Appendix of External Tables and Text A1-A10, C1-C2

The appendix contains a number of Tables, too large for publishing in the paper. In the main paper they are referred to as Table Axx, resp. Cxx. Below we give a short introduction to each table. The bibliography for these references is included in the bibliography of the main paper and at the end of this Appendix.

The Tables are available in PDF format. Tables A1, C1 are also available in ASCII format. They fall into 4 general categories:

I Observational data and processing

The observed data described in Section 2 are given and discussed in a series of tables A1-A4 below.

Table A1 gives the spectral observations in subsequent subtables A1.1-A1.6 as observed equivalent width (ew) (m\AA), accuracy of observed ew, interpolated best-fit model ew, accuracy of model ew, total combined accuracy and significance of observation with respect to total combined accuracy. The subtables have identical format: the observations are numbered as columns 1-26. Each line contains spectral line wavelength (\AA) and element number, stage of ionization as identifier and shows for each observation column (obs(1-26)) the relevant information of observation, best-fit model or result. When no information is available a '-' sign is displayed in the respective column.

Table A2 contains atomic line data for the observed lines in this paper; it also contains the accuracy-of-fit figures (χ^{2}) for each spectral line best-Chebychev-fit. The mean accuracy of fit per line is given in the last column of this table, as a 'fractional' accuracy, i.e. 0.011 means 1.1\% accuracy. The data comes from various authors (Kurucz \& Bell 1995; Kurucz \& Peytreman 1975; Martin et al. 1975; Wiese et al. 1969).

Table A3 contains tests of outlier lines and results of investigations into wavelengths and gf-values together with some wavelength areas including all (known) lines with an equivalent width $>$ 5 m\AA.

Table A4 correlates the wavelengths of observed lines with a list of atomic lines in the same wavelength neighbourhood for one set of observations and three different temperature models with temperatures from 4250 - 6250 K to find the mean wavelength shift between observed wavelengths and modelled lines in the region 5277 - 5510 \AA.

Table C1 describes the construction of the 3-dimensional interpolation program and library '3-dim-Chebychev-45-term-Spectral Line Library' used in Section 2 for the reduction of measured spectral lines.

II MK-data and B--V measurements

Table A5 is a critical compendium of MK data for HR 8752 in the period 1919 - 1987 from various authors. Included are some v data for 1908-1930 which were published but are not contemporary with the MK-data (Adams et al. 1921, 1935; Cannon \& Pickering 1924; Zug 1931).

Table A6 B--V and T_eff correlations for some visual colour observations around the year 1900 allow us to extend the T_eff and/ or B--V data down to 1900.

Table A7 is an annotated list and table of available B--V and other colour measurements in the period 1942 – 1974. For v data in the period 1908-1930 cf. Table A5 above .

Table A8 is a table with original and transformed data of available B--V measurements from 1976-1993 .

Table C2 describes the temperature calibration of hypergiants 'Calibrate-hyper', with two extra Figures, and gives code and reference data for transforms between MK, B--V, T_eff and (only to) BC, which are needed to use the MK and B--V data as joined data .

III Explanatory notes and work texts

Table A9 gives additional information on the values of the colour excesses (Johnson, 1968), when corrected for time-synchronization of MK- and B--V- data , and one extra Figure leading to the determination of Av.

Table A10 gives additional comments with respect to the historical text 'On the appearance of a new star' that show the historical interest in these observations (Cyprianus Leovitius 1573; Kronk 1999; Zsoldos and Percy 1991, Zsoldos 2010).

IV Detailed information on the Tables

Tables A1.1- A1.5 have the same format: the observations are numbered as columns 1-26. Each line contains a spectral line wavelength Angstrom and element number as identifier and shows for each column the relevant information of observation, best-fit model or result. When no information is available a '-' sign is displayed in the respective column.
A1.1 'OBSERVED' gives the measured equivalent widths (m\AA) together with the list of 'identified' wavelengths (Angstrom) and element numbers, stages of ionization for each of the observations obs(1-26).
A1.2 'SIGMAOBS' gives the estimated accuracy (milli Angstrom) of the measured equivalent widths. For obs4 and obs25, both measurements by Lobel, the values are referred to an accuracy of the continuum of 3 percent. For all other data a simple accuracy evaluation was used, cf. Table 2 in the main paper.
A1.3 'LTEMODEL' gives the best-fit model values equivalent widths in the same format as Table A1.1.
A1.4 'SIGMAMDL' gives the estimated accuracy of the best-fit model values taking account of the uncertainty in the log(gf)-value.
A1.6 'SIGNIFI' gives the results of the fits for each spectral line and for each observation as the difference between best-fit model value and observation, given in units of the combined estimation errors of observation- and model- values to which are added the accuracy values of the approximation, as contained and mentioned in Table A2.

A2 'lib2h197' gives atomic line data for the libary of observed lines in this paper; as an extra it contains, in the right hand part, the accuracy-of-fit figures (chi square) for each spectral line best Chebychev-fit procedure used to create the special library (Lib4C197 or tgv4c197) containing the parameter data for each line. The mean accuracy of fit per line is given in the last column, as a 'fractional' accuracy, i.e. 0.011 means 1.1\% accuracy.

A3 'outlier7' gives a general overview of outlier lines with the aid of Kurucz's line- and gf-values. It contains tests and results of investigations into wavelengths and gf-values together with some wavelength areas including all (known) lines with an equivalent width > 5 milli Angstrom.

A4 'correlate' correlates the wavelengths of observed lines with a list of atomic lines in the same wavelength neighbourhood to find the mean wavelength shift between observed wavelengths and modelled lines. The possible lines are from Kurucz in the region 5277 - 5510 (Angstrom), the observed data are from Piters et al. (1988). The correlation is tested for three different temperature models with T from 4250 - 6250 K. The highest correlation is found for about 39 steps of .005 Angstrom.

A5 'MK-Data' Compendium of available spectral type data for HR 8752 in the period 1919 - 1987. Also included are v data for 1908-1930 which were available with the MK-data, but not synchronous.

A6 'Zsoldos-early-colour' B−V and Teff correlation for some visual colour observations around the year 1900.

A7 '(B-V)-1950-Data' gives an annotated list and table of available B--V and other colour measurements in the period 1942 – 1974. For v data in the period 1908-1930 cf. Table A5 above.

A8 '(B−V)-1976-Data' gives an annotated list of available v, B−V measurements from 1976-1993.

A9 'E(B−V) and Av' gives additional information on the values of the colour excesses (Johnson, 1968) when corrected for time-synchronization of MK- and B--V- data and the creation of a graph leading to the determination of the R-ratio and Av, with comments.

A9 also includes one Figure not available in the main text: Fig.A9.1.

Fig. A9.1: The colour-excess ratio of HR8752, recalculated for synchronicity of MK-type, with the plot for the mean of 6 stars in Cepheus after Johnson (1968) as comparison. Looking at the build of the graph of the “mean”, we estimate for HR8752 an R=4.4 with an accuracy of +- 0.2 in analogy with Johnson's determination of the the R-value at 1/lambda=0.

A10 'A new star' Some comments are given with respect to the historical text 'On the appearance of a new star'. The mediaeval text may have relevance for the history of HR8752 or the other

Cassiopeia hypergiant ρ Cas.

C1 '3-dim-Chebychev-45-term-Spectral Line Library' is a symbolic program description of '3-dim-chebychev-interpolation' and sequence of terms for use in the Spectral Line Library prototype developed here.

C2 'Calibrate-hyper' describes procedures for calibration of temperatures for hypergiants with symbolic code and reference data for transforms between MK, B−V, Teff and (to) BC.

C2 includes two Figures not available in the main text: Fig.C2.1 and Fig.C2.2.

Fig. C2.1 shows Teff as a function of s-parameter (De Jager & Nieuwenhuijzen 1987).

Fig. C2.2 gives a comparison of the calibration as given in Fig.C2.1 with earlier Teff as a function of s-parameter calibration.

Table A1.1 [Observed.txt HR8752 27-11-2007 Equivalent width (mA) observed]

lamda(A)	ele	(1	(2	(3	(4	(5	(6	(7	(8	(9	(10	(11	(12	(13	(14	(15	(16	(17	(18	(19	(20	(21	(22	(23	(24	(25	(26
4491.41	2601	-	-	-	596	437	-	-	-	-	-	-	480	-	-	-	-	-	-	-	-	-	-	-	-	462	-
4501.27	2201	-	-	-	830	706	-	-	-	-	-	-	745	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4515.34	2601	-	-	-	758	518	-	-	-	-	-	-	539	-	-	-	-	-	-	-	-	-	-	-	-	539	-
4565.74	2401	-	-	-	248	164	-	-	-	-	-	-	185	-	-	-	-	-	-	-	-	-	-	-	-	186	-
4568.31	2201	-	-	-	202	66	-	-	-	-	-	-	125	-	-	-	-	-	-	-	-	-	-	-	-	112	-
4571.97	2201	-	-	-	810	753	-	-	-	-	-	-	796	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4576.34	2601	-	-	-	521	431	-	-	-	-	-	-	439	-	-	-	-	-	-	-	-	-	-	-	-	399	-
4592.05	2401	-	-	-	416	311	-	-	-	-	-	-	323	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4656.98	2601	-	-	-	441	376	-	-	-	-	-	-	350	-	-	-	-	-	-	-	-	-	-	-	-	329	-
4731.45	2601	-	-	-	478	357	-	-	-	-	-	-	375	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4805.09	2201	-	-	-	584	426	-	-	-	-	-	-	440	-	-	-	-	-	-	-	-	-	-	-	-	420	-
4812.34	2401	-	-	-	256	186	-	-	-	-	-	-	176	-	-	-	-	-	-	-	-	-	-	-	-	167	-
4864.32	2401	-	-	-	300	269	-	-	-	-	-	-	313	-	-	-	-	-	-	-	-	-	-	-	-	332	-
4871.32	2600	-	674	-	114	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	185	-
4874.01	2201	-	-	-	342	241	-	-	-	-	-	-	261	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4876.47	2401	-	-	-	468	369	-	-	-	-	-	-	378	-	-	-	-	-	-	-	-	-	-	-	-	372	-
4893.82	2601	-	421	-	136	98	-	-	-	-	-	-	112	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4903.31	2600	-	422	-	77	63	-	-	-	-	-	-	59	-	-	-	-	-	-	-	-	-	-	-	-	62	-
4911.19	2201	-	-	-	503	317	-	-	-	-	-	-	311	-	-	-	-	-	-	-	-	-	-	-	-	304	-
4918.99	2600	-	668	-	173	117	-	-	-	-	-	-	121	-	-	-	-	-	-	-	-	-	-	-	-	81	-
4923.93	2601	-	1376	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	899	-
4966.09	2600	-	331	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	51	-
5012.07	2600	-	684	-	93	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	94	-
5018.45	2601	-	1594	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	818	-
5049.82	2600	-	576	-	70	41	-	-	-	-	-	-	49	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5051.63	2600	-	580	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5052.17	600	-	-	-	99	-	38	31	54	47	28	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5072.28	2201	-	-	-	-	-	169	212	177	182	142	-	-	-	-	-	-	-	-	-	-	-	-	-	-	168	-
5087.42	3901	-	-	-	-	-	106	156	128	116	79	146	-	93	110	109	48	177	183	162	151	104	99	76	65	129	84
5097.31	2401	-	-	-	130	103	-	-	-	-	-	-	105	-	-	-	-	-	-	-	-	-	-	-	-	95	-
5100.66	2601	-	-	-	219	188	-	-	-	-	-	-	179	-	-	-	-	-	-	-	-	-	-	-	-	185	-
5110.41	2600	-	-	-	-	-	15	21	20	12	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5112.28	4001	-	-	-	-	-	34	37	40	21	25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5120.34	2601	-	-	-	-	-	83	100	96	73	52	-	-	-	-	-	-	-	-	-	-	-	-	-	-	85	-

5123.21	3901	-	-	-	-	-	51	70	64	44	26	-	-	-	-	-	-	-	-	-	-	-	-	-	-	95	-
5125.12	2600	-	-	-	-	-	28	37	37	30	29	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5127.87	2601	-	-	-	-	-	-	-	-	-	-	110	-	98	82	109	78	88	66	92	84	54	80	68	65	-	58
5129.15	2201	-	-	-	-	-	271	305	274	266	238	305	-	256	250	313	204	275	299	308	281	270	280	250	216	305	252
5133.68	2600	-	419	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	40	-
5151.91	2600	-	471	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	19	-
5154.07	2201	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	341	-
5160.82	2601	-	-	-	164	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5161.18	2601	-	454	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5162.29	2600	-	430	-	119	86	-	-	-	-	-	-	54	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5172.68	1200	-	-	-	-	-	-	-	-	-	-	348	-	256	304	288	234	331	340	380	332	276	325	296	272	-	284
5183.60	1200	-	-	-	-	-	362	413	373	365	328	385	-	355	340	298	313	403	374	364	379	323	378	353	333	437	326
5185.91	2201	-	-	-	420	348	292	329	265	273	266	325	347	262	259	311	253	312	328	326	322	281	302	286	260	315	273
5188.68	2201	-	-	-	-	-	-	-	-	-	-	453	-	453	442	517	412	518	510	530	504	483	491	491	425	-	448
5197.58	2601	-	957	-	695	512	497	565	484	506	477	533	553	475	482	559	537	542	508	526	504	526	-	533	527	515	491
5200.42	3901	-	-	-	-	-	69	85	69	67	32	93	-	50	45	53	54	115	92	117	114	-	-	55	49	121	72
5202.34	2600	-	419	-	65	65	-	-	-	-	-	-	132	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5211.54	2201	-	-	-	-	-	162	196	192	178	128	214	-	153	144	150	112	212	190	216	226	152	-	126	118	184	128
5229.86	2600	-	179	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5234.63	2601	-	1005	-	654	570	516	556	522	523	520	523	545	486	510	555	541	501	496	496	505	552	540	514	498	-	498
5237.33	2401	-	-	-	421	375	344	369	340	341	324	348	363	322	321	350	321	326	336	328	339	362	328	321	313	357	311
5239.81	2101	-	-	-	-	-	162	185	179	164	137	182	-	130	159	163	122	189	199	189	211	133	162	140	121	172	137
5243.46	2401	-	-	-	-	-	-	-	-	-	-	40	-	-	-	47	-	-	-	-	-	-	-	-	-	-	-
5246.77	2401	-	-	-	-	-	139	130	97	91	93	-	-	-	-	-	-	-	-	-	-	-	-	-	-	80	-
5262.10	2201	-	-	-	-	-	108	116	95	90	61	144	-	92	106	122	84	135	166	156	156	100	117	88	113	148	108
5264.81	2601	-	-	-	453	254	248	349	265	262	254	289	345	264	300	300	268	331	339	322	336	305	309	274	278	259	236
5266.56	2600	-	573	-	135	68	-	-	-	-	-	76	123	51	84	53	62	95	88	90	95	42	68	72	64	61	64
5276.00	2601	-	-	-	558	-	586	612	522	589	570	-	-	646	676	-	675	586	599	578	598	650	669	609	641	-	540
5281.79	2600	-	332	479	87	51	-	-	-	-	-	-	84	28	57	-	29	26	26	31	28	28	24	16	20	-	36
5284.11	2601	-	-	-	-	-	378	378	371	381	374	-	-	340	378	-	358	352	371	372	360	360	358	319	294	-	320
5302.30	2600	-	485	385	100	31	-	-	-	-	-	-	41	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5305.86	2401	-	-	459	232	-	-	-	-	-	-	-	-	120	120	-	124	143	134	152	160	140	125	130	136	-	134
5308.41	2401	-	-	-	-	-	140	159	156	139	131	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5310.69	2401	-	-	-	-	-	84	92	82	69	-	-	-	72	48	-	68	81	74	92	94	71	64	72	59	-	78
5313.56	2401	-	-	591	285	234	204	226	209	203	187	-	262	194	169	-	179	199	212	212	227	198	187	188	192	-	173
5316.62	2601	-	981	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-									

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5324.18	2600	-	565	503	235	96	-	-	-	-	-	-	112	50	92	-	84	104	87	78	86	39	66	70	55	-	64
5325.55	2601	-	534	628	-	-	202	264	197	218	212	-	-	183	208	-	194	218	220	224	231	203	209	222	190	-	186
5334.85	2401	-	-	651	266	273	145	174	147	143	144	-	279	140	145	-	181	172	171	172	164	152	177	145	155	-	148
5336.77	2201	-	-	1038	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5349.73	2600	-	-	-	-	-	-	-	-	-	-	-	-	25	36	-	33	56	54	62	70	27	32	36	51	-	31
5353.37	2600	-	-	-	-	-	-	-	-	-	-	-	-	12	8	-	19	27	41	32	35	-	10	13	13	-	16
5357.19	2101	-	-	-	-	-	25	32	20	13	12	-	-	15	22	-	16	18	35	18	27	-	26	13	21	-	34
5362.86	2601	-	754	-	576	405	472	537	457	479	446	-	419	393	421	-	413	406	403	399	394	465	464	412	405	-	390
5367.48	2600	-	334	363	113	70	45	75	53	52	51	-	87	57	72	-	55	82	80	71	73	63	71	68	47	-	70
5369.96	2600	-	-	-	-	-	-	-	-	-	-	-	-	64	81	-	71	100	102	93	90	64	80	74	56	-	70
5371.49	2600	-	883	996	182	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5381.02	2201	-	-	932	325	207	180	204	174	168	150	-	236	142	148	-	136	195	212	200	212	158	166	152	130	-	155
5383.37	2600	-	423	515	132	102	73	90	80	75	72	-	90	65	79	-	82	89	96	89	87	57	71	77	60	-	67
5389.48	2600	-	165	216	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5393.17	2600	-	-	432	-	-	-	-	-	-	-	-	-	37	48	-	45	61	38	58	62	40	29	44	43	-	33
5397.13	2600	-	876	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5400.50	2600	-	248	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5404.15	2600	-	523	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5405.77	2600	-	751	830	-	-	56	72	57	56	27	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5407.62	2401	-	-	-	-	-	112	96	111	130	82	-	-	75	56	-	46	96	98	110	97	95	89	82	75	-	80
5414.07	2601	-	674	-	-	-	-	-	-	-	-	-	-	197	110	-	122	163	145	182	166	182	148	144	159	-	132
5418.75	2201	-	-	734	250	225	130	170	129	135	97	-	200	116	139	-	95	159	170	196	184	120	143	120	115	-	125
5420.92	2401	-	-	405	130	116	100	126	90	119	80	-	138	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5424.07	2600	-	608	597	153	-	-	-	-	-	-	-	101	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5425.26	2601	-	421	-	321	205	230	284	204	204	189	-	274	195	220	-	200	217	270	254	224	214	224	146	189	-	184
5429.70	2600	-	788	843	187	-	69	114	89	80	49	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5432.55	2500	378	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5432.97	2601	-	-	-	206	191	116	156	123	106	102	-	100	92	128	-	90	141	148	140	124	111	114	113	125	-	97
5434.52	2600	753	650	745	-	-	24	21	49	21	14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5441.35	2600	130	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5445.04	2600	338	260	254	80	51	43	32	38	32	33	-	45	47	48	-	53	56	53	45	45	34	37	28	21	-	27
5446.92	2600	-	-	-	-	-	49	66	59	36	24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5455.62	2600	-	681	-	139	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5460.47	2200	134	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5468.10	2800	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

5476.90	2800	-	-	-	-	-	80	104	95	106	75	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5478.37	2401	-	-	-	-	-	114	170	144	121	123	-	-	107	104	-	112	145	157	144	147	142	122	122	98	-	114
5490.66	2201	436	-	-	-	-	43	51	48	56	31	-	-	34	39	-	34	62	74	70	69	35	33	43	31	-	33
5493.32	2600	-	-	227	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5497.52	2600	788	571	673	190	-	76	87	87	74	43	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5501.46	2600	817	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5502.07	2401	-	-	-	191	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5506.78	2600	760	448	419	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5508.61	2401	-	-	275	127	90	80	80	76	78	67	-	92	69	90	-	72	95	95	92	86	69	73	74	59	-	66
5526.79	2101	758	-	-	533	308	417	470	412	368	334	-	368	321	338	-	282	376	387	386	380	352	362	331	305	-	304
5534.85	2601	690	-	-	469	346	295	329	283	319	295	-	349	272	290	-	298	297	313	302	301	350	311	294	276	-	290
5536.58	2600	16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5563.60	2600	216	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5567.91	2101	657	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5569.62	2600	435	378	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5572.84	2600	468	389	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5576.09	2600	356	308	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5577.03	2600	20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5578.72	2800	112	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5586.76	2600	499	538	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5590.72	2700	70	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5593.30	1301	-	-	-	98	-	-	-	-	-	-	-	121	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5593.74	2800	76	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5611.36	2600	46	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5615.64	2600	-	511	-	208	103	-	-	-	-	-	-	109	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5624.54	2600	-	300	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5628.62	2400	13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5633.97	2600	149	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5647.23	2700	22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5650.70	2600	37	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5653.89	2600	50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5662.16	2200	119	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5670.85	2300	80	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5679.94	2200	34	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5686.52	2600	-	151	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5689.49	2200	23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-									

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5727.05	2300	247	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5737.06	2300	25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5748.35	2800	264	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5754.66	2800	244	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5778.46	2600	53	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5783.09	2400	37	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5783.89	2400	37	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5816.37	2600	109	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5838.37	2600	21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5852.22	2600	40	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5862.37	2600	152	114	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5866.45	2200	151	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5916.25	2600	191	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5918.54	2200	42	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5929.67	2600	122	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5930.17	2600	186	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5937.81	2200	17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5952.72	2600	237	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5965.83	2200	39	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5978.54	2200	142	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5991.38	2601	368	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5996.73	2800	22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6003.03	2600	211	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6007.31	2800	80	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6013.48	2500	129	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6020.17	2600	228	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6021.79	2500	212	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6024.07	2600	272	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6039.73	2300	23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6055.99	2600	94	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6062.89	2600	67	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6064.63	2200	83	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6065.48	2600	477	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6082.72	2600	151	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6084.10	2601	241	-	-	147	87	-	-	-	-	-	-	94	-	-	-	-	-	-	-	-	-	-	-	-	-	-

6113.32	2601	163	-	-	99	61	-	-	-	-	-	-	68	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6137.69	2600	524	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6149.26	2601	307	-	-	367	205	-	-	-	-	-	-	245	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6245.64	2101	-	-	-	244	162	-	-	-	-	-	-	128	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6246.32	2600	313	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6247.56	2601	353	-	-	467	362	-	-	-	-	-	-	333	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6305.65	2100	53	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6413.35	2100	25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6416.92	2601	426	-	-	234	191	-	-	-	-	-	-	193	-	-	-	-	-	-	-	-	-	-	-	-	-	-
lamda(A)	ele	(1	(2	(3	(4	(5	(6	(7	(8	(9	(10	(11	(12	(13	(14	(15	(16	(17	(18	(19	(20	(21	(22	(23	(24	(25	(26

Table A1.2 [SigmaObs.txt HR8752 27-11-2007 Estimated error (mA) observed equivalent width]

lamda(A)	ele	(1	(2	(3	(4	(5	(6	(7	(8	(9	(10	(11	(12	(13	(14	(15	(16	(17	(18	(19	(20	(21	(22	(23	(24	(25	(26
4491.41	2601	-	-	-	44.7	44.0	-	-	-	-	-	-	44.0	-	-	-	-	-	-	-	-	-	-	-	-	38.1	-
4501.27	2201	-	-	-	16.7	16.0	-	-	-	-	-	-	16.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4515.34	2601	-	-	-	49.6	49.0	-	-	-	-	-	-	49.0	-	-	-	-	-	-	-	-	-	-	-	-	31.2	-
4565.74	2401	-	-	-	26.6	26.0	-	-	-	-	-	-	26.0	-	-	-	-	-	-	-	-	-	-	-	-	39.6	-
4568.31	2201	-	-	-	38.5	44.0	-	-	-	-	-	-	44.0	-	-	-	-	-	-	-	-	-	-	-	-	36.6	-
4571.97	2201	-	-	-	11.4	11.0	-	-	-	-	-	-	11.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4576.34	2601	-	-	-	32.2	32.0	-	-	-	-	-	-	32.0	-	-	-	-	-	-	-	-	-	-	-	-	42.3	-
4592.05	2401	-	-	-	27.3	27.0	-	-	-	-	-	-	27.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4656.98	2601	-	-	-	28.7	28.0	-	-	-	-	-	-	28.0	-	-	-	-	-	-	-	-	-	-	-	-	28.8	-
4731.45	2601	-	-	-	24.2	24.0	-	-	-	-	-	-	24.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4805.09	2201	-	-	-	26.1	26.0	-	-	-	-	-	-	26.0	-	-	-	-	-	-	-	-	-	-	-	-	35.4	-
4812.34	2401	-	-	-	18.3	18.0	-	-	-	-	-	-	18.0	-	-	-	-	-	-	-	-	-	-	-	-	28.2	-
4864.32	2401	-	-	-	26.9	26.0	-	-	-	-	-	-	26.0	-	-	-	-	-	-	-	-	-	-	-	-	33.3	-
4871.32	2600	-	67.0	-	26.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	45.3	-
4874.01	2201	-	-	-	37.8	24.0	-	-	-	-	-	-	24.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4876.47	2401	-	-	-	49.7	37.0	-	-	-	-	-	-	37.0	-	-	-	-	-	-	-	-	-	-	-	-	41.4	-
4893.82	2601	-	42.0	-	57.7	45.0	-	-	-	-	-	-	45.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4903.31	2600	-	42.0	-	50.3	45.0	-	-	-	-	-	-	45.0	-	-	-	-	-	-	-	-	-	-	-	-	75.3	-
4911.19	2201	-	-	-	51.0	32.0	-	-	-	-	-	-	32.0	-	-	-	-	-	-	-	-	-	-	-	-	40.2	-
4918.99	2600	-	33.0	-	28.0	18.0	-	-	-	-	-	-	18.0	-	-	-	-	-	-	-	-	-	-	-	-	25.2	-
4923.93	2601	-	69.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	48.0	-
4966.09	2600	-	33.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	65.4	-
5012.07	2600	-	68.0	-	21.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	56.1	-
5018.45	2601	-	239.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	62.7	-
5049.82	2600	-	29.0	-	45.0	32.0	-	-	-	-	-	-	32.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5051.63	2600	-	29.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5052.17	600	-	-	-	50.6	-	3.8	3.1	5.4	4.7	5.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5072.28	2201	-	-	-	-	-	8.5	10.6	8.9	9.1	7.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	33.9	-
5087.42	3901	-	-	-	-	-	5.3	7.8	6.4	5.8	7.9	7.3	-	9.3	5.5	5.5	4.8	8.9	9.2	8.1	7.6	5.2	9.9	7.6	6.5	19.5	8.4
5097.31	2401	-	-	-	47.2	40.0	-	-	-	-	-	-	40.0	-	-	-	-	-	-	-	-	-	-	-	-	50.1	-
5100.66	2601	-	-	-	36.2	31.0	-	-	-	-	-	-	31.0	-	-	-	-	-	-	-	-	-	-	-	-	46.5	-
5110.41	2600	-	-	-	-	-	3.0	4.2	4.0	2.4	1.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5112.28	4001	-	-	-	-	-	3.4	3.7	4.0	4.2	5.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5120.34	2601	-	-	-	-	-	8.3	10.0	9.6	7.3	5.2	-	-	-	-	-	-	-									

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 15.0 15.4 14.1 13.5 14.0 12.5 10.8 32.4 12.6
 5133.68 2600   -  42.0   -    -    -    -    -    -    -    -    -    -    -    -    -    -    -
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 5161.18 2601   - 114.0   -    -    -    -    -    -    -    -    -    -    -    -    -    -    -
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 16.4 16.3 16.1 14.1 15.1 14.3 13.0 36.9 13.7
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 25.5 26.5 25.2 24.2 24.6 24.6 21.3   -  22.4
 5197.58 2601   -  48.0   -  32.0 26.0 24.8 28.3 24.2 25.3 47.7 26.7 26.0 23.8 24.1 28.0 26.9 27.1
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 5229.86 2600   -  18.0   -    -    -    -    -    -    -    -    -    -    -    -    -    -    -
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 5234.63 2601   - 101.0   -  27.1 25.0 25.8 27.8 26.1 26.2 26.0 26.2 25.0 24.3 25.5 27.8 27.1 25.1
 24.8 24.8 25.3 27.6 27.0 25.7 24.9   -  24.9
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 18.6 18.6 18.0 18.0 17.9 16.0 14.7   -  16.0
 5302.30 2600   -  24.0 39.0 27.9 10.0   -    -    -    -    -    -  10.0   -    -    -    -    -
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 5313.56 2401   -    -  30.0 25.5 21.0 10.2 11.3 10.5 10.2  9.4   -  21.0  9.7  8.5   -   9.0 10.0
 10.6 10.6 11.4  9.9  9.4  9.4  9.6   -   8.7
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5324.18 2600   -  28.0 50.0 22.7 10.0   -    -    -    -    -    -  10.0  5.0  9.2   -   8.4  5.2
 8.7  7.8  8.6  3.9  6.6  7.0  5.5   -   6.4
5325.55 2601   -  27.0 63.0   -    -  10.1 13.2  9.9 10.9 10.6   -    -   9.2 10.4   -   9.7 10.9
11.0 11.2 11.6 10.2 10.5 11.1  9.5   -   9.3
5334.85 2401   -    -  33.0 35.6 27.0  7.3  8.7  7.4  7.2  7.2   -  27.0  7.0  7.3   -   9.1  8.6
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20.2 20.0 19.7 23.3 23.2 20.6 20.3   -  19.5
5367.48 2600   -  17.0 36.0 41.3 27.0  4.5  7.5  5.3  5.2  5.1   -  27.0  5.7  7.2   -   5.5  8.2
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 5.1  9.3  9.0  6.4  8.0  7.4  5.6   -   7.0
5371.49 2600   -  88.0199.0 23.1   -    -    -    -    -    -    -    -    -    -    -    -    -
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10.6 10.0 10.6  7.9  8.3  7.6  6.5   -   7.8
5383.37 2600   -  21.0 51.0 45.9 32.0  7.3  9.0  8.0  7.5  7.2   -  32.0  6.5  7.9   -   8.2  8.9
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13.5 12.7 11.2 10.7 11.2  7.3  9.5   -   9.2
5429.70 2600   -  79.0 84.0 27.8   -   6.9  5.7  8.9  8.0  4.9   -    -    -    -    -    -    -
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5434.52 2600 75.3 52.0 97.0   -    -   4.8  4.2  4.9  4.2  2.8   -    -    -    -    -    -    -
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5468.10 2800  1.0   -    -    -    -    -    -    -    -    -    -    -    -    -    -    -    -
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19.4 19.3 19.0 17.6 18.1 16.6 15.3   -  15.2
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5647.23 2700  2.0   -    -    -    -    -    -    -    -    -    -    -    -    -    -    -    -
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5650.70 2600  4.0   -    -    -    -    -    -    -    -    -    -    -    -    -    -    -    -
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5653.89 2600  5.0   -    -    -    -    -    -    -    -    -    -    -    -    -    -    -    -
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5670.85 2300  8.0   -    -    -    -    -    -    -    -    -    -    -    -    -    -    -    -
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5686.52 2600   - 60.0   -    -    -    -    -    -    -    -    -    -    -    -    -    -    -
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5689.49	2200	2.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5727.05	2300	25.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5737.06	2300	3.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5748.35	2800	26.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5754.66	2800	24.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5778.46	2600	5.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5783.09	2400	4.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5783.89	2400	4.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5816.37	2600	11.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5838.37	2600	2.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5852.22	2600	4.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5862.37	2600	15.2	57.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5866.45	2200	15.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5916.25	2600	19.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5918.54	2200	4.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5929.67	2600	12.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5930.17	2600	19.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5937.81	2200	2.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5952.72	2600	24.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5965.83	2200	4.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5978.54	2200	14.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5991.38	2601	37.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5996.73	2800	2.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6003.03	2600	21.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6007.31	2800	8.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6013.48	2500	13.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6020.17	2600	23.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6021.79	2500	21.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6024.07	2600	27.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6039.73	2300	2.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6055.99	2600	9.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6062.89	2600	7.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6064.63	2200	8.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6065.48	2600	48.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6082.72	2600	15.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6084.10	2601	24.0	-	-	38.8	20.0	-	-	-	-	-	-	20.0	-	-	-	-	-									

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6113.32	2601	16.0	-	-	39.3	32.0	-	-	-	-	-	-	32.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6137.69	2600	52.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6149.26	2601	31.0	-	-	71.0	38.0	-	-	-	-	-	-	38.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6245.64	2101	-	-	-	35.0	24.0	-	-	-	-	-	-	24.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6246.32	2600	31.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6247.56	2601	35.0	-	-	48.3	36.0	-	-	-	-	-	-	36.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6305.65	2100	5.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6413.35	2100	3.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6416.92	2601	43.0	-	-	30.9	27.0	-	-	-	-	-	-	27.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
lamda(A)	ele	(1	(2	(3	(4	(5	(6	(7	(8	(9	(10	(11	(12	(13	(14	(15	(16	(17	(18	(19	(20	(21	(22	(23	(24	(25	(26

Table A1.3 [LTEmodel.txt HR8752 27-11-2007 Equivalent width (mA) best-fit model]

lamda(A)	ele	(1	(2	(3	(4	(5	(6	(7	(8	(9	(10	(11	(12	(13	(14	(15	(16	(17	(18	(19	(20	(21	(22	(23	(24	(25	(26
4491.41	2601	-	-	-	630	476	-	-	-	-	-	-	487	-	-	-	-	-	-	-	-	-	-	-	-	466	-
4501.27	2201	-	-	-	812	604	-	-	-	-	-	-	618	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4515.34	2601	-	-	-	689	522	-	-	-	-	-	-	532	-	-	-	-	-	-	-	-	-	-	-	-	512	-
4565.74	2401	-	-	-	172	124	-	-	-	-	-	-	133	-	-	-	-	-	-	-	-	-	-	-	-	118	-
4568.31	2201	-	-	-	189	119	-	-	-	-	-	-	133	-	-	-	-	-	-	-	-	-	-	-	-	110	-
4571.97	2201	-	-	-	781	582	-	-	-	-	-	-	596	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4576.34	2601	-	-	-	537	401	-	-	-	-	-	-	413	-	-	-	-	-	-	-	-	-	-	-	-	392	-
4592.05	2401	-	-	-	468	352	-	-	-	-	-	-	363	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4656.98	2601	-	-	-	324	236	-	-	-	-	-	-	250	-	-	-	-	-	-	-	-	-	-	-	-	228	-
4731.45	2601	-	-	-	424	312	-	-	-	-	-	-	326	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4805.09	2201	-	-	-	511	363	-	-	-	-	-	-	382	-	-	-	-	-	-	-	-	-	-	-	-	350	-
4812.34	2401	-	-	-	329	241	-	-	-	-	-	-	254	-	-	-	-	-	-	-	-	-	-	-	-	233	-
4864.32	2401	-	-	-	230	166	-	-	-	-	-	-	178	-	-	-	-	-	-	-	-	-	-	-	-	159	-
4871.32	2600	-	641	-	213	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	109	-
4874.01	2201	-	-	-	331	231	-	-	-	-	-	-	248	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4876.47	2401	-	-	-	451	336	-	-	-	-	-	-	349	-	-	-	-	-	-	-	-	-	-	-	-	327	-
4893.82	2601	-	320	-	98	68	-	-	-	-	-	-	75	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4903.31	2600	-	395	-	66	36	-	-	-	-	-	-	43	-	-	-	-	-	-	-	-	-	-	-	-	29	-
4911.19	2201	-	-	-	491	356	-	-	-	-	-	-	373	-	-	-	-	-	-	-	-	-	-	-	-	344	-
4918.99	2600	-	663	-	227	135	-	-	-	-	-	-	154	-	-	-	-	-	-	-	-	-	-	-	-	117	-
4923.93	2601	-	1208	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	763	-
4966.09	2600	-	330	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	21	-
5012.07	2600	-	510	-	71	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	29	-
5018.45	2601	-	1261	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	792	-
5049.82	2600	-	473	-	85	45	-	-	-	-	-	-	54	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5051.63	2600	-	448	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5052.17	600	-	-	-	120	-	56	75	63	62	59	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5072.28	2201	-	-	-	-	-	197	235	200	198	172	-	-	-	-	-	-	-	-	-	-	-	-	-	-	229	-
5087.42	3901	-	-	-	-	-	97	135	105	98	74	128	-	93	101	96	83	140	145	150	147	96	96	90	76	126	95
5097.31	2401	-	-	-	113	79	-	-	-	-	-	-	87	-	-	-	-	-	-	-	-	-	-	-	-	75	-
5100.66	2601	-	-	-	125	87	-	-	-	-	-	-	95	-	-	-	-	-	-	-	-	-	-	-	-	83	-
5110.41	2600	-	-	-	-	-	8	14	10	9	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5112.28	4001	-	-	-	-	-	29	39	31	29	21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5120.34	2601	-	-	-	-	-	91	110	94	90	73	-	-	-	-	-	-	-	-	-	-	-	-	-	-	107	-

