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The Henize sample of S stars

II. Data*

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Abstract. This paper presents data collected on the Henize sample of 205 S stars: (i) CORAVEL radial-velocity data; (ii) photometric data in the UBV bands of the Geneva photometric system; (iii) photometric data in the $JHKL$ bands of the SAAO photometric system; (iv) IRAS fluxes; (v) low-resolution spectra of 158 S stars. Close visual companions have been found for Hen 47, 94, 105 and 155. Spectroscopic orbital elements are provided for Hen 2, 108, 121, 137 and 147. The analysis of these data is presented in a companion paper.

Key words: stars: late-type — stars: AGB and post-AGB — stars: evolution — binaries: symbiotic — binaries: visual — binaries: spectroscopic

1. Introduction

The Henize sample of S stars (as listed in Stephenson 1984) comprises S stars south of $\delta = -25°$ and brighter than $R = 10.5$, and is supposedly complete. A large-scale study has been devoted to this sample in order to better characterize the two families of S stars, the intrinsic S stars (*bona fide* thermally-pulsing asymptotic giant branch stars) and the extrinsic S stars (binary masqueraders). The data are presented in this paper; for their analysis the reader is referred to Van Eck & Jorissen (2000; hereafter Paper III).

Section 2 presents the radial velocity data along with 5 new orbits; the Geneva photometry and $JHKL$ SAAO photometry are presented in Sects. 3 and 4, respectively. Estimates of the bolometric magnitudes are derived in Sect. 5. Section 6 discusses the IRAS fluxes available for Henize S stars, and Sect. 7 presents the method used to reduce 158 low-resolution spectra and to derive band-strength indices. All these data, along with the results of the multivariate classification performed in Paper III, are listed in accompanying tables.

2. CORAVEL radial velocities

2.1. CORAVEL monitoring of the Henize sample

Radial-velocity monitoring of the Henize sample of S stars has been performed between 1992 and 1997 on the Danish 1.54 m telescope at the European Southern Observatory (La Silla, Chile). A full description of the CORAVEL spectro-velocimeter can be found in Baranne et al. (1979). Basically, CORAVEL measures the velocity of a star by cross-correlating its spectrum with a mask reproducing about 1500 lines of neutral and ionized iron-group species from the spectrum of Arcturus (K1-2 III). The minimum of a gaussian fitted to the cross-correlation dip (cc-dip) thus obtained yields the radial velocity of the star. Further information on the CORAVEL observation and reduction techniques can be found in Duquennoy et al. (1991). Some useful additional information can be derived from the cc-dip: in particular, the parameter Sb, defined as the width of the cc-dip corrected for the instrumental profile, is related to the average stellar line width. It is defined as

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$Sb = (\sigma^2 - \sigma_0^2)^{1/2}$, where σ is the observed width of the stellar cc-dip, and $\sigma_0 = 6.29$ km s^{-1} is the instrumental width (i.e., the width of the cc-dip of minor planets reflecting the sun light, corrected for the solar rotational velocity and photospheric turbulence).

The radial-velocity data are listed in Table 3, as described in Appendix A. The standard deviation of the radial velocity is listed instead of the $P(\chi^2)$, because most S stars exhibit large velocity variations due to either binarity or envelope motions. These velocity variations are typically larger than the error on the measurements, hence the $P(\chi^2)$ is most of the time close to zero and is therefore not an efficient tool to detect binary stars.

The individual measurements will be available at the *Centre de Données Stellaires* (CDS) in Strasbourg or on our dedicated web page *http://www-astro.ulb.ac.be/*.

2.2. Radial velocity curves and orbital parameters

Despite the fact that all extrinsic S stars ought to be binaries (see Jorissen et al. 1998 and Paper III), the number of radial-velocity measurements in the present survey was generally not sufficient to derive a reliable orbit, except in the cases listed in Table 1 and displayed in Fig. 1. Table 1 also provides a few very preliminary orbits derived from 6 or 7 measurements only.

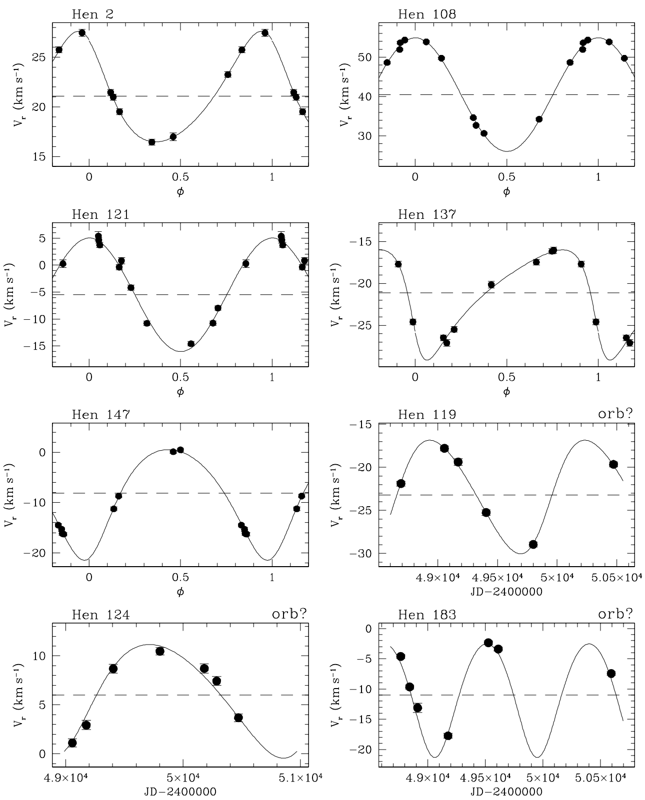

Fig. 1. Orbits for 5 Henize S stars. The last three panels labelled "orb?" provide preliminary orbits

3. Geneva photometry

The Henize sample of S stars has been monitored in the Geneva photometric system on the Swiss telescope at La Silla (Chile). Detailed information on this photometric system and on the data reduction can be found in Golay (1980), Rufener (1988) and Rufener & Nicolet (1988). Among the 205 S stars of the Henize sample, 179 could be reached with the 70 cm Swiss telescope, with an average of 4 good-quality photometric measurements (in all filters) per star.

3.1. Rejected measurements

Some photometric measurements have been discarded. They concern mostly misclassified stars, or stars with abnormal colours:

- *Misclassified stars:* Hen 22 and 154 are two stars misclassified as S, as revealed by low-resolution spectra (Van Eck & Jorissen 1999, hereafter Paper I; see also Paper III). Hen 22 is a mid-K giant (~K3-5) and Hen 154 a late-G giant (~G8);
- *Single measurement revealing abnormally blue colours:* Only a single very blue measurement ($U - B = 2.26$; $B - V = 0.48$) is available for Hen 82; a nearby field main-sequence star could well have been measured instead of the faint and variable S star Hen 82. In fact, the S star Hen 82 is most probably a Mira (strong H_α and H_β emission are visible on its low-resolution spectrum; spectral type S5,8 according to Henize (as listed in Stephenson 1984). Although Mira stars are known to sometimes exhibit such blue colours, Hen 82 has been removed from the photometric data set, given the lack of additional photometry confirming the blue colours of this star. The same holds true for Hen 181 (=V407 Sco; $U - B = 2.17$; $B - V = -0.53$);
- *Close visual binaries:* Several stars (Hen 47, 94, 105, 155) were found to be close visual binaries, and their photometric data have therefore not been considered for the cluster analysis presented in Paper III.

  In all these cases, two spectra separated by less than $10''$ (angular separation on the sky projected on the direction perpendicular to the slit, corresponding to less than 15 pixels on the CCD frame) have been recorded by the Boller & Chivens spectrograph (Sect. 7). Rough estimates of the companion spectral type could be obtained in all cases, but Hen 94 which is too faint: Hen 47 ($> 5''$): S + K4V; Hen 105 ($> 4''$): S + late BV or early AV; Hen 155 ($> 14''$): S + G5 IV-III. The numbers in parentheses provide a lower limit on the angular separation.

Table 1. Orbital elements for Henize S stars. The second line of the first five entries provides the errors on the orbital elements

Hen	P [days]	T [HJD −2 400 000]	e	γ [km s^{-1}]	ω [deg]	K [km s^{-1}]	a sin$i$ [Gm]	f(m) $M_{\odot}$	N	O−C [km s^{-1}]	ΔT [days]
2	1146.97	38128.45	0.21	21.06	33.40	5.57	86.00	0.019	8	0.10	4931
	2.05	16.28	0.01	0.07	5.96	0.07	1.11	0.001			
108	197.24	48632.01	0.00	40.51	0.00	14.41	39.09	0.061	10	0.60	1826
	0.30	1.48	–	0.30	–	0.52	1.40	0.007			
121	763.63	49280.49	0.00	−5.495	0.00	10.54	110.69	0.092	11	0.96	1778
	5.89	5.04	–	0.30	–	0.51	5.40	0.013			
137	636.39	49699.02	0.44	−21.12	120.22	6.57	51.68	0.014	9	0.63	1780
	12.38	24.16	0.17	0.47	23.57	1.88	8.29	0.007			
147	335.76	49559.54	0.22	−8.13	195.56	11.01	49.58	0.043	8	0.52	1579
	1.09	23.78	0.14	0.60	31.33	2.39	10.86	0.028			
• preliminary orbits											
119	1300	48612	0.14	−23	254	7	118	0.039	6	0.20	1781
124	1983	51068	0.17	6	226	6	155	0.038	7	0.69	1414
183	889	49059	0.10:	−11	173	9	114	0.076	7	0.63	1827

Hen 47 is the only one among those cases where the physical association between the two stars is clearly unlikely. The difference in absolute visual magnitudes between the S star and a K4V star is at least 7 magnitudes, but the observed difference in apparent visual magnitudes is less extreme, since the available photometry clearly reveals composite colours.

All these pairs lie within 2° of the galactic plane (except Hen 155 with $b = 20°$) where crowding may be severe. If some of these pairs would nevertheless turn out to be physical, the less evolved main sequence companion would allow to set a lower limit on the mass of the S star, namely $> 3\ M_{\odot}$ for Hen 105. These masses are compatible with S stars being intermediate-mass stars;

– *Magnitudes fainter than 16.5:* All magnitudes fainter than 16.5 were rejected, as well as their associated standard deviations, because at such faint magnitudes the flux contribution from the sky is dominating. For our S stars, magnitudes fainter than 16.5 only occur in the U filter, except for Hen 122 ($B = 17.82$), which is flagged in Table 4.

The stars having $U > 16.5$ fall in two categories: (i) either the star has *some* of its U measurements fainter than $U = 16.5$; in that case only the measurements brighter than $U = 16.5$ were considered; (ii) the star has *all* its U measurements fainter than $U = 16.5$; no U standard deviation is computed in that case. The column labelled n_U in Table 4 indicates the number of measurements fainter than $U = 16.5$.

3.2. Average colours and standard deviation

The average magnitudes were computed from the weighted fluxes according to Eq. (2) of Rufener (1988), where the weights refer to the quality of the measurements.

The reduced standard deviation $\sigma_{\rm r}$ is computed by quadratically subtracting the instrumental error σ_0 from the standard deviation σ. The instrumental error is computed by interpolating Fig. 2 of Barblan et al. (1998), giving the mean precision as a function of the magnitude for observations performed in the Geneva system. If $\sigma \leq \sigma_0$, then $\sigma_{\rm r} = 0$. The reduced standard deviation has not been computed for magnitudes fainter than 16.5, because of the large uncertainties affecting the mean precision σ_0 at such faint magnitudes.

3.3. Dereddening

Each star has been dereddened according to the following procedure:

(i) If $10° \leq |b| < 45°$, the colour excess E_{B-V} is taken from Burstein & Heiles (1982) and is multiplied by the factor $[1 - \exp(-10\ r\ \sin|b|)]$, where r is the distance in kpc and b is the galactic latitude (Feast et al. 1990); 72 stars are concerned. The visual extinction is then computed with $A_V = R \times E_{B-V}$, where $R = 3.1$.

(ii) If $|b| < 7.6°$, $A_V(r)$ is taken from Neckel & Klare (1980); 70 stars are concerned.

(iii) If $|b| \geq 45°$, or if the star is not on the Milky Way fields defined by Neckel & Klare (1980), or if it falls outside their $A_V(r)$ diagram (i.e., if the star is located too far away), then the visual extinction is taken from Arenou et al. (1992); 37 stars are concerned.

