		.90					
170385	S43 12589			AB	4.2	2	7.896	11	-.069	0	.112	8	.310	13	2	2.692	7	
170580	N03 3727	6941	11399	A		2	6.680	0	.111	4	.055	6	.293	1	4	2.650	4	5,7 IR
				B	20.1	2	11.295	10	.337	7	.186	11	.790	38	2	2.972	49	IR
				C	66.9	2	12.792	66	.365	75	.361	160	.538	37	2	2.529	49	
170740	S10 4713	6946	11414	A		3	5.755	2	.224	5	-.002	5	.229	1	3	2.639	8	5,7 *
				B	12.3	2	9.287	15	.336	3	.048	16	.847	4	2	2.887	27	5,7
171247	N08 3741	6967	11448	A		2	6.429	14	.010	15	.083	23	.740	24	3	2.719	4	5,7
				B	38.7	1	10.44		.85		.66		.41					
173360	S49 12336			A		3	6.933	5	-.027	3	.111	9	.863	5	3	2.812	3	
				B	25.6	2	12.317	16	.332	10	.059	6	.546	48	2	2.698	23	
				C	32.0	2	12.077	31	.769	42	.535	16	.571	24	2	2.570	10	
174152	S41 13159			A		2	6.491	27	-.014	11	.078	13	.472	1	2	2.712	4	*
				B	10.1	2	9.402	72	.043	35	.114	14	.841	21	2	2.726	66	
174585	N32 3227	7100	11732	A		3	5.90		-.051		.074		.253		3	2.660		2
174638	N33 3223	7106	11745	A		4	3.41		.067		.058		.332		3	2.455		2
175876	S20 5344		11872	A		2	6.927	4	-.012	3	.030	4	-.150	1	2	2.585	1	
				B	17.0	2	12.270	0	1.289	35	.739	314			2	2.680	89	
176873	N12 3770		11952	A		2	6.818	3	.097	3	.038	7	.635	10	2	2.709	7	
				B	14.7	2	10.758	54	.205	6	.156	10	.975	48	2	2.919	45	
177817	S16 5153	7239	12039	A		4	6.103	7	.005	1	.086	3	.674	2	3	2.721	3	5,7
				B	6.4	1	8.78		.04		.19		1.03					
177880	S01 3649		12038	A		2	6.836	10	.114	4	.042	28	.435	38	2	2.684	0	
				B	13.9	2	9.702	14	.121	7	.123	3	.851	18	2	2.840	0	
179316	N00 4133			A		2	8.584	4	.324	3	-.100	13	.275	8	2	2.634	0	
				B	50.4	3	10.204	5	.347	9	.138	17	.399	14	3	2.634	7	
179761	N02 3824	7287	12182	A		2	5.148	9	-.012	2	.082	1	.642	0	4	2.694	4	5,7
				B	36.2	1	13.18		1.21									
180183	S56 9141			A		2	6.815	0	-.073	1	.089	1	.190	0	3	2.654	3	IR
				B	19.4	2	11.447	11	.617	48	.340	75	.711	65	2	2.556	1	IR
180555	N14 3852	7307	12248	A		2	5.676	3	-.010	0	.130	10	.956	0	2	2.836	4	
				B	8.2	1	9.29		.43		.10		.64		1	2.71		
181454	S44 13277	7337		A		2	3.957	6	-.043	1	.109	2	.761	1	2	2.772	10	11 IR
				B	28.3	2	7.208	2	.192	2	.188	15	.638	16	2	2.687	68	11 IR
181558	S19 5412	7339		A		2	6.269	1	-.032	1	.097	4	.454	6	2	2.726	14	* IR
				B	46.9	2	12.999	45	.759	45	.638	57	.773	8	2	2.576	20	IR
182110	S17 5611			AB		3	7.056	10	.007	5	.150	3	.974	2	3	2.905	9	
				B	5.3	1	13.81		1.94									
185507	N05 4225	7474	12737	A		2	5.249	74	.081	1	.011	2	.261	5	4	2.650	6	5,7 IR
				B	47.8	1	12.46		1.09		.56		.71					IR
185514	S15 5421		12748	A		2	7.590	25	.014	14	.041	40	.491	28	2	2.692	1	
				B	11.4	1	12.33		.35		.19		.38					
193924	S57 9674	7790		A		7	1.94		-.092		.087		.271			2.662		8,1
				B	145.4	1	9.23		.84		.78		.58					
				C	140	1	11.06		.84		.63		1.86					
				X	65	1	13.50		.25		.30		.30					*
194262	N05 4503		13810	A		2	7.233	7	-.029	1	.112	1	.721	28	2	2.738	3	
				B	8.9	1	12.99		.56		.51		.49					
195556	N48 3142	7844	13932	A		3	4.94		.001		.060		.320		3	2.620		2
199218	N40 4354	8009	14413	A		3	6.70		-.005		.079		.611		4	2.598		4
201819	N35 4426	8105	14724	A		3	6.53		-.008		.034		-.012		3	2.585		2
211924	N05 4998	8513	15847	AB	6.2	2	5.372	10	.031	1	.057	7	.493	3	2	2.669	7	*
				C	12.4	1	11.32		.58		.20		.77		1	2.711		
212581	S65 4044	8540		A		4	4.514	8	-.013	4	.141	4	.993	8	4	2.855	4	
				B	6.9	1	8.62		.31		.16		.41					
222661	S15 6476	8988	16944	AB	5.7	3	4.492	2	-.019	2	.139	3	.923	6	3	2.877	3	5,7