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5123.21 3901   -    -    -    -    -    31   46   35   31   22   -    -    -    -    -    -    -
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5125.12 2600   -    -    -    -    -    21   30   25   24   22   -    -    -    -    -    -    -
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5127.87 2601   -    -    -    -    -    -    -    -    -    -    59   -    50   49   53   46   60
 62   63   62   52   51   49   48   -    49
5129.15 2201   -    -    -    -    -   276  325  276  277  244  306   -   259  270  286  259  313
 316  320  315  284  288  266  249  320  261
5133.68 2600   -   408   -    -    -    -    -    -    -    -    -    -    -    -    -    -    -
 -    -    -    -    -    -    -    50   -
5151.91 2600   -   300   -    -    -    -    -    -    -    -    -    -    -    -    -    -    -
 -    -    -    -    -    -    -    5   -
5154.07 2201   -    -    -    -    -    -    -    -    -    -    -    -    -    -    -    -    -
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5160.82 2601   -    -    -    64   -    -    -    -    -    -    -    -    -    -    -    -    -
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5161.18 2601   -   321   -    -    -    -    -    -    -    -    -    -    -    -    -    -    -
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5162.29 2600   -   371   -    81   47   -    -    -    -    -    -    55   -    -    -    -    -
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5172.68 1200   -    -    -    -    -    -    -    -    -    -   446   -   436  480  481  500  482
 464  457  455  494  515  474  437   -   452
5183.60 1200   -    -    -    -    -   472  538  464  489  493  493   -   483  527  539  556  528
 508  500  498  551  575  527  492  528  499
5185.91 2201   -    -    -   495  348  290  340  289  291  259  319  368  272  283  302  274  326
 328  332  327  300  304  281  263  334  274
5188.68 2201   -    -    -    -    -    -    -    -    -    -   412   -   368  384  416  388  419
 417  419  414  415  425  389  370   -   371
5197.58 2601   -   926   -   751  570  513  559  492  520  517  516  581  488  507  565  545  520
 511  510  505  566   -   530  521  561  492
5200.42 3901   -    -    -    -    -    54   78   60   54   39   75   -    51   55   52   44   82
 87   90   88   -    -    48   40   72   52
5202.34 2600   -   385   -    45   23   -    -    -    -    -    -    28   -    -    -    -    -
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5211.54 2201   -    -    -    -    -   149  183  153  148  123  175   -   139  143  148  129  181
 186  190  187  146   -   137  126  177  139
5229.86 2600   -   127   -    -    -    -    -    -    -    -    -    -    -    -    -    -    -
 -    -    -    -    -    -    -    -    -
5234.63 2601   -   945   -   768  584  525  572  503  532  531  528  595  500  519  579  559  532
 522  521  517  580  598  544  534   -   504
5237.33 2401   -    -    -   510  384  339  376  330  342  325  351  396  320  329  362  338  355
 352  353  350  361  368  339  329  375  321
5239.81 2101   -    -    -    -    -   107  141  113  106   82  136   -   100  105  104   89  144
 150  155  152  103  103   96   84  134  100
5243.46 2401   -    -    -    -    -    -    -    -    -    -    8   -    -    -    6    -    -
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5246.77 2401   -    -    -    -    -    90  108   93   89   73   -    -    -    -    -    -    -
 -    -    -    -    -    -    -   105   -
5262.10 2201   -    -    -    -    -   155  194  160  154  123  185   -   142  146  152  129  191
 197  204  199  150  150  139  127  187  142
5264.81 2601   -    -    -   406  301  261  295  257  261  237  278  314  242  246  270  242  280
 282  285  282  267  270  250  242  293  241
5266.56 2600   -   591   -   166   96   -    -    -    -    -    86  111   82   99   77   85  113
 107  103  104   82   85   83   65   82   89
5276.00 2601   -    -    -   805   -   552  600  529  559  560   -    -   526  547   -   590  558
 548  546  542  611  630  573  563   -   531
5281.79 2600   -   388  391   61   33   -    -    -    -    -    -    39   28   35   -    28   42
 39   37   38   27   28   28   21   -    31
5284.11 2601   -    -    -    -    -   326  365  318  327  305   -    -   304  311   -   315  343
 343  345  341  341  347  319  310   -   304
5302.30 2600   -   361  365   55   30   -    -    -    -    -    -    36   -    -    -    -    -
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5305.86 2401   -    -   470  245   -    -    -    -    -    -    -    -   136  137   -   127  169
 174  178  175  144  144  135  129   -   135
5308.41 2401   -    -    -    -    -   171  197  172  170  147   -    -    -    -    -    -    -
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5310.69 2401   -    -    -    -    -    79   94   81   78   -    -    -    72   71   -    64   93
 97  100   98   74   73   69   65   -    71
5313.56 2401   -    -   532  333  246  211  241  210  210  187   -   258  196  198   -   191  231
 234  238  235  212  213  199  191   -   195
5316.62 2601   -  1026   -    -    -    -    -    -    -    -    -    -    -    -    -    -    -
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5324.18	2600	-	616	630	190	112	-	-	-	-	-	-	129	97	116	-	101	130	124	119	120	98	102	98	78	-	104
5325.55	2601	-	803	844	-	-	410	451	396	414	402	-	-	387	399	-	420	421	417	418	414	443	454	415	406	-	389
5334.85	2401	-	-	564	367	272	235	267	233	235	211	-	285	218	222	-	216	255	257	260	257	238	241	224	215	-	218
5336.77	2201	-	-	896	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5349.73	2600	-	-	-	-	-	-	-	-	-	-	-	-	2	2	-	2	3	2	2	2	2	2	2	1	-	2
5353.37	2600	-	-	-	-	-	-	-	-	-	-	-	-	8	10	-	8	11	10	10	10	-	8	8	6	-	8
5357.19	2101	-	-	-	-	-	6	9	7	6	4	-	-	6	6	-	5	9	10	11	10	-	6	5	4	-	6
5362.86	2601	-	772	-	573	431	382	422	370	385	370	-	443	359	370	-	385	395	392	393	389	409	418	383	374	-	361
5367.48	2600	-	415	412	108	64	45	63	51	50	47	-	74	59	72	-	62	79	74	70	71	58	60	59	46	-	64
5369.96	2600	-	-	-	-	-	-	-	-	-	-	-	-	62	76	-	65	83	78	74	75	61	64	63	49	-	67
5371.49	2600	-	958	1032	316	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5381.02	2201	-	-	771	317	209	164	204	169	163	131	-	229	150	155	-	137	200	207	213	209	158	159	148	135	-	150
5383.37	2600	-	504	506	160	97	69	94	78	76	72	-	110	87	106	-	93	115	108	103	104	88	92	89	71	-	95
5389.48	2600	-	200	212	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5393.17	2600	-	-	372	-	-	-	-	-	-	-	-	-	26	32	-	26	38	36	34	34	25	26	25	19	-	28
5397.13	2600	-	818	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5400.50	2600	-	276	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5404.15	2600	-	471	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5405.77	2600	-	857	900	-	-	89	127	100	95	81	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5407.62	2401	-	-	-	-	-	148	173	150	146	124	-	-	135	136	-	125	168	173	177	174	143	143	134	127	-	134
5414.07	2601	-	439	-	-	-	-	-	-	-	-	-	-	105	105	-	95	134	139	143	141	110	110	103	98	-	104
5418.75	2201	-	-	756	300	197	154	193	159	153	122	-	217	141	145	-	128	190	196	203	198	148	148	138	126	-	140
5420.92	2401	-	-	407	176	126	103	123	106	102	84	-	136	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5424.07	2600	-	511	514	164	-	-	-	-	-	-	-	113	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5425.26	2601	-	587	-	353	260	223	255	222	222	197	-	273	205	207	-	199	243	247	251	247	223	224	209	201	-	203
5429.70	2600	-	858	900	235	-	88	126	98	94	80	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5432.55	2500	343	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5432.97	2601	-	-	-	235	171	144	168	146	142	120	-	182	131	130	-	120	162	168	172	169	138	138	129	124	-	129
5434.52	2600	683	712	725	-	-	52	78	60	57	47	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5441.35	2600	60	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5445.04	2600	295	313	316	56	32	22	32	26	25	23	-	38	30	37	-	31	42	39	36	37	29	30	30	23	-	33
5446.92	2600	-	-	-	-	-	77	112	87	83	70	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5455.62	2600	-	726	-	159	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5460.47	2200	81	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5468.10	2800	32	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

5476.90	2800	-	-	-	-	-	27	41	32	30	25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5478.37	2401	-	-	-	-	-	132	154	133	130	110	-	-	120	121	-	111	150	154	158	155	127	126	119	113	-	119
5490.66	2201	479	-	-	-	-	61	81	65	60	45	-	-	55	57	-	47	82	87	91	89	56	56	52	47	-	55
5493.32	2600	-	-	117	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5497.52	2600	431	435	451	39	-	12	18	14	13	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5501.46	2600	426	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5502.07	2401	-	-	-	191	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5506.78	2600	444	456	468	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5508.61	2401	-	-	357	158	114	95	112	97	93	77	-	123	86	86	-	77	110	114	118	116	89	88	84	79	-	85
5526.79	2101	829	-	-	454	302	240	295	245	241	206	-	327	228	241	-	224	289	293	298	293	246	250	231	210	-	231
5534.85	2601	615	-	-	503	375	330	368	322	331	311	-	389	308	315	-	320	346	345	348	344	346	352	324	315	-	308
5536.58	2600	33	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5563.60	2600	176	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5567.91	2101	763	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5569.62	2600	417	443	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5572.84	2600	505	533	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5576.09	2600	305	294	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5577.03	2600	19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5578.72	2800	262	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5586.76	2600	564	588	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5590.72	2700	73	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5593.30	1301	-	-	-	6	-	-	-	-	-	-	-	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5593.74	2800	98	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5611.36	2600	26	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5615.64	2600	-	632	-	195	116	-	-	-	-	-	-	133	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5624.54	2600	-	330	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5628.62	2400	36	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5633.97	2600	145	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5647.23	2700	76	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5650.70	2600	49	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5653.89	2600	62	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5662.16	2200	73	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5670.85	2300	111	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5679.94	2200	23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5686.52	2600	-	126	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5689.49	2200	42	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-									

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5727.05	2300	185	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5737.06	2300	70	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5748.35	2800	159	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5754.66	2800	261	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5778.46	2600	88	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5783.09	2400	71	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5783.89	2400	93	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5816.37	2600	165	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5838.37	2600	48	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5852.22	2600	74	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5862.37	2600	217	187	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5866.45	2200	215	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5916.25	2600	219	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5918.54	2200	103	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5929.67	2600	69	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5930.17	2600	222	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5937.81	2200	50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5952.72	2600	151	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5965.83	2200	109	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5978.54	2200	98	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5991.38	2601	425	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5996.73	2800	42	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6003.03	2600	228	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6007.31	2800	154	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6013.48	2500	216	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6020.17	2600	227	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6021.79	2500	267	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6024.07	2600	266	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6039.73	2300	87	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6055.99	2600	172	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6062.89	2600	82	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6064.63	2200	47	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6065.48	2600	406	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6082.72	2600	172	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6084.10	2601	340	-	-	148	106	-	-	-	-	-	-	114	-	-	-	-	-	-	-	-	-	-	-	-	-	-

6113.32	2601	246	-	-	79	56	-	-	-	-	-	-	61	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6137.69	2600	447	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6149.26	2601	447	-	-	323	242	-	-	-	-	-	-	253	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6245.64	2101	-	-	-	170	101	-	-	-	-	-	-	116	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6246.32	2600	316	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6247.56	2601	572	-	-	466	351	-	-	-	-	-	-	363	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6305.65	2100	50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6413.35	2100	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6416.92	2601	454	-	-	316	235	-	-	-	-	-	-	247	-	-	-	-	-	-	-	-	-	-	-	-	-	-
lamda(A)	ele	(1	(2	(3	(4	(5	(6	(7	(8	(9	(10	(11	(12	(13	(14	(15	(16	(17	(18	(19	(20	(21	(22	(23	(24	(25	(26

Table A1.4 [SigmaMdl.txt HR8752 27-11-2007 Estimated error equivalent width (mA) best-fit model]

lamda(A)	ele	(1	(2	(3	(4	(5	(6	(7	(8	(9	(10	(11	(12	(13	(14	(15	(16	(17	(18	(19	(20	(21	(22	(23	(24	(25	(26
4491.41	2601	-	-	-	25.8	20.4	-	-	-	-	-	-	20.2	-	-	-	-	-	-	-	-	-	-	-	-	20.4	-
4501.27	2201	-	-	-	35.0	28.1	-	-	-	-	-	-	27.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4515.34	2601	-	-	-	45.0	35.5	-	-	-	-	-	-	35.2	-	-	-	-	-	-	-	-	-	-	-	-	35.3	-
4565.74	2401	-	-	-	49.1	36.7	-	-	-	-	-	-	38.2	-	-	-	-	-	-	-	-	-	-	-	-	35.6	-
4568.31	2201	-	-	-	52.2	36.0	-	-	-	-	-	-	38.5	-	-	-	-	-	-	-	-	-	-	-	-	34.6	-
4571.97	2201	-	-	-	36.1	28.9	-	-	-	-	-	-	28.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4576.34	2601	-	-	-	53.3	42.0	-	-	-	-	-	-	41.4	-	-	-	-	-	-	-	-	-	-	-	-	42.0	-
4592.05	2401	-	-	-	56.6	44.5	-	-	-	-	-	-	43.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4656.98	2601	-	-	-	72.0	55.4	-	-	-	-	-	-	55.7	-	-	-	-	-	-	-	-	-	-	-	-	54.8	-
4731.45	2601	-	-	-	61.0	47.6	-	-	-	-	-	-	47.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4805.09	2201	-	-	-	49.3	39.0	-	-	-	-	-	-	38.5	-	-	-	-	-	-	-	-	-	-	-	-	39.0	-
4812.34	2401	-	-	-	62.3	48.1	-	-	-	-	-	-	48.4	-	-	-	-	-	-	-	-	-	-	-	-	47.7	-
4864.32	2401	-	-	-	66.1	49.9	-	-	-	-	-	-	51.3	-	-	-	-	-	-	-	-	-	-	-	-	48.9	-
4871.32	2600	-	31.9	-	33.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	21.3	-
4874.01	2201	-	-	-	63.4	48.1	-	-	-	-	-	-	48.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4876.47	2401	-	-	-	59.9	47.0	-	-	-	-	-	-	46.5	-	-	-	-	-	-	-	-	-	-	-	-	46.8	-
4893.82	2601	-	52.9	-	33.6	24.1	-	-	-	-	-	-	25.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4903.31	2600	-	21.0	-	13.2	7.9	-	-	-	-	-	-	9.1	-	-	-	-	-	-	-	-	-	-	-	-	6.8	-
4911.19	2201	-	-	-	59.7	47.1	-	-	-	-	-	-	46.5	-	-	-	-	-	-	-	-	-	-	-	-	47.0	-
4918.99	2600	-	32.4	-	33.9	23.4	-	-	-	-	-	-	24.8	-	-	-	-	-	-	-	-	-	-	-	-	22.2	-
4923.93	2601	-	33.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	21.5	-
4966.09	2600	-	25.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5.9	-
5012.07	2600	-	11.7	-	8.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4.4	-
5018.45	2601	-	36.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	22.8	-
5049.82	2600	-	21.9	-	16.0	9.6	-	-	-	-	-	-	11.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5051.63	2600	-	11.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5052.17	600	-	-	-	37.9	-	20.6	25.4	21.8	22.0	21.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5072.28	2201	-	-	-	-	-	44.0	47.8	42.0	44.6	44.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	48.2	-
5087.42	3901	-	-	-	-	-	30.2	37.3	30.6	30.2	25.2	35.0	-	28.3	30.3	30.9	27.8	36.0	36.3	37.0	36.3	30.8	31.3	28.8	25.7	36.5	28.8
5097.31	2401	-	-	-	37.5	27.1	-	-	-	-	-	-	29.0	-	-	-	-	-	-	-	-	-	-	-	-	26.1	-
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5110.41	2600	-	-	-	-	-	1.4	2.3	1.8	1.6	1.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5112.28	4001	-	-	-	-	-	13.5	17.5	14.3	13.3	10.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5120.34	2601	-	-	-	-	-	34.5	39.6	34.4	34.3	29.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	39.1	-

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20.9 21.2 21.0 18.8 18.7 17.8 17.5   -  17.6
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5633.97 2600 18.8   -    -    -    -    -    -    -    -    -    -    -    -    -    -    -    -
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5647.23 2700 15.8   -    -    -    -    -    -    -    -    -    -    -    -    -    -    -    -
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5650.70 2600 12.4   -    -    -    -    -    -    -    -    -    -    -    -    -    -    -    -
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5653.89 2600 13.5   -    -    -    -    -    -    -    -    -    -    -    -    -    -    -    -
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5662.16 2200 19.8   -    -    -    -    -    -    -    -    -    -    -    -    -    -    -    -
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5670.85 2300105.6   -    -    -    -    -    -    -    -    -    -    -    -    -    -    -    -
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5679.94 2200  8.1   -    -    -    -    -    -    -    -    -    -    -    -    -    -    -    -
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5686.52 2600   -  20.1   -    -    -    -    -    -    -    -    -    -    -    -    -    -    -
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5689.49 2200 10.0   -    -    -    -    -    -    -    -    -    -    -    -    -    -    -    -
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5727.05	2300	20.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
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5748.35	2800	51.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
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5783.89	2400	14.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5816.37	2600	29.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5838.37	2600	20.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
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5862.37	2600	35.5	47.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5866.45	2200	32.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
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5929.67	2600	16.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5930.17	2600	25.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5937.81	2200	9.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
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6003.03	2600	29.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6007.31	2800	43.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
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6020.17	2600	26.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6021.79	2500	22.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6024.07	2600	24.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
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6064.63	2200	10.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6065.48	2600	8.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6082.72	2600	19.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6084.10	2601	45.9	-	-	45.4	33.4	-	-	-	-	-	-	35.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-

6113.32	2601	43.0	-	-	28.4	20.4	-	-	-	-	-	-	22.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6137.69	2600	9.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6149.26	2601	48.3	-	-	63.5	48.7	-	-	-	-	-	-	49.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6245.64	2101	-	-	-	49.8	32.6	-	-	-	-	-	-	35.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6246.32	2600	24.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6247.56	2601	49.3	-	-	62.6	48.5	-	-	-	-	-	-	48.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6305.65	2100	9.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6413.35	2100	1.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6416.92	2601	49.4	-	-	63.2	48.4	-	-	-	-	-	-	49.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
lamda(A)	ele	(1	(2	(3	(4	(5	(6	(7	(8	(9	(10	(11	(12	(13	(14	(15	(16	(17	(18	(19	(20	(21	(22	(23	(24	(25	(26

Table A1.5 [TotSigma.txt HR8752 27-11-2007 Combined total error of observation and best-fit model]

lamda(A)	ele	(1	(2	(3	(4	(5	(6	(7	(8	(9	(10	(11	(12	(13	(14	(15	(16	(17	(18	(19	(20	(21	(22	(23	(24	(25	(26
4491.41	2601	-	-	-	52	49	-	-	-	-	-	-	49	-	-	-	-	-	-	-	-	-	-	-	-	44	-
4501.27	2201	-	-	-	39	33	-	-	-	-	-	-	33	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4515.34	2601	-	-	-	67	61	-	-	-	-	-	-	61	-	-	-	-	-	-	-	-	-	-	-	-	47	-
4565.74	2401	-	-	-	56	45	-	-	-	-	-	-	46	-	-	-	-	-	-	-	-	-	-	-	-	53	-
4568.31	2201	-	-	-	65	57	-	-	-	-	-	-	59	-	-	-	-	-	-	-	-	-	-	-	-	51	-
4571.97	2201	-	-	-	38	31	-	-	-	-	-	-	31	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4576.34	2601	-	-	-	63	53	-	-	-	-	-	-	53	-	-	-	-	-	-	-	-	-	-	-	-	60	-
4592.05	2401	-	-	-	63	52	-	-	-	-	-	-	52	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4656.98	2601	-	-	-	78	62	-	-	-	-	-	-	63	-	-	-	-	-	-	-	-	-	-	-	-	62	-
4731.45	2601	-	-	-	66	54	-	-	-	-	-	-	53	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4805.09	2201	-	-	-	57	48	-	-	-	-	-	-	47	-	-	-	-	-	-	-	-	-	-	-	-	53	-
4812.34	2401	-	-	-	65	52	-	-	-	-	-	-	52	-	-	-	-	-	-	-	-	-	-	-	-	56	-
4864.32	2401	-	-	-	72	57	-	-	-	-	-	-	58	-	-	-	-	-	-	-	-	-	-	-	-	59	-
4871.32	2600	-	85	-	45	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	51	-
4874.01	2201	-	-	-	74	54	-	-	-	-	-	-	55	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4876.47	2401	-	-	-	78	60	-	-	-	-	-	-	60	-	-	-	-	-	-	-	-	-	-	-	-	63	-
4893.82	2601	-	68	-	67	51	-	-	-	-	-	-	52	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4903.31	2600	-	53	-	52	46	-	-	-	-	-	-	46	-	-	-	-	-	-	-	-	-	-	-	-	76	-
4911.19	2201	-	-	-	79	57	-	-	-	-	-	-	57	-	-	-	-	-	-	-	-	-	-	-	-	62	-
4918.99	2600	-	63	-	46	31	-	-	-	-	-	-	32	-	-	-	-	-	-	-	-	-	-	-	-	34	-
4923.93	2601	-	78	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	53	-
4966.09	2600	-	46	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	66	-
5012.07	2600	-	81	-	24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	56	-
5018.45	2601	-	242	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	67	-
5049.82	2600	-	50	-	48	34	-	-	-	-	-	-	34	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5051.63	2600	-	46	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5052.17	600	-	-	-	64	-	21	26	23	23	22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5072.28	2201	-	-	-	-	-	45	49	43	46	45	-	-	-	-	-	-	-	-	-	-	-	-	-	-	59	-
5087.42	3901	-	-	-	-	-	31	39	32	31	27	36	-	30	31	32	29	38	38	39	38	32	33	30	27	42	30
5097.31	2401	-	-	-	60	48	-	-	-	-	-	-	49	-	-	-	-	-	-	-	-	-	-	-	-	57	-
5100.66	2601	-	-	-	54	43	-	-	-	-	-	-	44	-	-	-	-	-	-	-	-	-	-	-	-	54	-
5110.41	2600	-	-	-	-	-	3	5	4	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5112.28	4001	-	-	-	-	-	14	18	15	14	11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5120.34	2601	-	-	-	-	-	36	41	36	35	30	-	-	-	-	-	-	-									

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5123.21 3901   -    -    -    -    -   14   19   15   14   11    -    -    -    -    -    -    -
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5125.12 2600   -    -    -    -    -    9   13   11   12   11    -    -    -    -    -    -    -
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5127.87 2601   -    -    -    -    -    -    -    -    -    -   21    -   20   20   20   19   22
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5129.15 2201   -    -    -    -    -   48   52   46   49   51   47    -   47   49   55   54   47
 46   45   45   55   57   52   51   60   48
5133.68 2600   -   66    -    -    -    -    -    -    -    -    -    -    -    -    -    -    -
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5151.91 2600   -   52    -    -    -    -    -    -    -    -    -    -    -    -    -    -    -
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5154.07 2201   -    -    -    -    -    -    -    -    -    -    -    -    -    -    -    -    -
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5160.82 2601   -    -    -   42    -    -    -    -    -    -    -    -    -    -    -    -    -
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5161.18 2601   -  131    -    -    -    -    -    -    -    -    -    -    -    -    -    -    -
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5162.29 2600   -   99    -   50   41    -    -    -    -    -    -   42    -    -    -    -    -
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5172.68 1200   -    -    -    -    -    -    -    -    -    -   24    -   21   23   24   22   24
 23   25   23   23   26   23   22    -   22
5183.60 1200   -    -    -    -    -   23   26   23   24   22   24    -   23   23   22   23   25
 24   23   24   23   26   24   23   46   22
5185.91 2201   -    -    -   74   61   49   52   46   50   52   47   61   47   49   56   55   47
 46   45   45   56   58   53   52   62   48
5188.68 2201   -    -    -    -    -    -    -    -    -    -   41    -   42   44   50   49   43
 41   41   41   50   52   48   46    -   43
5197.58 2601   -   55    -   42   34   32   35   31   33   53   33   34   31   32   37   36   34
 32   32   31   36    -   35   35   34   32
5200.42 3901   -    -    -    -    -   24   32   26   24   18   31    -   22   24   24   20   32
 33   34   33    -    -   22   19   47   23
5202.34 2600   -   51    -   32   31    -    -    -    -    -    -   31    -    -    -    -    -
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5211.54 2201   -    -    -    -    -   41   46   40   41   38   43    -   38   40   43   40   44
 43   43   43   43    -   40   38   46   39
5229.86 2600   -   40    -    -    -    -    -    -    -    -    -    -    -    -    -    -    -
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5234.63 2601   -  105    -   39   33   33   35   32   33   34   33   33   32   33   36   36   32
 31   31   31   37   37   34   33    -   32
5237.33 2401   -    -    -   73   60   47   49   44   48   51   44   60   45   47   54   54   44
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5239.81 2101   -    -    -    -    -   34   41   34   34   29   39    -   31   33   35   31   39
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5243.46 2401   -    -    -    -    -    -    -    -    -    -    5    -    -    -    5    -    -
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5246.77 2401   -    -    -    -    -   30   34   31   31   27    -    -    -    -    -    -    -
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5262.10 2201   -    -    -    -    -   48   54   47   48   43   51    -   45   46   50   46   51
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5264.81 2601   -    -    -   70   53   48   52   45   49   50   46   53   46   49   54   53   47
 46   45   45   55   57   51   51   59   46
5266.56 2600   -   59    -   39   27    -    -    -    -    -   20   29   18   22   19   20   23
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5276.00 2601   -    -    -   34    -   36   37   32   36   36    -    -   38   40    -   42   36
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5281.79 2600   -   37   57   27   20    -    -    -    -    -    -   20    9   10    -    9   11
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5284.11 2601   -    -    -    -    -   48   51   46   50   53    -    -   47   50    -   56   46
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5302.30 2600   -   42   50   31   13    -    -    -    -    -    -   14    -    -    -    -    -
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5305.86 2401   -    -   80   74    -    -    -    -    -    -    -    -   44   45    -   45   48
 48   48   47   49   50   46   45    -   44
5308.41 2401   -    -    -    -    -   43   47   41   43   42    -    -    -    -    -    -    -
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5310.69 2401   -    -    -    -    -   28   32   28   27    -    -    -   26   25    -   24   31
 31   32   32   27   27   26   24    -   26
5313.56 2401   -    -   63   69   54   46   50   44   47   47    -   54   44   45    -   49   45
 44   44   44   51   52   48   47    -   44
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5316.62	2601	-	247	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5324.18	2600	-	59	72	41	25	-	-	-	-	-	-	26	20	24	-	23	23	24	23	23	21	23	22	19	-	21
5325.55	2601	-	40	71	-	-	25	27	23	26	27	-	-	24	26	-	29	24	23	23	23	29	30	28	27	-	24
5334.85	2401	-	-	72	82	63	53	57	50	54	56	-	64	51	53	-	59	52	50	50	49	60	62	56	56	-	52
5336.77	2201	-	-	214	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5349.73	2600	-	-	-	-	-	-	-	-	-	-	-	-	5	4	-	3	6	5	6	7	5	3	4	5	-	3
5353.37	2600	-	-	-	-	-	-	-	-	-	-	-	-	4	4	-	5	7	6	5	5	-	3	4	3	-	5
5357.19	2101	-	-	-	-	-	6	5	5	4	3	-	-	4	5	-	4	6	6	6	7	-	6	4	5	-	4
5362.86	2601	-	70	-	69	55	54	57	53	55	59	-	54	51	54	-	62	50	48	47	47	62	65	58	58	-	52
5367.48	2600	-	42	51	47	31	12	17	14	14	13	-	32	15	18	-	16	19	18	17	17	16	16	16	13	-	16
5369.96	2600	-	-	-	-	-	-	-	-	-	-	-	-	16	18	-	17	20	17	18	18	16	17	17	14	-	17
5371.49	2600	-	114	214	39	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5381.02	2201	-	-	113	84	62	43	49	42	43	39	-	63	40	41	-	41	45	45	45	45	45	46	42	40	-	40
5383.37	2600	-	48	67	55	38	18	22	19	19	18	-	39	19	22	-	22	23	22	22	22	20	21	21	18	-	20
5389.48	2600	-	39	40	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5393.17	2600	-	-	92	-	-	-	-	-	-	-	-	-	8	10	-	9	12	10	11	11	8	9	8	7	-	8
5397.13	2600	-	124	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5400.50	2600	-	51	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5404.15	2600	-	217	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5405.77	2600	-	104	113	-	-	14	18	14	14	13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5407.62	2401	-	-	-	-	-	46	52	45	47	44	-	-	44	44	-	45	48	48	47	48	49	50	46	45	-	44
5414.07	2601	-	87	-	-	-	-	-	-	-	-	-	-	34	33	-	32	38	38	39	38	37	36	34	33	-	33
5418.75	2201	-	-	82	87	67	48	55	47	48	44	-	69	44	46	-	46	51	51	51	50	50	51	46	44	-	45
5420.92	2401	-	-	70	71	59	34	37	33	33	30	-	60	-	-	-	-	-	-	-	-	-	-	-	-	-	-
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5425.26	2601	-	68	-	76	55	47	51	44	48	48	-	55	45	46	-	50	46	46	45	44	52	54	48	48	-	45
5429.70	2600	-	108	114	39	-	14	17	16	15	12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5432.55	2500	61	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5432.97	2601	-	-	-	64	50	40	44	39	40	37	-	52	38	38	-	39	41	41	41	40	41	42	39	38	-	38
5434.52	2600	97	83	117	-	-	10	12	10	10	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5441.35	2600	21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5445.04	2600	46	53	49	39	25	10	13	11	11	10	-	26	13	15	-	14	17	16	15	15	12	13	13	11	-	14
5446.92	2600	-	-	-	-	-	17	21	18	17	15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5455.62	2600	-	190	-	59	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5460.47	2200	19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5468.10	2800	14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-									

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5476.90 2800   -    -    -    -    -   11   12   13   10   11    -    -    -    -    -    -    -
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5478.37 2401   -    -    -    -    -   38   42   37   38   35    -    -   35   36    -   36   40
 40   40   39   39   40   37   37    -   35
5490.66 2201  71    -    -    -    -   26   33   27   26   20    -    -   24   24    -   21   32
 33   34   34   25   25   23   21    -   23
5493.32 2600   -    -   69    -    -    -    -    -    -    -    -    -    -    -    -    -    -
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5497.52 2600  84  147  171   43    -    8    9    9    8    5    -    -    -    -    -    -    -
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5501.46 2600  89    -    -    -    -    -    -    -    -    -    -    -    -    -    -    -    -
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5502.07 2401   -    -    -   61    -    -    -    -    -    -    -    -    -    -    -    -    -
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5506.78 2600  83   41   73    -    -    -    -    -    -    -    -    -    -    -    -    -    -
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5508.61 2401   -    -   79   54   42   32   36   31   31   28    -   43   29   30    -   28   34
 35   35   34   31   31   29   28    -   29
5526.79 2101  95    -    -   74   54   51   56   49   50   50    -   55   47   50    -   53   50
 49   49   48   55   57   52   49    -   48
5534.85 2601  84    -    -   76   59   47   50   44   49   51    -   59   46   48    -   55   45
 44   43   43   55   57   51   51    -   46
5536.58 2600  14    -    -    -    -    -    -    -    -    -    -    -    -    -    -    -    -
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5563.60 2600  31    -    -    -    -    -    -    -    -    -    -    -    -    -    -    -    -
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5567.91 2101  91    -    -    -    -    -    -    -    -    -    -    -    -    -    -    -    -
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5569.62 2600  54   45    -    -    -    -    -    -    -    -    -    -    -    -    -    -    -
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5572.84 2600  62   61    -    -    -    -    -    -    -    -    -    -    -    -    -    -    -
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5576.09 2600  42   32    -    -    -    -    -    -    -    -    -    -    -    -    -    -    -
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5577.03 2600   9    -    -    -    -    -    -    -    -    -    -    -    -    -    -    -    -
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5578.72 2800  61    -    -    -    -    -    -    -    -    -    -    -    -    -    -    -    -
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5586.76 2600  67   57    -    -    -    -    -    -    -    -    -    -    -    -    -    -    -
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5590.72 2700  14    -    -    -    -    -    -    -    -    -    -    -    -    -    -    -    -
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5593.30 1301   -    -    -   52    -    -    -    -    -    -    -   51    -    -    -    -    -
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5593.74 2800  31    -    -    -    -    -    -    -    -    -    -    -    -    -    -    -    -
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5611.36 2600  11    -    -    -    -    -    -    -    -    -    -    -    -    -    -    -    -
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5615.64 2600   -   74    -   58   33    -    -    -    -    -    -   34    -    -    -    -    -
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5624.54 2600   -   45    -    -    -    -    -    -    -    -    -    -    -    -    -    -    -
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5628.62 2400  34    -    -    -    -    -    -    -    -    -    -    -    -    -    -    -    -
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5633.97 2600  25    -    -    -    -    -    -    -    -    -    -    -    -    -    -    -    -
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5647.23 2700  16    -    -    -    -    -    -    -    -    -    -    -    -    -    -    -    -
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5650.70 2600  13    -    -    -    -    -    -    -    -    -    -    -    -    -    -    -    -
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5662.16 2200  23    -    -    -    -    -    -    -    -    -    -    -    -    -    -    -    -
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5737.06	2300	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5748.35	2800	59	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
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5862.37	2600	40	75	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5866.45	2200	38	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5916.25	2600	33	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5918.54	2200	18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5929.67	2600	21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5930.17	2600	34	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5937.81	2200	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5952.72	2600	35	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5965.83	2200	26	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5978.54	2200	29	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5991.38	2601	61	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5996.73	2800	17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6003.03	2600	38	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6007.31	2800	45	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6013.48	2500	32	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
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6021.79	2500	33	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6024.07	2600	39	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6039.73	2300	11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6055.99	2600	31	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6062.89	2600	27	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6064.63	2200	13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
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6082.72	2600	27	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6084.10	2601	53	-	-	60	39	-	-	-	-	-	-	41	-	-	-	-	-										

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6113.32	2601	46	-	-	49	38	-	-	-	-	-	-	39	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6137.69	2600	60	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6149.26	2601	58	-	-	96	62	-	-	-	-	-	-	62	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6245.64	2101	-	-	-	61	41	-	-	-	-	-	-	43	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6246.32	2600	43	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6247.56	2601	61	-	-	80	61	-	-	-	-	-	-	61	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6305.65	2100	11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6413.35	2100	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6416.92	2601	66	-	-	71	56	-	-	-	-	-	-	56	-	-	-	-	-	-	-	-	-	-	-	-	-	-
lamda(A)	ele	(1	(2	(3	(4	(5	(6	(7	(8	(9	(10	(11	(12	(13	(14	(15	(16	(17	(18	(19	(20	(21	(22	(23	(24	(25	(26