The dereddening procedure then requires to assign absolute visual magnitudes to S stars. From HIPPARCOS parallaxes, intrinsic S stars are known to be brighter than extrinsic S stars (Van Eck et al. 1998), but several factors (intrinsic variability, as well as the Lutz-Kelker bias) prevent from giving accurate average luminosities for both classes of S stars. The only previous large-scale estimate of absolute visual magnitudes of S stars is by Yorka & Wing (1979), who derived that the average M_V at maximum light is of the order −1.5 to −2.0 for Mira S stars (i.e., intrinsic S stars) and −1 for non-Mira S stars (presumably mostly extrinsic S stars).

In principle intrinsic S stars and extrinsic S stars should thus be assigned different absolute magnitudes (say $M_V = -1$ for extrinsic S stars and $M_V = -2$ for intrinsic S stars), depending on whether they have technetium or not. This approach has not been retained here since (i) the only unambiguous way to distinguish extrinsic from intrinsic S stars is technetium detection, and this information is available only for 70 S stars (out of 205); the other parameters capable of segregating the two kinds of S stars have only a statistical efficiency (see the discussion about *Sb* in Paper III), and (ii) this would introduce an a priori distinction between extrinsic and intrinsic S stars, which would then be difficult to disentangle from possible genuine photometric differences derived subsequently.

While the intrinsic S stars are brighter than the extrinsic ones, they are also much redder, hence their V magnitude is dimmed. Therefore the single plausible value of $M_V = -1$ has been assigned, for dereddening purposes only, to both extrinsic and intrinsic S stars.

The dereddening process is iterated until convergence of the apparent V magnitude is achieved (to a level of 10^{-4} mag). The dereddened U and B magnitudes are then computed, using $E_{U-B} = 0.652 \times E_{B-V}$, a relation derived by Cramer (1994) for B stars in the Geneva photometric system (no such relation is available for late-type stars).

4. *JHKL* photometry

Observations in the J, H, K and L bands (1.2, 1.6, 2.2, and 3.4 μm) were obtained at the South African Astronomical Observatory (SAAO) for 138 Henize stars.

The majority of the observations were made with the Mk II IR photometer on the 0.75 m telescope at SAAO, Sutherland, although a few measurements were made with the 1.0 m there. The observations were reduced to the SAAO system using the standards of Carter (1990). For a few of the stars observations have been previously reported in Catchpole et al. (1979). These early observations have been corrected to the Carter (1990) system and where necessary meaned with later observations. The accuracy of the photometry is typically better than 0.06 mag in J and H, 0.04 mag in K and 0.1 mag in L. The values given in Table 5 are based on multiple observations for a number of the stars, especially variables or suspected variables.

These colours were dereddened using the colour excess E_{B-V} obtained in Sect. 3.3 combined with unpublished colour excess ratios for the SAAO system kindly made available by Dr. I. Glass (1999, priv. comm.).

5. Bolometric magnitudes

Apparent bolometric magnitudes could be computed for 126 Henize S stars by integrating the spectral energy distribution derived from the Geneva U, B and V bands ($\lambda_{\rm eff}$ = 3463, 4227 and 5488 Å, respectively) and from the SAAO J, H, K and L bands ($\lambda_{\rm eff}$ = 1.2, 1.6, 2.2 and 3.4 μm, respectively). All the photometry was corrected from interstellar reddening as described in Sects. 3.3 and 4. The flux calibration for the SAAO photometry was kindly provided by Dr. I. Glass (1999, priv. comm.); for the Geneva photometry, it is taken from Rufener & Nicolet (1988). No correction has been applied for the contribution of the flux longward of 3.4 μm which is generally quite small (< 5% of the total energy distribution; Glass & Feast 1973). These apparent bolometric magnitudes are listed in the column $m_{\rm bol}$ in Table 5.

Unfortunately these bolometric magnitudes are only available for 126 stars. A second estimate of the bolometric magnitudes has thus been performed; it is less restrictive but also far less accurate. Multivariate classification has been performed on the 205 S stars of the Henize sample (Sect. 8 and Paper III), resulting in a classification of the stars in 6 well-defined and rather homogeneous groups (Sect. 8 and Paper III). For each group, a bolometric correction in the V band (BC_V) has been derived from the stars that have a reliable apparent bolometric magnitude available from the integration of the $UBVJHKL$ fluxes. Thanks to these average bolometric corrections, apparent bolometric magnitudes could be computed for the 170 stars with a V magnitude available. These apparent bolometric magnitudes are listed in the column $m_{\mathrm{bol},V}$ of Table 5.

6. IRAS photometry

The $K-[12]$ and $K-[25]$ colour indices have been computed from IRAS non-colour-corrected fluxes of good quality (quality flag of 3); they are listed in Table 5. The colour index $K-[i]$ is defined as $K-[i] = K + 2.5 \times \log[F(i)/F_0(i)]$, where $F(i)$ is the (non colour-corrected) flux in the i band from the IRAS Point Source Catalogue, $F_0(12\ \mu\mathrm{m}) = 28.3$ Jy, and $F_0(25\ \mu\mathrm{m}) = 6.73$ Jy.

The IRAS fluxes of Hen 55 (= IRAS 08457–4548) have been disregarded, because this star is very near from IRAS 08459–4547 located about 2′ to the east, and possibly contaminating its IRAS fluxes. Despite a quality flag of 3 at 25 μm, Hen 2 (= IRAS 01309–7913) has also been excluded because its 25 μm flux is at the IRAS sensitivity limit (0.2 Jy) and leads to an unphysical $K-[25]$ colour falling to the blue of the Rayleigh-Jeans point.

7. Low-resolution spectroscopy

7.1. Observations and reductions

Low-resolution spectra ($\Delta\lambda \sim 3$ Å), covering the spectral range 4400 − 8200 Å, have been obtained at the European Southern Observatory (ESO, La Silla, Chile) on the 1.52 m telescope equipped with the Boller & Chivens spectrograph (grating #23 + filter GG 420; dispersion of 114 Å mm^{-1}) and a Loral/Lesser thinned, UV flooded 2048×2048 CCD (CCD #39; 15 μm pixels).

The CCD frames were corrected for the electronic offset (bias), for the relative pixel-to-pixel response variation (flat-field) and for the sky foreground lines. Wavelength calibration was performed from helium-argon lamp spectra taken at least every two spectra. An optimal extraction of the spectra was performed according to the method of Horne (1986). The extracted spectra were multiplied by the instrumental response function, obtained from the spectra of flux-calibrated standard stars (namely CD−32°9927, LTT 3218, LTT 4816). The whole reduction sequence was performed within the “long” context of the MIDAS software package.

The signal-to-noise (S/N) ratio was estimated for each spectrum in the following way: three S/N values were computed for the three best exposed CCD lines (along the dispersion axis), in the neighbourhood of three spectral region of interest ($\sim$ 6000, 7000 and 7500 Å). These S/N values were then combined according to Eq. (17) of Newberry (1991). When the exposure time on a given star has been split in two, the final S/N ratio was computed using Eq. (18) of Newberry (1991). The degradation of the S/N ratio due to flat-field correction has not been taken into account. The average of these three S/N ratio values are listed in Table 6 for each target star.

Such low-resolution spectra have been obtained for 158 stars out of the 205 Henize S stars. Some spectral standards K stars, M stars and non-Henize S stars were also observed.

Table 2. Wavelength boundaries (in Å) used in the computation of the band indices defined in Sect. 7.2

name	$\lambda_{\mathrm{B,i}}$	$\lambda_{\mathrm{B,f}}$	$\lambda_{\mathrm{C,i}}$	$\lambda_{\mathrm{C,f}}$
Na D	5883	5903	5800	5847
ZrO	4640	4657	4600	4625
ZrO	5718	5735	5680	5720
ZrO	5748	5757	5680	5720
ZrO	6378	6382	6310	6345
ZrO	6412	6441	6310	6345
ZrO	6505	6530	6452	6475
ZrO	6541	6560	6452	6475
TiO	5448	5454	5410	5448
TiO	5591	5600	5500	5550
TiO	5615	5620	5500	5550
TiO	5759	5767	5680	5720
TiO	5810	5820	5800	5847
TiO	5847	5869	5800	5847
TiO	6159	6180	6067	6130
TiO	6187	6198	6067	6130
TiO	6651	6674	6452	6475
TiO	6681	6706	6452	6475
TiO	6714	6735	6452	6475
TiO	7054	7069	7014	7057
TiO	7125	7144	7014	7057
LaO	7380	7390	7362	7403
LaO	7403	7410	7362	7403

7.2. Construction of band-strength indices

These low-resolution spectra allow to distinguish subclasses within the S family. To set this classification on a quantitative basis, band-strength indices have been constructed that indicate the strength of a specific band (or line) with respect to a nearby pseudo-continuum. More precisely, the index characterizing the band/line X_λ is defined as $I_{\mathrm{X},\lambda} = (C_{\max} - B_{\min})/C_{\max}$, where $C_{\max}$ is the maximum “pseudo-continuum” flux inside the wavelength interval [$\lambda_{\mathrm{C,i}}$, $\lambda_{\mathrm{C,f}}$], and $B_{\min}$ is the minimum “band” flux inside the wavelength interval [$\lambda_{\mathrm{B,i}}$, $\lambda_{\mathrm{B,f}}$]. The adopted values of $\lambda_{\mathrm{B,i}}$, $\lambda_{\mathrm{B,f}}$, $\lambda_{\mathrm{C,i}}$ and $\lambda_{\mathrm{C,f}}$ are listed in Table 2. An average index I_{X} for a given oxide is then computed as the mean strength of all the bands listed in Table 2 for that oxide.

The ZrO bands used in the computation of the mean ZrO index were taken from Table 1 of Ake (1979), but only the 7 bands not too strongly contaminated by TiO bands have finally been retained. In practice, Pearson’s correlation coefficients between each ZrO index and the average

TiO index were computed for all non-pure S stars. If they were larger than 0.6, the corresponding ZrO band was rejected.

8. Multivariate classification

S stars from the Henize sample have been classified into several groups using a multivariate classification scheme combining the most relevant parameters described in the previous sections. The clustering algorithm is described in Paper III. Two different clustering have been performed, resulting in a classification in either two or six groups of S stars. The cluster assigned to a given star is listed in Cols. C_2 and C_6 of Table 6, corresponding to the 2- and 6-clusters classifications, respectively. The last column labelled C_f lists the assignment finally retained, as either intrinsic ("i") or extrinsic ("e").

9. Conclusion

A large set of data has been obtained for the Henize sample of S stars, as detailed in the present paper. Their analysis is presented in Paper III. All these data (individual measurements and spectra, as well as the various tables contained in this paper) will be available in electronic format at the internet address *http://www-astro.ulb.ac.be/*.

Acknowledgements. We thank Patricia Whitelock for some of the JHK observations.

Appendix A. Tables

The tables listed in this appendix contain the following columns:

• **Table 3: CORAVEL data**

▷ Hen and GCGSS are the Henize and Stephenson numbers, respectively, as listed in the General Catalogue of Galactic S stars (Stephenson 1984);

▷ Tc indicates whether the star is technetium-rich (y) or technetium-poor (n) as derived in Paper I;

▷ N_C is the number of CORAVEL radial-velocity measurements;

▷ ΔT stands for the time span (in days) of the observations;

▷ V_r (km s^{-1}) is the mean heliocentric radial velocity and $\sigma(V_\mathrm{r})$ (km s^{-1}) its standard deviation;

▷ $\overline{\epsilon}_1$ (km s^{-1}) gives the average error on one measurement;

▷ Sb (km s^{-1}) and PR are the reduced width and the depth of the CORAVEL cross-correlation dip, respectively;

▷ V_ran (km s^{-1}) indicates the range of the radial velocity measurements.

• **Table 4: Geneva photometric data**

▷ N_p is the number of measurements in the Geneva photometric system;

▷ V and V_0 are the reddened and dereddened visual apparent magnitude;

▷ $U-B$, $B-V$ and $(U-B)_0$, $(B-V)_0$ are the reddened and dereddened colour indices, respectively;

▷ m indicates the method chosen for dereddening the photometry, as described in Sect. 3.3 [1: E_{B-V} is taken from Burstein & Heiles (1982); 2: $A_V(r)$ is taken from Neckel & Klare (1980); 3: $A_V(r)$ is taken from Arenou et al. (1992)];

▷ n_U is the number of measurements fainter than $U = 16.5$; they were all discarded;

▷ $\sigma_\mathrm{r}(U)$, $\sigma_\mathrm{r}(B)$ and $\sigma_\mathrm{r}(V)$ stand for the reduced standard deviation of the U, B and V magnitudes.