TABLE II. — *Root-mean-square (RMS) errors in the mean values of the indices given in table I as a function of the brightness of the stars.*

Interval in V	RMS error in units of 0.001 V	b-y	m_1	c_1	β	Number of stars
2.5 - 3.5	6	2	7	9	4	2
3.5 - 4.5	6	3	5	9	7	13
4.5 - 5.5	11	4	5	7	5	45
5.5 - 6.5	12	4	6	8	5	61
6.5 - 7.5	13	5	6	10	8	64
7.5 - 8.5	27	10	10	19	12	56
8.5 - 9.5	30	10	14	25	14	34
9.5 - 10.5	28	16	24	24	19	29
10.5 - 11.5	52	27	49	74	35	38
11.5 - 12.5	33	25	56	84	49	38
12.5 - 13.5	53	37	80	67	36	20
13.5 - 14.5	74	91	116	41	43	3

TABLE III. — *Comparison with Grønbech and Olsen (G & O).*

	Number of stars	Δ=Lindroos - G&O (in units of 0.001) ΔV	Δ(b-y)	Δm_1	Δc_1	Δβ
V<7.0	20	-1 ± 24	0 ± 7	1 ± 6	3 ± 13	1 ± 9
V>7.0	7	51 ± 64	9 ± 29	30 ± 50	80 ± 55	

TABLE IV. — *Comparison with Oblak.*

	Number of stars	Δ=Lindroos - Oblak (in units of 0.001) ΔV	Δ(b-y)	Δm_1	Δc_1	Δβ
V<7.0	8	12 ± 30	-2 ± 15	-2 ± 14	-14 ± 9	-4 ± 16
V>7.0	13	16 ± 46	3 ± 21	1 ± 21	5 ± 33	-15 ± 51