Table A1.6 [Signifi.txt HR8752 27-11-2007 Delta(model- observed)/sigma]

lamda(A)	ele	(1	(2	(3	(4	(5	(6	(7	(8	(9	(10	(11	(12	(13	(14	(15	(16	(17	(18	(19	(20	(21	(22	(23	(24	(25	(26
4491.41	2601	-	-	-	0.7	0.8	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-
4501.27	2201	-	-	-	-0.5	-3.1	-	-	-	-	-	-	-3.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4515.34	2601	-	-	-	-1.0	0.1	-	-	-	-	-	-	-0.1	-	-	-	-	-	-	-	-	-	-	-	-	-0.6	-
4565.74	2401	-	-	-	-1.4	-0.9	-	-	-	-	-	-	-1.1	-	-	-	-	-	-	-	-	-	-	-	-	-1.3	-
4568.31	2201	-	-	-	-0.2	0.9	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-	0.0	-
4571.97	2201	-	-	-	-0.7	-5.5	-	-	-	-	-	-	-6.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4576.34	2601	-	-	-	0.2	-0.6	-	-	-	-	-	-	-0.5	-	-	-	-	-	-	-	-	-	-	-	-	-0.1	-
4592.05	2401	-	-	-	0.8	0.8	-	-	-	-	-	-	0.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4656.98	2601	-	-	-	-1.5	-2.2	-	-	-	-	-	-	-1.6	-	-	-	-	-	-	-	-	-	-	-	-	-1.6	-
4731.45	2601	-	-	-	-0.8	-0.8	-	-	-	-	-	-	-0.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4805.09	2201	-	-	-	-1.3	-1.3	-	-	-	-	-	-	-1.2	-	-	-	-	-	-	-	-	-	-	-	-	-1.3	-
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4874.01	2201	-	-	-	-0.1	-0.2	-	-	-	-	-	-	-0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4876.47	2401	-	-	-	-0.2	-0.5	-	-	-	-	-	-	-0.5	-	-	-	-	-	-	-	-	-	-	-	-	-0.7	-
4893.82	2601	-	-1.5	-	-0.6	-0.6	-	-	-	-	-	-	-0.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4903.31	2600	-	-0.5	-	-0.2	-0.6	-	-	-	-	-	-	-0.3	-	-	-	-	-	-	-	-	-	-	-	-	-0.4	-
4911.19	2201	-	-	-	-0.2	0.7	-	-	-	-	-	-	1.1	-	-	-	-	-	-	-	-	-	-	-	-	0.6	-
4918.99	2600	-	-0.1	-	1.2	0.6	-	-	-	-	-	-	1.0	-	-	-	-	-	-	-	-	-	-	-	-	1.1	-
4923.93	2601	-	-2.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-2.6	-
4966.09	2600	-	0.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-0.4	-
5012.07	2600	-	-2.2	-	-0.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1.2	-
5018.45	2601	-	-1.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-0.4	-
5049.82	2600	-	-2.1	-	0.3	0.1	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5051.63	2600	-	-2.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5052.17	600	-	-	-	0.3	-	0.9	1.7	0.4	0.7	1.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5072.28	2201	-	-	-	-	-	0.6	0.5	0.5	0.3	0.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.0	-
5087.42	3901	-	-	-	-	-	-0.3	-0.6	-0.7	-0.6	-0.2	-0.5	-	0.0	-0.3	-0.4	1.2	-1.0	-1.0	-0.3	-0.1	-0.3	-0.1	0.5	0.4	-0.1	0.4
5097.31	2401	-	-	-	-0.3	-0.5	-	-	-	-	-	-	-0.4	-	-	-	-	-	-	-	-	-	-	-	-	-0.3	-
5100.66	2601	-	-	-	-1.7	-2.4	-	-	-	-	-	-	-1.9	-	-	-	-	-	-	-	-	-	-	-	-	-1.9	-
5110.41	2600	-	-	-	-	-	-2.0	-1.5	-2.2	-1.0	0.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5112.28	4001	-	-	-	-	-	-0.3	0.1	-0.6	0.5	-0.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5120.34	2601	-	-	-	-	-	0.2	0.2	-0.1	0.5	0.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.4	-

```
5123.21 3901   -    -    -    -    - -1.4 -1.3 -1.9 -0.9 -0.4   -    -    -    -    -    -    -
  -    -    -    -    -    -    - -1.2   -
5125.12 2600   -    -    -    -    - -0.7 -0.5 -1.1 -0.5 -0.6   -    -    -    -    -    -    -
  -    -    -    -    -    -    -    -    -
5127.87 2601   -    -    -    -    -    -    -    -    -    -  -2.4   -  -2.3 -1.7 -2.8 -1.7 -1.3
-0.2 -1.3 -1.0 -0.1 -1.4 -1.0 -0.9   -  -0.5
5129.15 2201   -    -    -    -    -  0.1  0.4  0.0  0.2  0.1  0.0   -   0.1  0.4 -0.5  1.0  0.8
 0.4  0.3  0.8  0.3  0.1  0.3  0.7  0.3  0.2
5133.68 2600   - -0.2    -    -    -    -    -    -    -    -    -    -    -    -    -    -    -
  -    -    -    -    -    -    -  0.3   -
5151.91 2600   - -3.3    -    -    -    -    -    -    -    -    -    -    -    -    -    -    -
  -    -    -    -    -    -    - -0.4   -
5154.07 2201   -    -    -    -    -    -    -    -    -    -    -    -    -    -    -    -    -
  -    -    -    -    -    -    - -1.7   -
5160.82 2601   -    -    -  -2.4    -    -    -    -    -    -    -    -    -    -    -    -    -
  -    -    -    -    -    -    -    -    -
5161.18 2601   - -1.0    -    -    -    -    -    -    -    -    -    -    -    -    -    -    -
  -    -    -    -    -    -    -    -    -
5162.29 2600   - -0.6    - -0.7 -1.0    -    -    -    -    -    -  0.0    -    -    -    -    -
  -    -    -    -    -    -    -    -    -
5172.68 1200   -    -    -    -    -    -    -    -    -    -  4.1    -  8.8  7.7  8.2 12.0  6.4
 5.3  3.1  5.4  9.4  7.5  7.7  7.5   -   7.7
5183.60 1200   -    -    -    -    -  4.7  4.8  3.9  5.2  7.4  4.5   -   5.6  8.1 10.9 10.6  4.9
 5.6  5.8  5.0  9.8  7.7  7.3  7.0  2.0  7.8
5185.91 2201   -    -    -  1.0  0.0 -0.1  0.2  0.5  0.4 -0.1 -0.1  0.3  0.2  0.5 -0.2  0.4  0.3
 0.0  0.1  0.1  0.3  0.0 -0.1  0.1  0.3  0.0
5188.68 2201   -    -    -    -    -    -    -    -    -    -  -1.0   -  -2.0 -1.3 -2.0 -0.5 -2.3
-2.3 -2.7 -2.2 -1.4 -1.3 -2.2 -1.2   -  -1.8
5197.58 2601   - -0.6    -  1.3  1.7  0.5 -0.2  0.2  0.4  0.8 -0.5  0.8  0.4  0.8  0.2  0.2 -0.7
 0.1 -0.5  0.0  1.1   -  -0.1 -0.2  1.3  0.0
5200.42 3901   -    -    -    -    - -0.6 -0.2 -0.4 -0.5  0.4 -0.6   -   0.1  0.4  0.0 -0.5 -1.0
-0.2 -0.8 -0.8   -    -  -0.3 -0.5 -1.0 -0.9
5202.34 2600   - -0.7    - -0.6 -1.3    -    -    -    -    -    - -3.3    -    -    -    -    -
  -    -    -    -    -    -    -    -    -
5211.54 2201   -    -    -    -    - -0.3 -0.3 -1.0 -0.7 -0.1 -0.9   -  -0.4  0.0  0.0  0.4 -0.7
-0.1 -0.6 -0.9 -0.1   -   0.3  0.2 -0.2  0.3
5229.86 2600   - -1.3    -    -    -    -    -    -    -    -    -    -    -    -    -    -    -
  -    -    -    -    -    -    -    -    -
5234.63 2601   - -0.6    -  2.9  0.4  0.3  0.5 -0.6  0.3  0.3  0.2  1.5  0.4  0.3  0.7  0.5  1.0
 0.8  0.8  0.4  0.8  1.6  0.9  1.1   -   0.2
5237.33 2401   -    -    -  1.2  0.1 -0.1  0.2 -0.2  0.0  0.0  0.1  0.6  0.0  0.2  0.2  0.3  0.7
 0.4  0.6  0.3  0.0  0.7  0.3  0.3  0.3  0.2
5239.81 2101   -    -    -    -    - -1.6 -1.1 -1.9 -1.7 -1.9 -1.2   -  -1.0 -1.6 -1.7 -1.1 -1.1
-1.2 -0.8 -1.5 -0.9 -1.7 -1.4 -1.3 -0.9 -1.2
5243.46 2401   -    -    -    -    -    -    -    -    -    -  -6.2   -    -    -  -7.7   -    -
  -    -    -    -    -    -    -    -    -
5246.77 2401   -    -    -    -    - -1.6 -0.6 -0.1 -0.1 -0.8   -    -    -    -    -    -    -
  -    -    -    -    -    -    -  0.4   -
5262.10 2201   -    -    -    -    -  1.0  1.4  1.4  1.3  1.4  0.8   -   1.1  0.9  0.6  1.0  1.1
 0.6  0.9  0.9  1.0  0.6  1.1  0.3  0.6  0.8
5264.81 2601   -    -    - -0.7  0.9  0.3 -1.0 -0.2  0.0 -0.3 -0.2 -0.6 -0.5 -1.1 -0.5 -0.5 -1.1
-1.2 -0.8 -1.2 -0.7 -0.7 -0.5 -0.7  0.6  0.1
5266.56 2600   -  0.3    -  0.8  1.0    -    -    -    -    -  0.5 -0.4  1.7  0.7  1.3  1.2  0.8
 0.9  0.6  0.4  2.1  0.9  0.5  0.1  0.5  1.3
5276.00 2601   -    -    -  7.4    - -1.0 -0.3  0.2 -0.8 -0.3   -    -  -3.1 -3.2   -  -2.0 -0.8
-1.4 -0.9 -1.6 -1.0 -0.9 -1.0 -2.0   -  -0.3
5281.79 2600   -  1.5 -1.5 -1.0 -0.9    -    -    -    -    -    - -2.2  0.0 -2.2   -  -0.1  1.5
 1.3  0.7  1.0 -0.1  0.5  1.6  0.1   -  -0.6
5284.11 2601   -    -    -    -    - -1.1 -0.3 -1.2 -1.1 -1.3   -    -  -0.8 -1.3   -  -0.8 -0.2
-0.6 -0.6 -0.4 -0.3 -0.2  0.0  0.3   -  -0.3
5302.30 2600   - -3.0 -0.4 -1.5 -0.1    -    -    -    -    -    - -0.4    -    -    -    -    -
  -    -    -    -    -    -    -    -    -
5305.86 2401   -    -  0.1  0.2    -    -    -    -    -    -    -    -   0.4  0.4   -   0.1  0.5
 0.8  0.5  0.3  0.1  0.4  0.1 -0.2   -   0.0
5308.41 2401   -    -    -    -    -  0.7  0.8  0.4  0.7  0.4   -    -    -    -    -    -    -
  -    -    -    -    -    -    -    -    -
5310.69 2401   -    -    -    -    - -0.2  0.1  0.0  0.3   -    -    -   0.0  0.9   -  -0.2  0.4
 0.7  0.2  0.1  0.1  0.3 -0.1  0.3   -  -0.3
5313.56 2401   -    - -0.9  0.7  0.2  0.1  0.3  0.0  0.2  0.0   -  -0.1  0.0  0.6   -   0.2  0.7
 0.5  0.6  0.2  0.3  0.5  0.2  0.0   -   0.5
5316.62 2601   -  0.2    -    -    -    -    -    -    -    -    -    -    -    -    -    -    -
```

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  -    -    -    -    -    -    -    -    -
5324.18 2600   -   0.9  1.8 -1.1  0.6   -    -    -    -    -    -   0.6  2.3  1.0   -   0.8  1.1
 1.5  1.8  1.5  2.8  1.6  1.3  1.2   -   1.9
5325.55 2601   -   6.8  3.1   -    -   8.4  6.9  8.5  7.6  6.9   -    -   8.5  7.5   -   7.8  8.4
 8.4  8.3  7.8  8.3  8.1  7.0  8.0   -   8.3
5334.85 2401   -    -  -1.2  1.2  0.0  1.7  1.6  1.7  1.7  1.2   -   0.1  1.5  1.4   -   0.6  1.6
 1.7  1.8  1.9  1.4  1.0  1.4  1.1   -   1.3
5336.77 2201   -    -  -0.7   -    -    -    -    -    -    -    -    -    -    -    -    -    -
  -    -    -    -    -    -    -    -    -
5349.73 2600   -    -    -    -    -    -    -    -    -    -    -    -  -4.7 -9.3   -  -9.4 -9.5
-9.5 -9.6 -9.7 -4.7 -9.4 -9.5 -9.8   -  -9.3
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-5.5 -4.7 -5.0   -  -0.7 -1.5 -2.2   -  -1.7
5357.19 2101   -    -    -    -    -  -3.2 -4.3 -2.5 -1.7 -2.4   -    -  -2.2 -3.0   -  -2.9 -1.5
-4.1 -1.2 -2.3   -  -3.5 -2.1 -3.5   -  -6.4
5362.86 2601   -   0.3   -   0.0  0.5 -1.7 -2.0 -1.7 -1.7 -1.3   -   0.4 -0.7 -0.9   -  -0.5 -0.2
-0.2 -0.1 -0.1 -0.9 -0.7 -0.5 -0.5   -  -0.6
5367.48 2600   -   2.0  1.0 -0.1 -0.2  0.0 -0.8 -0.1 -0.2 -0.3   -  -0.4  0.1  0.0   -   0.4 -0.2
-0.4 -0.1 -0.1 -0.3 -0.7 -0.6 -0.1   -  -0.4
5369.96 2600   -    -    -    -    -    -    -    -    -    -    -    -  -0.1 -0.3   -  -0.3 -0.8
-1.4 -1.1 -0.8 -0.2 -0.9 -0.7 -0.5   -  -0.2
5371.49 2600   -   0.7  0.2  3.5   -    -    -    -    -    -    -    -    -    -    -    -    -
  -    -    -    -    -    -    -    -    -
5381.02 2201   -    -  -1.4 -0.1  0.0 -0.4  0.0 -0.1 -0.1 -0.5   -  -0.1  0.2  0.2   -   0.0  0.1
-0.1  0.3 -0.1  0.0 -0.2 -0.1  0.1   -  -0.1
5383.37 2600   -   1.7 -0.1  0.5 -0.1 -0.2  0.2 -0.1  0.1  0.0   -   0.5  1.2  1.2   -   0.5  1.1
 0.5  0.6  0.8  1.5  1.0  0.6  0.6   -   1.4
5389.48 2600   -   0.9 -0.1   -    -    -    -    -    -    -    -    -    -    -    -    -    -
  -    -    -    -    -    -    -    -    -
5393.17 2600   -    -  -0.7   -    -    -    -    -    -    -    -    -  -1.4 -1.7   -  -2.3 -2.0
-0.2 -2.3 -2.6 -1.9 -0.4 -2.2 -3.4   -  -0.6
5397.13 2600   -  -0.5   -    -    -    -    -    -    -    -    -    -    -    -    -    -    -
  -    -    -    -    -    -    -    -    -
5400.50 2600   -   0.6   -    -    -    -    -    -    -    -    -    -    -    -    -    -    -
  -    -    -    -    -    -    -    -    -
5404.15 2600   -  -0.2   -    -    -    -    -    -    -    -    -    -    -    -    -    -    -
  -    -    -    -    -    -    -    -    -
5405.77 2600   -   1.0  0.6   -    -   2.4  3.1  3.0  2.8  4.3   -    -    -    -    -    -    -
  -    -    -    -    -    -    -    -    -
5407.62 2401   -    -    -    -    -   0.8  1.5  0.9  0.4  1.0   -    -   1.4  1.8   -   1.8  1.5
 1.6  1.4  1.6  1.0  1.1  1.1  1.2   -   1.2
5414.07 2601   -  -2.7   -    -    -    -    -    -    -    -    -    -  -2.7 -0.2   -  -0.8 -0.8
-0.2 -1.0 -0.7 -2.0 -1.1 -1.2 -1.8   -  -0.9
5418.75 2201   -    -   0.3  0.6 -0.4  0.5  0.4  0.6  0.4  0.6   -   0.2  0.6  0.1   -   0.7  0.6
 0.5  0.1  0.3  0.6  0.1  0.4  0.2   -   0.3
5420.92 2401   -    -   0.0  0.7  0.2  0.1 -0.1  0.5 -0.5  0.1   -   0.0   -    -    -    -    -
  -    -    -    -    -    -    -    -    -
5424.07 2600   -  -1.2 -0.7  0.2   -    -    -    -    -    -    -   0.3   -    -    -    -    -
  -    -    -    -    -    -    -    -    -
5425.26 2601   -   2.4   -   0.4  1.0 -0.1 -0.6  0.4  0.4  0.2   -   0.0  0.2 -0.3   -   0.0  0.6
-0.5 -0.1  0.5  0.2  0.0  1.3  0.3   -   0.4
5429.70 2600   -   0.6  0.5  1.2   -   1.3  0.7  0.6  0.9  2.5   -    -    -    -    -    -    -
  -    -    -    -    -    -    -    -    -
5432.55 2500 -0.6   -    -    -    -    -    -    -    -    -    -    -    -    -    -    -    -
  -    -    -    -    -    -    -    -    -
5432.97 2601   -    -    -   0.5 -0.4  0.7  0.3  0.6  0.9  0.5   -   1.6  1.0  0.1   -   0.8  0.5
 0.5  0.8  1.1  0.7  0.6  0.4  0.0   -   0.8
5434.52 2600 -0.7  0.8 -0.2   -    -   2.9  4.7  1.1  3.6  4.1   -    -    -    -    -    -    -
  -    -    -    -    -    -    -    -    -
5441.35 2600 -3.3   -    -    -    -    -    -    -    -    -    -    -    -    -    -    -    -
  -    -    -    -    -    -    -    -    -
5445.04 2600 -0.9  1.0  1.3 -0.6 -0.8 -2.0  0.0 -1.1 -0.7 -1.0   -  -0.3 -1.3 -0.7   -  -1.6 -0.9
-0.9 -0.6 -0.6 -0.4 -0.6  0.1  0.1   -   0.4
5446.92 2600   -    -    -    -    -   1.7  2.1  1.6  2.8  3.0   -    -    -    -    -    -    -
  -    -    -    -    -    -    -    -    -
5455.62 2600   -   0.2   -   0.3   -    -    -    -    -    -    -    -    -    -    -    -    -
  -    -    -    -    -    -    -    -    -
5460.47 2200 -2.8   -    -    -    -    -    -    -    -    -    -    -    -    -    -    -    -
  -    -    -    -    -    -    -    -    -
5468.10 2800  1.8   -    -    -    -    -    -    -    -    -    -    -    -    -    -    -    -
  -    -    -    -    -    -    -    -    -
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5476.90 2800   -    -    -    -    -  -4.8 -5.3 -4.9 -7.7 -4.8   -    -    -    -    -    -    -
  -    -    -    -    -    -    -    -    -
5478.37 2401   -    -    -    -    -   0.5 -0.4 -0.3  0.2 -0.4   -    -   0.4  0.5   -   0.0  0.1
-0.1  0.4  0.2 -0.4  0.1 -0.1  0.4   -   0.1
5490.66 2201  0.6   -    -    -    -   0.7  0.9  0.6  0.2  0.7   -    -   0.9  0.7   -   0.6  0.6
 0.4  0.6  0.6  0.9  0.9  0.4  0.7   -   0.9
5493.32 2600   -    - -1.6    -    -    -    -    -    -    -    -    -    -    -    -    -    -
  -    -    -    -    -    -    -    -    -
5497.52 2600 -4.2 -0.9 -1.3 -3.5    -  -8.2 -7.4 -8.1 -7.9 -7.0   -    -    -    -    -    -    -
  -    -    -    -    -    -    -    -    -
5501.46 2600 -4.4    -    -    -    -    -    -    -    -    -    -    -    -    -    -    -    -
  -    -    -    -    -    -    -    -    -
5502.07 2401   -    -    -   0.0    -    -    -    -    -    -    -    -    -    -    -    -    -
  -    -    -    -    -    -    -    -    -
5506.78 2600 -3.8  0.2  0.7    -    -    -    -    -    -    -    -    -    -    -    -    -    -
  -    -    -    -    -    -    -    -    -
5508.61 2401   -    -   1.0  0.6  0.6  0.5  0.9  0.7  0.5  0.4   -   0.7  0.6 -0.1   -   0.2  0.4
 0.6  0.7  0.9  0.6  0.5  0.3  0.7   -   0.7
5526.79 2101  0.7   -    -  -1.1 -0.1 -3.5 -3.2 -3.5 -2.5 -2.6   -  -0.7 -2.0 -1.9   -  -1.1 -1.7
-1.9 -1.8 -1.8 -1.9 -2.0 -1.9 -1.9   -  -1.5
5534.85 2601 -0.9   -    -   0.4  0.5  0.7  0.8  0.9  0.3  0.3   -   0.7  0.8  0.5   -   0.4  1.1
 0.7  1.1  1.0 -0.1  0.7  0.6  0.8   -   0.4
5536.58 2600  1.3    -    -    -    -    -    -    -    -    -    -    -    -    -    -    -    -
  -    -    -    -    -    -    -    -    -
5563.60 2600 -1.3    -    -    -    -    -    -    -    -    -    -    -    -    -    -    -    -
  -    -    -    -    -    -    -    -    -
5567.91 2101  1.2    -    -    -    -    -    -    -    -    -    -    -    -    -    -    -    -
  -    -    -    -    -    -    -    -    -
5569.62 2600 -0.3  1.5    -    -    -    -    -    -    -    -    -    -    -    -    -    -    -
  -    -    -    -    -    -    -    -    -
5572.84 2600  0.6  2.4    -    -    -    -    -    -    -    -    -    -    -    -    -    -    -
  -    -    -    -    -    -    -    -    -
5576.09 2600 -1.2 -0.4    -    -    -    -    -    -    -    -    -    -    -    -    -    -    -
  -    -    -    -    -    -    -    -    -
5577.03 2600 -0.1    -    -    -    -    -    -    -    -    -    -    -    -    -    -    -    -
  -    -    -    -    -    -    -    -    -
5578.72 2800  2.5    -    -    -    -    -    -    -    -    -    -    -    -    -    -    -    -
  -    -    -    -    -    -    -    -    -
5586.76 2600  1.0  0.9    -    -    -    -    -    -    -    -    -    -    -    -    -    -    -
  -    -    -    -    -    -    -    -    -
5590.72 2700  0.2    -    -    -    -    -    -    -    -    -    -    -    -    -    -    -    -
  -    -    -    -    -    -    -    -    -
5593.30 1301   -    -    -  -1.8    -    -    -    -    -    -    -  -2.2    -    -    -    -    -
  -    -    -    -    -    -    -    -    -
5593.74 2800  0.7    -    -    -    -    -    -    -    -    -    -    -    -    -    -    -    -
  -    -    -    -    -    -    -    -    -
5611.36 2600 -1.8    -    -    -    -    -    -    -    -    -    -    -    -    -    -    -    -
  -    -    -    -    -    -    -    -    -
5615.64 2600   -   1.6    -  -0.2  0.4    -    -    -    -    -    -   0.7    -    -    -    -    -
  -    -    -    -    -    -    -    -    -
5624.54 2600   -   0.7    -    -    -    -    -    -    -    -    -    -    -    -    -    -    -
  -    -    -    -    -    -    -    -    -
5628.62 2400  0.7    -    -    -    -    -    -    -    -    -    -    -    -    -    -    -    -
  -    -    -    -    -    -    -    -    -
5633.97 2600 -0.2    -    -    -    -    -    -    -    -    -    -    -    -    -    -    -    -
  -    -    -    -    -    -    -    -    -
5647.23 2700  3.3    -    -    -    -    -    -    -    -    -    -    -    -    -    -    -    -
  -    -    -    -    -    -    -    -    -
5650.70 2600  0.9    -    -    -    -    -    -    -    -    -    -    -    -    -    -    -    -
  -    -    -    -    -    -    -    -    -
5653.89 2600  0.8    -    -    -    -    -    -    -    -    -    -    -    -    -    -    -    -
  -    -    -    -    -    -    -    -    -
5662.16 2200 -2.0    -    -    -    -    -    -    -    -    -    -    -    -    -    -    -    -
  -    -    -    -    -    -    -    -    -
5670.85 2300  0.3    -    -    -    -    -    -    -    -    -    -    -    -    -    -    -    -
  -    -    -    -    -    -    -    -    -
5679.94 2200 -1.3    -    -    -    -    -    -    -    -    -    -    -    -    -    -    -    -
  -    -    -    -    -    -    -    -    -
5686.52 2600   -  -0.4    -    -    -    -    -    -    -    -    -    -    -    -    -    -    -
  -    -    -    -    -    -    -    -    -
5689.49 2200  1.8    -    -    -    -    -    -    -    -    -    -    -    -    -    -    -    -
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5727.05	2300	-1.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5737.06	2300	5.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5748.35	2800	-1.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5754.66	2800	0.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5778.46	2600	1.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5783.09	2400	1.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5783.89	2400	3.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5816.37	2600	1.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5838.37	2600	1.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5852.22	2600	2.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5862.37	2600	1.6	1.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5866.45	2200	1.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5916.25	2600	0.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5918.54	2200	3.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5929.67	2600	-2.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5930.17	2600	1.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5937.81	2200	3.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5952.72	2600	-2.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5965.83	2200	2.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5978.54	2200	-1.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5991.38	2601	0.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5996.73	2800	1.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6003.03	2600	0.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6007.31	2800	1.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6013.48	2500	2.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6020.17	2600	0.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6021.79	2500	1.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6024.07	2600	-0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6039.73	2300	6.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6055.99	2600	2.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6062.89	2600	0.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6064.63	2200	-2.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6065.48	2600	-1.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6082.72	2600	0.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6084.10	2601	1.9	-	-	0.0	0.5	-	-	-	-	-	-	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-

6113.32	2601	1.8	-	-	-0.4	-0.1	-	-	-	-	-	-	-0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6137.69	2600	-1.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6149.26	2601	2.4	-	-	-0.5	0.6	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6245.64	2101	-	-	-	-1.2	-1.5	-	-	-	-	-	-	-0.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6246.32	2600	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6247.56	2601	3.6	-	-	0.0	-0.2	-	-	-	-	-	-	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6305.65	2100	-0.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6413.35	2100	-6.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6416.92	2601	0.4	-	-	1.1	0.8	-	-	-	-	-	-	1.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
lamda(A)	ele	(1	(2	(3	(4	(5	(6	(7	(8	(9	(10	(11	(12	(13	(14	(15	(16	(17	(18	(19	(20	(21	(22	(23	(24	(25	(26

A2 'lib2h197' gives atomic line data for the libary of observed lines in this paper; as an extra it contains, in the right hand part, the accuracy-of-fit figures (chi square) for each spectral line best Chebychev-fit procedure used to create the special library (Lib4C197 or tgv4c197) containing the parameter data for each line. The mean accuracy of fit per line is given in the last column, as a 'fractional' accuracy, i.e. 0.011 means 1.1\% accuracy.

We use gf-values for the observed lines from Wiese et al.(1969) and when not available there, from Kurucz & Bell (1995).

The accuracy numbers have been taken from Wiese et al.'s (1969) classification B,C... and E. For Kurucz values we use the accuracy classification classification E and associated accuracies in %. These accuracy values are given here as logarithmic values, i.e. a (logarithmic) accuracy number of .0969 corresponds to an accuracy of 25%.

lamda(A)	ele,ion	elo(cm-1)	10log(gf)	accuracy
4491.41	2601	23031.30	-2.687	0.0969
4501.27	2201	8997.71	-0.748	0.1461
4515.34	2601	22939.36	-2.481	0.1761
4565.74	2401	32603.40	-2.110	0.1761
4568.31	2201	9872.73	-2.647	0.1761
4571.97	2201	12676.97	-0.521	0.1461
4576.34	2601	22939.36	-3.043	0.1761
4592.05	2401	32854.95	-1.217	0.1761
4629.34	2601	22637.21	-2.379	0.1761
4656.98	2601	23317.63	-3.630	0.2041
4731.45	2601	23317.63	-3.367	0.1761
4805.09	2201	16625.11	-1.118	0.1461
4812.34	2401	31168.58	-1.796	0.1761
4864.32	2401	31130.00	-2.080	0.2041
4871.32	2600	23110.94	-0.407	0.1139
4874.01	2201	24961.03	-0.785	0.1761
4876.47	2401	31168.58	-1.465	0.1761
4893.82	2601	22810.36	-4.462	0.1761
4903.31	2600	23244.83	-1.072	0.0969
4911.19	2201	25192.79	-0.334	0.1761
4918.99	2600	23110.94	-0.365	0.1139
4923.93	2601	23318.00	-1.320	0.0969
4966.09	2600	26874.55	-0.885	0.1139
5012.07	2600	6928.27	-2.642	0.0607
5018.45	2601	23318.00	-1.220	0.0969
5049.82	2600	18378.18	-1.426	0.0969
5051.63	2600	7376.76	-2.794	0.0607
5052.167	600	61981.820	-1.648	0.1761
5069.09	2201	25192.79	-1.397	0.1761
5072.28	2201	25192.79	-0.749	0.1761
5087.42	3901	8743.32	-0.170	0.1761
5087.86	3901	7985.00	-0.160	0.2041
5097.31	2401	29951.88	-2.631	0.1761
5100.66	2601	22637.21	-4.359	0.1761
5110.41	2600	0.00	-3.760	0.0607
5112.28	4001	13390.00	-0.750	0.2041
5120.34	2601	22740.00	-4.214	0.2041
5123.21	3901	8003.12	-0.830	0.1761
5125.117	2600	34039.514	-0.140	0.1761
5125.23	2800	29668.92	-0.650	0.1761
5127.358	2600	7376.760	-3.307	0.0607
5127.866	2601	44929.550	-2.535	0.1761
5129.15	2201	15257.43	-1.404	0.1461
5133.68	2600	33695.39	0.142	0.1761
5151.91	2600	8154.71	-3.323	0.0607
5154.07	2201	12628.73	-1.922	0.1461
5160.82	2601	44680.00	-2.641	0.2041
5161.18	2601	22910.00	-4.483	0.2041
5162.29	2600	33695.39	0.023	0.1761
5172.684	1200	21870.464	-0.393	0.0607
5183.60	1200	21911.18	-0.158	0.0414
5185.91	2201	15265.62	-1.345	0.1761
5188.68	2201	12758.11	-1.218	0.1461
5197.58	2601	26055.42	-2.100	0.0969
5200.42	3901	7985.00	-0.570	0.2041
5202.34	2600	17550.18	-1.838	0.0607

5211.54	2201	20891.66	-1.356	0.1761
5229.86	2600	34039.50	-0.910	0.1761
5234.63	2601	25981.63	-2.052	0.0969
5237.33	2401	32854.31	-1.155	0.1761
5239.81	2101	11736.36	-0.765	0.1761
5243.457	2401	32603.400	-3.451	0.1761
5243.773	2600	34328.749	-1.150	0.0969
5246.77	2401	29951.88	-2.460	0.1761
5262.10	2201	12660.00	-2.106	0.2041
5264.81	2601	26055.42	-3.188	0.1761
5266.56	2600	24180.86	-0.492	0.1139
5272.397	2401	48039.090	-2.030	0.1761
5274.977	2600	32873.619	-2.207	0.1761
5276.00	2601	25805.33	-1.945	0.0969
5281.79	2600	24506.92	-1.015	0.0969
5284.11	2601	23317.63	-3.196	0.1761
5302.30	2600	26479.38	-0.877	0.1139
5305.86	2401	30890.00	-2.080	0.2041
5308.41	2401	32836.68	-1.810	0.1761
5310.69	2401	32844.76	-2.273	0.1761
5313.56	2401	32854.95	-1.650	0.1761
5316.62	2601	25428.78	-1.854	0.0969
5324.18	2600	25899.99	-0.241	0.1139
5325.55	2601	25981.63	-2.599	0.0969
5334.85	2401	32830.00	-1.562	0.2041
5336.77	2201	12758.11	-1.703	0.1461
5349.733	2600	35379.206	-1.300	0.0969
5353.373	2600	33095.937	-0.840	0.1461
5357.19	2101	12154.42	-2.110	0.2041
5362.86	2601	25810.00	-2.739	0.2041
5367.48	2600	35611.62	0.353	0.1139
5369.958	2600	35257.319	0.350	0.1139
5371.49	2600	7728.06	-1.644	0.0607
5381.02	2201	12628.73	-2.079	0.1761
5383.37	2600	34782.42	0.500	0.1139
5389.48	2600	35611.62	-0.402	0.1461
5393.17	2600	26140.18	-0.915	0.1139
5397.13	2600	7376.76	-1.993	0.1761
5400.50	2600	35257.32	-0.150	0.1761
5404.15	2600	35767.56	0.523	0.1761
5405.77	2600	7985.78	-1.844	0.0607
5407.62	2401	30890.00	-2.088	0.2041
5414.07	2601	25981.63	-3.791	0.1761
5418.75	2201	12758.00	-2.110	0.2041
5420.92	2401	30307.44	-2.356	0.1761
5424.07	2600	34843.94	0.520	0.1761
5425.26	2601	25805.33	-3.359	0.1761
5429.70	2600	7728.06	-1.879	0.0607
5432.55	2500	0.00	-3.795	0.1139
5432.95	2600	35856.40	-1.042	0.0969
5432.97	2601	26352.77	-3.629	0.1761
5434.52	2600	8154.71	-2.121	0.0607
5441.35	2600	34782.42	-1.726	0.0969
5444.59	2700	32830.00	0.100	0.2041
5445.04	2600	35379.21	-0.009	0.1761
5446.92	2600	7985.78	-1.928	0.0969
5455.62	2600	8146.00	-2.098	0.2041
5460.47	2200	386.87	-2.804	0.1139
5468.10	2800	31031.02	-1.611	0.1761
5476.90	2800	14728.84	-0.892	0.1139
5478.37	2401	33694.15	-1.908	0.1761
5490.66	2201	12580.00	-2.650	0.2041
5493.322	2600	29356.742	-1.677	0.1761
5493.50	2600	33095.94	-1.836	0.0969
5493.876	1400	45293.629	-0.620	0.1761
5497.52	2600	8154.71	-2.849	0.0607
5501.46	2600	7728.06	-2.957	0.1761
5502.067	2401	33618.940	-1.990	0.1761
5506.78	2600	7985.78	-2.797	0.0607
5508.61	2401	33521.11	-2.117	0.1761
5526.79	2101	14261.32	0.025	0.1761

5534.85	2601	26170.18	-2.923	0.1761
5536.58	2600	22838.32	-3.812	0.1761
5563.60	2600	33801.57	-0.983	0.0969
5567.91	2101	12154.00	-0.500	0.1761
5569.62	2600	27559.58	-0.533	0.1139
5572.84	2600	27394.69	-0.311	0.1139
5576.09	2600	27666.35	-1.009	0.0969
5577.03	2600	40594.43	-1.551	0.1761
5578.72	2800	13521.35	-2.641	0.1903
5586.76	2600	27166.82	-0.206	0.1139
5590.72	2700	16470.60	-1.870	0.0969
5593.300	1301	106920.560	0.410	0.1761
5593.74	2800	31441.64	-0.840	0.1461
5611.36	2600	29320.03	-2.993	0.1761
5615.64	2600	26874.55	-0.140	0.1139
5624.54	2600	27559.58	-0.900	0.1139
5628.62	2400	27597.22	-0.772	0.4140
5633.97	2600	40257.31	-0.269	0.0969
5647.23	2700	18389.57	-1.560	0.0969
5650.70	2600	41018.05	-0.956	0.0969
5653.89	2600	35379.21	-1.644	0.0969
5662.16	2200	18695.23	-0.109	0.1139
5670.85	2300	8715.76	-0.425	0.4140
5679.94	2200	19937.86	-0.575	0.1761
5686.52	2600	36686.16	-0.629	0.0969
5689.49	2200	18525.07	-0.469	0.1139
5727.05	2300	8715.76	-0.011	0.0607
5737.06	2300	8578.53	-0.736	0.0607
5748.35	2800	13521.35	-3.259	0.1761
5754.66	2800	15609.84	-2.335	0.1139
5778.46	2600	20874.48	-3.592	0.1761
5783.09	2400	26801.93	-0.500	0.1761
5783.89	2400	26796.00	-0.295	0.0607
5816.37	2600	36686.16	-0.685	0.1461
5838.37	2600	31805.07	-2.337	0.1761
5852.22	2600	36686.16	-1.335	0.0969
5862.37	2600	36700.00	-0.360	0.2041
5866.45	2200	8602.34	-0.840	0.1139
5916.25	2600	19788.25	-2.993	0.0607
5918.54	2200	8602.34	-1.467	0.0969
5929.67	2600	36686.16	-1.391	0.0969
5930.17	2600	37521.16	-0.229	0.1461
5937.81	2200	8602.34	-1.887	0.0969
5952.72	2600	32133.99	-1.429	0.0969
5965.83	2200	15156.79	-0.409	0.1139
5978.54	2200	15108.12	-0.496	0.1139
5991.38	2601	25428.78	-3.737	0.1761
5996.73	2800	34163.26	-1.064	0.1461
6003.03	2600	31307.00	-1.120	0.1461
6007.31	2800	13521.00	-3.330	0.1761
6013.48	2500	24779.00	-0.251	0.1139
6020.17	2600	37163.00	-0.270	0.1461
6021.79	2500	24802.00	0.034	0.1139
6024.07	2600	36686.00	-0.120	0.1461
6039.73	2300	8579.00	-0.650	0.0607
6055.99	2600	38175.00	-0.460	0.1461
6062.89	2600	17750.00	-4.140	0.1761
6064.63	2200	8437.00	-1.944	0.1139
6065.48	2600	21039.00	-1.530	0.0607
6082.72	2600	17927.00	-3.573	0.0607
6084.10	2601	25805.00	-3.980	0.1761
6113.32	2601	25981.63	-4.297	0.1761
6137.69	2600	20874.00	-1.403	0.0607
6149.26	2601	31368.45	-2.904	0.1761
6245.637	2101	12154.420	-0.980	0.1761
6246.32	2600	29056.32	-0.956	0.1461
6247.56	2601	31387.95	-2.516	0.1761
6305.65	2100	168.30	-1.280	0.0969
6413.35	2100	168.30	-2.310	0.0969
6416.92	2601	31388.00	-2.920	0.1761

A3 'outlier7' gives a general overview of outlier lines with the aid of Kurucz's line- and gf-values. It contains tests and results of investigations into wavelengths and gf-values together with some wavelength areas including all (known) lines with an equivalent width > 5 milli Angstrom.

What is the reason for the so-called 'outliers'? In the following we investigate a number of large differences between model- and observed-values of the equivalent widths (mA) of some lines.