• **Table 5: Infrared photometric data**

▷ the first 4 columns (after the Henize number) list the $JHKL$ photometry taken at SAAO (Sect. 4);

▷ $(V-K)_0$ is the dereddened colour index;

▷ the $K-[12]$ and $K-[25]$ indices, as described in Sect. 6, come next;

▷ m_bol is the apparent bolometric magnitude obtained by integrating the spectral energy distribution in the $UBVJHKL$ bands (Sect. 5);

▷ $m_{\mathrm{bol},V}$ is a less accurate estimate of the apparent bolometric magnitude derived by applying an appropriate bolometric correction to the V magnitude (see Sect. 5).

• **Table 6: Spectroscopic data and clustering results**

▷ I_ZrO, I_TiO, I_NaD and I_LaO are the band strength indices as defined in Sect. 7.2;

▷ S/N stands for the signal-to-noise ratio of the low-resolution spectra used to derive the band strength indices (Sect. 7);

▷ the weight assigned to each Henize star in order to correct for the unequal galactic longitude coverage at different galactic latitudes is listed in Col. w (see Paper III);

▷ l and b stand for the galactic longitudes and latitudes, respectively;

▷ C_2 and C_6 are the group assignments derived from the clustering algorithm for 2 and 6 resulting clusters (see Sect. 8 and Paper III);

▷ C_f is the final retained classification, where "e" and "i" stand for "extrinsic" and "intrinsic", respectively.

Missing data are indicated by a dash.

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Table 3. Henize S stars: CORAVEL data

Hen	GCGSS	HD/CoD	var	Tc	N_c	ΔT [days]	V_r [km s^{-1}]	$\sigma(V_r)$ [km s^{-1}]	$\overline{\epsilon}_1$ [km s^{-1}]	Sb [km s^{-1}]	PR	V_{ran} [km s^{-1}]
1	3	310		n	6	2338	10.3	0.5	0.2	4.3	0.41	1.4
2	39	9810		n	8	4931	21.5	3.7	1.3	4.2	0.42	11.0
3	104	29704	HQ Eri	n	5	1826	26.5	2.3	1.0	6.1	0.30	5.3
4	107			–	4	1826	–6.8	0.2	0.2	4.5	0.43	0.5
5	139			n	4	1826	77.6	2.2	1.1	5.0	0.36	4.7
6	141			n	4	1826	49.0	2.4	1.2	6.1	0.30	5.1
7	178	40706		n	4	1829	53.8	6.0	3.0	4.3	0.40	13.2
8	202	–39:2449		y	4	1827	47.4	2.1	1.1	6.2	0.28	6.0
9	204	–60:1381		n	4	1827	–7.2	0.7	0.4	3.8	0.43	1.8
10	206			–	4	1829	–9.6	5.4	2.7	4.8	0.32	12.9
11	229		CSV777	–	–	–	–	–	–	–	–	–
12	230	–43:2537		–	3	1827	110.5	1.2	0.7	9.3	0.13	1.4
13	236		CSV793	–	–	–	–	–	–	–	–	–
14	242	–34:3019		n	5	1826	31.2	1.2	0.6	4.3	0.42	3.1
15	245			–	2	1826	49.2	6.7	4.7	2.6	0.11	10.5
16	248			y	5	1829	38.1	0.8	0.4	6.0	0.34	1.8
17	256			–	5	1827	76.8	2.9	1.3	4.8	0.34	7.2
18	294			n	6	1828	67.6	6.6	2.7	5.6	0.22	13.8
19	328			y	5	1828	71.5	1.3	0.6	6.0	0.34	2.4
20	342	–45:3132		y	5	1829	–13.5	1.0	0.5	6.2	0.29	2.7
21	353			–	4	1416	35.5	0.6	0.4	7.2	0.18	2.0
22	359	–53:1875		–	4	1825	–10.4	3.0	1.5	3.3	0.46	7.4
23	361			–	3	717	55.6	2.1	1.2	7.8	0.22	4.6
24	368			–	3	714	35.3	3.5	2.0	9.6	0.25	6.1
25	372		CSV6592	–	–	–	–	–	–	–	–	–
26	371			–	–	–	–	–	–	–	–	–
27	380			–	1	–	4.0	–	1.4	18.6	0.25	–
28	390	62340		n	4	1827	25.9	2.0	1.0	4.4	0.39	4.1
29	393			–	4	1828	49.0	0.8	0.4	5.9	0.39	1.9
30	407		KU Pup	–	3	1154	26.0	3.0	1.7	9.1	0.33	6.9
31	434	65152		n	5	1827	–15.5	1.8	0.8	4.1	0.42	4.4
32	436		SU Pup	–	4	1746	68.8	2.8	1.4	8.5	0.11	6.4
33	438	–29:5241		–	–	–	–	–	–	–	–	–
34	446		X Vol	y	3	763	17.9	1.9	1.1	9.6	0.16	3.4
35	447	–71:435		n	5	1828	–13.6	3.3	1.5	3.9	0.46	10.2
36	448	–31:5393		y	5	1779	39.4	1.9	0.8	7.2	0.18	4.9
37	456	–41:3702		y	5	1780	12.8	1.4	0.6	7.1	0.27	2.8
38	457			–	3	1411	34.0	1.9	1.1	6.5	0.33	3.9
39	461	–65:601		y	6	1827	12.1	1.1	0.4	6.2	0.31	3.3
40	470	–30:5736		–	3	740	74.5	1.7	1.0	7.4	0.27	3.4
41	474	–27:5131		y	3	766	11.8	1.5	0.9	7.0	0.15	3.2
42	476			–	2	351	56.6	1.8	1.2	5.9	0.34	2.5
43	487	–26:5801		n	5	1829	37.9	6.3	2.8	5.1	0.35	14.2
44	489	–29:5912		–	4	1780	32.4	2.1	1.1	6.1	0.30	4.5
45	490	–32:5117		y	5	1778	16.4	0.8	0.4	4.9	0.38	1.9
46	498	–36:4526		–	4	1778	29.4	0.8	0.4	5.2	0.35	2.0
47	506	–35:4598		–	4	1779	8.9	1.6	0.8	7.1	0.32	4.3
48	523			–	4	1826	81.8	3.1	1.5	6.2	0.29	9.3
49	526			–	2	715	27.9	0.8	0.6	6.2	0.50	1.5
50	533	–36:4827	WY Pyx	–	3	833	59.9	1.1	0.6	10.0	0.14	2.3
51	540			–	4	1828	18.8	0.4	0.2	7.8	0.33	0.7
52	541			–	4	1826	–12.6	3.0	1.5	5.0	0.37	6.2
53	542	–38:4762		–	4	1156	37.3	1.8	0.9	8.5	0.26	3.5
54	543		CSV1356	–	–	–	–	–	–	–	–	–
55	550			–	–	–	–	–	–	–	–	–
56	558			–	4	1762	34.5	1.7	0.8	6.8	0.20	4.3
57	559			y	5	1827	5.3	1.1	0.5	6.0	0.29	2.6
58	567			–	–	–	–	–	–	–	–	–
59	570			–	4	1827	31.4	3.5	1.7	4.2	0.36	10.7
60	575			–	–	–	–	–	–	–	–	–
61	580			–	4	1412	47.9	3.2	1.6	4.7	0.38	7.6
62	584			–	–	–	–	–	–	–	–	–
63	588	–33:5772		n	6	1945	19.3	0.6	0.3	4.5	0.40	1.8
64	591	–28:6970		y	4	1827	44.3	0.5	0.3	6.9	0.32	1.3
65	592	–41:4839		–	5	1825	67.5	3.4	1.5	5.7	0.34	8.6
66	593	–33:5803		y	5	1828	7.3	0.7	0.3	6.7	0.31	1.9
67	611	–81:302		–	6	1898	–22.8	0.8	0.3	5.2	0.36	2.4
68	614	298563	UU Vel	–	1	–	2.5	–	1.1	13.9	0.28	–
69	617			–	5	1780	–2.4	2.8	1.2	8.5	0.27	6.6
70	625	–46:5417		–	5	1780	57.0	4.0	1.8	5.6	0.32	10.3
71	628			–	6	1827	–26.4	1.8	0.8	4.3	0.41	4.5
72	629			–	4	743	21.5	5.8	2.9	12.4	0.25	16.4
73	633			–	–	–	–	–	–	–	–	–
74	638			–	4	1825	–0.9	6.2	3.1	4.5	0.41	13.0
75	640			–	–	–	–	–	–	–	–	–
76	646	–32:6905		–	5	1780	–11.5	3.8	1.7	4.0	0.43	9.1
77	650			–	5	1827	7.6	1.1	0.5	6.5	0.30	2.7
78	652			–	4	1827	7.2	3.8	1.9	10.0	0.28	13.0
79	653			n	5	1744	–34.1	0.4	0.2	4.8	0.36	1.0
80	656			y	3	701	–0.2	4.1	2.4	7.9	0.11	6.8
81	657			–	–	–	–	–	–	–	–	–
82	659			–	4	1416	20.6	3.2	1.6	12.3	0.25	6.1
83	660			–	4	1413	26.8	4.6	2.3	3.6	0.43	9.3
84	661			–	–	–	–	–	–	–	–	–
85	662			–	4	1078	3.2	1.1	0.6	7.7	0.23	2.6
86	663	–39:6149		–	5	1747	–2.0	4.8	2.2	4.4	0.40	10.6
87	664	–60:2927		–	4	1829	21.5	1.1	0.6	10.3	0.44	3.2
88	667	–30:8296		y	5	1827	–1.2	0.9	0.4	6.3	0.31	2.2
89	668			y	4	1827	3.8	1.4	0.7	6.8	0.29	3.2
90	672	–54:3378		n	4	1413	12.2	1.5	0.7	4.8	0.38	3.2
91	677			–	2	742	–3.3	3.7	2.6	7.7	0.12	5.5
92	682			–	4	1096	–21.1	1.1	0.6	6.7	0.32	2.7
93	687			–	3	716	37.3	1.4	0.8	9.2	0.28	2.8
94	692			–	3	467	–4.4	3.1	1.8	7.7	0.31	5.2
95	693			y	5	1825	15.7	1.2	0.6	7.1	0.27	3.9
96	695			–	3	1092	–15.3	1.7	1.0	6.7	0.30	3.7
97	696	92681	HP Vel	y	5	1828	0.8	0.9	0.4	7.7	0.26	2.1
98	699			–	4	1763	0.5	0.8	0.4	6.9	0.25	2.0
99	702			–	4	1156	3.5	2.3	1.2	9.6	0.31	6.1
100	703		TT 9	–	2	1780	–4.0	4.3	3.0	11.0	0.42	6.3
101	704	–34:6961	Z Ant	y	4	1074	–3.8	2.5	1.2	10.0	0.20	7.1
102	705			–	–	–	–	–	–	–	–	–