TABLE V. — *JHKL magnitudes for double stars.*

HD		N	J	ERR	H	ERR	K	ERR	L	ERR
480	A	1	7.27	(0)	7.36	(0)	7.39	(0)	7.34	(1)
480	B	1	11.37	(1)	11.08	(0)	11.10	(1)		
32964	A	2	5.28	(0)	5.30	(5)	5.30	(4)	5.33	(6)
32964	B	2	8.88	(3)	8.34	(5)	8.22	(8)		
33802	A	1	4.68	(0)	4.70	(0)	4.72	(1)	4.74	(0)
33802	B	1	8.48	(1)	8.23	(1)	8.15	(1)	8.69	(4)
35007	A	1	6.09	(0)	6.12	(0)	6.20	(0)	6.50	(3)
35007	C	1					10.41	(5)		
36013	A	1	7.39	(2)	7.25	(1)	7.21	(1)	7.17	(3)
36013	B	1					11.17	(4)		
36151	A	2	6.92	(0)	6.97	(2)	7.01	(0)	7.04	(3)
36151	B	2	9.58	(5)	9.28	(2)	9.25	(2)		
36151	C	2	10.64	(8)	10.50	(2)	10.43	(4)		
36779	A	2	6.64	(0)	6.70	(1)	6.76	(0)	6.77	(4)
36779	B	2	8.82	(2)	8.20	(0)	8.06	(1)	7.73	(2)
36861	A	1	3.85	(0)	3.99	(0)	4.03	(0)	4.32	(1)
36861	C	3	9.44	(1)	9.26	(2)	9.08	(2)	9.35	(6)
38426	A	1	7.22	(1)	7.27	(0)	7.32	(1)	7.24	(1)
38426	B	1					9.08	(1)		
38622	A	2	5.65	(0)	5.72	(1)	5.82	(7)	5.75	(1)
38622	C	2					10.40	(4)		
40494	A	2	4.72	(3)	4.78	(6)	4.82	(4)	4.85	(5)
40494	B	2					11.06	(11)		
48425	A	2	7.58	(5)	7.58	(0)	7.72	(7)	7.36	(4)
48425	C	2					11.06	(5)		
53191	A	1	7.85	(1)	7.90	(0)	7.92	(1)	7.58	(3)
53191	B	1					10.72	(4)		
56504	A	2	9.22	(2)	9.24	(8)	9.25	(2)		
56504	B	2	8.38	(3)	7.90	(7)	7.81	(1)	7.68	(9)
60575	A	3	8.75	(2)	8.81	(1)	8.80	(6)	9.18	(6)
60575	B	1	7.71	(0)						
60575	C	2	7.68	(0)	6.81	(2)	6.43	(0)	6.16	(1)
63425	A	2	7.32	(4)	7.44	(0)	7.51	(2)	7.78	(6)
63425	B	2	4.33	(3)	3.55	(1)	3.29	(1)	3.13	(3)
70309	A	2	6.73	(4)	6.80	(6)	6.84	(1)	6.80	(8)
70309	B	2	9.23	(3)	8.84	(1)	8.73	(6)	8.22	(3)
71510	A	2	5.56	(2)	5.62	(0)	5.67	(0)	5.69	(1)
71510	B	1	9.24	(2)	9.18	(2)	9.20	(2)		
71510	C	2	9.65	(2)	9.41	(7)	9.24	(5)	8.91	(3)
74146	A	2	5.51	(3)	5.64	(1)	5.62	(0)	5.61	(4)
74146	B	2	8.23	(7)	8.05	(2)	8.03	(4)	7.94	(1)
76566	A	2	6.63	(5)	6.69	(3)	6.73	(1)	6.80	(2)
76566	B	2					10.86	(3)		
87901	B	2	6.45	(7)	6.00	(2)	5.90	(3)	5.80	(3)
90972	A	1	5.69	(0)	5.80	(0)	5.70	(0)	5.68	(2)
90972	B	1	8.48	(2)	8.00	(1)	8.08	(1)	7.92	(2)
91590	A	2	7.24	(8)	7.27	(4)	7.30	(3)	7.11	(1)
91590	B	2	9.53	(5)	9.48	(8)	9.54	(2)		
104901	A	2	6.77	(8)	6.71	(9)	6.62	(6)	6.55	(1)
104901	B	2	6.41	(2)	6.04	(1)	5.33	(0)	3.87	(0)
108767	A	2	3.01	(6)	3.03	(0)	3.03	(3)	3.01	(0)
108767	B	2	6.81	(1)	6.38	(1)	6.27	(1)	6.24	(2)
112244	A	2	5.31	(4)	5.28	(1)	5.26	(0)	5.17	(1)
112244	B	1	9.48	(2)	8.90	(1)	8.76	(1)	8.91	(5)
113791	A	2	4.74	(4)	4.77	(0)	4.84	(0)	4.87	(2)
113791	B	2	8.47	(1)	8.16	(0)	8.09	(2)	7.87	(3)
123445	A	2	6.30	(4)	6.33	(3)	6.32	(2)	6.29	(1)
123445	B	2	11.00	(19)	10.29	(8)	9.98	(6)		
124471	A	3	5.90	(3)	5.95	(2)	5.99	(1)	6.05	(7)
124471	B	3					10.92	(33)		
127971	A	3	6.02	(6)	6.02	(2)	6.04	(4)	6.09	(5)
127971	B	3	9.19	(6)	8.75	(1)	8.58	(5)	8.48	(5)
129791	A	2	6.77	(1)	6.74	(2)	6.72	(1)	6.63	(0)
129791	B	3	10.15	(3)	9.73	(2)	9.68	(7)		
135240	A	2	5.16	(7)	5.19	(0)	5.23	(3)	5.22	(2)
135240	B	2	10.06	(3)	9.21	(2)	8.85	(1)		
135591	A	2	5.57	(3)	5.58	(1)	5.62	(2)	5.63	(1)
135591	C	2	10.32	(4)	10.36	(2)	10.38	(18)		
137387	A	2	5.57	(5)	5.51	(4)	5.38	(4)	5.03	(5)
137387	B	2	8.57	(7)	7.85	(3)	7.65	(4)	7.43	(8)
138800	A	1	5.70	(0)	5.66	(0)	5.67	(0)	5.68	(1)
138800	B	1	10.53	(6)	10.54	(2)	10.34	(3)		
141468	A	1	8.60	(1)	8.81	(2)	8.73	(2)		
141468	B	2	7.34	(0)	6.48	(2)	6.30	(3)	6.11	(1)
143118	A	2	3.96	(2)	4.01	(2)	4.10	(1)	4.12	(2)
143118	B	2	7.64	(1)	7.60	(7)	7.59	(7)	7.54	(1)
149249	A	2	7.36	(8)	7.37	(1)	7.39	(7)	7.52	(2)
149249	C	2	11.34	(6)	11.19	(5)	11.12	(4)		
157246	A	1	3.59	(0)	3.64	(0)	3.69	(0)	3.67	(0)
157246	C	1					10.66	(3)		
158094	A	1	3.73	(0)	3.84	(0)	3.78	(0)	3.79	(0)
158094	B	2	8.15	(1)	7.42	(0)	7.21	(0)	7.22	(4)
170580	A	1	6.35	(0)	6.46	(0)	6.45	(0)	6.34	(1)
170580	B	1	10.21	(5)	10.28	(4)	9.63	(2)		
180183	A	1	7.25	(2)	7.29	(0)	7.36	(1)	7.33	(5)
180183	B	1	10.06	(0)	10.21	(6)	9.35	(2)		
181454	A	1	4.16	(0)	4.20	(0)	4.22	(0)	4.18	(0)
181454	B	1	6.63	(0)	6.45	(0)	6.42	(0)	6.30	(0)
181558	A	1	6.46	(3)	6.46	(0)	6.51	(0)	6.54	(1)
181558	B	1	11.04	(3)	10.73	(1)	10.37	(1)		
185507	A	1	5.20	(0)	5.20	(0)	5.24	(0)	5.23	(0)
185507	B	2	9.36	(0)	8.59	(0)	8.37	(0)	8.52	(8)