From an inspection of the files "ltemodel", "observed", "signifi" we find a number of instances where model- and observed-values diverge appreciably. (In actual fact we should test all lines for this phenomenon.) We take 10% as a lower limit of contribution. In some instances gf-values used may be too low. or too high with respect to the accuracies estimated for them. In the same way the estimated accuracies of the observed values of the equivalent widths may be too optimistic. We find however that another identification for high T observations may be needed.

Below is a selection of lines that have problems in modelling equivalent widths in comparison with observed values, as given in the files: "ltemodel", "observed", "signifi". We must therefore compare outliers as indicated in the various files, and we see that in some cases extra modelled lines need to be taken into account, in other lines it seems that the gf-values used are either somewhat too low, or too high, and that we should also check when the given accuracies of the measurements and/or of log(gf) are too optimistic.

This is possibly the case in the following lines (lamda in A): Numbers indicate observation number as e.g.5)

5051.63 A trial of 5052.17 600 for high temperature is equiblend at 6500 K. We adopt this identity for 6,8-12
5125.23 A trial of 5125.12 2600 for high temperature gives good results. We adopt this identity for 8-12
5127.36 A trial of 5127.87 2601 for high temperature gives good results. We adopt this identity for 13,15-26,28
5243.78 A trial of 5243.46 2401 for high temperature gives better results, but identity not certain. We use for 13,17
5432.55 .97 operate at lower temperatures, and 5432.95 2601 at higher temperatures
5444.59 A trial of 5445.05 2600 was already incorporated. We now delete the identity 5444.59 and keep 5445.04 for 5
5476.90 check gf, is conform Kurucz (We take no action)
5493.50 A trial of 5493.88 1400 gives better results, wavelength more consistent cf. original publication. Adopt for 5
5501.46 A trial of 5502.07 2401 for high temperature gives good results. We adopt this identity for 6,27
5593.74 A trial of 5593.30 1301 for high temperature gives a slight improvement, but is ident correct? Keep both for 6,14
6246.32 A trial of 6245.64 2101 for high temperature gives good results. We adopt this identity for 6,7,14

A too low tolerance character B, C etc may lead to high chi-square for a line. Some values of gf seem low resp. high
5172.68 -- gf tolerance of 15 % is possibly too optimistic? (In all these cases we take no action)
5183.60 -- gf tolerance of 10 % is possibly too optimistic?
5325.55 -- gf tolerance of 25 % is possibly too optimistic?
5737.06 -- gf tolerance of 15 % is possibly too optimistic?

Blends may play a role, lines are approximately 1 A wide: (We take no action for these lines)
5349.74 blend with 5349.76 2301 or identification? try 5350.36 2301
5353.37 blend with 5353.25
5357.19 blend with 5357.35
5371.49 blend with 5371.33 .44 .60
5497.52 blend with 5497.41
6413.32 blend with 6413.11

We follow the development along the temperature scale, and see that in a number of instances extra lines have to be calculated and the values of eb have to be combined with the eb of the identified (main contributing)line to an estimated accuracy of 10% in the model contributing to the equivalent width. The table shows equivalent widths (mA)
for lines with lamda (A), element number and indicated model-atmospheres (function of temperature). In the columns under the used models we give calculated model eb´s followed by their sigma's due to the accuracy of gf.

Table of lines from Kurucz in the region of lines where model- and observed-values of eb differ appreciably:

Lamda (A)	C	ele	9250g20v06		8250g10v06		7250g05v06		6250g05v06		5250g10v06		4250g00v06	
5051.250	.	2400	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.29	0.14	2.05	0.86
5051.260	.	2600	0.00	0.00	0.00	0.00	0.00	0.04	0.58	0.27	1.99	0.83	7.23	2.94
5051.280	.	2600	0.33	0.16	0.71	0.31	10.14	4.06	62.83	19.70	155.91	28.66	281.27	25.26
5051.510	.	2800	0.16	0.10	0.40	0.19	6.48	2.64	47.06	16.00	141.90	28.99	265.78	25.87
5051.540	.	2200	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.32	0.16	5.06	2.08
5051.580	.	600	0.71	0.32	0.99	0.43	7.82	3.17	20.14	7.65	7.90	3.04	2.68	1.05
5051.600	.	2300	0.00	0.00	0.00	0.00	0.00	0.00	0.20	0.11	1.23	0.53	12.38	4.96
5051.630	.	2600	0.89	0.38	3.25	1.35	74.66	22.74	265.15	23.97	439.78	22.30	736.16	59.44
5051.900	.	2400	0.00	0.00	0.00	0.00	0.61	0.27	8.36	3.38	70.93	22.24	354.57	25.39
5052.050	.	2200	0.00	0.00	0.00	0.00	0.00	0.00	0.58	0.26	3.59	1.49	42.94	15.47
5052.170	.	600	15.08	5.85	23.67	8.90	135.42	29.80	202.24	26.02	111.76	20.45	50.32	10.51
5052.500	.	2600	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.08	0.81	0.36	7.72	3.14
5124.540	.	2600	0.00	0.00	0.00	0.00	0.82	0.36	5.42	2.22	16.74	6.49	52.41	17.43
5124.620	.	2600	0.00	0.00	0.00	0.00	0.80	0.35	7.62	3.09	41.39	14.59	189.11	32.08
5124.720	.	2600	0.13	0.09	0.28	0.14	3.87	1.61	23.95	9.00	66.22	20.20	155.36	29.62
5124.730	.	2700	0.00	0.00	0.00	0.00	0.00	0.00	0.34	0.17	1.68	0.71	8.72	3.52
5124.800	.	2700	0.00	0.00	0.00	0.00	0.08	0.08	1.09	0.47	5.15	2.11	26.68	10.03
5124.860	.	1400	0.00	0.00	0.00	0.00	0.19	0.11	1.51	0.64	4.99	2.05	12.57	4.96
5125.120	.	2600	3.60	1.49	7.21	2.92	76.69	22.62	209.24	25.04	302.46	22.88	414.83	21.74
5125.170	.	2200	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.07	0.43	0.20	2.71	1.14
5125.230	.	2800	0.27	0.14	0.62	0.27	9.51	3.82	64.29	20.11	169.89	28.99	290.84	25.07
5125.240	.	2601	1.25	0.54	1.66	0.70	2.22	0.93	2.16	0.91	0.59	0.26	0.22	0.11
5125.260	.	2600	0.00	0.00	0.00	0.00	0.25	0.13	1.86	0.78	6.12	2.50	21.56	8.23
5125.600	.	1400	0.09	0.10	0.20	0.11	2.78	1.16	17.03	6.61	46.84	15.77	88.91	23.37
5125.710	.	2700	0.00	0.00	0.00	0.00	0.00	0.03	0.67	0.30	3.35	1.39	18.93	7.36
5125.840	.	2600	1.84	0.78	3.78	1.57	46.39	15.85	169.41	27.22	268.92	24.05	386.20	22.15
5125.920	.	2601	0.54	0.25	0.58	0.26	0.53	0.24	0.32	0.16	0.00	0.00	0.00	0.00
5126.530	.	2600	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.10	0.49	0.22	1.96	0.82
5126.570	.	2300	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	1.79	0.76
5126.580	.	2600	0.00	0.00	0.00	0.00	0.00	0.00	0.13	0.09	0.84	0.36	5.70	2.34
5126.810	.	2700	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.28	0.14	1.91	0.80
5126.820	.	2800	0.22	0.12	0.52	0.24	8.16	3.30	56.63	18.38	157.64	29.18	279.49	25.56

5126.930 . 2401	0.40	0.19	0.78	0.34	2.05	0.86	3.06	1.27	1.23	0.53	0.74	0.33
5127.060 . 2200	0.00	0.00	0.00	0.00	0.00	0.00	0.31	0.16	1.82	0.76	18.75	7.35
5127.340 . 2600	0.00	0.00	0.00	0.00	0.59	0.27	4.64	1.91	18.53	7.16	78.60	23.58
5127.350 . 2600	0.00	0.00	0.00	0.00	0.67	0.30	4.51	1.86	14.20	5.56	46.01	15.76
5127.360 . 2600	0.24	0.13	0.99	0.43	27.95	10.44	189.98	29.09	379.19	22.91	620.35	32.04
5127.370 . 2200	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.26	0.13	4.31	1.78
5127.650 . 2801	1.30	0.54	1.06	0.45	0.44	0.20	0.00	0.05	0.00	0.00	0.00	0.00
5127.680 . 2600	0.00	0.00	0.00	0.00	0.19	0.11	4.71	1.94	86.79	26.02	419.77	22.34
5127.870 . 2601	25.05	8.92	38.02	12.47	70.09	20.70	89.13	23.27	42.62	13.25	25.23	7.64
5128.030 . 1400	0.00	0.00	0.04	0.07	1.35	0.58	8.60	3.47	25.17	9.39	52.99	17.01
5128.080 . 2800	0.00	0.00	0.00	0.00	0.09	0.09	1.20	0.52	5.88	2.41	29.48	10.95
5172.070 . 2300	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.26	0.13	4.17	1.73
5172.080 . 600	0.00	0.00	0.00	0.00	0.24	0.14	0.86	0.37	0.34	0.17	0.08	0.09
5172.200 . 2600	0.00	0.00	0.00	0.00	0.20	0.11	2.71	1.14	21.25	8.18	169.23	33.88
5172.290 . 2700	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.09	0.69	0.30	4.14	1.71
5172.530 . 700	0.32	0.16	0.30	0.16	0.55	0.25	0.37	0.18	0.00	0.00	0.00	0.00
5172.680 . 1200	148.80	26.44	213.26	23.74	391.49	22.52	545.09	37.92	783.08	78.60	1603.82	243.30
5172.790 . 2600	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.24	0.13	1.77	0.74
5172.870 . 2800	0.00	0.04	0.15	0.10	2.98	1.24	23.37	8.84	87.42	24.55	212.02	29.16
5172.990 . 2601	19.40	7.14	28.82	9.96	50.64	16.45	62.72	18.92	26.67	9.15	14.87	5.01
5173.000 . 2600	0.00	0.00	0.00	0.00	0.00	0.02	0.50	0.22	1.70	0.72	6.22	2.54
5173.040 . 2600	0.00	0.00	0.00	0.00	0.00	0.00	0.20	0.11	0.89	0.39	3.99	1.66
5173.120 . 2600	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.09	1.66	0.70
5173.300 . 2600	0.00	0.00	0.00	0.00	0.00	0.05	0.64	0.28	2.14	0.90	7.67	3.11
5173.480 . 2700	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.07	0.51	0.23	2.79	1.17
5173.500 . 2600	0.00	0.00	0.00	0.00	0.11	0.10	1.64	0.69	11.20	4.48	94.75	27.35
5182.950 . 2600	0.00	0.00	0.00	0.00	0.00	0.00	0.30	0.15	1.62	0.69	10.72	4.30
5183.050 . 2700	0.00	0.00	0.00	0.00	0.00	0.00	0.34	0.17	1.75	0.74	9.58	3.86
5183.180 . 2200	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.22	2.72	1.14	26.30	10.04
5183.400 . 2400	0.00	0.00	0.00	0.00	0.00	0.00	0.44	0.21	4.97	2.05	119.16	32.90
5183.460 . 2600	0.00	0.00	0.00	0.00	0.00	0.00	0.17	0.11	1.43	0.61	14.75	5.85
5183.470 . 2700	0.00	0.00	0.00	0.00	0.00	0.00	0.26	0.13	1.33	0.57	7.17	2.92
5183.530 . 2601	3.08	1.26	2.85	1.16	2.09	0.86	0.94	0.41	0.08	0.09	0.00	0.00
5183.540 . 2600	0.00	0.00	0.00	0.00	0.05	0.07	0.77	0.34	2.53	1.06	8.78	3.54
5183.600 . 1200	181.01	25.00	241.73	22.23	420.31	23.97	597.76	48.08				

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894.42 103.09     1931.71 288.83
5183.690 . 2600    0.00   0.00        0.00   0.00        0.00   0.00        0.22   0.11
1.59   0.67       14.56   5.78
5183.710 . 2201    2.76   1.14       10.24   4.10       67.12  21.27      150.97  30.40
150.17  29.00      181.34  28.38
5183.810 . 2200    0.00   0.00        0.00   0.00        0.00   0.00        0.21   0.12
2.52   1.05       75.16  24.59
5184.150 . 2600    0.00   0.00        0.00   0.03        0.97   0.42        6.35   2.59
19.45   7.44       59.57  19.16
5184.180 . 2600    0.00   0.00        0.00   0.05        1.33   0.57        9.94   3.99
37.38  13.27      130.76  30.00
5184.250 . 2600    0.04   0.07        0.17   0.11        2.55   1.07       16.00   6.23
46.00  15.52      119.30  28.18
5184.270 . 2600    0.42   0.20        0.90   0.39       12.40   4.92       72.71  21.65
169.00  28.67      293.51  25.34
5184.400 . 2600    0.00   0.00        0.00   0.00        0.00   0.00        0.19   0.11
0.71   0.32        2.55   1.07

5243.140 . 2400    0.00   0.00        0.00   0.00        0.14   0.10        1.41   0.60
5.33   2.19       27.01  10.20
5243.190 . 2601    6.72   2.67        7.86   3.07        8.43   3.32        6.62   2.66
1.55   0.65        0.49   0.22
5243.300 . 2400    0.00   0.00        0.00   0.00        0.44   0.21        2.93   1.22
8.23   3.32       26.20   9.83
5243.350 . 2400    0.00   0.00        0.05   0.07        1.91   0.81       14.23   5.60
50.82  16.95      178.48  32.91
5243.460 . 2401    1.42   0.61        3.49   1.45       13.45   5.32       27.99  10.37
17.61   6.70       15.91   5.78
5243.500 . 2600    0.00   0.00        0.00   0.00        0.32   0.16        2.32   0.97
7.62   3.09       26.72   9.99
5243.530 . 2700    0.00   0.00        0.00   0.00        0.23   0.13        2.50   1.05
14.54   5.74       88.25  25.81
5243.700 . 2200    0.00   0.00        0.00   0.00        0.00   0.00        0.39   0.19
2.52   1.06       31.93  11.99
5243.780 . 2600    0.30   0.16        0.66   0.30        9.35   3.76       58.39  18.71
149.82  28.99      279.06  26.35
5243.800 . 2800    0.00   0.00        0.00   0.00        0.09   0.09        1.21   0.52
6.01   2.45       30.14  11.18
5243.920 . 2601    1.11   0.48        1.04   0.45        0.75   0.33        0.31   0.15
0.00   0.00        0.00   0.00
5244.230 . 2300    0.00   0.00        0.00   0.00        0.00   0.00        0.00   0.00
0.16   0.10        2.78   1.17
5244.290 . 2200    0.00   0.00        0.00   0.00        0.00   0.00        0.00   0.00
0.14   0.10        7.03   2.88
5244.400 . 2200    0.00   0.00        0.00   0.00        0.00   0.00        0.11   0.11
0.74   0.33        6.11   2.51

5275.440 . 2600    0.00   0.00        0.00   0.00        0.33   0.17        2.36   0.99
7.42   3.00       24.49   9.23
5275.470 . 2301    0.00   0.00        0.00   0.00        0.04   0.07        0.38   0.18
0.39   0.19        0.72   0.32
5275.510 . 2400    0.00   0.00        0.00   0.00        0.00   0.00        0.10   0.10
0.59   0.26        3.51   1.46
5275.560 . 2301    0.05   0.08        0.32   0.16        1.83   0.78        4.27   1.76
2.80   1.16        2.84   1.17
5275.610 . 2600    0.00   0.00        0.00   0.00        0.00   0.00        0.29   0.15
1.17   0.50        4.96   2.04
5275.640 . 2300    0.00   0.00        0.00   0.00        0.00   0.00        0.00   0.03
0.51   0.24        7.33   3.00
5275.750 . 2400    0.33   0.16        0.90   0.39       15.08   5.92       92.18  24.91
206.73  27.86      378.55  24.82
5275.780 . 2400    0.00   0.00        0.00   0.00        0.00   0.00        0.10   0.10
0.59   0.26        3.50   1.46
5275.970 . 2600    0.00   0.00        0.00   0.00        0.00   0.00        0.05   0.07
0.38   0.18        1.44   0.62
5276.000 . 2601  262.59  23.91      311.49  21.98      418.68  25.38      476.44  29.56
439.05  25.81      405.35  23.37
5276.070 . 2400    0.29   0.15        0.81   0.36       13.62   5.38       85.73  24.01
199.39  28.24      372.06  25.06
5276.160 . 2600    0.00   0.00        0.00   0.00        0.62   0.27        5.57   2.28
27.97  10.42      138.10  31.61
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5276.280 . 2400	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.13	1.66	0.70
5276.400 . 2200	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.21	0.12	1.38	0.59
5276.440 . 2600	0.00	0.00	0.00	0.00	0.75	0.33	5.01	2.06	15.81	6.15	51.04	17.13
5301.950 . 2100	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.81	0.36	56.52	19.90
5302.140 . 2300	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.07	1.71	0.73
5302.300 . 2600	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.30	0.15	1.25	0.54
5302.300 . 2600	2.48	1.03	5.94	2.42	77.66	22.97	227.20	25.07	347.60	22.99	497.88	22.89
5302.360 . 600	0.46	0.22	0.66	0.30	5.27	2.17	13.34	5.23	4.97	1.97	1.60	0.66
5302.400 . 2501	1.94	0.82	2.03	0.85	2.05	0.86	1.26	0.54	0.17	0.11	0.00	0.00
5302.410 . 2400	0.00	0.00	0.00	0.00	0.00	0.00	0.49	0.23	2.16	0.90	13.59	5.41
5302.430 . 2501	10.94	4.19	11.35	4.31	11.46	4.36	7.27	2.88	1.28	0.54	0.26	0.13
5302.870 . 600	2.70	1.13	3.77	1.56	26.60	9.96	58.50	18.08	22.55	7.41	7.57	2.61
5303.020 . 600	0.00	0.04	0.05	0.08	1.04	0.45	2.75	1.15	1.00	0.43	0.29	0.14
5325.040 . 2400	0.00	0.00	0.00	0.00	0.48	0.22	3.15	1.31	8.85	3.55	28.17	10.49
5325.270 . 2700	0.00	0.00	0.00	0.00	0.99	0.43	8.02	3.25	34.72	12.53	130.29	30.19
5325.550 . 2601	171.27	24.60	226.94	23.18	329.41	22.93	379.44	23.33	348.81	22.92	317.65	23.05
5325.700 . 2601	0.36	0.17	0.54	0.25	0.84	0.37	0.93	0.41	0.26	0.13	0.08	0.08
5325.920 . 2800	0.00	0.00	0.00	0.00	0.00	0.00	0.55	0.25	2.42	1.02	10.28	4.12
5325.940 . 2700	0.00	0.00	0.00	0.00	0.00	0.00	0.39	0.19	1.88	0.79	9.53	3.84
5326.000 . 2500	0.00	0.00	0.00	0.00	0.17	0.11	1.23	0.53	3.07	1.28	7.86	3.18
5349.080 . 2700	0.00	0.00	0.00	0.00	0.00	0.04	0.67	0.30	3.16	1.32	16.27	6.39
5349.150 . 2700	0.00	0.00	0.00	0.00	0.04	0.07	1.09	0.47	6.62	2.70	46.44	16.28
5349.180 . 2601	1.12	0.48	1.04	0.45	0.72	0.31	0.29	0.14	0.00	0.00	0.00	0.00
5349.310 . 2100	0.00	0.00	0.00	0.00	0.00	0.00	0.48	0.22	3.44	1.43	49.63	17.60
5349.460 . 2000	0.00	0.00	0.00	0.04	4.56	1.88	44.22	15.22	126.85	28.36	284.43	29.20
5349.670 . 600	0.00	0.00	0.00	0.05	0.83	0.37	2.20	0.92	0.77	0.34	0.20	0.12
5349.710 . 2100	0.00	0.00	0.00	0.00	0.00	0.00	0.11	0.11	2.45	1.03	130.51	35.80
5349.740 . 2600	0.15	0.10	0.36	0.17	5.34	2.19	35.30	12.62	104.59	26.52	231.21	29.11
5349.760 . 2301	0.16	0.11	0.75	0.33	5.41	2.22	16.91	6.61	16.42	6.39	24.78	9.01
5349.870 . 2500	0.00	0.03	0.08	0.09	1.56	0.67	8.66	3.49	20.46	7.73	48.40	16.26
5350.270 . 2100	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.44	0.20	6.96	2.85
5350.360 . 2301	0.41	0.20	1.57	0.67	11.02	4.41	33.18	12.13	32.19	11.67	46.18	14.88
5350.410 . 2600	0.00	0.00	0.00	0.00	0.00	0.04	0.61	0.27	2.00	0.84	6.94	2.82
5353.080 . 2601	2.55	1.05	2.41	0.99	1.70	0.71	0.77	0.34				

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0.00   0.06        0.00   0.00
5353.190 . 2300    0.00   0.00        0.00   0.00        0.00   0.00        0.00   0.00
0.04   0.07        8.58   3.50
5353.250 . 2601    1.49   0.63        1.40   0.59        0.97   0.42        0.41   0.19
0.00   0.00        0.00   0.00
5353.370 . 2600    0.83   0.36        1.78   0.76       24.05   9.08      118.71  27.20
227.93  26.79      357.16  24.07
5353.390 . 2800    0.00   0.00        0.00   0.00        1.64   0.70       19.63   7.58
125.93  30.36      335.93  26.41
5353.410 . 2400    0.00   0.00        0.00   0.00        0.00   0.04        0.57   0.25
1.58   0.67        4.91   2.02
5353.420 . 2300    0.00   0.00        0.00   0.00        0.00   0.00        0.37   0.18
2.42   1.02       29.52  11.18
5353.440 . 2600    0.00   0.00        0.00   0.00        0.00   0.00        0.17   0.11
0.68   0.30        2.50   1.05
5353.500 . 2700    0.00   0.00        0.08   0.08        2.01   0.84       15.21   5.96
58.44  18.91      172.35  31.08
5353.670 . 2400    0.00   0.00        0.00   0.00        0.00   0.00        0.05   0.08
0.33   0.17        1.27   0.55
5353.960 . 2600    0.00   0.00        0.00   0.00        0.29   0.14        2.12   0.89
6.88   2.80       23.82   9.02

5356.600 . 2600    0.00   0.00        0.00   0.00        0.23   0.12        1.72   0.73
5.59   2.29       19.47   7.51
5356.620 .  700    0.27   0.14        0.30   0.16        0.57   0.26        0.41   0.20
0.00   0.00        0.00   0.00
5357.200 . 2101    0.25   0.13        1.40   0.59       16.46   6.45       57.37  19.05
65.68  20.65      106.06  26.16
5357.340 . 2800    0.00   0.00        0.00   0.00        0.11   0.11        1.29   0.55
5.41   2.22       22.05   8.42
5357.350 . 2301    0.05   0.07        0.42   0.20        3.22   1.34       10.28   4.13
10.02   4.01       15.51   5.94
5357.930 . 2401    0.56   0.26        0.57   0.25        0.54   0.24        0.28   0.14
0.00   0.00        0.00   0.00
5358.010 . 2700    0.00   0.00        0.00   0.00        0.00   0.02        0.71   0.32
4.22   1.75       29.24  10.96
5358.110 . 2600    0.00   0.00        0.00   0.00        0.00   0.04        0.87   0.38
5.50   2.25       46.20  16.30

5370.990 . 2600    0.00   0.00        0.00   0.00        0.00   0.00        0.53   0.25
2.38   1.00       12.63   5.03
5371.270 . 2601    3.47   1.41        3.25   1.31        2.26   0.93        1.01   0.44
0.08   0.09        0.00   0.00
5371.330 . 2800    0.19   0.11        0.41   0.20        5.63   2.31       36.04  12.82
100.78  25.90      198.22  29.17
5371.440 . 2600    0.16   0.11        0.38   0.18        5.57   2.28       36.32  12.92
105.61  26.60      230.41  29.17
5371.490 . 2600   11.85   4.69       38.81  13.61      254.06  24.72      414.67  22.44
636.42  38.25     1648.52 252.28
5371.510 . 2400    0.00   0.00        0.00   0.00        0.23   0.12        1.87   0.79
6.59   2.68       29.78  11.11
5371.600 . 2600    0.71   0.31        1.46   0.62       19.29   7.43       99.70  25.51
202.31  27.88      326.35  24.97
5371.980 . 2600    0.00   0.00        0.00   0.00        0.00   0.06        0.69   0.31
2.39   1.00        8.84   3.57
5372.010 . 2600    0.00   0.00        0.00   0.00        0.00   0.00        0.13   0.10
0.99   0.43        7.77   3.16
5372.020 . 2600    0.00   0.00        0.00   0.06        1.29   0.55        8.25   3.33
25.13   9.37       74.72  22.44

5413.700 . 2700    0.00   0.00        0.00   0.00        0.22   0.12        2.08   0.88
9.70   3.90       47.82  16.53
5413.730 . 2700    0.00   0.00        0.00   0.00        0.00   0.00        0.48   0.22
2.75   1.15       18.16   7.09
5414.070 . 2601   31.50  11.09       63.94  19.02      157.38  29.48      218.40  26.81
185.15  27.01      157.62  23.64
5414.710 . 2601    0.77   0.34        0.74   0.33        0.49   0.23        0.19   0.11
0.00   0.00        0.00   0.00
5414.850 . 2601    8.33   3.18        7.86   2.98        5.51   2.14        2.58   1.07
0.35   0.17        0.00   0.00
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5431.850 . 2600	0.00	0.00	0.00	0.00	0.13	0.10	1.14	0.50	3.74	1.54	13.02	5.16
5432.090 . 2301	0.00	0.00	0.00	0.00	0.19	0.11	0.75	0.33	0.74	0.32	1.21	0.52
5432.330 . 2200	0.00	0.00	0.00	0.00	0.00	0.00	0.19	0.11	1.41	0.61	18.23	7.18
5432.330 . 2400	0.00	0.00	0.00	0.00	0.00	0.00	0.21	0.12	1.04	0.45	6.64	2.72
5432.470 . 2200	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.23	0.13	3.23	1.35
5432.550 . 2500	0.00	0.00	0.00	0.00	1.06	0.46	19.25	7.47	188.04	33.77	524.71	21.71
5432.800 . 1601	14.04	3.78	11.44	2.96	3.07	1.01	0.32	0.16	0.00	0.00	0.00	0.00
5432.950 . 2600	0.29	0.14	0.63	0.29	8.69	3.50	53.08	17.41	137.11	28.79	262.96	27.82
5432.970 . 2601	40.73	13.61	78.98	21.48	178.19	28.93	236.26	25.97	202.42	26.54	171.81	23.96
5432.970 . 2100	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.32	0.16	5.38	2.22
5434.070 . 1201	0.60	0.27	0.48	0.22	0.39	0.19	0.12	0.12	0.00	0.00	0.00	0.00
5434.150 . 2300	0.00	0.00	0.00	0.00	0.00	0.00	0.48	0.23	3.12	1.30	37.41	13.80
5434.340 . 2200	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.28	0.14	2.46	1.03
5434.520 . 2600	3.77	1.56	13.24	5.22	174.02	29.87	349.90	22.57	545.61	27.73	1064.45	133.01
5434.570 . 2700	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.41	0.20	2.33	0.98
5435.030 . 2600	0.11	0.10	0.26	0.14	3.50	1.45	21.09	8.02	57.92	18.43	138.79	29.66
5435.170 . 2600	0.00	0.00	0.00	0.00	0.61	0.28	4.65	1.91	18.03	6.98	73.83	22.75
5435.180 . 800	5.68	2.30	5.66	2.30	8.94	3.54	6.30	2.50	0.89	0.39	0.10	0.10
5444.100 . 2500	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.24	0.13	2.73	1.14
5444.390 . 2601	9.87	3.70	9.26	3.45	6.41	2.46	2.98	1.22	0.40	0.19	0.00	0.02
5444.590 . 2700	0.00	0.00	0.00	0.00	0.00	0.03	0.65	0.30	3.18	1.33	17.08	6.69
5444.620 . 2501	0.35	0.17	0.59	0.27	1.20	0.52	1.48	0.63	0.48	0.22	0.20	0.12
5444.740 . 2001	0.00	0.04	0.04	0.07	0.58	0.27	0.89	0.38	0.18	0.11	0.00	0.00
5445.040 . 2600	3.75	1.55	7.49	3.03	76.52	22.52	206.70	25.52	302.70	23.94	418.82	23.07
5445.310 . 2601	1.92	0.80	1.83	0.76	1.26	0.53	0.56	0.25	0.00	0.03	0.00	0.00
5467.590 . 2000	0.00	0.00	0.00	0.00	0.00	0.00	0.20	0.12	0.50	0.23	0.97	0.42
5467.720 . 2601	0.55	0.25	0.69	0.31	0.73	0.33	0.58	0.26	0.07	0.08	0.00	0.00
5467.770 . 2600	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.24	0.13	2.34	0.98
5467.790 . 2300	0.00	0.00	0.00	0.00	0.00	0.00	0.44	0.21	2.88	1.20	34.89	12.99
5468.090 . 2700	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.13	5.79	2.39
5468.100 . 2800	0.00	0.00	0.00	0.00	0.78	0.35	6.46	2.63	28.34	10.52	105.24	27.72
5468.360 . 2200	0.00	0.00	0.00	0.00	0.00	0.00	0.21	0.12	2.86	1.19	95.59	29.52
5468.410 . 2100	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.47	0.22	7.35	3.01
5468.440 . 2201	0.08	0.09	0.48	0.23	3.54	1.48	10.35	4.16	9.04	3.63	12.42	4.81

5468.470 . 3900	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.36	0.18	5.83	2.40
5468.630 . 2600	0.00	0.00	0.00	0.00	0.00	0.04	0.63	0.29	2.18	0.92	8.04	3.26
5476.290 . 2600	0.61	0.28	1.35	0.58	18.51	7.15	99.44	25.57	208.77	28.09	341.77	25.12
5476.510 . 2700	0.00	0.00	0.00	0.00	0.00	0.00	0.28	0.14	1.74	0.74	12.12	4.85
5476.560 . 2600	2.07	0.87	4.38	1.80	52.66	17.47	180.53	27.09	286.88	24.69	415.18	23.35
5476.630 . 2201	0.29	0.15	0.68	0.30	2.53	1.07	4.06	1.67	1.69	0.71	1.04	0.45
5476.900 . 2800	2.43	1.02	7.23	2.94	110.09	27.80	283.48	23.87	441.65	23.77	641.31	34.01
5476.970 . 2300	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.08	2.60	1.09
5477.080 . 2700	0.00	0.00	0.00	0.00	0.25	0.13	2.56	1.07	13.48	5.34	73.95	23.03
5477.400 . 2301	0.00	0.00	0.00	0.00	0.13	0.10	0.62	0.28	0.65	0.29	1.18	0.51
5477.480 . 2401	3.54	1.47	8.50	3.41	30.54	11.22	58.30	18.74	36.86	12.62	30.88	9.86
5477.670 . 2601	0.79	0.35	1.96	0.83	7.58	3.08	17.88	6.94	13.01	5.11	13.45	5.06
5477.670 . 1500	0.00	0.00	0.00	0.00	0.58	0.26	3.61	1.50	4.25	1.74	2.47	1.01
5477.690 . 2200	0.00	0.00	0.00	0.00	1.03	0.45	9.65	3.88	49.77	16.95	249.69	34.15
5492.860 . 2201	2.95	1.23	11.69	4.65	78.91	23.81	174.23	30.96	181.24	29.87	226.23	29.90
5493.150 . 3900	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.08	2.10	0.89
5493.220 . 1400	0.04	0.07	0.16	0.11	2.46	1.02	15.13	5.92	43.06	14.80	84.14	22.97
5493.320 . 2600	0.19	0.11	0.52	0.24	8.66	3.50	61.21	19.46	176.49	30.06	335.68	25.92
5493.460 . 2000	0.00	0.00	0.00	0.00	0.00	0.00	0.23	0.13	0.59	0.27	1.27	0.54
5493.500 . 2600	0.00	0.02	0.13	5.23	2.59	1.09	19.39	7.46	72.17	21.92	207.28	31.37
5493.620 . 2600	0.00	0.00	0.00	0.00	0.00	0.00	0.42	0.20	2.00	0.85	11.62	4.66
5493.810 . 2600	0.00	0.00	0.00	0.02	1.16	0.50	8.84	3.56	35.42	12.73	133.08	30.88
5493.830 . 2601	23.66	7.69	22.32	7.13	16.20	5.61	8.33	3.22	1.26	0.52	0.20	0.12
5493.880 . 1400	3.38	1.40	5.14	2.11	44.00	15.14	141.21	27.16	208.19	27.16	243.50	25.85
5493.890 . 2600	0.00	0.00	0.00	0.00	0.00	0.00	0.19	0.11	1.67	0.71	18.38	7.21
5494.120 . 2200	0.00	0.00	0.00	0.00	0.00	0.00	0.18	0.11	0.99	0.43	7.65	3.13
5494.240 . 1400	0.71	0.32	1.12	0.48	10.94	4.37	52.56	17.15	104.34	25.63	143.56	26.66
5497.040 . 2401	0.29	0.14	0.48	0.23	0.91	0.39	1.00	0.44	0.25	0.14	0.05	0.07
5497.410 . 3901	0.81	0.36	4.22	1.74	56.07	18.68	150.24	30.70	157.95	29.71	200.52	29.86
5497.420 . 2500	0.00	0.00	0.00	0.00	0.10	0.10	1.10	0.48	4.02	1.66	18.36	7.15
5497.520 . 2600	0.69	0.30	2.57	1.08	61.50	19.92	252.48	25.94	445.48	24.25	733.09	48.16
5497.710 . 2601	1.09	0.47	1.59	0.67	2.36	0.99	2.57	1.08	0.78	0.35	0.34	0.17
5497.860 . 2200	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.45	0.21	3.88	1.62
5497.880 . 2600	0.00	0.00	0.00	0.00	0.00	0.00	0.13	0.10	1.36	0.58	16.72	6.60

5497.920 . 2401	1.06	0.46	2.79	1.16	11.64	4.64	25.86	9.69	17.35	6.64	16.67	6.08		
5497.950 . 2200	0.00	0.00	0.00	0.00	0.00	0.00	0.34	0.17	4.08	1.69	124.22	34.62		
5498.050 . 2401	0.00	0.00	0.00	0.06	0.43	0.21	1.04	0.45	0.65	0.29	0.64	0.29		
5498.190 . 1600	0.17	0.11	0.29	0.14	3.07	1.28	12.53	4.94	8.00	3.12	3.42	1.34		

5500.820 . 2300	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.11	0.10	15.32	6.12
5501.020 . 2601	2.37	0.98	2.25	0.93	1.50	0.63	0.66	0.29	0.00	0.04	0.00	0.00
5501.080 . 2501	1.55	0.66	2.52	1.05	4.97	2.04	6.12	2.48	2.08	0.87	1.01	0.43
5501.400 . 2800	0.00	0.00	0.06	0.08	1.67	0.71	11.48	4.57	38.10	13.44	102.35	26.55
5501.460 . 2600	0.58	0.26	2.23	0.93	55.24	18.40	245.03	26.41	440.51	24.27	726.85	46.57
5501.490 . 2700	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	1.11	0.48	20.31	7.93
5501.560 . 1600	0.32	0.16	0.50	0.23	4.84	2.00	19.27	7.35	12.25	4.61	5.23	1.97
5502.070 . 2401	30.68	10.94	63.75	19.18	154.11	29.12	204.12	26.90	155.21	26.28	120.38	21.46

5593.080 . 2700	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.18	0.11	1.63	0.70
5593.140 . 2001	0.07	0.08	0.15	0.11	0.93	0.41	1.39	0.59	0.30	0.16	0.00	0.04
5593.300 . 1301	13.99	4.41	11.16	3.47	3.89	1.34	0.66	0.30	0.00	0.00	0.00	0.00
5593.730 . 2800	0.07	0.08	0.26	0.14	4.32	1.79	31.50	11.47	105.86	27.10	229.72	29.72
5593.750 . 2600	0.00	0.00	0.00	0.00	0.25	0.13	1.89	0.80	6.21	2.53	21.80	8.34

5736.630 . 2400	0.00	0.00	0.00	0.00	0.14	0.11	1.44	0.62	5.83	2.38	32.06	11.94
5737.060 . 2300	0.00	0.00	0.00	0.00	0.27	0.14	3.92	1.63	37.24	13.53	327.40	33.78
5737.530 . 2601	1.13	0.48	1.10	0.47	0.69	0.31	0.28	0.14	0.00	0.00	0.00	0.00
5737.700 . 2601	0.40	0.19	1.01	0.44	3.82	1.59	8.87	3.58	6.11	2.48	6.02	2.40