Table 3. continued

Hen	GCGSS	HD/CoD	var	Tc	$N_{\rm C}$	ΔT [days]	$V_{\rm r}$ [km s^{-1}]	$\sigma(V_{\rm r})$ [km s^{-1}]	$\overline{\epsilon}_1$ [km s^{-1}]	Sb [km s^{-1}]	PR	$V_{\rm ran}$ [km s^{-1}]
103	710		CSV1667	–	–	–	–	–	–	–	–	–
104	714	95013		y	4	1946	–14.3	1.1	0.6	5.7	0.33	2.0
105	715			–	4	1183	–30.7	1.4	0.7	5.4	0.33	3.0
106	718			–	2	1064	–46.0	2.5	1.8	6.7	0.26	3.6
107	719			–	4	1154	–39.8	2.3	1.2	6.0	0.34	4.5
108	720	95875		n	10	1826	44.1	10.1	3.2	5.0	0.39	23.6
109	724		CSV1705	–	–	–	–	–	–	–	–	–
110	725			–	4	1093	–4.2	2.1	1.1	4.0	0.45	5.1
111	728		TT12	–	3	1092	–16.7	0.4	0.3	7.6	0.38	0.6
112	734	–49:5949		–	–	–	–	–	–	–	–	–
113	736			–	6	1535	–11.1	2.1	0.9	6.6	0.26	4.3
114	742		RY Car	–	–	–	–	–	–	–	–	–
115	749			–	–	–	–	–	–	–	–	–
116	–			–	–	–	–	–	–	–	–	–
117	772			–	–	–	–	–	–	–	–	–
118	777			–	3	1412	6.4	3.4	2.0	3.9	0.38	6.8
119	778	104361		n	6	1781	–22.2	4.3	1.7	4.4	0.41	11.2
120	788		BH Cru	–	5	1093	–0.4	2.8	1.2	7.3	0.27	10.1
121	792	–27:8661		n	11	1778	–4.9	6.9	2.1	6.0	0.22	20.0
122	794		CSV1862	–	3	717	–3.3	7.6	4.4	6.8	0.32	13.7
123	795	–47:7642		n	5	1764	0.2	2.6	1.2	4.6	0.41	6.1
124	798			–	7	1414	6.3	3.6	1.4	4.6	0.32	9.4
125	801	–25:9367	FI Hya	–	3	743	53.7	2.6	1.5	7.1	0.13	4.7
126	802			n	5	747	–29.8	2.7	1.2	4.6	0.38	6.2
127	804	110994	BQ Oct	–	8	2147	–1.0	0.7	0.2	5.7	0.35	2.2
128	807	–42:7915		–	–	–	–	–	–	–	–	–
129	808	–46:8238		n	6	1779	–25.4	3.4	1.4	5.3	0.35	7.9
130	810			–	6	1781	–5.5	2.2	0.9	6.0	0.35	6.7
131	811			–	4	1111	–48.3	1.6	0.8	6.6	0.32	3.7
132	813	–72:869		n	7	1898	–44.7	0.8	0.3	4.4	0.40	2.5
133	814	114586		n	7	1764	1.1	0.8	0.3	5.4	0.36	2.1
134	815	–30:10427	V957 Cen	–	9	1705	61.5	2.4	0.8	6.3	0.26	7.3
135	816	115236	UY Cen	–	7	1882	–22.2	1.5	0.6	7.8	0.40	4.5
136	820		NZ Cen	–	3	328	–56.6	8.8	5.1	25.2	0.26	19.4
137	824	–50:7894		n	9	1780	–21.1	4.6	1.5	7.2	0.31	11.1
138	826	118685		n	8	1902	8.3	1.0	0.4	5.7	0.32	2.7
139	831			–	4	682	–21.1	0.5	0.3	4.9	0.33	1.0
140	832	120179		y	6	1781	–34.7	1.0	0.4	5.8	0.35	2.9
141	834	120460	VX Cen	y	4	835	–54.9	1.4	0.7	7.6	0.19	3.0
142	837		RY Cir	–	2	470	–3.6	2.1	1.5	7.7	0.17	3.0
143	839	122434		n	6	1106	–26.0	3.5	1.4	4.5	0.41	8.6
144	842		V335 Cen	–	5	1094	–28.7	2.4	1.1	7.9	0.23	5.8
145	846			–	4	1626	–26.2	2.0	1.0	6.3	0.31	3.9
146	850		KQ Cen	–	7	1572	–12.2	1.3	0.5	7.1	0.25	3.5
147	858	–25:10393		n	8	1579	–9.9	7.1	2.5	4.2	0.41	16.7
148	861		CSV2170	–	–	–	–	–	–	–	–	–
149	864	130859		n	6	1108	25.0	2.9	1.2	4.5	0.40	7.5
150	867	131217	CR Cir	n	8	1781	23.9	2.1	0.8	4.9	0.37	6.2
151	869			–	1	–	–22.0	–	1.9	21.1	0.21	–
152	870			–	2	466	–56.9	8.7	6.2	16.4	0.32	18.9
153	872		GI Lup	–	3	955	15.4	2.3	1.3	9.3	0.21	5.6
154	873			–	6	1112	–12.9	0.5	0.2	3.4	0.35	1.2
155	889		GN Lup	–	2	624	–55.7	2.0	1.4	9.8	0.22	3.0
156	899			–	–	–	–	–	–	–	–	–
157	904	–74:1067	VY Aps	–	5	1034	–38.3	1.5	0.7	8.1	0.41	4.9
158	909			–	–	–	–	–	–	–	–	–
159	913			–	1	–	16.9	–	1.4	–	0.08	–
160	914		Y TrA	–	3	1827	–50.7	0.6	0.4	8.0	0.11	3.1
161	923			–	–	–	–	–	–	–	–	–
162	927			y	6	1865	8.8	1.0	0.4	6.8	0.28	2.4
163	929			–	–	–	–	–	–	–	–	–
164	930			–	–	–	–	–	–	–	–	–
165	931	149511	ST Sco	–	5	1108	–12.9	1.9	0.9	9.5	0.23	5.0
166	935			–	4	958	–16.4	2.2	1.1	8.0	0.41	5.4
167	936		V650 Ara	–	3	680	–13.1	1.7	1.0	9.5	0.31	3.7
168	940	–60:6462	LQ Ara	–	4	759	0.4	2.5	1.3	7.9	0.41	5.5
169	–			–	4	761	–39.6	2.0	1.0	3.5	0.44	5.3
170	947		LS Ara	–	–	–	–	–	–	–	–	–
171	948			–	1	–	39.0	–	1.0	–	0.12	–
172	954	153858	RT Sco	–	1	–	–44.3	–	0.6	6.3	0.11	–
173	962			n	4	686	39.0	0.2	0.2	4.6	0.37	0.4
174	971			–	3	682	-0.4	2.7	1.6	7.2	0.24	5.0
175	974	156957	V635 Sco	y	5	1108	–34.0	0.6	0.3	6.5	0.28	1.4
176	975			–	–	–	–	–	–	–	–	–
177	977	–32:12687		y	5	1901	–20.7	0.7	0.3	6.2	0.30	1.7
178	978	157335	V521 Oph	y	3	833	56.5	1.8	1.0	9.0	0.18	4.6
179	994	160379		n	3	684	36.0	0.9	0.5	5.7	0.32	1.6
180	1003			–	–	–	–	–	–	–	–	–
181	1004	320767	V407 Sco	–	3	334	–29.0	2.8	1.6	7.1	0.12	6.4
182	1010	163896		n	5	1827	31.2	5.9	2.6	5.2	0.34	13.7
183	1014	164392	V354 Pav	n	7	1827	–7.2	5.0	1.9	4.7	0.37	15.4
184	1020			–	3	330	–68.3	1.2	0.7	7.7	0.41	2.4
185	1021			–	4	1749	5.9	1.1	0.6	5.8	0.27	2.9
186	1023	165774		n	5	886	–31.6	5.1	2.3	4.6	0.39	10.9
187	1025	165843	V355 Pav	n	6	1827	–26.0	1.4	0.6	4.8	0.38	3.5
188	1026	–36:12314	V659 Sgr	–	4	760	–30.8	1.8	0.9	7.0	0.33	4.3
189	1030			–	4	1748	–68.7	3.3	1.6	5.1	0.31	7.4
190	1044			–	4	1748	–85.9	4.0	2.0	3.9	0.37	10.1
191	1056	171100	V3574 Sgr	y	4	757	–56.6	1.1	0.5	7.0	0.22	3.0
192	1062		V2017 Sgr	–	–	–	–	–	–	–	–	–
193	1073	–23:14695		n	5	1823	–34.9	1.1	0.5	4.2	0.42	2.5
194	1119			–	4	1748	-43.2	3.3	1.6	5.9	0.33	6.7
195	1123			–	–	–	–	–	–	–	–	–
196	1162			–	4	758	–106.8	0.5	0.3	5.8	0.29	1.1
197	1195	191630	V378 Pav	y	8	2150	–12.9	0.6	0.2	5.6	0.36	1.8
198	1196	192194	RZ Sgr	–	4	757	–32.0	4.0	2.0	12.9	0.27	9.5
199	1212			n	4	760	2.4	2.6	1.3	4.5	0.40	6.8
200	1268	–48:13866		–	–	–	–	–	–	–	–	–
201	1275	–26:15676		n	3	682	7.3	8.3	4.8	3.9	0.42	16.6
202	1294	212087	π1 Gru	y	7	846	–5.7	1.5	0.6	8.9	0.23	4.2
203	1295			n	4	757	8.5	0.9	0.4	4.9	0.36	2.1
204	1303		CSV103101	n	3	682	–9.1	5.0	2.9	3.9	0.39	9.6
205	1324			–	–	–	–	–	–	–	–	–