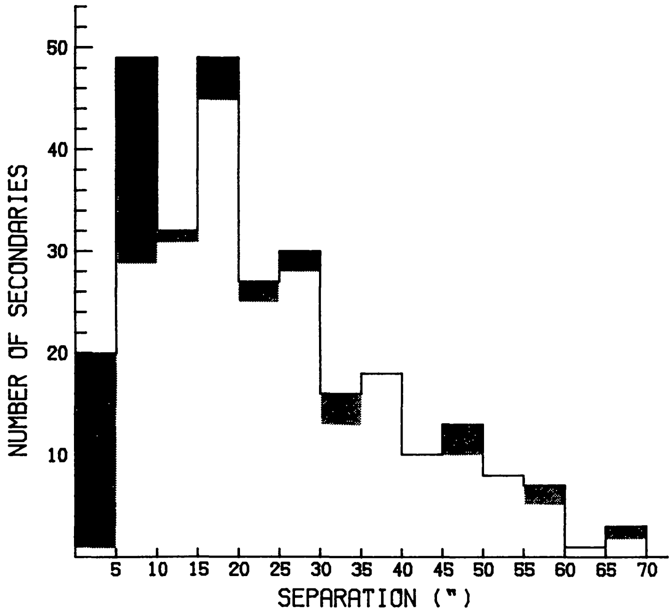

FIGURE 1. — The distribution of the separations between the primaries and the secondaries. The shaded parts represent secondaries for which only spectroscopic data is available. 7 stars have separations larger than 70″.