6245.190 . 2401	0.06	0.08	0.35	0.18	1.65	0.71	3.86	1.60	2.48	1.03	2.27	0.95
6245.220 . 2300	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.11	0.48	73.77	25.18
6245.640 . 2101	5.07	2.09	24.15	9.12	158.14	31.71	265.99	28.69	278.23	28.67	336.35	30.56
6246.320 . 2600	1.27	0.55	3.12	1.30	43.44	15.00	175.16	28.23	312.19	26.85	482.49	26.21
6246.370 . 2700	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.55	0.26	4.42	1.83
6246.600 . 600	0.75	0.34	1.14	0.50	8.02	3.25	17.99	6.83	5.96	2.32	1.63	0.66
6246.890 . 2700	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.14	5.25	2.17
6247.090 . 2600	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.41	0.20	2.09	0.88
6247.270 . 2700	0.00	0.00	0.00	0.00	0.00	0.00	0.22	0.13	1.16	0.50	5.46	2.24
6247.270 . 1400	0.00	0.00	0.00	0.00	0.00	0.00	0.21	0.13	0.64	0.29	1.11	0.48

6412.670 . 2600	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.29	0.16	1.23	0.53
6413.110 . 2200	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.24	0.14	28.70	11.11

```
6413.320 . 2100    0.00   0.00        0.00   0.00        0.00   0.00        0.00   0.07
2.09   0.88      129.73  37.89
6413.550 .  600    0.51   0.24        0.85   0.38        6.48   2.64       15.13   5.84
5.15   2.03        1.46   0.60
6413.940 . 2500    0.00   0.00        0.00   0.00        0.00   0.00        0.61   0.28
3.05   1.27       20.39   7.95

Lamda (A)C  ele     9250g20v06          8250g10v06          7250g05v06          6250g05v06
5250g10v06          4250g00v06
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A4 'corrallT' correlates the wavelengths of observed lines with a list of atomic lines in the same wavelength neighbourhood to find the mean wavelength shift between observed wavelengths and modelled lines. The possible lines are from Kurucz in the region 5277 - 5510 (Angstrom), the observed data are from Piters et al. (1988). The correlation is tested for three different temperature models with T from 4250 - 6250 K. The highest correlation is found for about 39 steps of .005 Angstrom.

In the line-list of Piters et al. (1988) other identifications were sought for the laboratory wavelengths of 5444.588 A and 5493.48 A as follows:
-5444.59. A trial of 5445.05 2600 gives better results, wavelength more consistent -5493.52. A trial of 5493.88 1400 gives better results, wavelength more consistent.
We adopt both changes for obs5, because both lead to wavelength difference of 1.96 A and 1.92 A respectively with respect to the observed wavelength, which is in good accordance with the mention in Piters et al. (1988) that "by comparing the spectrum of HR 8752, it became evident that the blue shift Delta-lambda-b of the stellar lines is about 2 A;"

The table below lists the results of a correlation test between the observed wavelengths and a list of lines for three model atmospheres that have e.w.'s larger than a few mA over the region 5277 to 5510 A. The correlation points to a wavelength shift of about 1.95 A. The identification of 5445.5 Fe I seems quite probable from Moore et al. (1966).

Correlation is done of the wavelengths of observed and all model lines larger than 5 mA in the region 5276 - 5685 A for 3 different Kurucz models. The observed and modeled linedata are both given in A (from mA) for the region 5277.2 - 5510.2 A. The wavelength bins are 1/20-th A wide. The offset or starting point is 5276 A, each point has an increment of 5 mA. The corelation output is in arbitrary units of A**2.

The observed wavelengths are given as measured, but they are not corrected for the velocity of the star with respect to us. The modeled lines are laboratory lines in vacuum. The lines are shifted with respect to each other in increments of 5 mA, and the product of each of the relevant bins is summed and displayed for each incremental step. In this way the mean shift can be deduced. This is a reasonable approximation, because of the small range of wavelengths we use here. The accuracy from begin to end
of the wavelength region is 2 bins. (Changing to to velocity space is more accurate.)

The table shows maximum correlation for n=39 in all three model calculations. This corresponds to a wavelength difference of 39*.05=1.95 A. Thus the tau-lag corresponds to 1.95 A.

n	CORREL 4250g00v06	CORREL 5250g10v06	CORREL 6250g05v06
0	.524715	.287413	.196048
1	.368822	.296866	.335573
2	.202263	.112167	.106196
3	.221859	.064219	.015859
4	.791847	.380028	.245933
5	.136850	.048260	.037552
6	.933446	.561097	.386883
7	.916766	.574770	.367274
8	.016985	.005490	.005020
9	.319845	.210610	.134007
10	.123960	.027375	.007859
11	.187129	.028514	.003282
12	1.173210	.729673	.503341
13	.635019	.391441	.225033
14	.048850	.013874	.005815
15	.091053	.016531	.005774
16	.068590	.011670	.003178
17	.447941	.267072	.156814
18	.066238	.044933	.042935
19	.023662	.006041	.006153
20	.007043	.001384	.000864
21	.274535	.084261	.032962
22	.205286	.118520	.103096
23	.130184	.025280	.006264
24	1.069829	.580861	.300509
25	.132102	.048197	.012552
26	.093114	.040588	.051272
27	.226059	.075149	.026483
28	.331796	.186579	.200678
29	.383675	.217960	.106190

30	.028612	.001696	.002218
31	.290585	.109183	.034174
32	.125158	.022208	.019207
33	1.431933	.598629	.425939
34	.423896	.331307	.335173
35	1.183546	.679700	.464310
36	.094101	.009028	.001575
37	.256228	.152572	.104323
38	.102430	.063499	.051817
39	2.402436	1.420927	1.117377
40	.551323	.424611	.365180
41	.587744	.342907	.202247
42	2.120434	.963933	.712616
43	.320582	.187331	.138714
44	.187656	.049852	.019199
45	.606733	.332482	.161488
46	.413898	.351732	.328285
47	.082533	.031769	.033361
48	.209790	.067424	.042836
49	.009344	.006145	.010954
50	.591001	.269564	.123421
51	.106125	.018423	.004853
52	.190689	.038479	.005246
53	.253411	.107302	.053514
54	.097848	.044886	.013547
55	.068857	.012598	.009869
56	.146254	.067853	.046271
57	.105078	.034448	.022442
58	.210263	.191740	.217136
59	.385693	.290986	.298595
60	.070084	.016216	.013374
61	.154910	.119949	.150687
62	.308570	.125039	.034323
63	.567407	.478572	.413760
64	.255944	.149158	.063684

Table A5 'MK-Data-rev-6'. Annotated list and table of observed Spectral type for HR 8752 for the period 1919-1987, collected from literature. Also three v- observations are given for the period 1908-1930. In some instances we try estimate dates from dates of some publications, and indicate some value of uncertainty.

In the list below we use an incremental reference number as identifier and indicate Julian Day (JD), date, (uncertainty in days), Morgan Keenan (MK) classification, s-parameter (cf. Appendix Table C2). Early measurements for HR8752 refer to either Boss 5931 = BD+56o2923 = BS8752 = HD 217476. A table collects relevant data at the end of this section. We discuss also some Non-MK measurements.

1) Non-MK Spectral data. One observation from the Henry Draper (HD) catalogue and two observations from Mount Wilson (MW) are available. They have to be transformed to the Morgan-Keenan (MK)-classification. An overview of the correlation between various spectral classifications by Schmidt-Kaler (1965, p.294 section 5.2.1.6) mentions Vyssotsky (1941), Seares & Joyner (1943) and Fehrenbach (1958). These give corrections from MW to HD, and from HD to MK. Thus for Mt Wilson two steps are needed: MW to HD, and subsequently HD to MK.

Seares & Joyner (1943, Fig.3 p.249) plots HD - MW against (MW). For the giant MW type G2: the difference HD-MW=-1.0 +- .1, for MW type G3: HD-MW=-0.6+- .1 (in units of one tenths of a spectral class). This is the first step.

Fehrenbach (1958, Tableau 17) compares MK standard stars (Johnson & Morgan, 1953) in both MW and HD systems and gives corrections to the difference between HD - MK , based on MK. We invert the found relationships and find values for MK - HD, based on HD. For HD F9.6 the correction is: MK-HD=+0.4, for HD G1.2: MK-HD=+0.8, for HD G4.4: MK-HD=+0.6. For HD G1.0: MK-HD=+0.7, for HD G2.4 we need to interpolate: MK-HD=+0.7

The above authors state that the transforms are not rigorous and show deviations of between 0.7 and 3.3 classification units. Seares & Joyner (1943, Table 2) give an Accidental Error between Mount Wilson and Harvard for G2 and G3 of between 2.4 and 3.2 (units of one tenths of a spectral class). We adopt an error of 2.8 units. (Fehrenbach, 1958, Fig. 34) shows deviations in the relations between Yerkes (MK) and Harvard (HD) of about 1.5 classification units around the mean. The resulting MK data therefore have limited accuracy.

1a) Adams et al. (1921) estimate a Mount Wilson spectral classification G2p for Boss 5913 from the intensities of the hydrogen lines in a publication on a study of parallaxes. If the data was taken after a 1917 publication as they mention, this might give as possible observation date 1917 - 1921 (publication date). We take as mean date 1919 Sept 15 +- 500 days.

Estimated	Measured Mt Wilson	Transformed: to HD	to MK
G2p	G2	G(1.0 +- 2.8)	G(1.7 +- 3.0)

The v-magnitude of v=5.6 +-0.1 (v corrected=5.5, Zug 1931) was taken from the Boss catalogue, published in 1910. For the v observation date we estimate 1908 Jan 1 +-500 days, JD=2417942.

1b) Cannon & Pickering (1924) observe spectral type cG0. Although no date is given, and unless other data comes available, we adopt as date 1922 September 15 +- 700 d. We transform the HD data to MK.

Measured Harvard	Transformed to MK
cG0 I	G(0.4 +- 1.5)

The v-magnitude of v=5.5 +-0.1 (v corrected=5.4, Zug 1931) was taken from the Draper catalogue published between 1914-1918. For the v observation date we estimate 1913 Jan 1 +-500 days, JD=2419769.

1c) Adams et al. (1935) give in their catalogue of the spectroscopic absolute magnitudes and parallaxes of 4179 stars for Boss 5931: the "Mt Wilson spectral type cG3, determined by direct comparison with the spectra of standard stars chosen to accord with the Harvard System and the criteria adopted by the International Astronomical Union."
The work is a continuation of earlier work (1917 ...1926). It is thought that the data might have been taken between 1926 and 1935. Unless other data comes available, we adopt as date 1930 Sept 15 +- 1000 days. We have to transform the Mt Wilson data to MK. The spectral type c characteristic indicates a star like alpha Cygni (Adams & Joy 1922).

Measured Mt Wilson	Transformed: to HD	to MK
cG3	G(2.4 +- 2.8)	G(3.1 +- 3.0)

The v-magnitude of v=5.47 +-0.03 (v corrected=5.36, Fernie 1972) was taken from the HD catalogue or Extension? published between 1925-1936. For the v observation date we estimate 1930 Jan 1 +-500 days, JD=2425978. The magnitude if given in accuracies of one-hundredth is from photoelectric measurements (Adams et al. 1935).

Combining the v-observations for HR8752 from 1a-1c with estimated date , JD, v corrected, accuracy, correction method, reference we find:

1a: 1908 Jan 1 +-500 days, JD=2417942, vc=5.5 +-0.1 (Zug 1931), ref. Adams et al. (1921)
1b: 1913 Jan 1 +-500 days, JD=2419769, vc=5.4 +-0.1 (Zug 1931), ref. Cannon & Pickering (1924)
1c: 1930 Jan 1 +-500 days, JD=2425978, vc=5.36 +-0.03 (Fernie 1972) ref. Adams et al. (1935)

Various measurements with Morgan & Keenan (1973) MK classification are given in subsections 2)-6) below.

2a) before 1947 <=G2Ia Nassau & van Albada (1947) in a study on luminosity criteria from objective prism spectra for stars from F0 to K5 continue an earlier study of Nassau & Seyfert (1946) on stars within 5 degree of the north pole. For B.D.+56o2923 they find spectral type MK G2Ia from drawings reproducing intensity distribution in spectrum, but they note (loc. cit., p.26) "The star BD+56o2923 shows exceptionally strong hydrogen and may be of earlier type than G2. More detailed study of the star seems highly desirable". In view of this remark we use G(1 +- 1). The observation procedure to obtain the spectra are described by Nassau & Seyfert (1946).
As`possible observation date we propose 1944 September 15 +- 300 days.
The so-called "Case" studies were established for the classification of spectra made with the 4o objective prism attached to the Burrell Telescope of the Warner and Swasey Observatory, Case Institute of Technology. Nassau & van Albada (1947) have i.a. used "The Atlas of Stellar Spectra" of Morgan, Keenan, & Kellman (1943) extensively. Comparison with other systems show that the "Case" classification appears to be in general agreement with the Henry Draper classification.

Measured 'Case Institute'	Transformed to MK	Transformed to MK
G1 +-1 Ia	G1 +-1	G(1.4 +- 1.5)

2b) before 1950 Nassau and Morgan (1952) find G0p (HD), G0Ia (Case Survey Spectral type) from objective-prism plates obtained for the Case survey for early-type stars of high luminosity (Nassau and Morgan 1951), now used for a survey of F0-G2 stars of luminosity classes I and II on the system of the Yerkes spectral atlas. The study on the early-type stars was presented at a symposium of the University of Michigan, 1950. It seems possible to position a date for when the plates were taken as 1949 June 1 +- 300 days. Note: We take the 'Case' spectral type to be equivalent to MK.

2c)1950-1957 Keenan & Pitts (1980, Table 2, pp. 561-2) [Perkins spectrograms in 1950 and 1957 give types ranging from G0 to G1], Morgan &_Keenan (1973, p. 44) mention [slow changes between G0 and G5 [Keenan 1971]].

1950 Sep G3 Fry & Aller (1975 p.56) Zsoldos 1986a [Keenan, 1971]. As observation date we take 1950 Sep 15 +- 15 days.
1957 Sep G0 Fry & Aller (1975 p.56) Zsoldos 1986a [Keenan, 1971]. As observation date we take 1957 Sep 15 +- 15 days.

2d)1970-1979 G4 var 0 Keenan & Pitts (1980, p. 562, Table 2) in their "Revised MK Spectral Types for G,K, and M Stars", state for BS8752 "The type G4 var 0 given in the catalogue is based on a series of matched spectrograms extending from 1970 to 1979. On these small-scale plates only the Balmer lines and the blend surrounding Sr II showed appreciable variations, and the detailed changes described by Harmer et al. (1978) did not affect the type appreciably."

1970-1979 G4 var 0 Keenan & Pitts (1980)

2e)1970 Jan G5 var O Morgan & Keenan (1973, Table 2) give for BS 8752 the spectral type as G5 var 0 from spectrograms of Januari 1970. They remark also "slow changes between G0 0 and G5 0 in the last 20 years (Keenan 1971)." As observation date we take 1970 Jan 15 +- 15 days.

1970 Jan 15 G5 var O Morgan & Keenan (1973)

2f)1970 Oct 16 G4 0 Morgan et al. (1981, Table 2, list of spectral types by Keenan), [Keenan (1971) classified the spectrum (of HR 8752) as .. G4-G5 in 1970 October (Fry & Aller 1975 p. 56), for which we take as observation date Oct 18, 1970. We shift the date to give different dates to the entries of October 16 and 22 1970.

1970 Oct 16	G4 0	Morgan et al. (1981)
1970 Oct 18	G4-5 0	Fry & Aller (1975)

2g)1971 Sep 21 G4 0-Ia Morgan et al. (1981, Table 2, list of spectral types by Keenan), 1971 September G4-G5 and Fry & Aller (1975, p.56) We combine the data as one entry.

1971 Sep 21 G4 0-Ia Morgan et al. (1981), Fry & Aller (1975)

2h) 1972 Aug 30 G5 0-Ia Morgan et al. (1981, spectral types, spectra Keenan)
1972 Oct G5 s=5.25 Fry & Aller (1975, p. 56) state "In 1972 October Morgan & Keenan (1973) classified the star as G5. Over the years HR 8752 has become fainter and redder." For the date in October we take 1972 October 15 +- 15 days.

2j) 1974 Oct 18 G4 0-Ia Morgan et al. (1981, Table 2, list of spectral types by Keenan)
1975 Oct 15,22 G4 0 Morgan et al. (1981, Table 2, list of spectral types by Keenan), we take a mean observation date of 1975 Oct 19.
1976 Sep 12 G4 0-Ia Morgan et al. (1981, Table 2, list of spectral types by Keenan)
1977 Nov 25 G4 0-Ia Morgan_et_al. (1981, Plate 20, Fig. 4)
1978 Sep 2 G4 0-Ia Morgan_et_al. (1981, Table 2, list of spectral types by Keenan)
1979 Sep 11 G3 0-Ia Morgan et al. (1981, Table 2, list of spectral types by Keenan)

General note on MK classification. Morgan et al. (1981, p.897) mention: "There is a complimentary approach to MK classification of the G0-K0 super-super giants, which while not furnishing absolute values for spectral type and luminosity class, can give a differential classification of good precision in the language of the observed features themselves; Fig. 4 (Plate 20) gives examples of this approach. In the figure are illustrated a spectrogram of the the F8 standard delta CMa, together with spectra of rho Cas, and HR 8752; all three spectrograms were obtained by Abt at the Kitt Peak National Observatory on 1977 November 25."

3) 1958-Nov-1959 F9-G0 +- 0.15 spectral class; Griffin & Redman (1960) started observing in Dec. 1956, and stopped in Febr. 1958. As mean estimated date we take 15 sep 1958 +- 100d.
Note: A spectral class of F9-G0 +- 0.15 class can be inferred from Cyan ratio of 2.17 (cf. loc. cit., Fig2.). They have included other measurements in their Fig. 1 and find that "the earlier measurements .... used in our Fig. 1 are not exactly comparable with each other or with ours." So it seems that the earlier (CN) data from i.a. Gyldenkerne (1958) cannot be used together with the Griffin & Redman data to find the spectral class of HR 8752 at the time of Gyldenkerne's measurement.

4)1971 Sep 1971 G4-5 Fry & Aller 1975 mention that " Keenan (1971) classified the spectrum as .., and G4-G5 in 1970 October, an aassignment which seems in accord with our observation of 1971 September." Morgan et al. (1981) from a comparison with model atmospheres find ksi=10 km/s gives the best results and for the available lines of Fe, Cr, and Ti, the best compromise model = 5500 K, and log g=1.5. As mean estimated date we take 15 sep 1971 +- 15d. We keep these data as reference information, but do not use them in the Tables.

4: 2441210 1971_Sep_15 ~G4-5 Teff=5500 +- 300 K, ksi=10 +2-5 km/s, log g=1.5 +- 0.5 Fry & Aller 1975

5)1973 August 13-17 spectrum plates G8-K3 Luck (1975) gives Teff 4000 +- 300 K. As observation date we take 1973 August 15.
This is not a MK spectrum designation but a comparison: cooler than G8 Ib (flux distribution), cooler than K3 Iab (0'CMa). We combine this with a new determination of K2-5 Lambert & Luck (1978) (see below subsection-6) to become G8-K5. A year later in 1974 November photoelectric measurements were taken that with the method of isophotal wavelengths (MacFarlane 1969) gives (B-V)=1.73 +-0.06. As observation date for the photoelectric measurements we take 1974 November 15 +- 15 days.

1973 August 13-17 comparison of spectrum plates: G8-K3 Luck (1975), later combined with subsection-6) below to G8-K5
1974 November 15 photoelectric spectrum measurement: isophotal wavelengths gives (B-V)=1.73 Luck (1975)

6)1977 Lambert & Luck (1978 p. 407, 418-419) mention "The strengthening of the Fe I line .... between 1965 and 1973 is consistent with the spectral drift from G3 to K", also they mention (loc. cit. p. 410 in Fig.3) "photographic spectra for November 1965, ...", so that we conclude that their November 1965 spectrum (cf. their Figure 3) gave rise to a mention of G3. We assume as observation date 1965 November 15 +- 15 days. Near-infrared ... spectra of the Ia-0 supergiant were obtained in 1976 October and 1977 June, with selected regions observed in 1976 September, November and December and 1977 January and February. The 1977 spectra show HR 8752 to be almost indistinguishable from the F8 Ia supergiant rho Cas. Since 1950, HR 8752 has progressed to the right in the HR diagram from a spectral type near G0 in 1950 to K in 1973. Lambert and Luck mention a spectrum K2-5 Ia, this we combine with Luck (1975), see below and above. New observations show that between 1973 and 1976, HR 8752 moved rapidly to the left to return to a spectral type near G0. For HR8752 in October 1976 a spectral type near GO is suggested (Lambert & Luck, 1978 p. 407). We could assume as spectrum F9.5-G1, but the data is not certain enough to use. In Lambert & Luck (1978, Figure 2) the spectrum of rho Cas (1977 August) is seen to be remarkably similar to the 1977 July spectrum of HR 8752. For mid 1977 first a spectrum earlier than G2 is given, and then for July 1977 a spectrum equal to that of rho Cas in 1977 August, with equivalent widths equal to about 10 percent. They assume rho Cas to have a F8Ia spectrum, but as rho Cas is variable (cf Note 1 below) synchronization is needed, and for the two given data we suggest a combined spectral type F8-G2 and a combined observation date 1977 July 15 +- 15 days.

1965 Nov 15	G3	Lambert_&_Luck_1978
1973 Aug 13_17	K2-5 Ia	Lambert_&_Luck_1978, this is combined with Luck (1975) to be: G8-K5
1975 reversal		Lambert_&_Luck_1978
1976 Oct	F9.5-G1	Lambert_&_Luck_1978 shell of gas [has been] ejected
1977 mid	<=G2	Lambert_&_Luck_1978 shell of several stellar radii
1977 Jul 15	F8 Ia	Lambert_&_Luck_1978, as rho Cas, combined with 1977 mid to F8-G2

Note1: The spectrum of rho Cas is assumed to be a standard value of F8 Ia for 1977 August, whereas Morgan et al. (1981) mention for rho Cas: 1976 October 13: G2 0-Ia, 1978 September 3: G3 0-Ia spectral types.

Note2:"A straightforward interpretation of the 1977 spectrum suggests that a shell of cool gas is expanding above a photosphere which is equivalent to a spectral type near F8Ia. An expansion velocity of 35 km/s is provided by the direct measurement of the shell absorption lines (see figs 4 and 9). The shell has a radius of several stellar radii. ...from metal emission-line observations".

Note3: Shell radius of several R* , micro vel. 7 km/s, macro vel. 11 km/s (Luck 1975), mdot ~10 ^-5 Msun/yr. "A permanent manifestion of a large-scale convection zone may be the highly turbulent photosphere."

7) 1985 Dec 16, 1987 Sep 22 F6:7, F6:7 Mantegazza (1988) finds the same spectral type from two spectra obtained at Ariago resp. Merate observatory. Later Mantegazza (1991, 1992) gives spectral type F7 (s=4.7) for both observations.

7p1:	2446416 1985_Dec_15	F6-7	s=(4.65+-0.05)	Mantegazza_1988
7p2:	2447057 1987_Sep_22	F6-7	s=(4.65+-0.05)	Mantegazza_1988

----

8) Sequence of MK and MK-equivalent measurements from 1919 - 1987.

No.	JD	date	+- days	MK	s-parameter	Reference
1a:	2422217	1919_Sep_15	500	G(1.7+-3.0)	s=(5.085+-0.165)	Adams_et_al._1921
1b:	2423313	1922_Sep_15	700	G(0.4+-1.5)	s=(5.02+-0.08)	HD_Catalogue_1924
1c:	2426235	1930_Sep_15	1000	G(3.1+-3.0)	s=(5.16+-0.15)	Adams_et_al._1935
2a:	2431349	1944_Sep_15	300	G(1.4+-1.5)	s=(5.07+-0.08)	Nassau_&_van_Albada_1947
2b:	2433069	1949_Jun_1	300	G0Ia	s=5.0	Nassau_&_Morgan_1951,_1952
2c2:	2433540	1950_Sep_15	15	G3	s=5.15	Fry_&_Aller_(1975)_[Keenan_1971],_Zsoldos_1986a
2c3:	2436097	1957_Sep_15	15	G0	s=5.0	Zsoldos_(1986a)_[Keenan_1971]
3:	2436462	1958_Sep_15	100	F9-G0+-0.15	s=(4.95+-0.15)	Griffin_&_Redman_(1960)
6a:	2439080	1965_Nov_15	15	G3	s=5.15	Lambert_&_Luck_1978
2e:	2440602	1970_Jan_15	15	G5varO	s=5.25	Morgan_&_Keenan_1973
2f1:	2440876	1970_Oct_16		G4O	s=5.2	Morgan_et_al._1981
2f2:	2440878	1970_Oct_18		G4-5O	s=5.22	Fry_&_Aller_(1975)
2g:	2441216	1971_Sep_21		G40-Ia	s=5.2	Morgan_et_al._1981,_Fry_&_Aller_(1975)
2h1:	2441560	1972_Aug_30		G50-Ia	s=5.25	Morgan_et_al._1981,_Fry_&_Aller_(1975)
2h2:	2441606	1972_Oct_15	15	G5	s=5.25	[Morgan_et_al._1972],_Fry_&_Aller_(1975)
5a:	2441910	1973_Aug_13_17		G8-K5 Ia	s=(5.7+-0.3)	Luck_1975,_Lambert_&_Luck_1978
2j1:	2442339	1974_Oct_18		G4 0-Ia	s=5.2	Morgan_et_al._(1981)
2j2:	2442705	1975_Oct_19		G4 0	s=5.2	Morgan_et_al._(1981)
2j3:	2443034	1976_Sep_12		G4 0-Ia	s=5.2	Morgan_et_al._(1981)
6f:	2443340	1977_Jul_15	15	F8-G2 Ia	s=(5.0+-0.2)	Lambert_&_Luck_1978
2j4:	2443473	1977-Nov-25		G4 0-Ia	s=5.2	Morgan_et_al._(1981)
2j5:	2443754	1978_Sep_2		G4 0-Ia	s=5.2	Morgan_et_al._(1981)
2j6:	2444128	1979_Sep_11		G3 0-Ia	s=5.15	Morgan_et_al._(1981)
7p1:	2446416	1985_Dec_15		F6-7	s=(4.65+-0.05)	Mantegazza_1988
7p2:	2447057	1987_Sep_22		F6-7	s=(4.65+-0.05)	Mantegazza_1988

Combining the v-observations for HR8752 from 1a-1c with JD, estimated date, v corrected, accuracy, correction method, Reference:

No.	JD	date	+- days	vc	tolerance	correction	Reference
1a:	2417942	1908_Jan_1	+-500	5.5	0.1	(Zug 1931)	Adams et al. (1921)
1b:	2419769	1913_Jan_1	+-500	5.4	0.1	(Zug 1931)	Cannon & Pickering (1924)
1c:	2425978	1930_Jan_1	+-500	5.36	0.03	(Fernie 1972)	Adams et al. (1935)

Table A6 'Zsoldos-early-colour-vsn-2' describes correlations for colours and temperatures to find B-V and Teff equivalents and accuracies for inclusion as early-colour data in Section 3 of the main paper. We give the data as the original email and from these data indicate Teff and B-V.

The data for the period around 1900 is given in the following email from E. Zsoldos on 11 Jun 2001, with subject HR8752:

beginning of email data

Unfortunately, there are very few colour estimates for HR 8752 (there are more for Rho Cas).

```
1900 Jul 27 (2415228)   G
1901 Jul 16 (2415582)   WG+
1902 Sep  1 (2415994)   WG
1902 Sep  2 (2415995)   WG
```

Here G is yellow, WG is white-yellow. The source is G. Mueller & P. Kempf 1903, Potsdam Publ. Band 14

I (I.K.) tried to convert these letter into (B-V).
J. Wilsing (1919, Potsdam Publ. Band 24, No. 74) gives a list of bright stars for which he calculated temperatures (p. 25, Table 3). The Table has 27 stars with colour WG, 13 with G and 6 with WG+.

Averaging the temperatures gives

```
WG      ->      5050 +- 1900
```

One star among the WG's has a rather discordant temperature, omitting it gives

```
WG      ->      4700 +- 800
WG+     ->      4800 +- 300
G       ->      4100 +- 700
```

I also collected the B-V values of the stars in the four groups from the Bright Star Catalogue. Omitting known variables (but keeping suspected variables), averaging gives the following:

```
WG      ->      0.85 +- 0.30 (n=26)
WG+     ->      1.02 +- 0.09 (n=6)
G       ->      1.17 +- 0.26 (n=13)
```

The stars used for the conversions were mostly giants, so some correction might be necessary.

Will these B-V values help? It looks like the star looked almost the same a hundred year ago than now. If you look at the long-term light curve (Observatory 106, 156), this is the time when the star reached the same brightness level as it has today.

There is one more colour estimate, made by H. Osthoff (1916, Specola Astronomica Vaticana Volume VIII), but he didn't give the date, only said the observations were made between 1894 and 1897. From three observations he estimated the colour (on his own scale) to be 6.2.
Mueller & Kempf (1907, Potsdam Publ. Band 17) correlated their and Osthoff's scales, so 6.2 corresponds roughly to G-. Using the same process as above, G- implies a temperature of about 4200 +- 700 (from 25 stars), or B-V=1.16 +- 0.26 (from 21 stars). However, since there is no exact date, this one does not help much.

end-of-email data

The following table gives these 'Early-color-1900' estimates of (B-V) and Teff. The (B-V) data are given as observations with code "C" in Fig.5.

The data for (B-V) have to be corrected for the influence of interstellar reddening. Assuming the observations are compatible with the Johnson (B-V) system, we use the procedure outlined in section 3 of the main paper to find the 'unreddened'(B-V), from which we find Teff using the calibrations outlined in Section 3. The Teff values found from the 'unreddened'(B-V) are displayed in Fig.8a as upward pinting triangles.

The observational direct data for Teff are given in Fig.8a as circles. They are not 'dereddened' and are lower than the respective Teff from the 'unreddened' (B-V) data.

Table of 'Zsoldos-early-color' estimates

JD	Date	color		(B-V)	d(B-V)			or Teff	dTeff	logT	dlogT	Reference
2413560	1896_Jan_1	G-	->	+1.16	.26	|	->	4200	700	3.623	0.072	Osthoff (1916)
2415228	1900_Jul_27	G	->	+1.17	.26	|	->	4100	700	3.613	0.074	Mueller & Kempf (1903)
2415582	1901_Jul_16	WG+	->	+1.02	.09	|	->	4800	300	3.681	0.027	Mueller & Kempf (1903)
2415994	1902_Sep_1	WG	->	+0.85	.30	|	->	4700	800	3.672	0.074	Mueller & Kempf (1903)
2415995	1902_Sep_2	WG	->	+0.85	.30	|	->	4700	800	3.672	0.074	Mueller & Kempf (1903)

Table A7 'B-V-1950-Data-vsn-7' Annotated list and table of (B-V) and other colour measurements from 1942 - 1974.

This document contains observations from the beginning of of photoelectric measurements and mentions different multicolour measurement systems. An area of uncertainty in using different colour systems is the transformation between systems, and the differences in influence of interstellar reddening. The hypergiant HR8752 was used as a reference standard, and not as a variable star, so that sometimes no mention is made of observation date. Also comparisons of colour data were referenced against the standard Morgan Keenan (MK) spectral classification as G0Ia. Oja (1963) remarked "The star is probably variable". In the main paper we mention a correction to the standard MK specification by using data from a created 'time history' to find the correct MK classification from lists of colour and temperature data.

The collected data is from various authors (Zsoldos 1986a; Fry & Aller 1975; Luck 1975; Parsons & Montemayor 1982) and the ADS at Strasbourg and from the open literature.
In the list below we use an incremental reference number as identifier and indicate Julian Day (JD), date, (uncertainty in days), Morgan Keenan (MK) classification, s-parameter (cf. Appendix Table C2). Early measurements for HR8752 refer to either Boss 5931 = BD+56o2923 = BS8752 = HD 217476. A table collects relevant data at the end of this section. We discuss also some Non-(B-V) measurements.

In order to find the 'íntrinsic' B-V, the reddening parameter E(B-V) has to be derived. Values in the literature vary from about 0.30 - 0.66. The published value of 0.82 by Johnson (1968) is incorrect, but is found to be 0.70 when spectral type and (B-V) observation are synchronized in time (see above and main paper Section 3) which allows us to compare synchronous (B-V) and MK observations. In this paper we use Johnson B-V, but also other color systems if suitable interstellar reddening corrections can be applied. Some color systems are less sensitive to interstellar extiction than the Johnson B-V system, and need a smaller correction factor . Gyldenkerne uses a colour system with limited influence of reddening of ~16% of that of the B-V system. This explains the confusion when comparing the Gyldenkerne data (Zsoldos 1986a) with Johnson (B-V) observations. It turns out that the observed value is within 16% of the classical (B-V) reddening and is thus already very near to the 'intrinsic'or unreddened value.

-1) Measurements of Stebbins and Whitford (1945)

a) Observations with a six-color photometer in the summers of 1940-1944 given as U6-I6 below indicate a six-color photometry system. We add the column (B-R)6 and take as observation date 1942 July 15 (JD 2430556), with an uncertainty of 720 days. The visual magnitude is not contemporary with the photometric measurements. The (spectroscopic) absolute magnitude M is from Adams et al. (1935). Early visual magnitudes are by Adams et al. (1921, mvis=5.5), Adams & Joy (1919, Boss 5931 mvis=5.6), but no actual observation dates are given. we give estimates of date in Table A5. Zug (1931) and Lamla (1965, section 5.2.6, p.334) give transforms from the (revised) Harvard photometric to the international photovisual system.

HD 217476	spectrum	m	M	U6	V6	B6	G6	R6	I6	(V-B)6	Obs	(B-R)6
(HR 8752)	cG3	5.48	-3.2	+1.53	+0.67	+0.39	+0.01	-0.39	-0.90	+0.28	1	+0.78

Spectrum, m , M are as given by Adams et al. (1935) from the Henry Draper catalogue.

b) Kron (1958) gives an overview of supergiants using Stebbins & Whitford (1945). With Kron's (1958, Fig. 4) we estimate excesses E(R-I)6= 0.64 +- .02 and E(V-B)6=0.29 +- .02. For thermal locus Kron mentions spectral type "f8". Kron mentions E(P-V)=1.78 * E(V-B)6 = 0.53.

c) Fernie (1972) transforms the Stebbins & Whitford (1945) observations to the Johnson UBVRI system, by intermediate use of 61 of the 139 stars in the list of UBVRI (Iriarte et al. 1965) with average deviations f 0.085 in V and 0.031 in B-V. The data below are from Table II (Fernie 1972) transformed to the Johnson system, but note that the used transform is only valid for unreddened data, and that spectral type and visual magnitude are not contemporary to the color observations.

HD	sp.T.	V	U-B	B-V	V-R	R-I	E(B-V)
217476	G0 Ia	5.36	1.09	1.28	0.92	0.84	0.58
		+- 0.085		+-0.031			

As date we take JD 2430556 (July 15, 1942), with an uncertainty of 700 days.

d) Schmidt (1972) finds E(V-B) = 0.66 from "results of the six-colour photometry (Kron 1958)," which depends on the measurements of Stebbins & Whitford (1945), "using Fernie's (1967) correction to the UBV system." Schmidt needed the value to correct observations of the Paschen continuum slope m6335-m8205 for interstellar absorption, using E(B-V)/ E(m6335-m8205) = 1.23, and from comparison with models finds Theta_eff=1.002 with a sigma of 0.033. This corresponds to Teff=5030

+- 171 K, which we use in the main paper as one of the four extra temperature measurements in Section 3.

-2a) Measurements of Johnson (1955, 1965) for HD 217476, taken as G0 Ia standard of the MK system are given in table 2 of Johnson & Morgan (1953) and in Table 3b of Johnson (1955). The photometric observations were made by Johnson at the McDonald Observatory in the winter of 1950-1951 and the summer of 1951. Luck (1975) gives 1951 as date. The total number of observations is 3.

No.	HD	Name	n	eps	V	B-V	U-B	Sp
277	217476	HR 8752	3	9	4.99	+1.29	+1.00	G0 Ia
accuracies					+-.017	+-.009	+-.017	

As date we take 1951 April 15 with an uncertainty of 135 days.

-2b) Measurements of Johnson (1965, Table 2, BS 8752) are given for variable star, J. D. 2438300.0 (27 Sept. 1963). We adopt an accuracy for V, B-V of 0.01 resp. 0.01.

no.	HD	name	Sp	V	U-V	B-V	V-R	V-I	V-J	V-K	V-L	V-M	V-N
96*	217476	BS 8752	G0 Ia	5.13	+2.88	+1.55	+1.17	+2.02	+2.61	+3.33	+3.59	-	+4.18

-2c) Measurements by Johnson et al. (1966) referenced in a publication by Zsoldos (1986a) Table II are given. We adopt an accuracy for V and B-V of 0.005.

V	B-V	U-B	date	JD
5.176	+1.535	+1.315	21 June 1964	2438568
5.106	+1.553	+1.339	02 July 1964	2438579

-3) Gyldenkerne (1955) made two measurements between september 1951 and summer 1953 in the author's S1-system in Sofienholm. The data (Gyldenkerne 1955, 1958; Strömgren & Gyldenkerne 1955) give a 'corrected' k-factor of k=0.414. The visual magnitude is m=5.5. Observations with system S1 were approximately from 1951 Sep. 26 to 1953 July 1 (Gyldenkerne, 1958, Table 3), so we take 1952 June 15 as observation date, with an uncertainty of 350 days. Strömgren & Gyldenkerne (1955) mention a probable error in B-V of +-0.016. We try to find the intrinsic (B-V).

k = .414 (+- .0092), n = .170 (+- .0061), g = .210 (+- .0078).

k,0 = k + E(k) = k + E(k) /E(B-V) * E(B-V)
E(k) /E(B-V)=0.118
(B-V) = +1.420 - 1.385 * k (Gyldenkerne, 1955, Eqn.2)
(B-V)0 = (B-V)-{1.385*E(k) /E(B-V)* (B-V)}=0.847v - E(B-V)*0.163=0.73 +-0.02, at second round =0.75 +-0.02, 3rd 0.76 +-.02, so second round is intermediate between low and high (E(B-V)= (0.49 - 0.76) with B-V~0.77-0.72 for Gyldenkerne ->B-V=0.75 +-.025.

The relatively small amount of reddening explains why the observations of Gyldenkerne deviate from other B-V (reddened) observations because they are (in comparison with (B-V) observations) already 84 % dereddened and therefore give an approximation to within 16% of E(B-V) of the intrinsic color B-V.

-4a) Oja (1963) made 4 observations in the years 1958-1960 with mean value:

Julian Date	+-	mU	+-	CU	+-	p	VU	+-	(B-V)J	(B-V)U	+-
2436751	500d	5.267	.011	0.520	.011	4	5.16	.010	1.29	1.39	.011

p=4 (measurements); the accuracies for B-V and for VU are given as estimates. The difference between (B-V)J (Johnson, 1955) and (B-V)U, and also between Johnson's (1954) v-magnitude of 4.99 m and VU V= 4.99 lead to Oja's remark "The differences in magnitude and colour cannot be explained by observational errors. The star is probably variable." (see introduction to this table).

As date we take 1959 August 1 with an uncertainty of 500 days.

-4b) Ljunggren and Oja (1965) observed with a new photometer in 1961 and give:

Julian Date	V	+-	B-V	+-	CU'	+-
2437544.6	4.98	.014	+1.36	.011	-0.066	.013

2437621.3	5.08	.014	+1.38	.011	-0.050	.013
2437646.2	5.14	.014	+1.33	.011	-0.094	.013
2437544.6	5.20	.014	+1.32	.011	-0.103	.013

-5) Sandage and Smith (1963) made an observation in July and September 1960 with new equipment including the use of a S20-surface cathode. Transforms from (b-v)20 and (u-b)20 colours to the Johnson, Morgan and Harris B-V, U-B values are given below. The accuracy of the B-V data is +- 0.05, for the U-B data is +- 0.07. The results for HR 8752 are from Sandage and Smith (1963, Table 1):

JM no	HD	Star name	Sp Type	(U-B)20	(B-V)20	(v-r)20	d(U-B)	n
277	217476	HR 8752	G0 Ia	+1.06	+1.38	+1.05	......	1

B-V = 1.100 (+-.004)* (b-v)20 + 1.023 (+-.003) (loc. cit. Eqn 1)
U-B = 1.015 (+-.003)* (b-v)20 - 1.575 (+-.006) (loc. cit. Eqn 2)

Although the effective wavelengths for u, b, v are slightly different from those of the U, B, V system, Sandage and Smith (1963) mention that "Our complete data taken together states that .. .. In any case the (B-V)20 and (U-B)20 colors are sufficiently close to B-V and U-B that they are used without further distinction in the remainder of the text and diagrams". We therefore use these data as B-V data.

As date we take 1960 July 15 +- 45 days.

-6) Measurements by Kraft & Hiltner (1961) were made with McDonald 82-inch reflector in October 1960. Considering other observations we estimate an accuracy for V, B-V of 0.02 and 0.02 respectively.

V	B-V	U-B	date
5.13	+1.46	+1.14	October 1960

As date we take JD 2437223 (October 15, 1960) with an uncertainty of 15 days.

-7) Measurements by Eggen (1968) indicate that the star is variable (V) and that two measurements were made (column N). The observation date is given as 1962-1964 (Luck, 1975, Zsoldos, 1986a). We estimate an accuracy for V, B-V of 0.02 and 0.02 respectively.

Star	Rem	V	B-V	U-B	N
HD 217476	V	5.12	+1.42	+1.14	2

As date we take 1963 July 1, with an uncertainty of 545 days.

-8) Measurement by Luck (1975) is derived from spectral scans for November 1974, using the method of isophotal wavelengths (MacFarlane 1969).

V	B-V	date
----	+1.73 +-0.06	November 1974

As date we take 1974 November 16 with an uncertainty of 15 days.

-9) The combined sequence of B-V measurements from 1942 - 1974, sorted in (mean) time, followed by the 'intrinsic' or (B-V)0 value of Gyldenkerne (1955), which was derived in the course of this work, for E(B-V)= 0.70. The other B-V values are observed values, that have to be dereddened to obtain 'intrinsic' values.

No.	JD	+- days	date	V	+-	B-V	+-	Reference
1:	2430556	720	15-07-1942	----	----	1.28	.031	Stebbins&Whitford (1945)
2a:	2433752	135	15-04-1951	4.99	.017	1.29	.009	Johnson (1955)
4a:	2436751	365	01-08-1959	5.16	.010	1.39	.011	Oja (1963)
5:	2437131	45	15-07-1960	----	----	1.38	.005	Sandage and Smith (1963)
6:	2437223	15	15-10-1960	5.13	.02	1.46	.02	Kraft & Hiltner (1961)
4b:	2437544.6		02-09-1961	4.98	.023	1.36	.024	Ljungren&Oja (1965)
4b:	2437621.3		17-11-1961	5.08	.023	1.38	.024	Ljungren&Oja (1965)
4b:	2437646.2		12-12-1961	5.14	.023	1.33	.024	Ljungren&Oja (1965)