Table 4. Henize S stars: Geneva photometric data

Hen	$N_{\rm p}$	V	$U-B$	$B-V$	n_U	V_0	$(U-B)_0$	$(B-V)_0$	m	$\sigma_{\rm r}(U)$	$\sigma_{\rm r}(B)$	$\sigma_{\rm r}(V)$
1	3	7.49	3.22	1.21	0	7.37	3.19	1.17	3	0.05	0.03	0.02
2	20	8.48	3.27	1.20	0	8.22	3.21	1.12	2	0.02	0.01	0.01
3	4	8.26	2.94	1.03	0	8.16	2.92	1.00	2	0.12	0.08	0.08
4	3	9.81	3.37	1.27	0	9.53	3.31	1.18	2	0.10	0.04	0.03
5	3	11.01	3.18	1.17	0	10.98	3.17	1.16	2	0.00	0.02	0.02
6	5	9.88	3.02	1.07	0	9.84	3.01	1.06	2	0.03	0.03	0.04
7	3	8.89	3.18	1.25	0	8.79	3.16	1.22	2	0.06	0.02	0.00
8	8	11.03	3.25	1.40	0	10.84	3.21	1.34	2	0.23	0.24	0.25
9	4	9.52	3.27	1.22	0	9.48	3.26	1.20	2	0.03	0.01	0.00
10	4	9.33	3.11	1.23	0	8.78	2.99	1.05	2	0.06	0.06	0.07
11	1	14.37	–	0.85	1	14.27	–	0.82	2	–	–	–
12	3	12.38	2.37	0.95	2	12.20	2.33	0.89	2	–	1.65	1.86
13	3	13.02	–	1.39	3	12.83	–	1.33	2	–	0.25	0.27
14	3	10.32	3.31	1.28	0	10.04	3.26	1.19	2	0.06	0.01	0.02
15	2	12.01	2.54	1.21	0	11.63	2.46	1.09	2	0.37	0.41	0.31
16	2	11.20	3.37	1.30	0	10.92	3.31	1.21	2	0.05	0.13	0.13
17	3	12.37	–	1.21	3	12.09	–	1.12	2	–	0.00	0.00
18	13	10.60	1.57	0.99	0	9.98	1.44	0.79	2	0.22	0.09	0.06
19	1	10.49	3.84	1.66	0	10.30	3.80	1.59	3	–	–	–
20	1	10.29	3.14	1.25	0	9.93	3.06	1.14	2	–	–	–
21	2	12.37	–	1.75	2	12.07	–	1.65	1	–	0.00	0.01
22	–	–	–	–	–	–	–	–	–	–	–	–
23	–	–	–	–	–	–	–	–	–	–	–	–
24	2	11.83	–	2.05	2	10.83	–	1.73	1	–	0.35	0.30
25	–	–	–	–	–	–	–	–	–	–	–	–
26	–	–	–	–	–	–	–	–	–	–	–	–
27	1	12.65	–	2.23	1	12.18	–	2.08	2	–	–	–
28	3	8.87	3.33	1.47	0	8.38	3.23	1.31	2	0.01	0.02	0.01
29	2	11.61	–	2.44	2	10.99	–	2.24	1	–	0.08	0.06
30	1	13.73	–	2.65	1	12.13	–	2.14	1	–	–	–
31	1	7.18	3.34	1.38	0	6.82	3.27	1.26	2	–	–	–
32	2	8.69	1.98	0.97	0	8.34	1.91	0.85	3	1.43	1.47	1.65
33	–	–	–	–	–	–	–	–	–	–	–	–
34	2	10.16	2.74	1.22	0	9.70	2.64	1.07	2	0.37	0.48	0.62
35	2	9.83	3.32	1.31	0	9.46	3.24	1.19	2	0.00	0.00	0.00
36	2	9.01	2.27	0.92	0	8.86	2.24	0.88	1	0.02	0.07	0.09
37	5	10.95	3.38	1.49	0	10.59	3.30	1.38	3	0.15	0.09	0.10
38	3	11.26	3.37	1.41	0	10.90	3.29	1.29	3	0.02	0.05	0.07
39	3	9.31	3.20	1.29	0	8.87	3.11	1.15	2	0.05	0.03	0.02
40	3	11.39	2.88	1.29	0	10.09	2.60	0.87	1	0.00	0.05	0.06
41	1	9.46	2.32	1.00	0	9.16	2.26	0.91	1	–	–	–
42	1	12.43	–	2.68	1	12.04	–	2.56	3	–	–	–
43	1	10.59	3.58	1.31	0	10.29	3.52	1.22	1	–	–	–
44	2	10.69	3.22	1.40	0	10.39	3.16	1.30	1	0.17	0.18	0.19
45	7	9.58	2.80	1.20	0	8.98	2.68	1.01	1	0.10	0.04	0.02
46	3	11.42	–	1.64	3	10.02	–	1.19	1	–	0.00	0.02
47	–	–	–	–	–	–	–	–	–	–	–	–
48	–	–	–	–	–	–	–	–	–	–	–	–
49	3	12.57	–	3.40	3	10.77	–	2.82	1	–	0.00	0.13
50	3	10.78	2.37	0.93	0	9.00	1.99	0.36	1	0.51	0.56	0.60
51	3	10.68	–	2.58	3	10.15	–	2.41	3	–	0.27	0.24
52	3	11.78	–	1.90	3	10.18	–	1.38	1	–	0.02	0.02
53	3	9.98	3.41	2.05	0	8.83	3.17	1.68	1	0.66	0.54	0.40
54	4	11.18	3.35	1.58	1	10.91	3.29	1.50	3	0.31	0.76	0.89
55	–	–	–	–	–	–	–	–	–	–	–	–
56	5	12.39	1.73	1.39	1	11.79	1.60	1.20	3	0.30	0.11	0.05
57	6	10.32	3.58	1.59	0	9.32	3.37	1.27	1	0.20	0.14	0.15
58	–	–	–	–	–	–	–	–	–	–	–	–
59	4	10.69	3.21	1.27	0	10.42	3.15	1.18	2	0.06	0.00	0.00
60	–	–	–	–	–	–	–	–	–	–	–	–
61	1	12.04	–	2.06	1	10.83	–	1.67	3	–	–	–
62	4	12.73	–	2.70	4	11.52	–	2.31	3	–	0.30	0.20
63	6	9.82	3.48	1.40	0	9.55	3.42	1.31	3	0.06	0.02	0.02
64	4	10.22	3.67	1.64	0	9.53	3.52	1.42	2	0.10	0.11	0.11
65	14	10.91	2.89	1.73	13	9.62	2.62	1.31	1	–	0.08	0.06
66	3	10.40	3.30	1.43	0	10.13	3.24	1.34	3	0.11	0.05	0.06
67	4	8.91	3.25	1.18	0	8.64	3.19	1.09	2	0.00	0.01	0.01
68	2	11.35	–	3.13	2	9.38	–	2.49	1	–	0.69	0.48
69	3	11.18	–	1.97	3	10.55	–	1.77	2	–	0.31	0.30
70	3	11.04	–	1.85	3	10.18	–	1.57	3	–	0.04	0.00
71	3	10.32	3.54	1.45	0	9.85	3.44	1.29	3	0.00	0.03	0.03
72	3	10.38	4.14	2.43	2	9.90	4.04	2.28	3	–	0.72	0.54
73	–	–	–	–	–	–	–	–	–	–	–	–
74	4	11.12	3.52	1.51	0	10.42	3.38	1.29	1	0.00	0.01	0.01
75	3	13.60	–	2.04	3	12.90	–	1.81	1	–	0.24	0.23
76	4	10.80	3.32	1.23	0	10.43	3.24	1.11	2	0.07	0.02	0.01
77	3	11.16	3.29	1.53	0	9.68	2.98	1.05	1	0.09	0.14	0.17
78	3	11.61	–	3.13	3	10.51	–	2.78	1	–	0.71	0.48
79	2	10.58	3.50	1.43	0	10.05	3.38	1.25	2	0.05	0.05	0.04
80	1	9.29	2.38	1.36	0	8.89	2.29	1.23	2	–	–	–
81	–	–	–	–	–	–	–	–	–	–	–	–
82	–	–	–	–	–	–	–	–	–	–	–	–
83	5	12.04	–	1.95	5	10.44	–	1.43	1	–	0.00	0.02
84	–	–	–	–	–	–	–	–	–	–	–	–
85	3	11.63	3.02	1.64	1	10.93	2.87	1.41	1	0.00	0.11	0.13
86	3	10.91	3.48	1.38	0	10.37	3.36	1.21	2	0.20	0.03	0.03
87	3	11.00	–	2.88	3	10.30	–	2.65	1	–	0.27	0.25
88	4	9.63	3.25	1.21	0	9.40	3.20	1.13	2	0.09	0.08	0.09
89	3	9.85	2.97	1.37	0	9.15	2.82	1.15	1	0.30	0.03	0.04
90	9	9.80	3.35	1.35	0	9.12	3.20	1.14	1	0.16	0.02	0.02
91	3	12.09	2.33	1.33	0	11.77	2.26	1.23	3	0.36	0.49	0.46
92	3	11.56	–	1.67	3	10.96	–	1.47	1	–	0.18	0.19
93	2	11.85	–	2.36	2	11.37	–	2.21	3	–	0.27	0.25
94	–	–	–	–	–	–	–	–	–	–	–	–
95	5	10.37	3.79	1.39	2	9.12	3.53	0.99	1	0.83	0.10	0.03
96	3	12.12	–	1.95	3	11.52	–	1.76	1	–	0.30	0.35
97	6	8.60	2.82	1.18	0	8.15	2.72	1.04	1	0.11	0.14	0.15
98	3	11.21	3.38	1.50	0	10.21	3.17	1.18	1	0.00	0.09	0.07
99	3	10.34	3.30	2.05	1	9.74	3.17	1.86	1	0.04	0.37	0.17
100	–	–	–	–	–	–	–	–	–	–	–	–
101	6	9.45	2.96	1.48	0	9.26	2.92	1.43	2	0.16	0.14	0.13
102	–	–	–	–	–	–	–	–	–	–	–	–

Table 4. continued

Hen	N_p	V	$U-B$	$B-V$	n_U	V_0	$(U-B)_0$	$(B-V)_0$	m	$\sigma_r(U)$	$\sigma_r(B)$	$\sigma_r(V)$
103	–	–	–	–	–	–	–	–	–	–	–	–
104	3	10.07	3.24	1.33	0	9.68	3.15	1.20	3	0.10	0.02	0.02
105	–	–	–	–	–	–	–	–	–	–	–	–
106	3	12.10	–	1.61	3	10.71	–	1.17	1	–	0.10	0.09
107	3	12.57	–	2.72	3	11.57	–	2.40	1	–	0.19	0.10
108	4	8.77	3.19	1.12	0	8.62	3.16	1.07	1	0.02	0.04	0.04
109	–	–	–	–	–	–	–	–	–	–	–	–
110	3	11.26	3.47	1.58	1	10.36	3.28	1.29	1	0.00	0.00	0.00
111	3	12.43	–	2.60	3	11.23	–	2.21	1	–	0.28	0.23
112	–	–	–	–	–	–	–	–	–	–	–	–
113	3	12.05	–	1.86	3	10.65	–	1.41	1	–	0.03	0.03
114	–	–	–	–	–	–	–	–	–	–	–	–
115	2	13.42	–	2.08	2	12.02	–	1.63	1	–	0.30	0.35
116	–	–	–	–	–	–	–	–	–	–	–	–
117	–	–	–	–	–	–	–	–	–	–	–	–
118	4	11.71	3.22	1.35	2	11.34	3.15	1.23	2	0.00	0.03	0.03
119	5	8.83	3.17	1.21	0	8.23	3.04	1.02	1	0.07	0.00	0.00
120	6	7.48	3.69	3.02	0	7.12	3.62	2.91	1	1.50	1.02	0.62
121	30	10.45	1.94	1.07	0	10.20	1.89	0.99	2	0.54	0.20	0.10
122	1	13.98	–	3.84:	1	13.70	–	3.75:	2	–	–	–
123	8	9.25	3.37	1.29	0	8.83	3.28	1.15	2	0.04	0.02	0.02
124	6	11.50	3.03	1.20	0	11.16	2.96	1.09	2	0.14	0.05	0.05
125	3	10.57	2.39	0.95	0	10.34	2.34	0.87	2	0.24	0.20	0.23
126	1	10.57	3.31	1.27	0	10.11	3.21	1.12	3	–	–	–
127	3	6.88	3.25	1.26	0	6.66	3.21	1.19	2	0.05	0.03	0.03
128	–	–	–	–	–	–	–	–	–	–	–	–
129	31	9.41	3.35	1.44	0	8.97	3.25	1.30	2	0.13	0.06	0.06
130	1	11.09	3.27	1.99	0	10.34	3.11	1.75	1	–	–	–
131	4	11.79	–	1.97	4	10.69	–	1.61	1	–	0.10	0.08
132	4	9.31	3.44	1.59	0	8.76	3.33	1.41	2	0.03	0.04	0.04
133	1	9.01	2.98	1.34	0	8.55	2.89	1.19	3	–	–	–
134	6	11.58	3.08	1.34	1	11.39	3.05	1.28	2	0.19	0.06	0.09
135	9	7.01	5.09	2.78	0	6.76	5.04	2.70	2	0.09	0.10	0.08
136	2	11.96	–	2.77	2	10.36	–	2.25	1	–	0.60	0.44
137	30	9.09	2.92	1.23	0	8.86	2.87	1.15	2	0.16	0.05	0.05
138	4	7.05	3.23	1.39	0	6.35	3.09	1.17	3	0.17	0.15	0.14
139	1	11.66	3.07	1.32	0	10.66	2.86	0.99	1	–	–	–
140	7	8.41	3.20	1.32	0	7.81	3.07	1.13	3	0.02	0.02	0.04
141	4	9.24	2.91	1.61	0	8.20	2.69	1.27	1	0.20	0.16	0.14
142	3	11.95	2.61	2.07	2	10.95	2.40	1.75	1	–	1.72	1.43
143	10	8.45	3.23	1.13	0	8.29	3.19	1.07	2	0.05	0.02	0.02
144	3	11.95	–	2.16	3	10.97	–	1.84	1	–	0.03	0.07
145	2	12.25	–	2.20	2	11.05	–	1.81	1	–	0.00	0.01
146	5	10.87	3.24	1.81	0	9.61	2.98	1.40	1	0.06	0.03	0.01
147	26	10.46	3.29	1.17	0	10.21	3.23	1.09	2	0.19	0.03	0.02
148	–	–	–	–	–	–	–	–	–	–	–	–
149	10	9.40	3.30	1.19	0	9.18	3.25	1.12	2	0.03	0.02	0.02
150	6	7.50	3.32	1.28	0	6.85	3.18	1.07	1	0.05	0.04	0.04
151	–	–	–	–	–	–	–	–	–	–	–	–
152	3	13.03	–	2.92	3	12.10	–	2.62	3	–	0.47	0.34
153	1	10.53	–	2.64	1	10.35	–	2.58	2	–	–	–
154	–	–	–	–	–	–	–	–	–	–	–	–
155	–	–	–	–	–	–	–	–	–	–	–	–
156	3	11.63	2.58	2.04	2	9.36	2.10	1.31	1	–	0.70	0.74
157	2	9.40	–	3.06	2	9.11	–	2.96	2	–	0.06	0.03
158	1	13.37	–	1.44	1	12.44	–	1.14	3	–	–	–
159	1	12.56	–	2.45	1	12.01	–	2.27	3	–	–	–
160	2	11.25	2.35	0.64	0	10.69	2.24	0.46	3	0.24	0.31	0.30
161	2	11.53	–	2.49	2	10.70	–	2.22	2	–	0.11	0.05
162	1	9.53	3.16	1.38	0	8.73	2.99	1.12	1	–	–	–
163	2	11.76	–	2.77	2	10.40	–	2.34	1	–	0.00	0.03
164	–	–	–	–	–	–	–	–	–	–	–	–
165	2	9.77	3.45	2.21	1	9.08	3.31	1.99	2	–	0.77	0.60
166	1	10.89	–	2.80	1	10.10	–	2.54	1	–	–	–
167	3	11.67	–	2.38	3	10.32	–	1.94	1	–	0.39	0.33
168	1	10.19	–	2.99	1	9.37	–	2.73	2	–	–	–
169	1	10.56	3.38	1.37	0	10.47	3.37	1.34	2	–	–	–
170	–	–	–	–	–	–	–	–	–	–	–	–
171	3	12.65	2.22	0.84	0	11.30	1.94	0.40	1	0.50	0.49	0.39
172	1	11.06	1.69	1.36	0	9.10	1.28	0.73	1	–	–	–
173	1	10.15	3.27	1.41	0	9.15	3.06	1.09	1	–	–	–
174	12	10.90	2.65	1.71	2	9.86	2.44	1.38	3	0.40	0.11	0.10
175	1	8.57	3.43	1.66	0	7.67	3.24	1.37	1	–	–	–
176	–	–	–	–	–	–	–	–	–	–	–	–
177	1	10.17	3.38	1.59	0	9.17	3.17	1.27	1	–	–	–
178	2	10.55	2.77	1.84	0	8.55	2.35	1.19	1	0.00	0.13	0.19
179	3	9.24	3.23	1.27	0	8.84	3.15	1.14	2	0.15	0.08	0.09
180	–	–	–	–	–	–	–	–	–	–	–	–
181	–	–	–	–	–	–	–	–	–	–	–	–
182	1	8.37	3.01	1.19	0	7.94	2.92	1.05	1	–	–	–
183	4	8.45	3.18	1.15	0	8.21	3.13	1.07	2	0.04	0.03	0.03
184	2	11.29	–	3.21	2	9.74	–	2.71	3	–	0.45	0.26
185	1	11.46	–	1.69	1	9.91	–	1.19	3	–	–	–
186	3	8.18	3.19	1.15	0	7.83	3.12	1.03	1	0.07	0.05	0.06
187	3	8.42	3.28	1.32	0	8.17	3.23	1.24	2	0.04	0.05	0.05
188	2	10.16	–	2.36	2	9.38	–	2.11	1	–	0.10	0.08
189	26	11.13	2.72	1.14	0	10.81	2.65	1.04	2	0.19	0.07	0.07
190	1	11.34	3.36	1.48	0	10.62	3.21	1.25	3	–	–	–
191	3	9.94	3.05	1.36	0	9.60	2.98	1.25	2	0.09	0.14	0.16
192	–	–	–	–	–	–	–	–	–	–	–	–
193	3	10.11	3.68	1.51	0	9.17	3.48	1.20	3	0.20	0.02	0.00
194	4	11.32	3.28	1.37	0	11.01	3.21	1.27	2	0.10	0.09	0.10
195	3	11.56	2.25	1.71	2	11.40	2.21	1.66	2	–	1.54	1.36
196	3	11.38	3.42	1.45	0	10.98	3.34	1.32	2	0.00	0.16	0.18
197	4	6.77	3.17	1.22	0	6.66	3.15	1.19	2	0.09	0.05	0.05
198	7	8.07	3.78	2.62	2	8.05	3.77	2.61	2	1.38	1.34	1.05
199	3	10.20	3.25	1.28	0	10.11	3.23	1.25	2	0.07	0.03	0.02
200	5	11.24	–	4.54	5	11.22	–	4.53	2	–	0.53	0.22
201	4	10.01	3.20	1.26	0	9.81	3.16	1.20	3	0.02	0.00	0.00
202	22	6.60	2.84	1.94	0	6.43	2.81	1.89	3	0.19	0.27	0.25
203	3	9.71	3.24	1.43	0	9.55	3.20	1.38	3	0.10	0.13	0.14
204	3	9.74	3.20	1.23	0	9.58	3.17	1.18	3	0.00	0.02	0.03
205	2	10.55	3.35	1.37	0	10.32	3.30	1.29	2	0.00	0.00	0.00