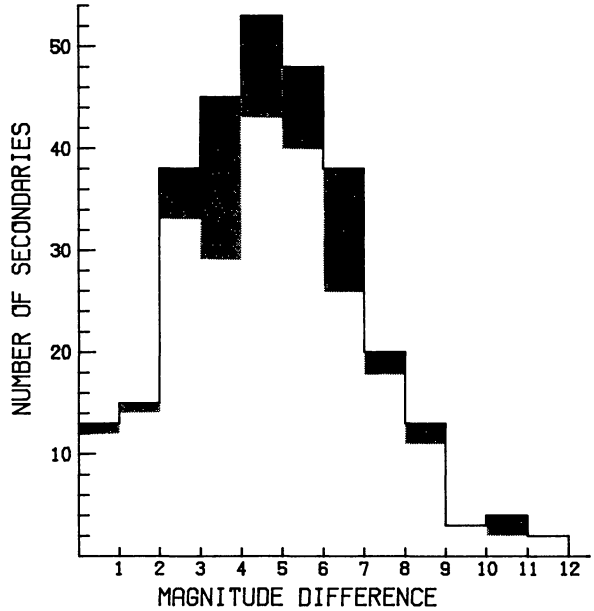

FIGURE 2. — The distribution of the magnitude difference, ΔV, between the 292 secondaries and their primaries. The small number of secondaries with ΔV less than two is a selection effect. The shaded parts have the same meaning as in Fig. 1.