```
4b: 2437647.2       13-12-1961  5.20  .023  1.32  .024  Ljungren&Oja (1965)
7:  2438212   550   01-07-1963  5.12  .02   1.42  .02   Eggen (1968)
2b: 2438300         27-09-1963  5.13  .01   1.55  .01   Johnson (1965)
2c: 2438568         16-06-1964  5.176 .005  1.535 .005  Johnson et al. (1966)
2c: 2438579         02-07-1964  5.106 .005  1.553 .005  (ref. Zsoldos, 1986a)
8:  2442368    15   16-11-1974  ----  ----  1.73  .06   Luck (1975)
----+-----------+----+----------+--------------------------------------------
Seperately: Gyldenkerne's (1955) 'intrinsic'  B-V  for E(B-V)=0.70.

No.    JD   +- days    date      V     +-   (B-V)0   +-    Reference
3a: 15-06-1952  300   2434179 [E(B-V)=0.700] 0.73  .016  Gyldenkerne (1955)
-------------------------------------------------------------------------------
```

Table A8 'B-V-1976-Data' (B-V) Observations, period 1976-1993

Overview of V, (B-V) measurements from JD 2443099 to JD 2449299, (1976 to 1993), combined from various authors. The author reference is given by a letter code from the following list.
The data given with the letter code "n" is published here for the first time, also as Appendix A12B 'Zsoldos-B-V-observations'.

The meaning of the code is as follows:

letter		bibliographic reference
a	=	1983MNRAS..203..403 Walker, E.N.
b	=	1979IBVS..1533 Moffett, T.J., Barnes, T.G.
c	=	1985MNRAS..216..517 Arellano Ferro, A.
d	=	1985IBVS..2718 Halbedel, E.M.
e	=	1986IBVS..2913 Zsoldos, E.
f	=	1988IBVS..3137 Mantegazza, L., Poretti, E., Antonello, E.
g	=	1986IBVS..2876 Halbedel, E.M.
h	=	1992A&A..263..123 Percy, J.R., Zsoldos, E.
i	=	1988IBVS..3170 Halbedel, E.M.
k	=	1991IBVS..3600 Halbedel, E.M.
m	=	1985IBVS..2715 Zsoldos, E., Oláh, K.
n	=	this paper observer Zsoldos, E.
p	=	1982ApJS..49..175 Parsons, S.B., Montemayor, T.J.
r	=	1993IBVS..3849 Halbedel, E.M.

Note: Where accuracies are given they are included in the Table, except for the material presented in (IBVS 3170) where we give the sum of accuracies of relative and and reference star measurements, because they are probably not statistically independent.
For the measurements of HR8752 by Zsoldos, Percy & Zsoldos, and also when no accuracy is mentioned, we take the numbers of 0.008 as error in V, and 0.012 as error in (B-V), following the numbers given in Zsoldos & Percy (1991) for Rho Cas.

The Table gives the observed date, v-magnitude and (B-V) with their accuracies and reference code as listed above.

To the table we have added columns for (B-V)0=(B-V)-E(B-V), mb=v+BC, E(B-V)=0.70, dE(B-V)=0.008 and their accuracies as used in this paper. (B-V)0 is transformed to spectral parameter s, to Teff and to BC using Appendix C2 'Calibrate-hyper'.

Julian Day	V	errV	(B-V)	d(B-V)	(B-V)0	d(B-V)0	s	ds	logteff	dlogteff	BC	dBC	mb	dmb	Ref
2443099.347	4.624	0.008	1.529	0.012	0.829	0.014	5.051	0.040	3.694	0.012	-0.200	0.029	4.424	0.030	a
2443100.351	4.623	0.008	1.527	0.012	0.827	0.014	5.050	0.040	3.694	0.012	-0.199	0.029	4.424	0.030	a
2443101.360	4.614	0.008	1.535	0.012	0.835	0.014	5.055	0.040	3.694	0.012	-0.202	0.029	4.412	0.030	a
2443103.336	4.605	0.008	1.541	0.012	0.841	0.014	5.060	0.040	3.693	0.012	-0.204	0.029	4.401	0.030	a
2443104.335	4.611	0.008	1.528	0.012	0.828	0.014	5.051	0.040	3.694	0.012	-0.199	0.029	4.412	0.030	a
2443105.344	4.605	0.008	1.535	0.012	0.835	0.014	5.055	0.040	3.694	0.012	-0.202	0.029	4.403	0.030	a
2443106.323	4.604	0.008	1.532	0.012	0.832	0.014	5.053	0.040	3.694	0.012	-0.201	0.029	4.403	0.030	a
2443107.360	4.615	0.008	1.525	0.012	0.825	0.014	5.048	0.040	3.694	0.012	-0.198	0.028	4.417	0.030	a
2443108.339	4.610	0.008	1.523	0.012	0.823	0.014	5.047	0.040	3.694	0.012	-0.198	0.028	4.412	0.030	a
2443109.323	4.606	0.008	1.531	0.012	0.831	0.014	5.053	0.040	3.694	0.012	-0.200	0.029	4.406	0.030	a
2443110.326	4.608	0.008	1.527	0.012	0.827	0.014	5.050	0.040	3.694	0.012	-0.199	0.029	4.409	0.030	a
2443111.331	4.601	0.008	1.535	0.012	0.835	0.014	5.055	0.040	3.694	0.012	-0.202	0.029	4.399	0.030	a
2443112.321	4.610	0.008	1.528	0.012	0.828	0.014	5.051	0.040	3.694	0.012	-0.199	0.029	4.411	0.030	a
2443367.000	4.873	0.014	1.590	0.009	0.890	0.012	5.096	0.039	3.689	0.012	-0.222	0.029	4.651	0.032	b

2443368.950	4.914	0.014	1.582	0.009	0.882	0.012	5.090	0.039	3.690	0.012	-0.219	0.029	4.695	0.032	b
2443371.000	4.869	0.014	1.574	0.009	0.874	0.012	5.084	0.039	3.691	0.012	-0.216	0.029	4.653	0.032	b
2443374.870	4.887	0.014	1.581	0.009	0.881	0.012	5.089	0.039	3.690	0.012	-0.219	0.029	4.668	0.032	b
2443377.000	4.874	0.014	1.592	0.009	0.892	0.012	5.097	0.039	3.689	0.012	-0.223	0.029	4.651	0.032	b
2443377.880	4.899	0.014	1.586	0.009	0.886	0.012	5.093	0.039	3.690	0.012	-0.221	0.029	4.678	0.032	b
2443389.458	4.905	0.008	1.618	0.012	0.918	0.014	5.118	0.040	3.687	0.012	-0.234	0.030	4.671	0.031	a
2443390.454	4.898	0.008	1.621	0.012	0.921	0.014	5.121	0.040	3.687	0.012	-0.236	0.030	4.662	0.031	a
2443391.424	4.893	0.008	1.626	0.012	0.926	0.014	5.125	0.040	3.686	0.012	-0.238	0.030	4.655	0.031	a
2443392.463	4.899	0.008	1.611	0.012	0.911	0.014	5.113	0.040	3.688	0.012	-0.231	0.030	4.668	0.031	a
2443393.420	4.888	0.008	1.616	0.012	0.916	0.014	5.117	0.040	3.687	0.012	-0.233	0.030	4.655	0.031	a
2443393.850	4.904	0.014	1.583	0.009	0.883	0.012	5.090	0.039	3.690	0.012	-0.220	0.029	4.684	0.032	b
2443394.411	4.899	0.008	1.607	0.012	0.907	0.014	5.109	0.040	3.688	0.012	-0.229	0.030	4.670	0.031	a
2443396.519	4.885	0.008	1.633	0.012	0.933	0.014	5.131	0.040	3.686	0.012	-0.241	0.030	4.644	0.031	a
2443397.455	4.900	0.008	1.614	0.012	0.914	0.014	5.115	0.040	3.687	0.012	-0.232	0.030	4.668	0.031	a
2443397.860	4.873	0.014	1.586	0.009	0.886	0.012	5.093	0.039	3.690	0.012	-0.221	0.029	4.652	0.032	b
2443398.477	4.887	0.008	1.624	0.012	0.924	0.014	5.123	0.040	3.686	0.012	-0.237	0.030	4.650	0.031	a
2443398.850	4.885	0.014	1.583	0.009	0.883	0.012	5.090	0.039	3.690	0.012	-0.220	0.029	4.665	0.032	b
2443403.530	4.889	0.008	1.618	0.012	0.918	0.014	5.118	0.040	3.687	0.012	-0.234	0.030	4.655	0.031	a
2443406.503	4.887	0.008	1.625	0.012	0.925	0.014	5.124	0.040	3.686	0.012	-0.237	0.030	4.650	0.031	a
2443411.412	4.886	0.008	1.615	0.012	0.915	0.014	5.116	0.040	3.687	0.012	-0.233	0.030	4.653	0.031	a
2443412.419	4.883	0.008	1.625	0.012	0.925	0.014	5.124	0.040	3.686	0.012	-0.237	0.030	4.646	0.031	a
2443414.403	4.874	0.008	1.620	0.012	0.920	0.014	5.120	0.040	3.687	0.012	-0.235	0.030	4.639	0.031	a
2443415.407	4.880	0.008	1.606	0.012	0.906	0.014	5.109	0.040	3.688	0.012	-0.229	0.030	4.651	0.031	a
2443416.414	4.871	0.008	1.616	0.012	0.916	0.014	5.117	0.040	3.687	0.012	-0.233	0.030	4.638	0.031	a
2443417.414	4.875	0.008	1.613	0.012	0.913	0.014	5.114	0.040	3.687	0.012	-0.232	0.030	4.643	0.031	a
2443418.415	4.883	0.008	1.600	0.012	0.900	0.014	5.104	0.040	3.689	0.012	-0.226	0.030	4.657	0.031	a
2443419.485	4.867	0.008	1.616	0.012	0.916	0.014	5.117	0.040	3.687	0.012	-0.233	0.030	4.634	0.031	a
2443420.408	4.850	0.008	1.630	0.012	0.930	0.014	5.129	0.040	3.686	0.012	-0.240	0.030	4.610	0.031	a
2443421.421	4.863	0.008	1.615	0.012	0.915	0.014	5.116	0.040	3.687	0.012	-0.233	0.030	4.630	0.031	a
2443422.409	4.860	0.008	1.612	0.012	0.912	0.014	5.113	0.040	3.688	0.012	-0.232	0.030	4.628	0.031	a
2443427.370	4.859	0.008	1.589	0.012	0.889	0.014	5.095	0.040	3.689	0.012	-0.222	0.029	4.637	0.030	a
2443427.680	4.850	0.014	1.590	0.009	0.890	0.012	5.096	0.039	3.689	0.012	-0.222	0.029	4.628	0.032	b
2443429.374	4.863	0.008	1.588	0.012	0.888	0.014	5.094	0.040	3.689	0.012	-0.222	0.029	4.641	0.030	a
2443495.600	4.854	0.014	1.567	0.009	0.867	0.012	5.078	0.039	3.691	0.012	-0.213	0.029	4.641	0.032	b
2443496.610	4.844	0.014	1.587	0.009	0.887	0.012	5.094	0.039	3.690	0.012	-0.221	0.029	4.623	0.032	b
2443508.560	4.893	0.014	1.595	0.009	0.895	0.012	5.100	0.039	3.689	0.012	-0.224	0.029			

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 4.669  0.033    b
2443739.544  4.873  0.008  1.471  0.012  0.771  0.014 | 5.013  0.039  3.698  0.012  -0.181  0.028
 4.692  0.029    m
2443775.472  4.866  0.008  1.553  0.012  0.853  0.014 | 5.068  0.040  3.692  0.012  -0.208  0.029
 4.658  0.030    a
2443776.424  4.864  0.008  1.536  0.012  0.836  0.014 | 5.056  0.040  3.693  0.012  -0.202  0.029
 4.662  0.030    a
2443785.414  4.850  0.008  1.539  0.012  0.839  0.014 | 5.058  0.040  3.693  0.012  -0.203  0.029
 4.647  0.030    a
2443786.401  4.854  0.008  1.538  0.012  0.838  0.014 | 5.057  0.040  3.693  0.012  -0.203  0.029
 4.651  0.030    a
2443787.420  4.851  0.008  1.534  0.012  0.834  0.014 | 5.055  0.040  3.694  0.012  -0.201  0.029
 4.650  0.030    a
2443788.421  4.865  0.008  1.526  0.012  0.826  0.014 | 5.049  0.040  3.694  0.012  -0.199  0.029
 4.666  0.030    a
2443789.412  4.864  0.008  1.527  0.012  0.827  0.014 | 5.050  0.040  3.694  0.012  -0.199  0.029
 4.665  0.030    a
2443790.410  4.860  0.008  1.532  0.012  0.832  0.014 | 5.053  0.040  3.694  0.012  -0.201  0.029
 4.659  0.030    a
2443792.453  4.860  0.008  1.536  0.012  0.836  0.014 | 5.056  0.040  3.693  0.012  -0.202  0.029
 4.658  0.030    a
2443793.403  4.850  0.008  1.541  0.012  0.841  0.014 | 5.060  0.040  3.693  0.012  -0.204  0.029
 4.646  0.030    a
2443797.325  4.867  0.008  1.489  0.012  0.789  0.014 | 5.025  0.039  3.697  0.012  -0.187  0.028
 4.680  0.029    m
2443797.412  4.870  0.008  1.524  0.012  0.824  0.014 | 5.048  0.040  3.694  0.012  -0.198  0.028
 4.672  0.030    a
2443848.210  4.859  0.008  1.460  0.012  0.760  0.014 | 5.006  0.039  3.699  0.012  -0.178  0.028
 4.681  0.029    m
2444083.526  4.801  0.008  1.438  0.012  0.738  0.014 | 4.992  0.039  3.700  0.012  -0.172  0.028
 4.629  0.029    m
2444113.444  4.791  0.008  1.362  0.012  0.662  0.014 | 4.943  0.039  3.705  0.012  -0.150  0.027
 4.641  0.028    m
2444128.340  4.729  0.008  1.367  0.012  0.667  0.014 | 4.947  0.039  3.705  0.012  -0.151  0.027
 4.578  0.028    m
2444133.562  4.729  0.008  1.375  0.012  0.675  0.014 | 4.952  0.039  3.704  0.012  -0.154  0.027
 4.575  0.028    m
2444158.431  4.737  0.008  1.356  0.012  0.656  0.014 | 4.939  0.040  3.706  0.012  -0.148  0.027
 4.589  0.028    m
2444166.508  4.752  0.008  1.355  0.012  0.655  0.014 | 4.939  0.040  3.706  0.012  -0.148  0.027
 4.604  0.028    m
2444172.296  4.746  0.008  1.366  0.012  0.666  0.014 | 4.946  0.039  3.705  0.012  -0.151  0.027
 4.595  0.028    m
2444480.772  4.892  0.008  1.362  0.012  0.662  0.014 | 4.943  0.039  3.705  0.012  -0.150  0.027
 4.742  0.028    p
2444481.805  4.891  0.008  1.363  0.012  0.663  0.014 | 4.944  0.039  3.705  0.012  -0.150  0.027
 4.741  0.028    p
2444486.774  4.793  0.008  1.376  0.012  0.676  0.014 | 4.953  0.039  3.704  0.012  -0.154  0.027
 4.639  0.028    c
2444488.672  4.850  0.008  1.372  0.012  0.672  0.014 | 4.950  0.039  3.705  0.012  -0.153  0.027
 4.697  0.028    c
2444492.685  4.834  0.008  1.365  0.012  0.665  0.014 | 4.945  0.039  3.705  0.012  -0.151  0.027
 4.683  0.028    c
2444498.721  4.812  0.008  1.382  0.012  0.682  0.014 | 4.957  0.039  3.704  0.012  -0.156  0.027
 4.656  0.028    c
2444499.565  4.856  0.008  1.328  0.012  0.628  0.014 | 4.920  0.040  3.708  0.012  -0.140  0.027
 4.716  0.028    m
2444511.437  4.857  0.008  1.325  0.012  0.625  0.014 | 4.918  0.040  3.708  0.012  -0.139  0.026
 4.718  0.028    m
2444514.385  4.851  0.008  1.337  0.012  0.637  0.014 | 4.926  0.040  3.707  0.012  -0.143  0.027
 4.708  0.028    m
2444521.706  4.752  0.008  1.487  0.012  0.787  0.014 | 5.023  0.039  3.697  0.012  -0.186  0.028
 4.566  0.029    c
2444522.665  4.758  0.008  1.491  0.012  0.791  0.014 | 5.026  0.039  3.697  0.012  -0.187  0.028
 4.571  0.029    c
2444535.703  4.748  0.008  1.499  0.012  0.799  0.014 | 5.031  0.039  3.696  0.012  -0.190  0.028
 4.558  0.029    c
2444536.634  4.752  0.008  1.502  0.012  0.802  0.014 | 5.033  0.039  3.696  0.012  -0.191  0.028
 4.561  0.029    c
2444541.289  4.857  0.008  1.358  0.012  0.658  0.014 | 4.941  0.040  3.706  0.012  -0.149  0.027
 4.708  0.028    m
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2444604.591 4.957 0.008 1.442 0.012 0.742 0.014 | 4.995 0.039 3.700 0.012 -0.173 0.028
4.784 0.029 p
2444606.564 4.955 0.008 1.449 0.012 0.749 0.014 | 4.999 0.039 3.699 0.012 -0.175 0.028
4.780 0.029 p
2444854.535 4.883 0.008 1.430 0.012 0.730 0.014 | 4.987 0.039 3.701 0.012 -0.169 0.027
4.714 0.029 m
2444861.878 4.818 0.008 1.427 0.012 0.727 0.014 | 4.985 0.039 3.701 0.012 -0.168 0.027
4.650 0.029 c
2444862.855 4.802 0.008 1.428 0.012 0.728 0.014 | 4.986 0.039 3.701 0.012 -0.169 0.027
4.633 0.029 c
2444872.827 4.765 0.008 1.423 0.012 0.723 0.014 | 4.983 0.039 3.701 0.012 -0.167 0.027
4.598 0.029 c
2445911.904 4.860 0.010 1.350 0.010 0.650 0.013 | 4.935 0.039 3.706 0.012 -0.147 0.027
4.713 0.028 d
2445939.786 4.810 0.010 1.320 0.010 0.620 0.013 | 4.914 0.039 3.708 0.012 -0.138 0.026
4.672 0.028 d
2445952.458 4.828 0.008 1.291 0.012 0.591 0.014 | 4.892 0.040 3.711 0.012 -0.129 0.026
4.699 0.027 m
2445957.471 4.814 0.008 1.276 0.012 0.576 0.014 | 4.879 0.040 3.712 0.012 -0.124 0.026
4.690 0.027 m
2445957.777 4.810 0.010 1.330 0.010 0.630 0.013 | 4.921 0.039 3.708 0.012 -0.141 0.026
4.669 0.028 d
2445959.804 4.820 0.010 1.320 0.010 0.620 0.013 | 4.914 0.039 3.708 0.012 -0.138 0.026
4.682 0.028 d
2445961.711 4.820 0.010 1.330 0.010 0.630 0.013 | 4.921 0.039 3.708 0.012 -0.141 0.026
4.679 0.028 d
2445962.780 4.820 0.010 1.320 0.010 0.620 0.013 | 4.914 0.039 3.708 0.012 -0.138 0.026
4.682 0.028 d
2445964.724 4.830 0.010 1.280 0.010 0.580 0.013 | 4.883 0.040 3.712 0.012 -0.125 0.026
4.705 0.028 d
2445967.704 4.820 0.010 1.300 0.010 0.600 0.013 | 4.899 0.040 3.710 0.012 -0.131 0.026
4.689 0.028 d
2445985.663 4.830 0.010 1.310 0.010 0.610 0.013 | 4.907 0.040 3.709 0.012 -0.135 0.026
4.695 0.028 d
2445989.434 4.835 0.008 1.267 0.012 0.567 0.014 | 4.871 0.040 3.713 0.012 -0.121 0.026
4.714 0.027 m
2445990.358 4.833 0.008 1.263 0.012 0.563 0.014 | 4.868 0.040 3.713 0.012 -0.119 0.026
4.714 0.027 m
2445990.366 4.831 0.008 1.273 0.012 0.573 0.014 | 4.877 0.040 3.712 0.012 -0.123 0.026
4.708 0.027 m
2445991.373 4.834 0.008 1.268 0.012 0.568 0.014 | 4.872 0.040 3.713 0.012 -0.121 0.026
4.713 0.027 m
2445993.370 4.847 0.008 1.251 0.012 0.551 0.014 | 4.857 0.041 3.714 0.012 -0.115 0.026
4.732 0.027 m
2446009.636 4.860 0.010 1.300 0.010 0.600 0.013 | 4.899 0.040 3.710 0.012 -0.131 0.026
4.729 0.028 d
2446012.617 4.870 0.010 1.310 0.010 0.610 0.013 | 4.907 0.040 3.709 0.012 -0.135 0.026
4.735 0.028 d
2446018.306 4.879 0.008 1.224 0.012 0.524 0.014 | 4.830 0.041 3.717 0.012 -0.105 0.026
4.774 0.027 m
2446019.245 4.921 0.008 1.171 0.012 0.471 0.014 | 4.769 0.043 3.724 0.012 -0.084 0.025
4.837 0.026 m
2446025.693 4.880 0.010 1.310 0.010 0.610 0.013 | 4.907 0.040 3.709 0.012 -0.135 0.026
4.745 0.028 d
2446029.602 4.890 0.010 1.320 0.010 0.620 0.013 | 4.914 0.039 3.708 0.012 -0.138 0.026
4.752 0.028 d
2446031.593 4.880 0.010 1.330 0.010 0.630 0.013 | 4.921 0.039 3.708 0.012 -0.141 0.026
4.739 0.028 d
2446034.606 4.900 0.010 1.330 0.010 0.630 0.013 | 4.921 0.039 3.708 0.012 -0.141 0.026
4.759 0.028 d
2446038.355 4.885 0.008 1.295 0.012 0.595 0.014 | 4.895 0.040 3.710 0.012 -0.130 0.026
4.755 0.027 e
2446039.276 4.882 0.008 1.292 0.012 0.592 0.014 | 4.892 0.040 3.711 0.012 -0.129 0.026
4.753 0.027 e
2446049.508 4.906 0.008 1.321 0.012 0.621 0.014 | 4.915 0.040 3.708 0.012 -0.138 0.026
4.768 0.028 m
2446050.620 4.900 0.010 1.380 0.010 0.680 0.013 | 4.955 0.039 3.704 0.012 -0.155 0.027
4.745 0.029 d
2446074.222 4.912 0.008 1.317 0.012 0.617 0.014 | 4.912 0.040 3.709 0.012 -0.137 0.026
4.775 0.028 m
2446082.595 4.910 0.010 1.370 0.010 0.670 0.013 | 4.949 0.039 3.705 0.012 -0.152 0.027

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 4.758  0.029    d
2446083.587  4.930  0.010  1.390  0.010  0.690  0.013 | 4.962  0.039  3.703  0.012  -0.158  0.027
 4.772  0.029    d
2446084.602  4.940  0.010  1.370  0.010  0.670  0.013 | 4.949  0.039  3.705  0.012  -0.152  0.027
 4.788  0.029    d
2446085.599  4.940  0.010  1.370  0.010  0.670  0.013 | 4.949  0.039  3.705  0.012  -0.152  0.027
 4.788  0.029    d
2446101.585  4.970  0.010  1.380  0.010  0.680  0.013 | 4.955  0.039  3.704  0.012  -0.155  0.027
 4.815  0.029    d
2446102.606  4.980  0.010  1.380  0.010  0.680  0.013 | 4.955  0.039  3.704  0.012  -0.155  0.027
 4.825  0.029    d
2446181.590  4.983  0.008  1.340  0.012  0.640  0.014 | 4.928  0.040  3.707  0.012  -0.144  0.027
 4.839  0.028    e
2446182.560  4.990  0.008  1.360  0.012  0.660  0.014 | 4.942  0.040  3.705  0.012  -0.149  0.027
 4.841  0.028    e
2446196.577  4.947  0.008  1.395  0.012  0.695  0.014 | 4.965  0.039  3.703  0.012  -0.159  0.027
 4.788  0.028    e
2446198.553  4.968  0.008  1.383  0.012  0.683  0.014 | 4.957  0.039  3.704  0.012  -0.156  0.027
 4.812  0.028    e
2446228.536  4.947  0.008  1.354  0.012  0.654  0.014 | 4.938  0.040  3.706  0.012  -0.148  0.027
 4.799  0.028    e
2446270.450  4.862  0.008  1.304  0.010  0.604  0.013 | 4.902  0.040  3.710  0.012  -0.133  0.026
 4.729  0.027    f
2446276.554  4.843  0.008  1.271  0.012  0.571  0.014 | 4.875  0.040  3.713  0.012  -0.122  0.026
 4.721  0.027    e
2446281.392  4.840  0.008  1.252  0.012  0.552  0.014 | 4.858  0.041  3.714  0.012  -0.116  0.026
 4.724  0.027    e
2446281.548  4.836  0.008  1.251  0.012  0.551  0.014 | 4.857  0.041  3.714  0.012  -0.115  0.026
 4.721  0.027    e
2446283.468  4.826  0.008  1.241  0.012  0.541  0.014 | 4.847  0.041  3.715  0.012  -0.112  0.026
 4.714  0.027    e
2446286.480  4.820  0.008  1.242  0.010  0.542  0.013 | 4.848  0.040  3.715  0.012  -0.112  0.026
 4.708  0.027    f
2446293.530  4.815  0.008  1.228  0.010  0.528  0.013 | 4.835  0.040  3.717  0.012  -0.107  0.025
 4.708  0.027    f
2446299.397  4.801  0.008  1.197  0.012  0.497  0.014 | 4.801  0.042  3.721  0.012  -0.095  0.025
 4.706  0.027    e
2446300.438  4.793  0.008  1.202  0.012  0.502  0.014 | 4.806  0.042  3.720  0.012  -0.097  0.025
 4.696  0.027    e
2446301.485  4.795  0.008  1.213  0.012  0.513  0.014 | 4.819  0.041  3.719  0.012  -0.101  0.025
 4.694  0.027    e
2446302.467  4.792  0.008  1.204  0.012  0.504  0.014 | 4.809  0.042  3.720  0.012  -0.098  0.025
 4.694  0.027    e
2446303.471  4.791  0.008  1.205  0.012  0.505  0.014 | 4.810  0.042  3.720  0.012  -0.098  0.025
 4.693  0.027    e
2446305.520  4.795  0.008  1.204  0.010  0.504  0.013 | 4.809  0.041  3.720  0.012  -0.098  0.025
 4.697  0.026    f
2446311.527  4.772  0.008  1.200  0.012  0.500  0.014 | 4.804  0.042  3.720  0.012  -0.096  0.025
 4.676  0.027    e
2446315.420  4.781  0.008  1.197  0.010  0.497  0.013 | 4.801  0.041  3.721  0.012  -0.095  0.025
 4.686  0.026    f
2446315.427  4.785  0.008  1.191  0.012  0.491  0.014 | 4.794  0.042  3.721  0.012  -0.093  0.025
 4.692  0.026    e
2446317.440  4.779  0.008  1.201  0.010  0.501  0.013 | 4.805  0.041  3.720  0.012  -0.097  0.025
 4.682  0.026    f
2446318.478  4.777  0.008  1.199  0.012  0.499  0.014 | 4.803  0.042  3.720  0.012  -0.096  0.025
 4.681  0.027    e
2446319.395  4.776  0.008  1.200  0.012  0.500  0.014 | 4.804  0.042  3.720  0.012  -0.096  0.025
 4.680  0.027    e
2446326.510  4.780  0.008  1.207  0.010  0.507  0.013 | 4.812  0.041  3.719  0.012  -0.099  0.025
 4.681  0.026    f
2446327.444  4.738  0.008  1.184  0.012  0.484  0.014 | 4.785  0.042  3.722  0.012  -0.090  0.025
 4.648  0.026    e
2446329.752  4.790  0.010  1.240  0.010  0.540  0.013 | 4.847  0.040  3.716  0.012  -0.111  0.026
 4.679  0.027    g
2446332.390  4.790  0.008  1.214  0.010  0.514  0.013 | 4.820  0.041  3.718  0.012  -0.102  0.025
 4.688  0.027    f
2446333.707  4.790  0.010  1.230  0.010  0.530  0.013 | 4.837  0.040  3.717  0.012  -0.108  0.025
 4.682  0.027    g
2446334.778  4.790  0.010  1.240  0.010  0.540  0.013 | 4.847  0.040  3.716  0.012  -0.111  0.026
 4.679  0.027    g
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2446335.750  4.780  0.010  1.250  0.010  0.550  0.013 | 4.856  0.040  3.715  0.012  -0.115  0.026
 4.665  0.028    g
2446347.743  4.780  0.010  1.250  0.010  0.550  0.013 | 4.856  0.040  3.715  0.012  -0.115  0.026
 4.665  0.028    g
2446349.310  4.793  0.008  1.227  0.010  0.527  0.013 | 4.834  0.040  3.717  0.012  -0.107  0.025
 4.686  0.027    f
2446350.785  4.790  0.010  1.240  0.010  0.540  0.013 | 4.847  0.040  3.716  0.012  -0.111  0.026
 4.679  0.027    g
2446351.802  4.790  0.010  1.260  0.010  0.560  0.013 | 4.865  0.040  3.714  0.012  -0.118  0.026
 4.672  0.028    g
2446352.794  4.800  0.010  1.250  0.010  0.550  0.013 | 4.856  0.040  3.715  0.012  -0.115  0.026
 4.685  0.028    g
2446353.745  4.790  0.010  1.270  0.010  0.570  0.013 | 4.874  0.040  3.713  0.012  -0.122  0.026
 4.668  0.028    g
2446356.330  4.799  0.008  1.231  0.010  0.531  0.013 | 4.838  0.040  3.717  0.012  -0.108  0.026
 4.691  0.027    f
2446357.688  4.810  0.010  1.270  0.010  0.570  0.013 | 4.874  0.040  3.713  0.012  -0.122  0.026
 4.688  0.028    g
2446364.418  4.804  0.008  1.235  0.012  0.535  0.014 | 4.842  0.041  3.716  0.012  -0.109  0.026
 4.695  0.027    e
2446364.440  4.818  0.008  1.253  0.010  0.553  0.013 | 4.859  0.040  3.714  0.012  -0.116  0.026
 4.702  0.027    f
2446372.300  4.838  0.008  1.246  0.010  0.546  0.013 | 4.852  0.040  3.715  0.012  -0.113  0.026
 4.725  0.027    f
2446376.470  4.840  0.008  1.254  0.010  0.554  0.013 | 4.860  0.040  3.714  0.012  -0.116  0.026
 4.724  0.027    f
2446376.707  4.870  0.010  1.260  0.010  0.560  0.013 | 4.865  0.040  3.714  0.012  -0.118  0.026
 4.752  0.028    g
2446377.700  4.830  0.010  1.280  0.010  0.580  0.013 | 4.883  0.040  3.712  0.012  -0.125  0.026
 4.705  0.028    g
2446378.280  4.834  0.008  1.268  0.010  0.568  0.013 | 4.872  0.040  3.713  0.012  -0.121  0.026
 4.713  0.027    f
2446391.652  4.870  0.010  1.290  0.010  0.590  0.013 | 4.891  0.040  3.711  0.012  -0.128  0.026
 4.742  0.028    g
2446392.647  4.870  0.010  1.290  0.010  0.590  0.013 | 4.891  0.040  3.711  0.012  -0.128  0.026
 4.742  0.028    g
2446409.661  4.870  0.010  1.310  0.010  0.610  0.013 | 4.907  0.040  3.709  0.012  -0.135  0.026
 4.735  0.028    g
2446410.560  4.860  0.010  1.290  0.010  0.590  0.013 | 4.891  0.040  3.711  0.012  -0.128  0.026
 4.732  0.028    g
2446412.310  4.875  0.008  1.296  0.010  0.596  0.013 | 4.896  0.040  3.710  0.012  -0.130  0.026
 4.745  0.027    f
2446427.566  4.940  0.010  1.330  0.010  0.630  0.013 | 4.921  0.039  3.708  0.012  -0.141  0.026
 4.799  0.028    g
2446428.571  4.940  0.010  1.320  0.010  0.620  0.013 | 4.914  0.039  3.708  0.012  -0.138  0.026
 4.802  0.028    g
2446432.569  4.940  0.010  1.310  0.010  0.610  0.013 | 4.907  0.040  3.709  0.012  -0.135  0.026
 4.805  0.028    g
2446449.573  4.990  0.010  1.360  0.010  0.660  0.013 | 4.942  0.039  3.705  0.012  -0.149  0.027
 4.841  0.029    g
2446450.574  4.960  0.010  1.350  0.010  0.650  0.013 | 4.935  0.039  3.706  0.012  -0.147  0.027
 4.813  0.028    g
2446452.253  4.956  0.008  1.322  0.012  0.622  0.014 | 4.916  0.040  3.708  0.012  -0.138  0.026
 4.818  0.028    e
2446455.568  4.970  0.010  1.380  0.010  0.680  0.013 | 4.955  0.039  3.704  0.012  -0.155  0.027
 4.815  0.029    g
2446466.230  4.930  0.008  1.239  0.012  0.539  0.014 | 4.846  0.041  3.716  0.012  -0.111  0.026
 4.819  0.027    h
2446678.491  4.929  0.008  1.235  0.012  0.535  0.014 | 4.842  0.041  3.716  0.012  -0.109  0.026
 4.820  0.027    h
2446679.464  4.925  0.008  1.223  0.012  0.523  0.014 | 4.829  0.041  3.717  0.012  -0.105  0.026
 4.820  0.027    h
2446680.444  4.917  0.008  1.223  0.012  0.523  0.014 | 4.829  0.041  3.717  0.012  -0.105  0.026
 4.812  0.027    h
2446690.381  4.905  0.008  1.220  0.012  0.520  0.014 | 4.826  0.041  3.718  0.012  -0.104  0.026
 4.801  0.027    h
2446693.371  4.903  0.008  1.199  0.012  0.499  0.014 | 4.803  0.042  3.720  0.012  -0.096  0.025
 4.807  0.027    h
2446694.357  4.915  0.008  1.174  0.012  0.474  0.014 | 4.772  0.043  3.724  0.012  -0.085  0.025
 4.830  0.026    h
2446710.686  4.920  0.010  1.240  0.020  0.540  0.022 | 4.847  0.044  3.716  0.012  -0.111  0.026
```