Table 5. Henize S stars: infrared photometric data

Hen	K	$J-H$	$H-K$	$K-L$	$(V-K)_0$	IRAS	$K-[12]$	$K-[25]$	$m_{\rm bol}$	$m_{{\rm bol},V}$
1	3.10	0.93	0.19	0.12	4.28	00051–6235	0.57	0.65	5.90	5.46
2	4.07	0.92	0.20	0.15	4.18	01309–7913	–	–	6.84	6.32
3	2.67	0.96	0.25	0.18	5.50	04374–3033	0.69	0.81	5.63	6.25
4	5.22	0.95	0.20	0.01	4.34	04309–8416	0.62	–	8.03	7.62
5	5.80	0.81	0.08	0.14	5.18	05224–3354	–	–	8.56	9.07
6	4.18	0.96	0.24	0.22	5.65	05265–5113	0.84	0.64	7.14	7.93
7	4.64	0.92	0.18	0.14	4.16	05571–3804	0.64	–	7.43	7.21
8	5.50	0.94	0.25	0.28	5.36	06112–3932	1.95	2.72	8.42	8.09
9	5.30	0.97	0.17	-0.09	4.18	06116–6056	0.69	–	8.12	7.57
10	–	–	–	–	–	06024–8403	–	–	–	7.19
11	5.73	1.24	0.60	0.39	8.55	06308–2608	2.38	2.86	9.09	9.97
12	3.84	1.03	0.33	0.28	8.37	06312–4351	-0.55	–	6.92	7.89
13	–	–	–	–	–	06340–4748	–	–	–	10.92
14	5.82	0.95	0.16	0.09	4.25	06384–3450	–	–	8.58	8.13
15	4.82	0.86	0.14	0.23	6.85	06384–2738	-0.09	–	7.61	7.33
16	6.09	1.02	0.29	0.19	4.86	06388–3858	–	–	9.03	8.17
17	–	–	–	–	–	–	–	–	–	10.18
18	5.00	0.95	0.27	0.19	5.03	06591–2902	0.68	–	7.85	7.36
19	5.41	0.96	0.22	0.10	4.91	07148–3014	0.71	–	8.30	7.55
20	4.31	1.01	0.25	0.11	5.65	07207–4510	0.94	1.17	7.25	7.17
21	–	–	–	–	–	07250–3125	–	–	–	7.77
22	7.53	0.83	0.05	-0.12	–	07272–5331	–	–	–	–
23	4.68	1.15	0.32	0.34	–	07289–3056	1.11	–	–	–
24	–	–	–	–	–	07328–3408	–	–	–	6.53
25	–	–	–	–	–	07336–5949	–	–	–	–
26	–	–	–	–	–	–	–	–	–	–
27	5.86	0.81	0.54	–	6.37	07296–8238	2.57	3.06	–	7.88
28	3.96	0.95	0.24	0.12	4.47	07380–7013	0.65	0.68	6.76	6.48
29	5.41	1.17	0.32	0.36	5.64	07405–2544	0.70	–	8.42	8.23
30	–	–	–	–	–	07454–3026	–	–	–	7.83
31	2.46	0.98	0.22	0.18	4.40	07530–6027	0.61	0.69	5.27	4.91
32	–	–	–	–	–	07545–4400	–	–	–	4.03
33	–	–	–	–	–	07559–2929	–	–	–	–
34	3.06	0.98	0.32	0.35	6.68	07573–6509	1.27	1.61	6.04	5.40
35	5.59	0.80	0.18	-0.08	3.90	07568–7124	–	–	8.25	7.56
36	2.60	1.02	0.29	0.28	6.27	07595–3139	0.87	1.00	5.63	4.94
37	4.17	1.12	0.28	0.27	6.46	08023–4154	0.80	1.08	7.19	7.84
38	–	–	–	–	–	08024–4258	–	–	–	8.15
39	3.49	1.01	0.27	0.20	5.42	08023–6541	0.72	0.79	6.42	6.12
40	4.88	1.08	0.32	0.36	5.32	08074–3040	0.85	1.79	7.70	6.17
41	2.61	1.06	0.32	0.33	6.58	08098–2809	1.09	1.41	5.65	5.25
42	–	–	–	–	–	08102–3105	–	–	–	9.29
43	5.50	0.95	0.24	0.36	4.82	08150–2631	0.62	–	8.36	8.71
44	5.06	1.00	0.31	0.33	5.36	08164–2946	1.04	–	8.03	7.64
45	4.75	0.97	0.21	0.21	4.29	08166–3239	0.52	–	7.50	6.23
46	5.41	1.04	0.31	0.20	4.74	08199–3707	0.73	–	8.16	8.11
47	4.01	1.18	0.36	0.34	–	08234–3536	–	–	–	–
48	5.55	0.96	0.28	0.18	–	08304–2952	0.84	–	–	–
49	–	–	–	–	–	08308–3840	–	–	–	8.02
50	2.68	0.99	0.38	0.46	6.48	08348–3617	1.65	1.95	5.44	5.08
51	3.34	1.20	0.39	0.34	6.86	08388–5116	1.51	1.92	6.46	7.40
52	5.29	1.16	0.34	0.08	5.04	08390–4914	0.70	–	8.10	8.27
53	1.67	1.22	0.38	0.35	7.27	08403–3853	0.95	1.64	4.68	4.53
54	3.61	1.13	0.37	0.35	7.32	08416–3220	1.43	1.49	6.73	6.60
55	2.52	1.06	0.31	0.26	–	08457–4548	–	–	–	–
56	–	–	–	–	–	08487–5657	–	–	–	7.87
57	3.81	1.08	0.31	0.21	5.61	08490–5026	0.82	1.10	6.70	6.57
58	–	–	–	–	–	–	–	–	–	–
59	5.60	0.95	0.26	0.25	4.84	08547–7108	0.75	–	8.48	8.51
60	–	–	–	–	–	–	–	–	–	–
61	6.10	1.10	0.34	0.39	4.84	–	–	–	8.94	8.92
62	–	–	–	–	–	09049–4038	–	–	–	7.22
63	4.50	1.01	0.24	0.23	5.08	09062–3319	0.59	–	7.42	7.65
64	3.35	1.03	0.29	0.29	6.25	09070–2847	0.76	1.04	6.27	6.77
65	4.57	1.10	0.27	0.26	5.16	09070–4149	–	–	7.37	7.71
66	4.33	1.06	0.26	0.18	5.83	09081–3413	0.69	0.93	7.32	7.38
67	3.73	0.99	0.24	0.18	4.93	09166–8205	0.68	0.68	6.63	6.73
68	2.75	1.17	0.53	0.62	6.81	09338–5349	1.78	2.61	5.67	5.07
69	3.00	1.18	0.36	0.30	7.60	09358–6536	0.88	1.12	6.08	6.24
70	3.96	1.14	0.33	0.32	6.31	09400–4642	0.78	0.59	6.93	8.27
71	5.32	0.97	0.22	0.38	4.57	09411–6417	0.66	–	8.13	7.94
72	4.06	1.00	0.38	0.41	5.88	09415–6327	1.29	1.63	7.06	5.60
73	–	–	–	–	–	–	–	–	–	–
74	6.20	1.05	0.21	0.46	4.29	09471–6111	–	–	8.96	8.84
75	–	–	–	–	–	09484–6344	–	–	–	8.59
76	6.21	1.01	0.16	0.38	4.25	09549–3244	–	–	8.97	8.52
77	5.05	1.01	0.30	–	4.77	09572–4943	0.85	–	–	6.93
78	2.60	1.17	0.38	0.34	8.00	10015–4634	0.91	1.25	5.61	6.20
79	–	–	–	–	–	10009–6834	–	–	–	8.14
80	2.72	1.06	0.36	0.33	6.21	10017–7012	1.05	1.21	5.76	4.58
81	5.33	0.93	0.48	–	–	10038–6055	1.69	2.19	–	–
82	3.44	1.27	0.45	–	–	10041–6136	-0.98	–	–	–
83	6.25	1.05	0.20	0.21	4.34	–	–	–	8.85	8.86
84	4.83	1.21	0.49	0.60	–	10045–5955	2.32	2.92	–	–
85	3.71	1.12	0.34	0.26	7.28	10053–4602	0.97	1.65	6.74	6.62
86	6.00	1.05	0.21	0.16	4.42	10053–4015	–	–	8.81	8.78
87	3.44	1.30	0.42	0.39	6.93	10053–6042	1.16	1.74	6.58	7.55
88	4.28	1.00	0.24	0.22	5.15	10139–3045	0.84	–	7.20	6.65
89	3.59	1.02	0.32	–	5.62	10138–6046	1.05	1.18	–	6.39
90	4.73	0.97	0.23	0.25	4.45	10155–5439	0.67	–	7.50	7.22
91	–	–	–	–	–	10213–4602	–	–	–	7.47
92	4.76	1.14	0.31	0.18	6.25	10256–5158	0.87	–	7.78	8.20
93	2.31	1.15	0.38	0.34	9.11	10308–6707	0.88	1.36	5.42	7.07
94	–	–	–	–	–	10358–6028	–	–	–	–
95	3.77	0.97	0.28	0.26	5.47	–	–	–	6.53	6.37
96	–	–	–	–	–	10380–5256	–	–	–	8.76
97	1.87	1.03	0.30	0.24	6.32	10389–5149	0.81	1.03	4.85	5.40
98	4.42	1.13	0.30	0.30	5.89	10410–5624	–	–	7.33	7.45
99	3.05	1.17	0.36	0.35	6.74	10422–5448	0.88	1.45	6.12	5.43
100	3.83	1.60	0.62	0.52	–	–	–	–	–	–
101	1.64	1.17	0.33	0.34	7.64	10436–3459	1.71	2.45	4.76	4.96
102	–	–	–	–	–	–	–	–	–	–