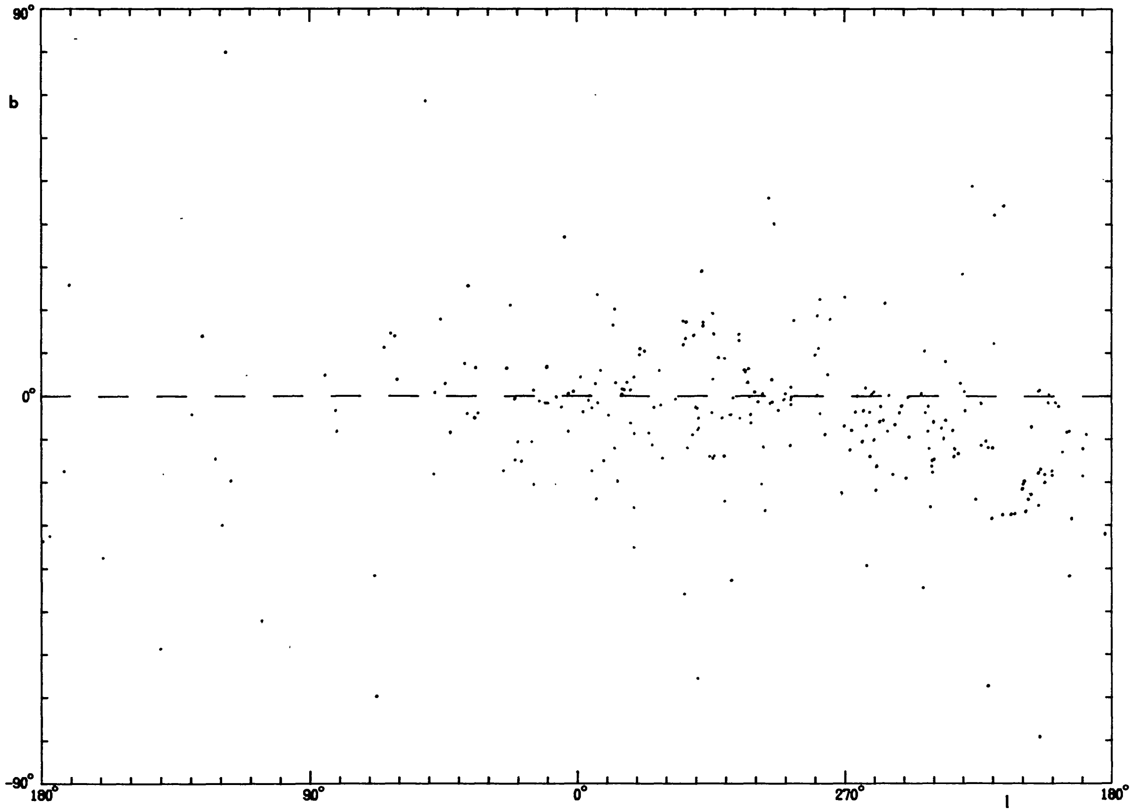

FIGURE 3. — The galactic coordinates of the programme stars. The small number of stars between $l = 0°$ and $l = 180°$ reflect that the material is mainly from the southern sky. The positions of the stars roughly follows that of the Gould's Belt.

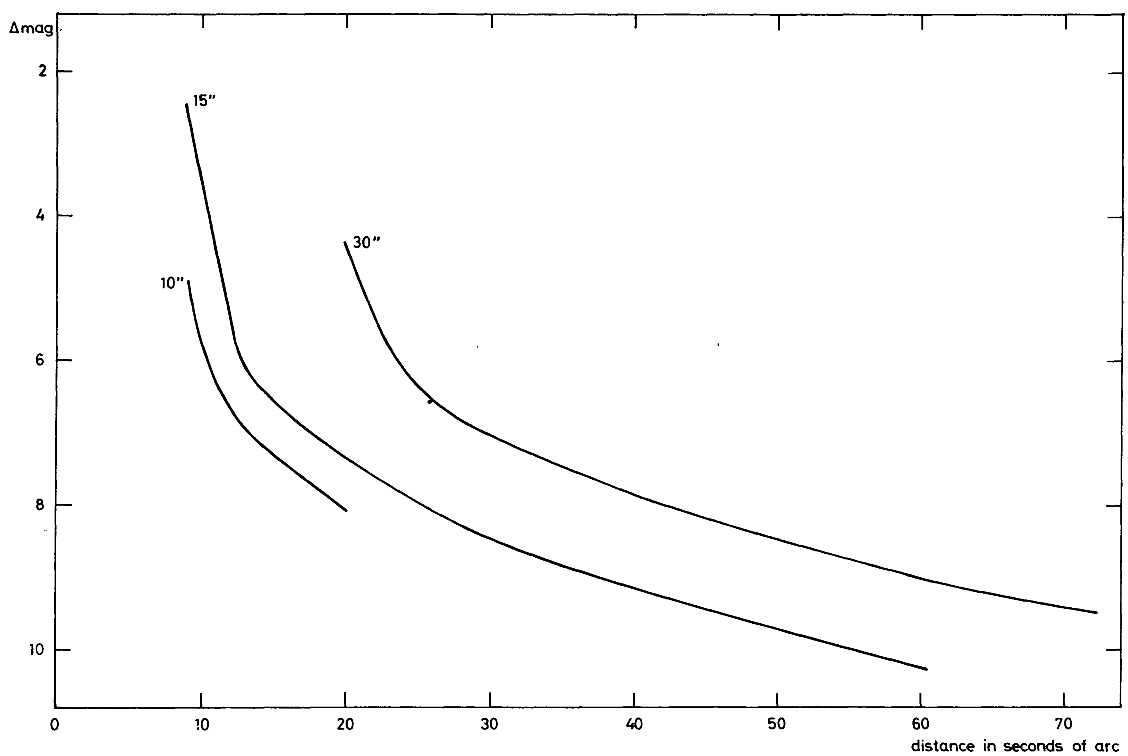

FIGURE 4. — Amount of light scattered into diaphragms with diameters of 10″, 15″ and 30″ as a function of the distance from a star. The scattered light is expressed as the magnitude difference from the centered star. These curves apply to the Danish 50 cm telescope and the four channel photometer.