4.809 0.028 i
2446713.795 4.880 0.010 1.250 0.020 0.550 0.022 | 4.856 0.043 3.715 0.012 -0.115 0.026
4.765 0.028 i
2446714.782 4.880 0.010 1.230 0.020 0.530 0.022 | 4.837 0.044 3.717 0.012 -0.108 0.026
4.772 0.028 i
2446717.727 4.880 0.010 1.230 0.020 0.530 0.022 | 4.837 0.044 3.717 0.012 -0.108 0.026
4.772 0.028 i
2446722.351 4.891 0.008 1.229 0.012 0.529 0.014 | 4.836 0.041 3.717 0.012 -0.107 0.026
4.784 0.027 h
2446730.780 4.910 0.010 1.210 0.020 0.510 0.022 | 4.815 0.045 3.719 0.012 -0.100 0.026
4.810 0.028 i
2446732.739 4.880 0.010 1.250 0.020 0.550 0.022 | 4.856 0.043 3.715 0.012 -0.115 0.026
4.765 0.028 i
2446735.684 4.870 0.010 1.220 0.020 0.520 0.022 | 4.826 0.045 3.718 0.012 -0.104 0.026
4.766 0.028 i
2446738.503 4.909 0.008 1.224 0.012 0.524 0.014 | 4.830 0.041 3.717 0.012 -0.105 0.026
4.804 0.027 h
2446746.258 4.919 0.008 1.183 0.012 0.483 0.014 | 4.784 0.042 3.722 0.012 -0.089 0.025
4.830 0.026 h
2446748.275 4.925 0.008 1.233 0.012 0.533 0.014 | 4.840 0.041 3.716 0.012 -0.109 0.026
4.816 0.027 h
2446754.606 4.900 0.010 1.290 0.020 0.590 0.022 | 4.891 0.042 3.711 0.012 -0.128 0.027
4.772 0.028 i
2446755.654 4.910 0.010 1.250 0.020 0.550 0.022 | 4.856 0.043 3.715 0.012 -0.115 0.026
4.795 0.028 i
2446756.738 4.950 0.010 1.250 0.020 0.550 0.022 | 4.856 0.043 3.715 0.012 -0.115 0.026
4.835 0.028 i
2446759.611 4.840 0.010 1.240 0.020 0.540 0.022 | 4.847 0.044 3.716 0.012 -0.111 0.026
4.729 0.028 i
2446773.632 4.910 0.010 1.210 0.020 0.510 0.022 | 4.815 0.045 3.719 0.012 -0.100 0.026
4.810 0.028 i
2446774.614 4.940 0.010 1.190 0.020 0.490 0.022 | 4.792 0.046 3.721 0.013 -0.092 0.026
4.848 0.028 i
2446775.269 4.947 0.008 1.228 0.012 0.528 0.014 | 4.835 0.041 3.717 0.012 -0.107 0.026
4.840 0.027 h
2446776.612 4.950 0.010 1.230 0.020 0.530 0.022 | 4.837 0.044 3.717 0.012 -0.108 0.026
4.842 0.028 i
2446777.578 4.930 0.010 1.230 0.020 0.530 0.022 | 4.837 0.044 3.717 0.012 -0.108 0.026
4.822 0.028 i
2446794.626 5.010 0.010 1.190 0.020 0.490 0.022 | 4.792 0.046 3.721 0.013 -0.092 0.026
4.918 0.028 i
2446795.595 5.020 0.010 1.260 0.020 0.560 0.022 | 4.865 0.043 3.714 0.012 -0.118 0.026
4.902 0.028 i
2446797.577 4.990 0.010 1.240 0.020 0.540 0.022 | 4.847 0.044 3.716 0.012 -0.111 0.026
4.879 0.028 i
2446800.590 4.990 0.010 1.250 0.020 0.550 0.022 | 4.856 0.043 3.715 0.012 -0.115 0.026
4.875 0.028 i
2446814.578 5.000 0.010 1.300 0.020 0.600 0.022 | 4.899 0.042 3.710 0.012 -0.131 0.027
4.869 0.029 i
2446817.582 5.000 0.010 1.300 0.020 0.600 0.022 | 4.899 0.042 3.710 0.012 -0.131 0.027
4.869 0.029 i
2446945.942 4.990 0.010 1.130 0.020 0.430 0.022 | 4.710 0.051 3.730 0.013 -0.066 0.026
4.924 0.027 i
2446948.947 4.970 0.010 1.200 0.020 0.500 0.022 | 4.804 0.046 3.720 0.013 -0.096 0.026
4.874 0.028 i
2446949.941 4.980 0.010 1.200 0.020 0.500 0.022 | 4.804 0.046 3.720 0.013 -0.096 0.026
4.884 0.028 i
2446951.907 4.990 0.010 1.200 0.020 0.500 0.022 | 4.804 0.046 3.720 0.013 -0.096 0.026
4.894 0.028 i
2446966.502 4.976 0.008 1.218 0.012 0.518 0.014 | 4.824 0.041 3.718 0.012 -0.103 0.025
4.873 0.027 h
2446983.528 4.977 0.008 1.211 0.012 0.511 0.014 | 4.817 0.041 3.719 0.012 -0.100 0.025
4.877 0.027 h
2446984.490 4.994 0.008 1.208 0.012 0.508 0.014 | 4.813 0.042 3.719 0.012 -0.099 0.025
4.895 0.027 h
2446985.487 4.985 0.008 1.222 0.012 0.522 0.014 | 4.828 0.041 3.718 0.012 -0.105 0.026
4.880 0.027 h
2446994.846 4.970 0.010 1.220 0.020 0.520 0.022 | 4.826 0.045 3.718 0.012 -0.104 0.026
4.866 0.028 i
2446997.515 5.000 0.008 1.203 0.012 0.503 0.014 | 4.808 0.042 3.720 0.012 -0.097 0.025
4.903 0.027 h

2447016.490	5.022	0.008	1.237	0.012	0.537	0.014	|	4.844	0.041	3.716	0.012	-0.110	0.026	4.912	0.027	h
2447018.466	5.018	0.008	1.245	0.012	0.545	0.014	|	4.851	0.041	3.715	0.012	-0.113	0.026	4.905	0.027	h
2447019.443	5.020	0.008	1.240	0.012	0.540	0.014	|	4.847	0.041	3.716	0.012	-0.111	0.026	4.909	0.027	h
2447027.372	5.029	0.008	1.232	0.012	0.532	0.014	|	4.839	0.041	3.716	0.012	-0.108	0.026	4.921	0.027	h
2447028.777	5.010	0.010	1.270	0.020	0.570	0.022	|	4.874	0.043	3.713	0.012	-0.122	0.027	4.888	0.028	i
2447029.386	5.023	0.008	1.239	0.012	0.539	0.014	|	4.846	0.041	3.716	0.012	-0.111	0.026	4.912	0.027	h
2447031.405	5.040	0.008	1.232	0.012	0.532	0.014	|	4.839	0.041	3.716	0.012	-0.108	0.026	4.932	0.027	h
2447032.401	5.033	0.008	1.233	0.012	0.533	0.014	|	4.840	0.041	3.716	0.012	-0.109	0.026	4.924	0.027	h
2447040.462	5.000	0.008	1.242	0.012	0.542	0.014	|	4.848	0.041	3.715	0.012	-0.112	0.026	4.888	0.027	h
2447045.834	5.030	0.010	1.290	0.020	0.590	0.022	|	4.891	0.042	3.711	0.012	-0.128	0.027	4.902	0.028	i
2447046.799	5.010	0.010	1.290	0.020	0.590	0.022	|	4.891	0.042	3.711	0.012	-0.128	0.027	4.882	0.028	i
2447047.820	5.030	0.010	1.260	0.020	0.560	0.022	|	4.865	0.043	3.714	0.012	-0.118	0.026	4.912	0.028	i
2447049.750	4.970	0.010	1.270	0.020	0.570	0.022	|	4.874	0.043	3.713	0.012	-0.122	0.027	4.848	0.028	i
2447050.843	4.980	0.010	1.250	0.020	0.550	0.022	|	4.856	0.043	3.715	0.012	-0.115	0.026	4.865	0.028	i
2447051.702	4.990	0.010	1.250	0.020	0.550	0.022	|	4.856	0.043	3.715	0.012	-0.115	0.026	4.875	0.028	i
2447060.348	4.972	0.008	1.212	0.012	0.512	0.014	|	4.818	0.041	3.719	0.012	-0.101	0.025	4.871	0.027	h
2447062.354	4.976	0.008	1.215	0.012	0.515	0.014	|	4.821	0.041	3.718	0.012	-0.102	0.025	4.874	0.027	h
2447062.775	4.960	0.010	1.240	0.020	0.540	0.022	|	4.847	0.044	3.716	0.012	-0.111	0.026	4.849	0.028	i
2447066.782	4.980	0.010	1.230	0.020	0.530	0.022	|	4.837	0.044	3.717	0.012	-0.108	0.026	4.872	0.028	i
2447067.687	4.970	0.010	1.220	0.020	0.520	0.022	|	4.826	0.045	3.718	0.012	-0.104	0.026	4.866	0.028	i
2447087.719	4.950	0.010	1.210	0.020	0.510	0.022	|	4.815	0.045	3.719	0.012	-0.100	0.026	4.850	0.028	i
2447088.752	4.960	0.010	1.200	0.020	0.500	0.022	|	4.804	0.046	3.720	0.013	-0.096	0.026	4.864	0.028	i
2447089.627	4.940	0.010	1.210	0.020	0.510	0.022	|	4.815	0.045	3.719	0.012	-0.100	0.026	4.840	0.028	i
2447098.269	4.935	0.008	1.173	0.012	0.473	0.014	|	4.771	0.043	3.724	0.012	-0.085	0.025	4.850	0.026	h
2447100.345	4.935	0.008	1.173	0.012	0.473	0.014	|	4.771	0.043	3.724	0.012	-0.085	0.025	4.850	0.026	h
2447102.745	4.920	0.010	1.210	0.020	0.510	0.022	|	4.815	0.045	3.719	0.012	-0.100	0.026	4.820	0.028	i
2447106.696	4.900	0.010	1.210	0.020	0.510	0.022	|	4.815	0.045	3.719	0.012	-0.100	0.026	4.800	0.028	i
2447124.681	4.910	0.010	1.170	0.020	0.470	0.022	|	4.767	0.048	3.724	0.013	-0.084	0.026	4.826	0.028	i
2447125.680	4.900	0.010	1.170	0.020	0.470	0.022	|	4.767	0.048	3.724	0.013	-0.084	0.026	4.816	0.028	i
2447126.627	4.900	0.010	1.170	0.020	0.470	0.022	|	4.767	0.048	3.724	0.013	-0.084	0.026	4.816	0.028	i
2447127.634	4.910	0.010	1.170	0.020	0.470	0.022	|	4.767	0.048	3.724	0.013	-0.084	0.026	4.826	0.028	i
2447128.622	4.900	0.010	1.180	0.020	0.480	0.022	|	4.780	0.047	3.723	0.013	-0.088	0.026	4.812	0.028	i
2447160.301	4.917	0.008	1.106	0.012	0.406	0.014	|	4.670	0.046	3.735	0.013	-0.055	0.024	4.862	0.025	h
2447169.577	4.880	0.010	1.160	0.020	0.460	0.022	|	4.754	0.048	3.726	0.013	-0.079	0.026	4.801	0.028	i
2447170.586	4.860	0.010	1.170	0.020	0.470	0.022	|	4.767	0.048	3.724	0.013	-0.084	0.026	4.776	0.028	i
2447173.578	4.910	0.010	1.120	0.020	0.420	0.022	|	4.694	0.052	3.732	0.013	-0.062	0.025			

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 4.848  0.027    i
2447174.578  4.910  0.010  1.100  0.020  0.400  0.022 | 4.660  0.054  3.736  0.013  -0.052  0.025
 4.858  0.027    i
2447175.586  4.960  0.010  1.150  0.020  0.450  0.022 | 4.740  0.049  3.727  0.013  -0.075  0.026
 4.885  0.028    i
2447207.242  4.966  0.008  1.155  0.012  0.455  0.014 | 4.747  0.043  3.726  0.012  -0.077  0.025
 4.889  0.026    h
2447208.239  4.981  0.008  1.147  0.012  0.447  0.014 | 4.735  0.044  3.728  0.012  -0.074  0.025
 4.907  0.026    h
2447213.249  5.007  0.008  1.162  0.012  0.462  0.014 | 4.757  0.043  3.725  0.012  -0.080  0.025
 4.927  0.026    h
2447290.577  5.085  0.008  1.189  0.012  0.489  0.014 | 4.791  0.042  3.722  0.012  -0.092  0.025
 4.993  0.026    h
2447320.932  5.009  0.015  1.225  0.016  0.525  0.018 | 4.831  0.043  3.717  0.012  -0.106  0.026
 4.903  0.030    k
2447334.515  5.022  0.008  1.216  0.012  0.516  0.014 | 4.822  0.041  3.718  0.012  -0.102  0.025
 4.920  0.027    h
2447335.517  5.022  0.008  1.203  0.012  0.503  0.014 | 4.808  0.042  3.720  0.012  -0.097  0.025
 4.925  0.027    h
2447349.477  4.997  0.008  1.179  0.012  0.479  0.014 | 4.779  0.042  3.723  0.012  -0.088  0.025
 4.909  0.026    h
2447371.475  4.962  0.008  1.148  0.012  0.448  0.014 | 4.737  0.044  3.727  0.012  -0.074  0.025
 4.888  0.026    h
2447372.463  4.976  0.008  1.150  0.012  0.450  0.014 | 4.740  0.044  3.727  0.012  -0.075  0.025
 4.901  0.026    h
2447374.429  4.961  0.008  1.162  0.012  0.462  0.014 | 4.757  0.043  3.725  0.012  -0.080  0.025
 4.881  0.026    h
2447375.421  4.986  0.008  1.161  0.012  0.461  0.014 | 4.755  0.043  3.725  0.012  -0.080  0.025
 4.906  0.026    h
2447408.450  5.002  0.008  1.141  0.012  0.441  0.014 | 4.727  0.044  3.729  0.012  -0.071  0.025
 4.931  0.026    h
2447409.400  5.013  0.008  1.144  0.012  0.444  0.014 | 4.731  0.044  3.728  0.012  -0.072  0.025
 4.941  0.026    h
2447411.507  4.963  0.008  1.106  0.012  0.406  0.014 | 4.670  0.046  3.735  0.013  -0.055  0.024
 4.908  0.025    h
2447411.847  5.000  0.015  1.166  0.016  0.466  0.018 | 4.762  0.045  3.725  0.013  -0.082  0.025
 4.918  0.029    k
2447412.777  5.006  0.015  1.144  0.016  0.444  0.018 | 4.731  0.046  3.728  0.013  -0.072  0.025
 4.934  0.029    k
2447433.328  5.022  0.008  1.154  0.012  0.454  0.014 | 4.745  0.043  3.727  0.012  -0.077  0.025
 4.945  0.026    h
2447435.829  5.035  0.015  1.184  0.016  0.484  0.018 | 4.785  0.044  3.722  0.012  -0.090  0.026
 4.945  0.030    k
2447436.742  5.006  0.015  1.229  0.016  0.529  0.018 | 4.836  0.042  3.717  0.012  -0.107  0.026
 4.899  0.030    k
2447437.707  5.028  0.015  1.161  0.016  0.461  0.018 | 4.755  0.045  3.725  0.013  -0.080  0.025
 4.948  0.029    k
2447440.738  5.053  0.015  1.173  0.016  0.473  0.018 | 4.771  0.045  3.724  0.012  -0.085  0.025
 4.968  0.030    k
2447441.713  5.044  0.015  1.187  0.016  0.487  0.018 | 4.789  0.044  3.722  0.012  -0.091  0.026
 4.953  0.030    k
2447446.346  5.056  0.008  1.163  0.012  0.463  0.014 | 4.758  0.043  3.725  0.012  -0.081  0.025
 4.975  0.026    h
2447454.349  5.050  0.008  1.165  0.012  0.465  0.014 | 4.761  0.043  3.725  0.012  -0.082  0.025
 4.968  0.026    h
2447461.301  5.055  0.008  1.170  0.012  0.470  0.014 | 4.767  0.043  3.724  0.012  -0.084  0.025
 4.971  0.026    h
2447470.677  5.062  0.015  1.196  0.016  0.496  0.018 | 4.799  0.044  3.721  0.012  -0.095  0.026
 4.967  0.030    k
2447472.681  5.014  0.015  1.186  0.016  0.486  0.018 | 4.788  0.044  3.722  0.012  -0.090  0.026
 4.924  0.030    k
2447475.643  5.041  0.015  1.193  0.016  0.493  0.018 | 4.796  0.044  3.721  0.012  -0.093  0.026
 4.948  0.030    k
2447477.628  5.046  0.015  1.179  0.016  0.479  0.018 | 4.779  0.044  3.723  0.012  -0.088  0.025
 4.958  0.030    k
2447489.240  5.035  0.008  1.133  0.012  0.433  0.014 | 4.714  0.044  3.730  0.012  -0.067  0.025
 4.968  0.026    h
2447501.661  5.023  0.015  1.158  0.016  0.458  0.018 | 4.751  0.046  3.726  0.013  -0.079  0.025
 4.944  0.029    k
2447509.224  4.992  0.008  1.119  0.012  0.419  0.014 | 4.692  0.045  3.732  0.013  -0.061  0.024
 4.931  0.026    h
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2447516.592 5.015 0.015 1.164 0.016 0.464 0.018 | 4.759 0.045 3.725 0.013 -0.081 0.025
4.934 0.029 k
2447525.609 4.988 0.015 1.178 0.016 0.478 0.018 | 4.778 0.045 3.723 0.012 -0.087 0.025
4.901 0.030 k
2447526.584 5.002 0.015 1.129 0.016 0.429 0.018 | 4.708 0.048 3.731 0.013 -0.066 0.025
4.936 0.029 k
2447527.592 4.962 0.015 1.162 0.016 0.462 0.018 | 4.757 0.045 3.725 0.013 -0.080 0.025
4.882 0.029 k
2447529.242 4.985 0.008 1.108 0.012 0.408 0.014 | 4.674 0.046 3.734 0.013 -0.056 0.024
4.929 0.025 h
2447530.217 4.991 0.008 1.104 0.012 0.404 0.014 | 4.667 0.046 3.735 0.013 -0.054 0.024
4.937 0.025 h
2447538.199 4.982 0.008 1.096 0.012 0.396 0.014 | 4.652 0.046 3.737 0.013 -0.050 0.024
4.932 0.025 h
2447540.577 4.984 0.015 1.135 0.016 0.435 0.018 | 4.718 0.047 3.730 0.013 -0.068 0.025
4.916 0.029 k
2447552.222 4.989 0.008 1.079 0.012 0.379 0.014 | 4.620 0.048 3.740 0.013 -0.042 0.024
4.947 0.025 h
2447703.911 5.086 0.015 1.191 0.016 0.491 0.018 | 4.794 0.044 3.721 0.012 -0.093 0.026
4.993 0.030 k
2447712.496 5.070 0.008 1.137 0.012 0.437 0.014 | 4.721 0.044 3.729 0.012 -0.069 0.025
5.001 0.026 h
2447788.768 4.991 0.015 1.136 0.016 0.436 0.018 | 4.719 0.047 3.729 0.013 -0.069 0.025
4.922 0.029 k
2447790.740 5.015 0.015 1.122 0.016 0.422 0.018 | 4.697 0.048 3.732 0.013 -0.062 0.025
4.953 0.029 k
2447793.806 4.950 0.015 1.133 0.016 0.433 0.018 | 4.714 0.047 3.730 0.013 -0.067 0.025
4.883 0.029 k
2447805.386 4.988 0.008 1.077 0.012 0.377 0.014 | 4.616 0.048 3.741 0.013 -0.041 0.024
4.947 0.025 h
2447806.350 4.989 0.008 1.093 0.012 0.393 0.014 | 4.647 0.047 3.737 0.013 -0.049 0.024
4.940 0.025 h
2447806.779 4.971 0.015 1.100 0.016 0.400 0.018 | 4.660 0.050 3.736 0.013 -0.052 0.025
4.919 0.029 k
2447810.740 4.967 0.015 1.145 0.016 0.445 0.018 | 4.733 0.046 3.728 0.013 -0.073 0.025
4.894 0.029 k
2447818.734 4.989 0.015 1.128 0.016 0.428 0.018 | 4.707 0.048 3.731 0.013 -0.065 0.025
4.924 0.029 k
2447820.304 5.003 0.008 1.082 0.012 0.382 0.014 | 4.626 0.047 3.740 0.013 -0.044 0.024
4.959 0.025 h
2447821.350 4.995 0.008 1.076 0.012 0.376 0.014 | 4.614 0.048 3.741 0.013 -0.041 0.024
4.954 0.025 h
2447823.268 4.997 0.008 1.079 0.012 0.379 0.014 | 4.620 0.048 3.740 0.013 -0.042 0.024
4.955 0.025 h
2447824.277 5.021 0.008 1.079 0.012 0.379 0.014 | 4.620 0.048 3.740 0.013 -0.042 0.024
4.979 0.025 h
2447825.280 5.010 0.008 1.077 0.012 0.377 0.014 | 4.616 0.048 3.741 0.013 -0.041 0.024
4.969 0.025 h
2447827.738 4.986 0.015 1.126 0.016 0.426 0.018 | 4.704 0.048 3.731 0.013 -0.064 0.025
4.922 0.029 k
2447835.698 4.991 0.015 1.111 0.016 0.411 0.018 | 4.679 0.049 3.734 0.013 -0.057 0.025
4.934 0.029 k
2447840.256 5.018 0.008 1.093 0.012 0.393 0.014 | 4.647 0.047 3.737 0.013 -0.049 0.024
4.969 0.025 h
2447842.349 5.017 0.008 1.098 0.012 0.398 0.014 | 4.656 0.046 3.736 0.013 -0.051 0.024
4.966 0.025 h
2447843.257 5.030 0.008 1.070 0.012 0.370 0.014 | 4.602 0.048 3.742 0.013 -0.038 0.024
4.992 0.025 h
2447849.325 5.015 0.008 1.071 0.012 0.371 0.014 | 4.604 0.048 3.742 0.013 -0.039 0.024
4.976 0.025 h
2447854.270 5.033 0.008 1.067 0.012 0.367 0.014 | 4.596 0.049 3.743 0.013 -0.037 0.024
4.996 0.025 h
2447859.648 5.021 0.015 1.121 0.016 0.421 0.018 | 4.695 0.048 3.732 0.013 -0.062 0.025
4.959 0.029 k
2447860.266 5.045 0.008 1.067 0.012 0.367 0.014 | 4.596 0.049 3.743 0.013 -0.037 0.024
5.008 0.025 h
2447878.626 4.990 0.015 1.151 0.016 0.451 0.018 | 4.741 0.046 3.727 0.013 -0.076 0.025
4.914 0.029 k
2447880.588 5.039 0.015 1.133 0.016 0.433 0.018 | 4.714 0.047 3.730 0.013 -0.067 0.025
4.972 0.029 k
2447896.595 5.046 0.015 1.142 0.016 0.442 0.018 | 4.728 0.047 3.728 0.013 -0.072 0.025

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 4.974  0.029    k
2447915.592  5.044  0.015  1.131  0.016  0.431  0.018 | 4.711  0.047  3.730  0.013  -0.067  0.025
 4.977  0.029    k
2447917.588  5.057  0.015  1.130  0.016  0.430  0.018 | 4.710  0.047  3.730  0.013  -0.066  0.025
 4.991  0.029    k
2447919.224  5.049  0.008  1.114  0.012  0.414  0.014 | 4.684  0.045  3.733  0.013  -0.059  0.024
 4.990  0.026    h
2448041.927  5.036  0.015  1.136  0.016  0.436  0.018 | 4.719  0.047  3.729  0.013  -0.069  0.025
 4.967  0.029    k
2448086.547  5.125  0.008  1.109  0.012  0.409  0.014 | 4.675  0.046  3.734  0.013  -0.056  0.024
 5.069  0.025    h
2448093.542  5.087  0.008  1.127  0.012  0.427  0.014 | 4.705  0.045  3.731  0.013  -0.065  0.024
 5.022  0.026    h
2448101.538  5.103  0.008  1.096  0.012  0.396  0.014 | 4.652  0.046  3.737  0.013  -0.050  0.024
 5.053  0.025    h
2448109.517  5.060  0.008  1.101  0.012  0.401  0.014 | 4.661  0.046  3.736  0.013  -0.053  0.024
 5.007  0.025    h
2448122.779  5.030  0.015  1.106  0.016  0.406  0.018 | 4.670  0.049  3.735  0.013  -0.055  0.025
 4.975  0.029    k
2448128.492  5.040  0.008  1.109  0.012  0.409  0.014 | 4.675  0.046  3.734  0.013  -0.056  0.024
 4.984  0.025    h
2448133.820  5.031  0.015  1.109  0.016  0.409  0.018 | 4.675  0.049  3.734  0.013  -0.056  0.025
 4.975  0.029    k
2448134.432  5.058  0.008  1.103  0.012  0.403  0.014 | 4.665  0.046  3.735  0.013  -0.054  0.024
 5.004  0.025    h
2448151.442  5.057  0.008  1.083  0.012  0.383  0.014 | 4.628  0.047  3.740  0.013  -0.044  0.024
 5.013  0.025    h
2448159.742  5.028  0.015  1.099  0.016  0.399  0.018 | 4.658  0.050  3.736  0.013  -0.052  0.025
 4.976  0.029    k
2448163.342  5.040  0.008  1.101  0.012  0.401  0.014 | 4.661  0.046  3.736  0.013  -0.053  0.024
 4.987  0.025    h
2448174.358  5.053  0.008  1.073  0.012  0.373  0.014 | 4.608  0.048  3.742  0.013  -0.040  0.024
 5.013  0.025    h
2448176.292  5.037  0.008  1.092  0.012  0.392  0.014 | 4.645  0.047  3.738  0.013  -0.048  0.024
 4.989  0.025    h
2448176.677  5.000  0.015  1.119  0.016  0.419  0.018 | 4.692  0.048  3.732  0.013  -0.061  0.025
 4.939  0.029    k
2448178.711  5.039  0.015  1.101  0.016  0.401  0.018 | 4.661  0.050  3.736  0.013  -0.053  0.025
 4.986  0.029    k
2448190.293  5.065  0.008  1.102  0.012  0.402  0.014 | 4.663  0.046  3.736  0.013  -0.053  0.024
 5.012  0.025    h
2448201.670  5.068  0.015  1.112  0.016  0.412  0.018 | 4.680  0.049  3.734  0.013  -0.058  0.025
 5.010  0.029    k
2448202.276  5.085  0.008  1.108  0.012  0.408  0.014 | 4.674  0.046  3.734  0.013  -0.056  0.024
 5.029  0.025    h
2448204.608  5.075  0.015  1.116  0.016  0.416  0.018 | 4.687  0.049  3.733  0.013  -0.060  0.025
 5.015  0.029    k
2448225.616  5.099  0.015  1.136  0.016  0.436  0.018 | 4.719  0.047  3.729  0.013  -0.069  0.025
 5.030  0.029    k
2448228.638  5.120  0.015  1.151  0.016  0.451  0.018 | 4.741  0.046  3.727  0.013  -0.076  0.025
 5.044  0.029    k
2448232.196  5.138  0.008  1.097  0.012  0.397  0.014 | 4.654  0.046  3.737  0.013  -0.051  0.024
 5.087  0.025    h
2448244.618  5.101  0.015  1.134  0.016  0.434  0.018 | 4.716  0.047  3.730  0.013  -0.068  0.025
 5.033  0.029    k
2448271.225  5.092  0.008  1.131  0.012  0.431  0.014 | 4.711  0.044  3.730  0.012  -0.067  0.025
 5.025  0.026    h
2448414.931  5.078  0.021  1.070  0.004  0.370  0.009 | 4.602  0.042  3.742  0.012  -0.038  0.023
 5.040  0.031    r
2448475.561  5.120  0.008  1.062  0.012  0.362  0.014 | 4.586  0.049  3.744  0.013  -0.034  0.023
 5.086  0.025    h
2448477.562  5.159  0.008  1.051  0.012  0.351  0.014 | 4.562  0.050  3.747  0.013  -0.029  0.023
 5.130  0.025    h
2448480.462  5.171  0.008  1.046  0.012  0.346  0.014 | 4.551  0.050  3.748  0.013  -0.027  0.023
 5.144  0.024    h
2448485.488  5.178  0.008  1.041  0.012  0.341  0.014 | 4.539  0.051  3.750  0.013  -0.025  0.023
 5.153  0.024    h
2448502.431  5.173  0.008  1.035  0.012  0.335  0.014 | 4.525  0.051  3.751  0.013  -0.022  0.023
 5.151  0.024    h
2448506.415  5.172  0.008  1.043  0.012  0.343  0.014 | 4.544  0.051  3.749  0.013  -0.026  0.023
 5.146  0.024    h
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2448508.428	5.168	0.008	1.031	0.012	0.331	0.014	4.515	0.052	3.752	0.013	-0.020	0.023	5.148	0.024	h
2448532.770	5.095	0.020	1.066	0.005	0.366	0.009	4.594	0.043	3.743	0.012	-0.036	0.023	5.059	0.030	r
2448533.460	5.159	0.008	1.020	0.012	0.320	0.014	4.488	0.053	3.755	0.013	-0.016	0.023	5.143	0.024	h
2448534.356	5.165	0.008	1.021	0.012	0.321	0.014	4.491	0.053	3.755	0.013	-0.016	0.023	5.149	0.024	h
2448535.737	5.103	0.020	1.057	0.007	0.357	0.011	4.575	0.045	3.745	0.013	-0.032	0.023	5.071	0.030	r
2448536.360	5.158	0.008	1.027	0.012	0.327	0.014	4.506	0.052	3.753	0.013	-0.019	0.023	5.139	0.024	h
2448546.695	5.128	0.015	1.051	0.006	0.351	0.010	4.562	0.044	3.747	0.013	-0.029	0.023	5.099	0.027	r
2448557.302	5.153	0.008	1.006	0.012	0.306	0.014	4.452	0.054	3.760	0.013	-0.010	0.022	5.143	0.024	h
2448559.333	5.149	0.008	1.007	0.012	0.307	0.014	4.454	0.054	3.759	0.013	-0.010	0.022	5.139	0.024	h
2448561.278	5.139	0.008	1.010	0.012	0.310	0.014	4.462	0.054	3.758	0.013	-0.012	0.022	5.127	0.024	h
2448562.310	5.145	0.008	1.007	0.012	0.307	0.014	4.454	0.054	3.759	0.013	-0.010	0.022	5.135	0.024	h
2448562.681	5.104	0.012	1.044	0.001	0.344	0.008	4.546	0.042	3.749	0.012	-0.026	0.022	5.078	0.025	r
2448573.309	5.150	0.008	0.991	0.012	0.291	0.014	4.410	0.056	3.764	0.013	-0.005	0.022	5.145	0.023	h
2448592.260	5.138	0.008	1.006	0.012	0.306	0.014	4.452	0.054	3.760	0.013	-0.010	0.022	5.128	0.024	h
2448593.239	5.142	0.008	0.995	0.012	0.295	0.014	4.422	0.056	3.763	0.013	-0.006	0.022	5.136	0.023	h
2448597.240	5.107	0.008	1.024	0.012	0.324	0.014	4.498	0.052	3.754	0.013	-0.017	0.023	5.090	0.024	h
2448597.660	5.064	0.020	1.047	0.008	0.347	0.011	4.553	0.046	3.748	0.013	-0.028	0.023	5.036	0.030	r
2448599.247	5.149	0.008	0.987	0.012	0.287	0.014	4.399	0.057	3.766	0.013	-0.003	0.022	5.146	0.023	h
2448600.264	5.135	0.008	0.990	0.012	0.290	0.014	4.407	0.056	3.765	0.013	-0.004	0.022	5.131	0.023	h
2448603.249	5.147	0.008	0.989	0.012	0.289	0.014	4.404	0.056	3.765	0.013	-0.004	0.022	5.143	0.023	h
2448620.582	5.080	0.020	1.033	0.017	0.333	0.019	4.520	0.059	3.752	0.013	-0.021	0.023	5.059	0.031	r
2448636.586	5.089	0.020	1.073	0.013	0.373	0.015	4.608	0.049	3.742	0.013	-0.040	0.024	5.049	0.031	r
2448637.589	5.075	0.020	1.086	0.015	0.386	0.017	4.634	0.050	3.739	0.013	-0.046	0.024	5.029	0.031	r
2448642.229	5.101	0.008	1.019	0.012	0.319	0.014	4.486	0.053	3.756	0.013	-0.015	0.023	5.086	0.024	n
2448646.230	5.109	0.008	1.042	0.012	0.342	0.014	4.541	0.051	3.749	0.013	-0.025	0.023	5.084	0.024	n
2448732.945	5.042	0.018	1.000	0.003	0.300	0.009	4.435	0.045	3.761	0.013	-0.008	0.022	5.034	0.028	r
2448800.927	5.001	0.024	0.983	0.004	0.283	0.009	4.387	0.047	3.767	0.013	-0.002	0.021	4.999	0.032	r
2448813.532	5.088	0.008	0.872	0.012	0.172	0.014	3.977	0.076	3.818	0.015	-0.004	0.023	5.084	0.024	n
2448853.475	5.098	0.008	0.964	0.012	0.264	0.014	4.329	0.060	3.774	0.014	0.003	0.021	5.101	0.023	n
2448859.374	5.113	0.008	0.973	0.012	0.273	0.014	4.357	0.059	3.771	0.013	0.001	0.021	5.114	0.023	n
2448897.348	5.215	0.008	1.011	0.012	0.311	0.014	4.465	0.054	3.758	0.013	-0.012	0.022	5.203	0.024	n
2448898.749	5.152	0.023	0.999	0.002	0.299	0.008	4.433	0.045	3.762	0.013	-0.007	0.022	5.145	0.032	r
2448901.726	5.155	0.018	1.012	0.001	0.312	0.008	4.468	0.044	3.758	0.013	-0.012	0.022	5.143	0.028	r
2448904.309	5.202	0.008	1.001	0.012	0.301	0.014	4.438	0.055	3.761	0.013	-0.008	0.022	5.194	0.024	n
2448932.740	5.124	0.032	1.068	0.026	0.368	0.027	4.598	0.068	3.743	0.014	-0.037	0.026	5.087	0.041	r
2448933.700	5.133	0.022	1.053	0.001	0.353	0.008	4.566	0.042	3.746	0.012	-0.030	0.023			

```
 5.103  0.032    r
2448936.271  5.166  0.008  1.060  0.012  0.360  0.014 | 4.581  0.049  3.745  0.013  -0.033  0.023
 5.133  0.025    n
2448951.689  5.156  0.020  1.030  0.012  0.330  0.014 | 4.513  0.052  3.753  0.013  -0.020  0.023
 5.136  0.030    r
2449005.252  5.136  0.008  0.973  0.012  0.273  0.014 | 4.357  0.059  3.771  0.013   0.001  0.021
 5.137  0.023    n
2449006.229  5.128  0.008  0.985  0.012  0.285  0.014 | 4.393  0.057  3.766  0.013  -0.003  0.022
 5.125  0.023    n
2449254.380  5.095  0.008  0.894  0.012  0.194  0.014 | 4.072  0.071  3.806  0.015   0.005  0.021
 5.100  0.023    n
2449266.368  5.089  0.008  0.888  0.012  0.188  0.014 | 4.047  0.073  3.809  0.015   0.003  0.022
 5.092  0.023    n
2449289.231  5.087  0.008  0.903  0.012  0.203  0.014 | 4.109  0.070  3.801  0.015   0.007  0.021
 5.094  0.023    n
2449290.222  5.085  0.008  0.894  0.012  0.194  0.014 | 4.072  0.071  3.806  0.015   0.005  0.021
 5.090  0.023    n
2449292.269  5.097  0.008  0.892  0.012  0.192  0.014 | 4.064  0.072  3.807  0.015   0.004  0.021
 5.101  0.023    n
2449299.293  5.107  0.008  0.880  0.012  0.180  0.014 | 4.012  0.074  3.814  0.015   0.000  0.022
 5.107  0.023    n
```

Table A9 'E(B-V)-and-R-ratio-rev-6' Direct E(B-V) and R-ratio determinations for HR8752 from measurements of (B-V) and contemporary-time-estimate of spectral MK classification.