Table 5. continued

Hen	K	$J-H$	$H-K$	$K-L$	$(V-K)_0$	IRAS	$K-[12]$	$K-[25]$	$m_{\rm bol}$	$m_{{\rm bol},V}$
103	–	–	–	–	–	–	–	–	–	–
104	4.21	1.08	0.25	0.24	5.51	10551–5250	–	–	7.16	6.92
105	4.75	1.04	0.32	0.32	–	–	–	–	–	–
106	–	–	–	–	–	10590–6210	–	–	–	7.96
107	4.88	1.17	0.44	–	6.78	10599–5615	0.95	–	–	8.82
108	4.32	0.90	0.20	0.18	4.31	11006–5600	0.71	–	7.12	7.03
109	6.25	0.56	0.40	1.51	–	11041–6820	2.46	2.64	–	–
110	–	–	–	–	–	11045–6142	–	–	–	8.45
111	–	–	–	–	–	–	–	–	–	8.47
112	–	–	–	–	–	11111–5002	–	–	–	–
113	5.15	1.29	0.34	0.20	5.63	11160–6553	0.62	–	8.08	7.90
114	–	–	–	–	–	11179–6135	–	–	–	–
115	–	–	–	–	–	11232–6059	–	–	–	7.72
116	–	–	–	–	–	–	–	–	–	–
117	–	–	–	–	–	11512–5944	–	–	–	–
118	–	–	–	–	–	–	–	–	–	9.43
119	4.24	0.90	0.22	0.21	4.04	11583–5548	0.71	0.56	6.93	6.64
120	1.56	1.18	0.47	0.33	5.59	12135–5600	1.23	1.54	4.72	4.37
121	4.14	0.96	0.27	0.25	6.08	12219–2802	0.66	–	7.10	7.58
122	5.21	0.96	0.27	–	8.52	12238–5208	1.18	–	–	9.40
123	4.47	1.00	0.20	0.14	4.39	12262–4735	0.56	–	7.27	6.92
124	6.06	0.91	0.24	0.01	5.13	12311–4219	–	–	8.93	9.25
125	3.73	0.86	0.42	0.54	6.63	12372–2623	1.50	1.71	6.75	6.42
126	5.35	0.99	0.24	0.24	4.80	12407–5328	0.62	–	8.20	8.20
127	1.47	1.36	0.70	0.70	5.21	13079–8931	0.80	0.85	4.80	3.91
128	–	–	–	–	–	12464–4249	–	–	–	–
129	4.11	1.01	0.22	0.14	4.90	12505–4654	0.68	–	6.97	7.07
130	4.34	1.18	0.32	0.27	6.07	12581–6638	0.90	1.24	7.35	7.58
131	4.26	1.19	0.36	0.36	6.53	12598–6042	0.90	1.32	7.24	7.93
132	4.14	1.04	0.22	0.22	4.67	13074–7256	0.72	0.75	6.98	6.85
133	3.60	0.97	0.27	0.09	5.00	13093–5644	0.60	0.80	6.48	6.64
134	6.20	0.84	0.28	0.23	5.21	13117–3110	–	–	9.10	8.64
135	0.58	1.15	0.36	0.37	6.21	13136–4426	1.30	1.79	3.69	4.01
136	3.62	1.51	0.66	0.66	6.88	13226–6302	2.17	3.39	6.83	6.05
137	3.59	0.97	0.26	0.18	5.29	13328–5056	0.58	0.57	6.52	6.95
138	–	–	–	–	–	13372–7136	–	–	–	4.44
139	–	–	–	–	–	13462–6747	–	–	–	7.91
140	2.72	1.03	0.28	0.16	5.15	13460–5507	0.65	0.68	5.62	5.06
141	0.44	1.07	0.36	0.30	7.85	13477–6009	0.98	1.25	3.40	3.90
142	6.92	0.87	0.00	0.36	4.12	13517–6702	4.64	5.22	9.39	6.65
143	3.89	0.90	0.21	0.17	4.41	13597–4144	0.51	0.57	6.70	6.38
144	3.18	1.15	0.37	0.33	7.87	14069–5905	0.94	1.32	6.19	6.66
145	–	–	–	–	–	14134–5959	–	–	–	8.29
146	2.51	1.14	0.36	0.30	7.22	14215–6346	0.80	0.99	5.45	5.31
147	5.84	0.86	0.17	0.08	4.40	14297–2558	–	–	8.58	8.63
148	–	–	–	–	–	14372–6106	–	–	–	–
149	4.72	0.97	0.17	–	4.48	14485–3746	0.67	–	–	7.27
150	2.06	1.00	0.26	0.14	4.84	14510–6052	0.59	0.68	4.91	4.94
151	–	–	–	–	–	14549–6313	–	–	–	–
152	–	–	–	–	–	14556–5455	–	–	–	7.80
153	2.19	1.24	0.56	0.66	8.17	15030–4116	1.91	2.50	5.49	6.04
154	–	–	–	–	–	15048–7216	–	–	–	–
155	3.68	1.00	0.45	0.39	–	15209–3251	0.86	1.10	–	–
156	–	–	–	–	–	15437–5451	–	–	–	5.05
157	2.50	1.15	0.32	0.42	6.64	15548–7420	0.86	1.14	5.57	6.36
158	5.49	1.16	0.31	0.37	7.03	16026–5436	3.48	4.07	8.46	8.13
159	4.46	1.16	0.36	0.32	7.59	16079–6305	0.85	1.55	7.54	7.70
160	–	–	–	–	–	16097–6158	–	–	–	6.39
161	2.42	1.34	0.46	0.34	8.36	16209–2808	1.03	1.86	5.59	6.39
162	2.85	1.05	0.32	0.22	5.95	16245–5611	0.84	1.00	5.78	5.97
163	1.53	2.08	0.73	0.83	9.00	16316–5026	2.52	3.23	4.97	6.10
164	3.69	1.60	0.63	0.58	–	16317–4933	1.83	2.59	–	–
165	0.56	1.23	0.39	0.34	8.58	16334–3107	1.22	1.84	3.67	4.78
166	3.80	1.16	0.40	0.33	6.37	16382–5727	0.87	1.25	6.85	7.34
167	2.98	1.17	0.35	0.28	7.46	16396–5542	0.78	1.00	5.92	6.01
168	2.67	1.19	0.41	0.38	6.78	16472–6056	0.93	1.35	5.74	6.62
169	–	–	–	–	–	–	–	–	–	8.56
170	3.35	1.13	0.45	0.40	–	16546–6000	1.33	1.56	–	–
171	2.99	1.19	0.50	0.46	8.44	16552–5335	1.64	2.05	6.04	7.38
172	0.26	1.17	0.55	0.63	9.02	17001–3651	2.14	2.75	3.21	5.18
173	4.53	1.01	0.23	-0.04	4.71	17105–3219	–	–	7.29	7.24
174	3.81	1.04	0.41	–	6.15	17169–2311	0.87	–	–	5.95
175	1.43	1.07	0.31	0.24	6.33	17188–4141	0.73	0.96	4.36	4.92
176	–	–	–	–	–	17186–2914	–	–	–	–
177	3.12	1.15	0.32	0.28	6.14	17204–3258	0.92	–	6.07	6.42
178	–	–	–	–	–	17206–2826	–	–	–	4.63
179	3.71	1.00	0.22	0.12	5.17	17385–5356	0.74	0.89	6.60	6.93
180	4.62	1.78	0.78	0.68	–	17483–2811	2.43	–	–	–
181	3.05	1.07	0.55	–	–	17490–3502	1.47	–	–	–
182	3.04	0.97	0.24	0.19	4.95	17566–3019	0.51	0.89	5.90	6.36
183	3.47	1.31	0.23	–	4.77	18006–6510	0.68	0.69	–	6.63
184	–	–	–	–	–	18028–2555	–	–	–	6.98
185	4.57	1.09	0.28	0.03	5.48	18029–2541	–	–	7.34	7.16
186	3.28	0.85	0.25	0.18	4.58	18058–3658	0.53	0.76	6.08	6.24
187	3.40	0.99	0.22	0.16	4.80	18081–6749	0.60	0.64	6.27	6.26
188	3.23	1.15	0.33	0.35	6.22	18085–3625	1.00	1.41	6.22	6.62
189	–	–	–	–	–	18134–4902	–	–	–	8.90
190	–	–	–	–	–	18246–3304	–	–	–	8.72
191	2.66	1.04	0.30	0.28	6.97	18310–3541	0.95	1.37	5.68	5.29
192	–	–	–	–	–	18354–3436	–	–	–	–
193	4.74	1.03	0.25	0.14	4.52	18425–2341	0.71	–	7.50	7.26
194	–	–	–	–	–	19155–3922	–	–	–	9.10
195	–	–	–	–	–	–	–	–	–	7.10
196	5.96	0.75	0.34	0.27	5.06	19477–3221	–	–	8.80	8.23
197	1.66	0.96	0.22	0.17	5.02	20100–6225	0.58	0.74	4.57	3.91
198	1.30	1.06	0.39	0.35	6.76	20120–4433	1.62	2.72	4.45	3.75
199	–	–	–	–	–	20231–4046	–	–	–	8.20
200	4.02	1.33	0.93	–	7.21	21172–4819	2.54	2.86	–	6.92
201	5.76	0.90	0.18	0.10	4.07	21307–2820	–	–	8.50	8.22
202	-2.12	1.14	0.43	0.44	8.57	22196–4612	1.64	2.41	1.07	2.13
203	5.01	0.86	0.23	0.21	4.55	22200–5412	0.81	–	7.83	7.64
204	5.17	0.92	0.21	0.16	4.42	22421–4508	0.51	–	7.99	7.99
205	4.99	1.00	0.25	0.19	5.35	–	–	–	7.93	8.41