In this section we discuss 1) obtaining E(B-V) and R-ratio from Johnson (1968) data using a time-synchronization for comparing MK- and B-V-data and 2) a note on R-ratio for yellow hypergiants. The note is an extension of the Note in subsection 3.2 of the main paper.

1) E(B-V) and R-ratio determinations from Johnson (1968) for HR8752 (BS8752) are based on a comparison of observed (B-V) with the (standard value) MK type G0. However, the spectral type changes in time and a comparison should be done with the 'best estimated spectral type' for the given time or period. We interpolate for the colour observation date JD 2438300 in the sequence of MK measurements between JD 2436462-2439080 (cf. our Table in Appendix A5 subsections 3:-6a:) with MK F9-G0Ia (s=4.95 +- 0.5) resp. G3 (s=5.15) to get a spectral parameter s=5.9 (G1.8) which we take to be spectral type G2. With Schmidt-Kaler (1982, section 4.1.2.1), and Johnson (1966, Table III) this leads to E(B−V)=0.70 +- ~0.02. The two techniques to time-synchronize the different types of observations (cf. also Section 3 in the main paper) result in the same number for E(B-V) and enhance the confidence in the found value.

The table below gives the corrected excess colours referenced against E(B−V). These values replace those in Johnson's (1968, Table 20) for HR8752.

Corrections for BS 8752:

E(U-V)	E(B-V)	E(V-R)	E(V-I)	E(V-J)	E(V-K)	E(V-L)	E(V-M)	E(V-N)	E(V-O)
E(B-V)	E(B-V)	E(B-V)	E(B-V)	E(B-V)	E(B-V)	E(B-V)	E(B-V)	E(B-V)	E(B-V)
=2.07	=1.00	=0.79	=1.40	=2.00	=2.33	=2.60	=----	=3.37	=----

With these values we derive a R-ratio=4.4 +- ~0.2, following the construction for Cepheus 'mean', mimicking Johnson's (1968, Fig. 31). A new Figure is shown as Fig. A13.1 . The note below considers the high value of R-ratio and thus also of Av=RxE(B-V).

Fig.A13.1

Fig.A13.1: The color-excess ratio of HR8752, recalculated for synchronicity of MK-type, with the plot for the mean of 6 stars in Cepheus after Johnson (1968) as comparison. We estimate for HR8752 an R=4.4 with an accuracy of +-0.2 in analogy with Johnson's determination of the the R-value at 1/lamda=0 for the 'mean'. With E(B-V)=0.70 the absorption in the v color is Av=3.08.

2) Note on R-ratio for yellow hypergiants: The high value for the R-ratio contrasts with the values of R = 3.0 to 3.1 that are usually attributed to O, B stars (cf. e.g. Fitzpatrick and Massa 2007). There are 2 possible reasons for this: 1)- This high value (if it is true) points un-ambiguously to the non-canonical IS reddening curve in the line-of-sight towards HR 8752 whatever the reason for that (it may well be the parameters of dust close to HR 8752), cf. also Johnson (1968) who indicates stark variations in line-of-sight variations for different regions in Cepheus. This last issue should indeed be the topic of a separate investigation. 2)- On the other hand studies show that the R-ratio does depend on spectral type, as is shown by Schmidt-Kaler (1961b), Lee (1970), Stothers (1972), that find deviations from R-ratio ˜ 3.1 to ~ 3.6, while Olson (1975), Gutiérrez-Moreno and Moreno (1975), Crawford and Mandwewala (1976 cf. Fig. 7) and Buser (1978) give values that go higher than the R-ratio ˜ 4.2. These authors combine stellar energy fluxes for various spectral types with the filter transmission curves (Olson, 1975) and different interstellar absorption laws (Crawford and Mandwewala, 1976) to obtain values of the R-ratio of total-to-selective absorption for (B−V) and other colour systems (cf. also below). We mention some authors:

Schmidt-Kaler (1961a) finds that R follows an approximate linear function of (B-V)0 and E(B-V). Lee (1970) finds R= 3.6 +- 0.3 derived from reddened M supergiants . In a paper on recalibration of absolute magnitudes of supergiants, Stothers (1972) takes the "distance moduli of stellar groups that have been determined from the magnitudes of B-type main sequence stars, using an extinction ratio of Av/E(B-V)=3.0." He proposes and uses R=3.0 for O,B,A stars, R=3.3 for F,G,K stars and R=3.6 for M stars, basically using the earlier references.

The variation of the ratio of total-to-selective absorption of a star's intrinsic color and color excess has been examined and put into a numerical relation by Olson (1975).

Calculations of the influence of several different laws of interstellar absorption for various spectral types combined with filter transmission curves to obtain reddening relations and the ratio of total-to-selective absorption have been published by Crawford & Mandwewala (1976) where they show R against E(B−V) for some spectral types: e.g. a G5 Ib star with E(B−V)=0.70 gives R~3.76. [In principle we could add our value adopted from Johnson (1968): HR 8752, G2 Ia+ and R=4.4, with E(B−V)=0.7 (our determinations).]

Buser (1978 Table 2) gives for a G2 Ib star: R=3.515 + 0.059*E(B-V) or R=3.556 for HR8752, whereas Gutiérrez-Moreno & Moreno (1975) for a star of luminosity class I with standard color index system (d) gives R=3.558 + 0.155*E(B-V) or R=3.667 for HR8752. It seems that both later types and higher luminosities give higher R-ratios, as is demonstrated by Fig.8 of Crawford et al. (1976), but their examples include no hypergiants.

A10 'A New Star' Writing about the new star of 1572, Cyprianus Leovitius (1573) mentioned two possible earlier new stars, approximately in the same region of the sky, appearing in A.D. 945 and 1264.

Below we give a copy of the (latin) text and a translation by one of us (EZ) as given in Section 5.11 of the main text and add some comments.

"Historiae perhibent tempore Ottonis primi Imperatoris similem stellam in eodem fere loco Coeli arsisse Anno Domini 945. Ubi magnae mutationes plurimaque mala, varias Provincias Europae pervaserunt: potissimum propter peregrinas gentes infusas in Germaniam. Verum multo locupletius testimonium in hiftorijs extat de Anno Domini 1264. Quo stella magna & lucida in parte coeli septentrionali circa sydus Cassiopeae apparuit, carens similiter crinibus, ac destituta motu suo proprio: cum paulo post duae praestantissimae ac florentissimae familiae Germanicae excisae sint: & inter Electores ac Principes Germaniae summae distractiones fuerint, interregnumque plurimorum annorum cum laniena secutum sit."

Translation:

"Histories tell us that in the times of Emperor Otto I, in A.D. 945 a similar star appeared in almost the same place of the sky. Various provinces of Europe were affected, generally in a bad way, mostly due to peoples intruding into Germany.We have more testimonies in histories of the year A.D. 1264, when a great and bright star appeared in the northern part of the sky, near the constellation Cassiopeia, also without a tail and a motion of his own: two of Germany's most excellent and flowering families were murdered not long after, there were disagreements between the Electors and Princes of Germany, and there was an interregnum for a long time, followed by a massacre."

Comments

They are clearly not comets, since Leovitius said about the second, that it was without a tail and motion. The use of "similiter" indicates that he thought the first one to be similar.

These objects are likely not the comets seen in these years. Kronk (1999 p.155) says that the comet seen in 945 was "a cubit long". Something a cubit long is not like a star. Unfortunately, it seems there is no data about its place on the sky.

More is known about the comet of 1264 (Kronk 1999 pp. 218-222). Its path went as follows: LMi-Leo-Cnc-Gem-CMi-Mon-Ori-Eri-Lep-Eri. This path is not the northern part of the sky, nor is it near Cassiopeia. It seems to have had a long tail which reached Cassiopeia and Cepheus, but again this is not a starlike object. And Leovitius (1573) clearly stated it was without a tail.

So these ‘stars’ are not identical with the comets; we simply do not know. However, there is a tiny possibility that one of them at least might have been really a ‘new star’, in which case - another huge maybe - we can think of HR 8752 (or, alternatively, of ρ Cas).

rho Cas would probably have been visible over long periods of time, and has a designated name-place in Cassiopeia. If the variations of v- magnitude for rho Cas in the period 1963-1989 between v=4.175 and v=4.692 (Zsoldos & Percy 1991) are representative for a longer period, rho Cas could be expected to stay visible to the naked eye, and would probably not be a candidate for a 'new' star.

Interesting is that the difference of 319 y between the above observations is not far from the numbers given for the recovery time for an indicated model of Maeder (1989) of 350 y.

If we sequence the two mediaeval observations as if they were of one star and use a (constant) recovery time of 320 y with a tolerance of 30 y, the sequence could possibly be extended to : 945, 1264, 1584 ± 30 y and 1904 ± 60 y. 'Naked eye' viewing of HR8752 with critical v~5.1 m would probably have been possible around 1900 (cf. Fig.12 in the main paper), with maximum light (v~~4.5) in the years around 1973. So in this respect the correlation between the extended (virtual) observations and HR8752 seems possible for constant recovery time, but this would have to be verified. Note that we are not certain of the values of the recovery time in our above estimations, nor of the possible maximum light.

Table C1 '3-dim-Chebychev' Gives a description of the symbolic code of the Chebychev 3-dimensional approximation used for fast interpolation of modelled equivalent width (ew) for variables in 3-space where the underlying parameters for each spectral line are kept in a specifically constructed Spectral Line Library (SLL).

The symbolic code describes a 3-dimension multi-term chebychev approximation for use in the Spectral Line Library where the number of terms 'n' is limited to n=45 as a practical number.

The code is used with set of equivalent widths from model calculations in a 3-dimensional grid of the (normalized) variables log(Teff), log(g), log(vturb). Each spectral line has atomic parameters found in an atomic line data library (here 'lib2h197') and has a number of 'n' parameters attached to it from applying the approximation code to an ensemble of suitable models in a given range of Teff, logG, Vturb. The errors of approximation (i.e. approximation-original data) over the 3 dimensions are also found and collected as 'n' 'error' parameters for use in the Spectral Line Library. We limit the Chebychev order to order=5, and the number of terms to terms n=45 to obtain a reasonable accuracy.

The structuring of the 3-dimensional approximation builds on the earlier work om mass-loss in the HR-diagram (de Jager et al. 1987) as function of log Teff and Log L, for a total of 20 terms Chebychev approximation.

This 3-dimensional approximation is used for interpolation of the equivalent width (ew) and for the error in equivalent width (dew) for each spectral line observed using the same general structure with now two sets of parameters P(l)=aijk specific for ew and dew respectively, where i, j, k are the specific chebychev indices for 1st, 2nd and 3rd dimension following an order specification given below.

We write log(ew)= sum n=0,N; sum i=n,0; sum j=n-i,0; sum k=n-i-j,0 aijk Ti[x1]Tj[x2]Tk[x3] where x1, x2, x3 are the normalized values in the 1st-, 2nd- and 3rd- dimensions, as shown in the following symbolic code and aijk are the set of constants (parameters) for each line in the SLL.

The sequence order is important when using the Data from the Spectral Line Library, and is built up as in the following subtable :

```
     i  j  k          i  j  k          i  j  k
n=0  0  0  0     n=1  1  0  0     n=2  2  0  0   up to n=N
                      0  1  0          1  1  0
                      0  1  0          1  0  1
                                       0  2  0
                                       0  1  1
                                       0  0  2
```

The three dimensions are specified on Teff=3250-10000K (logarithmically), log g=-1 to 5, and vt=4-50 km/s (logarithmically). They are then normalized on [a,b] as:

```
log(Teff)    z1 on [log(3250), log(10000)]  (K)
log(g)       z2 on [-1,5]                   (cm/sec^2)
log(vturb)   z3 on [log(4),log(50)]         (km/sec)
```

The following symbolic code writes the combined chebychev 3-dim polynomial as a vector G(), with a given sequential numbering for the code execution, i.e. the column "ijk" in the following symbolic code listing (which makes no part of the actual code).

```
ijk   gives indices of chebychev degree of combined 3-dim chebychev point
000   G(1)=1
100   G(2)=(2z1(x)-min1 -max1)/(max1 - min1) | normalization of logTeff
010   G(3)=(2z2(x)-min1 -max1)/(max2 - min2) | normalization of logG
001   G(4)=(2z3(x)-min3 -max3)/(max3 - min3) | normalization of logVturb
      L=2G(2); M=2G(3); N=2G(4)              | helpvalue for each dimension

ijk   cross product term     |   ijk   cross product term (continued)
200   G(5)=L*G(2)-1          |   202   G(26)=G(5)*G(10)
110   G(6)=G(2)*G(3)         |   130   G(27)=G(2)*G(17)
101   G(7)=G(2)*G(4)         |   121   G(28)=G(2)*G(8)*G(4)
020   G(8)=M*G(3)-1          |   112   G(29)=G(2)*G(3)*G(10)
011   G(9)=G(3)*G(4)         |   103   G(30)=G(2)*G(20)
002   G(10)=N*G(4)-1         |   040   G(31)=M*G(17)-G(8)
300   G(11)=L*G(5)-G(2)      |   031   G(32)=G(17)*G(4)
210   G(12)=G(5)*G(3)        |   022   G(33)=G(8)*G(10)
201   G(13)=G(5)*G(4)        |   013   G(34)=G(3)*G(20)
120   G(14)=G(2)*G(8)        |   004   G(35)=N*G(20)-G(10)
111   G(15)=G(2)*G(3)*G(4)   |   500   G(36)=L*G(21)-G(11)
102   G(16)=G(2)*G(10)       |   410   G(37)=G(21)*G(3)
```

```
030   G(17)=M*G(8)-G(3)       |   401   G(38)=G(21)*G(4)
021   G(18)=G(8)*G(4)         |   320   G(39)=G(11)*G(8)
012   G(19)=G(3)*G(10)        |   311   G(40)=G(11)*G(3)*G(4)
003   G(20)=N*G(10)-G(4)      |   302   G(41)=G(11)*G(10)
400   G(21)=L*G(11)-G(5)      |   230   G(42)=G(5)*G(17)
310   G(22)=G(11)*G(3)        |   221   G(43)=G(5)*G(8)*G(4)
301   G(23)=G(11)*G(4)        |   212   G(44)=G(5)*G(3)*G(10)
220   G(24)=G(5)*G(8)         |   203   G(45)=G(5)*G(20)
211   G(25)=G(5)*G(3)*G(4)
```

The result of the calculation is eb=P(1)+P(2)G(2)+P(3)G(3)+...+P(45)G(45)
where P(i) are the constants for a specific spectral line. For deb the same procedure applies with constants relevant to deb for a specific line.

The number of terms is limited to 45, after tests for achieving approximately 1-2% accuracy in the resulting equivalent width (eb) and error in equivalent width (deb) for an ensemble of spectral lines used. The following terms completing the 5th-degree chebychev coverage for the 3 dimensions are not used in this paper.

```
ijk   cross product term      |   ijk   cross product term (continued)
140   G(46)=G(2)*G(31)        |   041   G(52)=G(31)*G(4)
131   G(47)=G(2)*G(17)*G(4)   |   032   G(53)=G(17)*G(10)
122   G(48)=G(2)*G(8)*G(10)   |   023   G(54)=G(8)*G(20)
113   G(49)=G(2)*G(3)*G(20)   |   014   G(55)=G(3)*G(35)
104   G(50)=G(2)*G(35)        |   005   G(56)=N*G(35)-G(20)
050   G(51)=M*G(31)-G(17)
```

With this code we generate a set of Chebychev coefficients for each spectral line that combines all the various model points in log(Teff), log(g) and vturb, and inversely, allows through fast interpolation to find the best fit (observed - interpolated model) of the equivalent widths for the three variables log(Teff), log(g) and log(vturb). An analysis code does rhis for an ensemble of observed lines and finds the best solution (minimum-chi-squared fit).

Tabel C2 'Calibrate-hyper' A temperature calibration is given for hypergiants in subsection 1) using the s-variable defined by Table C2.1 (cf. also the Note below). To allow transforms between Mk, s, (B-V), Teff and to BC we also give symbolic code and reference data based on calibration data. The calibration transforms we use between MK or s and B-V and between MK or s and BC for hypergiants are based on Schmidt-Kaler (1982, for spectral type > Iab) and are given as formulas in Table C2.2. Other calibrations (Humphreys or Massey) do not modify the general observed trends of the main paper.

This section is based on spectral classification (Morgan & Keenan, 1973), infrared measurements (Johnson, 1966), brightest known stars (Humphreys, 1978), two-dimensional interpolation over HR-diagram using spectral class parameters s, b (De Jager & Nieuwenhuijzen 1987), general calibrations MK, (B-V), BC from Flower (1977), Böhm-Vitense (1981), Schmidt-Kaler(1982)and Gray (1992), together with specific data for hypergiants from De Jager (1998). In subsection 2) we mention calibrations for (B-V) and bolometric correction BC, and in subsection 3) we present associated transforms between MK, Teff and (B-V) and a transform from MK to BC. The errors due to the transform and the area of validity of each transform are also given.

1) For the calibration of Teff from MK classification we use the overview on Hypergiants by De Jager (1998 Table 2) Fig.C2.1 shows Teff as function of the spectral s-parameter. The line in the Figure positions the observations between two spectral class relations: for Ia and Ia+ (De Jager & Nieuwenhuijzen 1987). Cyg OB#12 follows the line for spectral class Ia, HD33579 through HD 11976 follow the line for Ia+ and mu Cep follows the line for Ia. In De Jager and Nieuwenhuijzen (1987) spectral class Ia+ has b-parameter b=0.0, class Ia b=0.6, and class Iab or I has b=1.0 .

The calibration line coincides with the Ia and Ia+ lines at high temperature (low value of s), then after s=2 stays close to the Ia line, between s=3.5-5 stays close to Ia+, and then stays close to the Ia line around 6=6.8 (with mu Cep). For lower temperatures we might add the observation of KY Cyg (De Jager 1998), and then see that the calibration line would also follow the Ia line from mu Cep to KY Cyg, resulting in a (future) calibration going to somewhat lower temperatures, but this has not been done here. In our work this has little importance as we have observations of spectral class in general earlier than about G5. The one exception is a measurement in 1973 of a cooler spectrum. We use the given calibration in the main paper for HR8752.

For practical purposes we use a piecewise numerical fit to the observational s-range of s=2.6-7.0. The resulting temperature calibration is valid within the limited spectral range of B8 - M2.

Table C2.1: Definitions of the s-variable for range of spectral type and the step range per 0.1 step spectral range

MK range	O1-O9	O9-B2	B2-A0	A0-F0	F0- G0	G0-K0	K0-M0	M0-M10
s	0.1-0.9	0.9-1.8	1.8-3.0	3.0-4.0	4.0-5.0	5.0-5.5	5.5-6.5	6.5-8.5
s-step	0.1	0.3	0.15	0.1	0.1	0.05	0.1	0.2

Note: The parameters s and b are mathematical representations of spectral resp. luminosity class, introduced by De Jager & Nieuwenhuijzen (1987) with the purpose to get rid of the usual discontinuities that occur in the gradients of those curves in which stellar parameters are plotted directly against spectral type . Except where indicated the estimated accuracy in s is 0.5-0.6 of one-tenth spectral step in MK, when transforming to and from MK spectral classification.

2) Calibrations for (B-V) and BC as function of s-parameter

The calibration transforms between MK (s) and (B-V) and between MK (s) and BC for hypergiants in 'Calibrate-Hyper' are based on Schmidt-Kaler (1982, (Ia) spectral type > Iab). The different interpolation parameters and their accuracies are given in subsection 3) below.

3) Description of transforms between (MK) s, Teff, (B-V) and BC for hypergiants as used in the main paper.

Note: In this paper we use Chebychev polynomials in the transforms (cf. main paper for reasons).

Chebychev polynomials of the first kindcan be written as T0=0, T1=x, T2=2x^2, T3=4x^3, T4=8x^4-8x^2-1, ... (Carnahan et al. 1969), and require normalization of data to [-1,1], eg. as follows: For a variable z on [minimum, maximum] the variable x to use as variable in the Chebychev polynomial is normalized as x=(2z -minimum -maximum)/(maximum - minimum).
It is possible to use a recursive definition of the terms, but we use as alternative for the 4th degree Chebychev polynomial; y=a-c+e+x*(b-3*d+x*(2*c-8e+x*(4*d+x*8*e))).

Errors are created in the transform and can be summed with the error in the measurement. We apply the quadratic error summation, assuming independent statistical errors.

The transforms are based on a 5-parameter Chebychev polynomial (4th order) interpolations. We give these details so that the results of the transforms of the original MK, Teff and (B-V) data can be verified.

The local variable x is normalized over the used range of interpolation.

for z on [min,max], x= (2z -min -max) /(max -min) is the normalization to x on [-1,1]
or alternatively: x=(z-mean)/rdev with mean=(max+min)/2; rdev=(max-min)/2
the Chebychev computational formula is y=a-c+e+x*(b-3*d+x*(2*c-8*e+x*(4*d+x*8*e)))
The following table contains the constants a-e for each of the indicated transforms (2nd column)=...x
The columns indicate type of transform, accuracy of interpolation in the result, minimum and maximum bounds of the independent variable x, the constants a-e used in the formula, and finally the mean and rdev as defined above.

Table C2.2 coefficients of interpolating formulas used for transformations

var -> res	+-	[min,max]	a	b	c	d	e	mean	rdev
s ->logTeff	0.012	[2.6,7.0]	3.75896	-0.25985	0.04368	-0.00722	0.00532	4.8	2.2
logTeff ->s	0.098	[3.5,4.1]	4.61292	-2.47427	0.54217	-0.06304	0.10708	3.8	0.3
s ->BC	0.021	[2.6,6.2]	-0.48642	-0.23007	-0.49348	-0.00741	-0.01042	4.4	1.8
s ->(B-V)	0.028	[3.0,6.0]	0.63114	0.82265	0.21170	-0.03161	-0.05704	4.5	1.5
(B-V) ->s	0.038	[0.0,1.6]	4.84940	1.28415	-0.29079	0.25259	-0.10847	0.8	0.8

Using the Table C2.2 the measurement error and the transform error are combined as follows:

The error in the result due to errors in the independent variable x is
dy/dx=b-3*d+x*(4*c-16*e+x*(12*d+x*32*e)) and
dx/dz= 2/(max-min) , which leads to
err(y)=dy/dx*dx/dz*err(z), which is the error in the result due to the measurement error.
Quadratically adding the error in the transformation itself, as given as "+-" in the table, and taking the square root, finally gives the total error.

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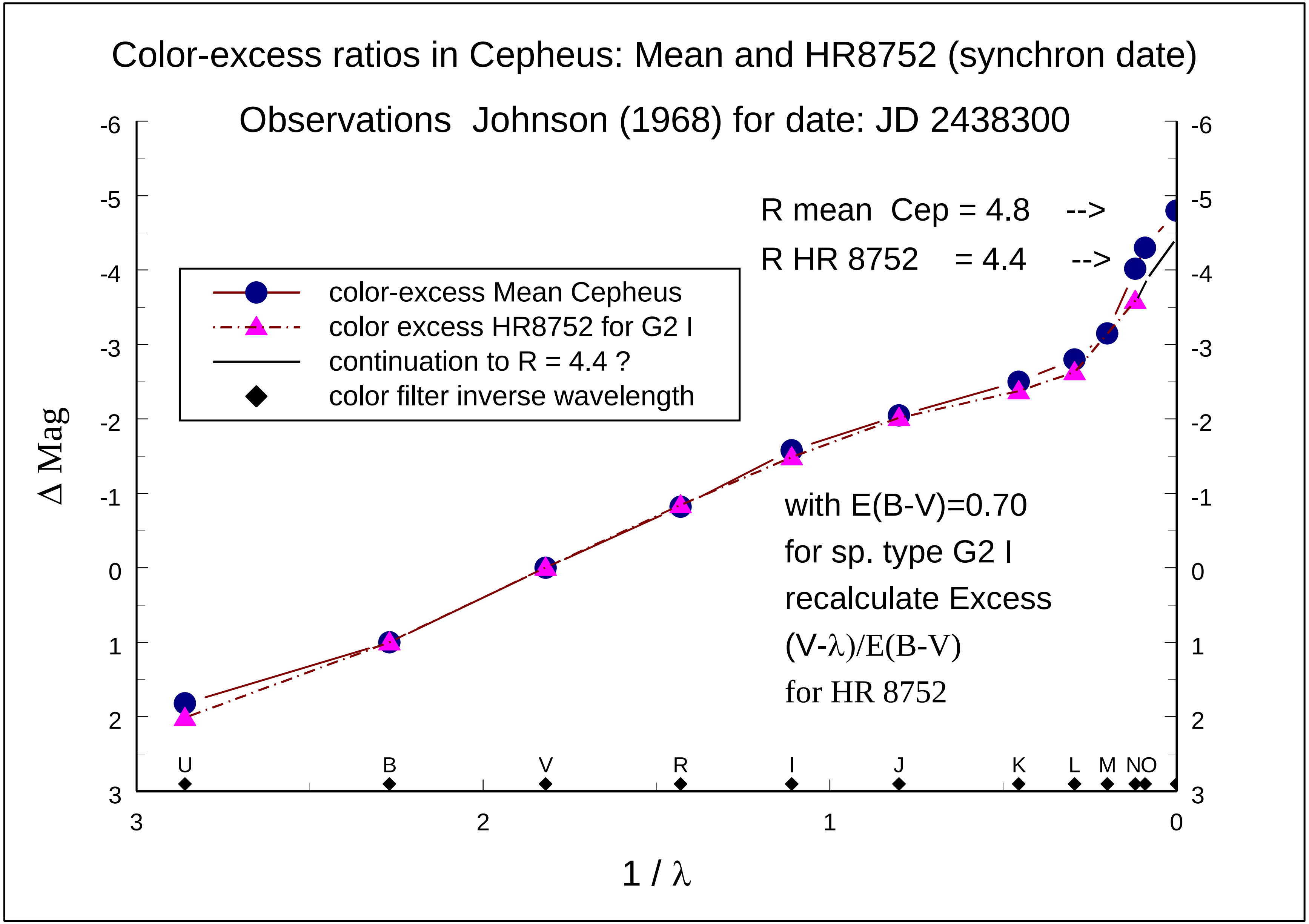

Color-excess ratios in Cepheus: Mean and HR8752 (synchron date)
Observations Johnson (1968) for date: JD 2438300
R mean Cep = 4.8 -->
R HR 8752 = 4.4 -->
color-excess Mean Cepheus
color excess HR8752 for G2 I
continuation to R = 4.4 ?
color filter inverse wavelength
with E(B-V)=0.70
for sp. type G2 I
recalculate Excess
(V-λ)/E(B-V)
for HR 8752
Δ Mag
-6
-5
-4
-3
-2
-1
0
1
2
3
U
B
V
R
I
J
K
L
M
NO
3
2
1
0
1 / λ

Fig. A9.1

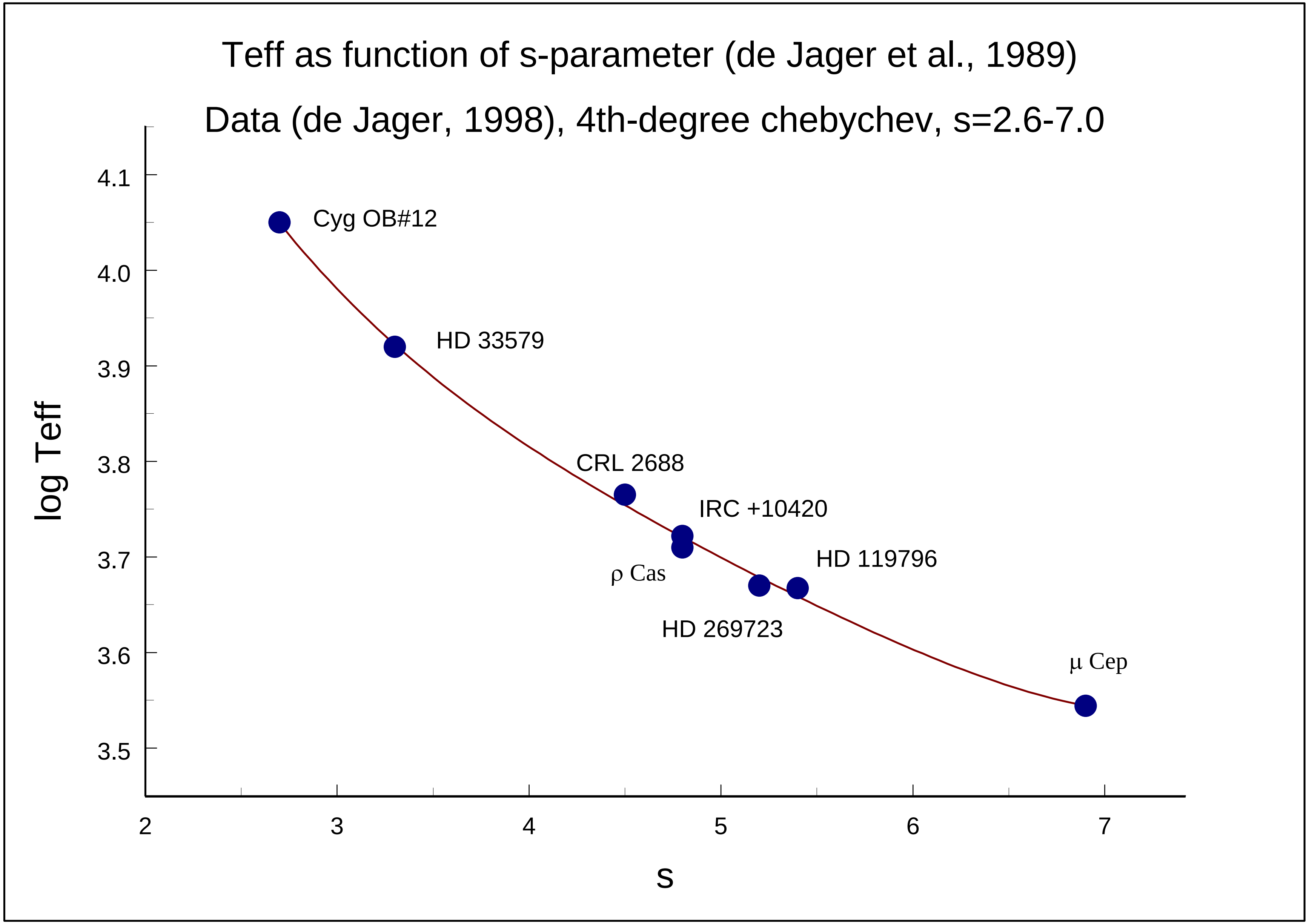
Teff as function of s-parameter (de Jager et al., 1989)
Data (de Jager, 1998), 4th-degree chebychev, s=2.6-7.0
log Teff
4.1
4.0
3.9
3.8
3.7
3.6
3.5
Cyg OB#12
HD 33579
CRL 2688
IRC +10420
ρ Cas
HD 119796
HD 269723
μ Cep
2
3
4
5
6
7
s

Fig. C2.1

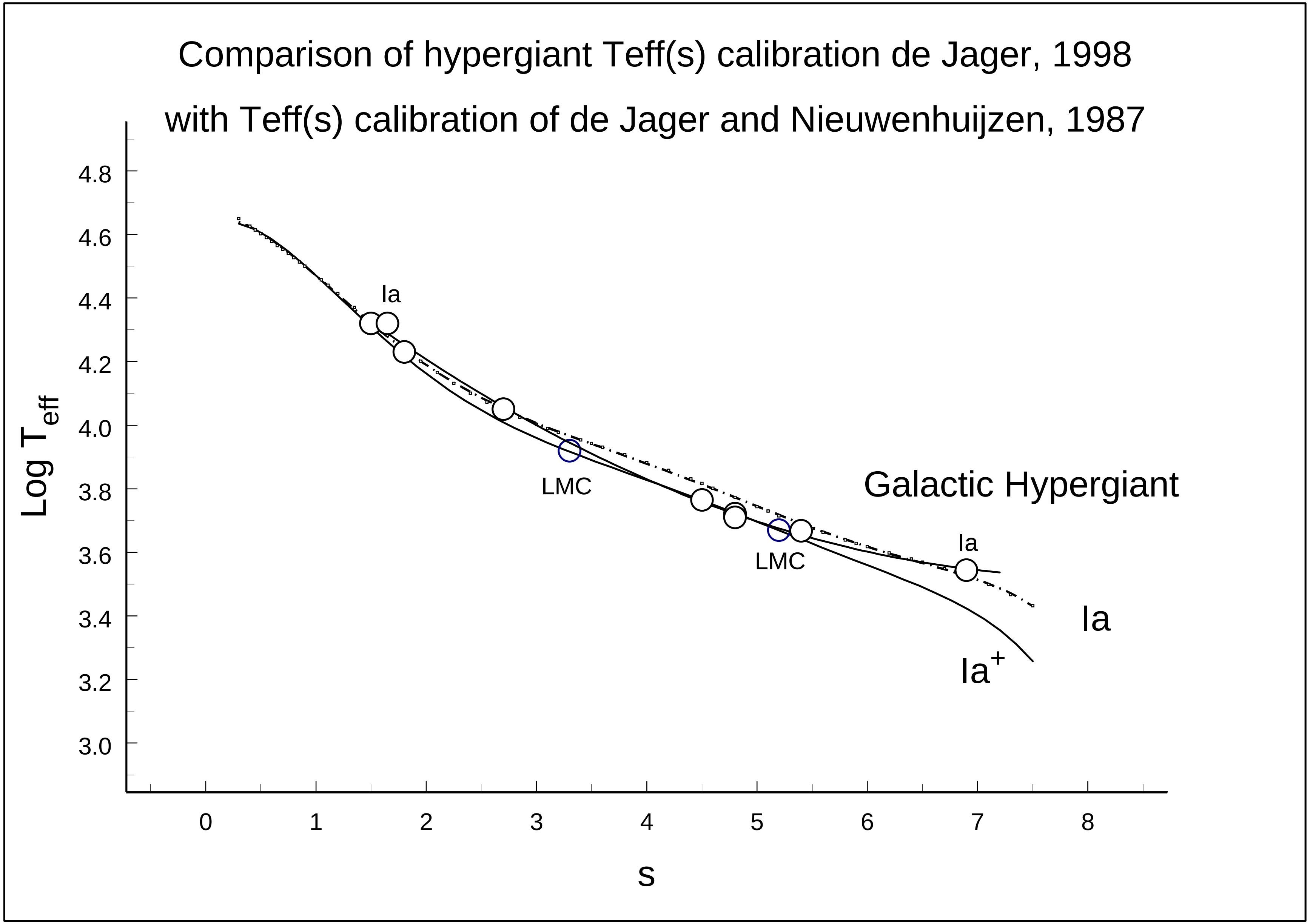
Comparison of hypergiant Teff(s) calibration de Jager, 1998
with Teff(s) calibration of de Jager and Nieuwenhuijzen, 1987
Log Teff
4.8
4.6
4.4
4.2
4.0
3.8
3.6
3.4
3.2
3.0
0
1
2
3
4
5
6
7
8
s
Ia
LMC
LMC
Ia
Galactic Hypergiant
Ia
Ia+

Fig. C2.2