Table 6. Spectroscopic data and clustering results

Hen	$I_{\rm ZrO}$	$I_{\rm TiO}$	$I_{\rm NaD}$	$I_{\rm LaO}$	S/N	w	l	b	C_2	C_6	$C_{\rm f}$
1	–	–	–	–	–	4.27	311.9	−53.7	1	2	e
2	–	–	–	–	–	4.59	300.6	−37.7	1	2	e
3	0.14	0.44	0.54	0.04	188	4.52	231.1	−40.9	1	2	e
4	0.08	0.23	0.43	0.06	182	3.37	297.5	−30.3	1	2	e
5	0.18	0.31	0.43	0.03	157	3.47	237.6	−32.3	1	2	e
6	0.17	0.43	0.55	0.05	233	3.61	258.3	−33.9	1	2	e
7	0.16	0.19	0.37	0.03	70	3.22	244.2	−26.5	1	1	e
8	0.28	0.34	0.46	0.03	188	3.15	246.5	−24.2	2	4	i
9	0.16	0.18	0.41	0.05	306	3.27	270.0	−28.2	1	2	e
10	0.22	0.39	0.54	0.06	192	3.27	296.3	−28.2	1	1	e
11	0.28	0.71	0.90	0.20	107	3.01	234.6	−15.8	2	6	i
12	0.20	0.33	0.42	0.03	174	3.10	252.2	−22.0	2	6	i
13	0.19	0.34	0.45	0.04	65	3.12	256.2	−22.6	1	2	e
14	0.18	0.21	0.43	0.05	157	3.03	243.6	−17.7	1	2	e
15	0.28	0.70	0.91	0.17	64	3.00	236.7	−14.8	2	6	i
16	0.15	0.35	0.47	0.04	125	3.05	247.8	−18.9	2	4	i
17	0.24	0.36	0.51	0.04	109	3.02	243.6	−16.7	1	2	e
18	0.27	0.36	0.47	0.02	139	2.96	239.9	−11.2	1	3	e
19	0.31	0.24	0.49	0.04	172	2.95	242.5	−8.7	2	4	i
20	0.17	0.44	0.54	0.04	155	2.99	256.8	−14.1	2	4	i
21	0.30	0.54	0.72	0.10	186	2.94	244.6	−7.3	2	6	i
22	0.06	0.09	0.34	0.06	90	3.01	265.2	−16.5	0	0	–
23	0.50	0.28	0.66	0.13	123	2.94	244.6	−6.3	2	6	i
24	0.36	0.40	0.73	0.08	201	2.94	247.8	−7.1	2	6	i
25	0.27	0.77	0.90	0.20	81	3.04	271.6	−18.3	2	6	i
26	–	–	–	–	–	2.92	239.0	−1.3	0	0	–
27	0.49	0.21	0.84	0.18	79	3.19	294.8	−25.7	2	6	i
28	0.27	0.21	0.44	0.06	219	3.10	282.1	−21.6	1	2	e
29	0.37	0.17	0.77	0.05	169	2.92	241.2	−1.6	2	4	i
30	0.51	0.33	0.76	0.20	119	2.93	245.9	−3.0	2	6	i
31	0.16	0.21	0.41	0.04	172	3.01	273.2	−16.3	1	2	e
32	0.28	0.82	0.94	0.13	171	2.95	258.5	−8.3	2	6	i
33	0.57	0.39	0.99	0.56	31	2.92	246.2	−0.5	0	0	i
34	0.17	0.53	0.62	0.04	215	3.03	277.9	−17.9	2	6	i
35	0.14	0.14	0.44	0.07	243	3.08	283.8	−20.6	1	2	e
36	0.16	0.39	0.48	0.03	210	2.92	248.4	−1.0	2	5	i
37	0.15	0.50	0.59	0.02	218	2.93	257.5	−5.9	2	4	i
38	0.18	0.39	0.50	0.05	194	2.94	258.4	−6.4	2	4	i
39	0.18	0.42	0.52	0.04	95	3.03	278.6	−17.7	2	4	i
40	0.12	0.43	0.59	0.04	211	2.92	248.5	0.9	2	5	i
41	0.21	0.38	0.50	0.03	202	2.93	246.7	2.8	2	5	i
42	0.44	0.21	0.81	0.17	104	2.92	249.2	1.2	2	4	i
43	0.25	0.31	0.51	0.03	237	2.93	245.8	4.5	1	1	e
44	0.24	0.40	0.51	0.03	207	2.93	248.8	3.1	2	4	i
45	0.17	0.24	0.46	0.05	147	2.92	251.2	1.5	2	4	i
46	0.29	0.28	0.50	0.05	126	2.92	255.3	−0.4	2	2	e
47	0.52	0.29	0.88	0.10	118	2.92	254.5	1.0	2	4	i
48	0.24	0.41	0.55	0.02	155	2.93	250.6	5.5	2	4	i
49	0.38	0.18	0.90	0.14	94	2.92	257.8	0.4	2	4	i
50	0.25	0.67	0.79	0.41	49	2.93	256.3	2.3	2	5	i
51	0.42	0.19	0.89	0.30	122	2.93	268.8	−6.0	2	4	i
52	0.20	0.30	0.46	0.05	97	2.93	267.2	−4.7	1	2	e
53	0.45	0.39	0.84	0.18	127	2.92	259.1	1.7	2	6	i
54	0.59	0.43	0.78	0.03	147	2.93	254.1	6.0	2	6	i
55	0.36	0.19	0.94	0.16	108	2.92	265.2	−1.7	2	6	i
56	0.29	0.45	0.59	0.04	169	2.95	274.2	−8.3	2	5	i
57	0.23	0.44	0.54	0.03	162	2.93	269.1	−4.2	2	4	i
58	0.09	0.27	0.43	0.05	71	2.92	266.5	−1.0	1	1	e
59	0.20	0.32	0.44	0.04	98	3.01	286.1	−16.5	1	2	e
60	–	–	–	–	–	2.95	277.6	−9.4	0	0	–
61	0.20	0.18	0.42	0.06	60	2.93	262.8	4.0	1	2	e
62	0.40	0.18	0.87	0.20	78	2.93	263.5	4.3	2	6	i
63	0.12	0.29	0.48	0.04	271	2.95	258.2	9.3	1	2	e
64	0.51	0.30	0.72	0.09	179	2.97	254.8	12.4	2	4	i
65	0.15	0.38	0.53	0.04	227	2.93	264.6	3.8	1	2	e
66	0.16	0.39	0.52	0.03	152	2.95	259.1	9.0	2	4	i
67	0.10	0.41	0.50	0.04	146	3.11	296.1	−22.3	2	2	e
68	0.49	0.22	0.97	0.37	73	2.92	276.3	−1.5	2	6	i
69	0.53	0.30	0.84	0.19	124	2.95	284.5	−10.0	2	6	i
70	0.19	0.38	0.52	0.03	133	2.93	272.3	4.5	1	2	e
71	0.19	0.22	0.45	0.05	110	2.95	284.0	−8.6	1	2	e
72	0.36	0.21	0.93	0.26	128	2.94	283.5	−8.0	2	6	i
73	0.29	0.63	0.75	0.05	86	2.93	273.0	4.9	2	6	i
74	0.16	0.21	0.41	0.05	82	2.93	282.4	−5.9	1	1	e
75	0.51	0.28	0.88	0.17	65	2.94	284.3	−7.7	2	6	i
76	0.18	0.22	0.47	0.06	142	3.02	265.2	16.9	1	2	e
77	0.23	0.36	0.48	0.04	112	2.93	276.4	4.0	2	4	i
78	0.44	0.23	0.93	0.25	159	2.94	275.1	6.9	2	6	i
79	0.16	0.35	0.51	0.08	164	2.96	288.4	−10.7	1	2	e
80	0.33	0.56	0.70	0.05	205	2.97	289.4	−12.0	2	6	i
81	0.41	0.17	0.72	0.25	43	2.93	283.9	−4.4	2	6	i
82	0.27	0.15	0.59	0.07	116	2.93	284.3	−5.0	2	5	i
83	0.23	0.17	0.52	0.07	77	2.93	278.5	3.2	1	1	e
84	0.23	0.15	0.95	0.07	108	2.93	283.4	−3.5	2	6	i
85	0.27	0.49	0.63	0.07	143	2.94	275.3	7.7	2	6	i
86	0.23	0.24	0.48	0.04	144	2.97	271.8	12.4	1	1	e
87	0.32	0.20	0.97	0.23	151	2.93	284.0	−4.1	2	4	i
88	0.17	0.42	0.52	0.04	224	3.08	267.2	21.0	2	4	i
89	0.17	0.37	0.52	0.07	234	2.93	284.8	−3.6	2	4	i
90	0.22	0.28	0.47	0.05	158	2.92	281.5	1.7	1	2	e
91	0.25	0.72	0.92	0.15	115	2.95	277.6	9.3	2	6	i
92	0.24	0.38	0.53	0.04	141	2.93	281.4	4.7	2	4	i
93	0.50	0.29	0.80	0.24	172	2.94	289.9	−7.9	2	6	i
94	0.45	0.22	0.89	0.20	69	2.92	287.0	−1.9	2	6	i
95	0.18	0.46	0.55	0.05	259	2.92	286.9	−1.7	2	4	i
96	0.47	0.23	0.87	0.25	79	2.93	283.5	4.8	2	4	i
97	0.21	0.43	0.55	0.05	185	2.93	283.1	5.9	2	4	i
98	0.26	0.42	0.53	0.04	155	2.92	285.6	2.0	2	4	i
99	0.39	0.29	0.87	0.10	230	2.93	284.9	3.5	2	6	i
100	0.30	0.24	0.93	0.08	157	2.92	287.1	−0.5	2	4	i
101	0.30	0.58	0.77	0.09	102	3.08	275.2	20.9	2	6	i
102	0.14	0.41	0.56	0.04	52	2.92	287.4	−0.6	0	0	–

Table 6. continued

Hen	$I_{\rm ZrO}$	$I_{\rm TiO}$	$I_{\rm NaD}$	$I_{\rm LaO}$	S/N	w	l	b	C_2	C_6	$C_{\rm f}$
103	0.39	0.32	0.88	0.16	71	2.92	288.1	0.0	2	6	i
104	0.17	0.41	0.55	0.05	155	2.93	285.8	6.1	2	4	i
105	0.22	0.38	0.52	0.05	92	2.92	289.1	−0.7	2	4	i
106	0.17	0.43	0.56	0.05	96	2.92	290.2	−2.1	2	4	i
107	0.44	0.21	0.88	0.21	75	2.93	287.9	3.3	2	4	i
108	0.14	0.26	0.50	0.06	293	2.93	287.8	3.6	1	1	e
109	0.28	0.55	0.66	0.04	165	2.94	293.3	−7.5	2	6	i
110	0.14	0.19	0.45	0.05	173	2.92	290.6	−1.4	1	2	e
111	0.44	0.19	0.89	0.24	134	2.92	290.2	0.3	2	4	i
112	0.14	0.71	0.88	0.05	108	2.95	286.9	9.7	2	6	i
113	0.24	0.32	0.50	0.04	139	2.93	293.4	−4.8	2	4	i
114	0.60	0.34	0.90	0.12	172	2.92	292.1	−0.7	2	6	i
115	0.47	0.26	0.73	0.13	84	2.92	292.3	0.0	2	6	i
116	–	–	–	–	–	2.93	296.4	−3.3	0	0	–
117	0.28	0.15	0.82	0.07	121	2.93	295.3	2.2	2	4	i
118	0.16	0.22	0.39	0.06	112	3.10	291.7	21.7	1	2	e
119	0.20	0.24	0.49	0.05	267	2.94	295.4	6.3	1	1	e
120	0.25	0.21	0.97	0.09	174	2.94	297.6	6.5	2	4	i
121	0.24	0.42	0.51	0.04	102	3.66	295.0	34.4	1	3	e
122	0.59	0.51	0.86	0.40	64	2.96	298.6	10.5	2	6	i
123	0.13	0.24	0.42	0.04	217	3.00	298.5	15.1	1	2	e
124	0.23	0.39	0.49	0.05	192	3.07	298.9	20.4	1	2	e
125	0.21	0.57	0.72	0.10	198	3.95	299.0	36.4	2	5	i
126	0.19	0.32	0.49	0.04	206	2.95	301.3	9.4	1	2	e
127	0.08	0.38	0.51	0.03	143	3.22	303.0	−26.7	2	4	i
128	0.35	0.15	0.89	0.39	67	3.07	302.0	20.1	2	6	i
129	0.25	0.29	0.46	0.05	260	3.01	302.8	16.0	1	2	e
130	0.49	0.23	0.82	0.18	152	2.93	303.6	−3.8	2	4	i
131	0.26	0.37	0.58	0.04	124	2.93	304.0	2.2	2	4	i
132	0.24	0.23	0.50	0.05	164	2.95	304.1	−10.1	1	2	e
133	0.24	0.31	0.47	0.06	203	2.93	305.4	6.1	1	2	e
134	0.19	0.35	0.43	0.03	105	3.43	308.1	31.5	2	4	i
135	0.24	0.14	0.91	0.06	129	3.04	307.1	18.3	2	4	i
136	0.51	0.27	0.99	0.47	44	2.92	306.4	−0.4	2	6	i
137	0.15	0.38	0.52	0.05	252	2.97	309.6	11.4	1	2	e
138	0.15	0.41	0.52	0.03	172	2.95	306.6	−9.1	1	2	e
139	0.17	0.41	0.54	0.05	88	2.93	308.1	−5.5	2	4	i
140	0.14	0.39	0.55	0.06	171	2.94	310.7	6.9	2	4	i
141	0.29	0.60	0.78	0.07	175	2.92	309.9	2.0	2	6	i
142	0.75	0.60	1.03	0.46	28	2.93	308.7	−4.8	2	6	i
143	0.15	0.28	0.51	0.07	178	3.05	316.4	19.3	1	2	e
144	0.45	0.47	0.76	0.14	148	2.93	312.5	2.4	2	6	i
145	0.21	0.38	0.54	0.06	100	2.92	312.9	1.3	2	4	i
146	0.42	0.46	0.67	0.09	176	2.93	312.6	−2.6	2	6	i
147	0.19	0.27	0.45	0.04	198	3.45	329.1	31.9	1	1	e
148	0.35	0.18	0.87	0.12	154	2.92	315.4	−0.8	2	6	i
149	0.20	0.28	0.46	0.06	159	3.06	327.1	19.5	1	2	e
150	0.16	0.35	0.51	0.03	134	2.92	317.0	−1.3	1	2	e
151	0.57	0.37	0.89	0.22	77	2.93	316.2	−3.6	2	6	i
152	0.43	0.17	0.95	0.32	51	2.93	320.2	3.7	2	6	i
153	0.42	0.18	0.93	0.45	119	3.00	327.9	15.1	2	6	i
154	0.05	0.06	0.22	0.07	152	2.97	312.8	−12.0	0	0	–
155	0.52	0.25	0.76	0.19	144	3.07	335.9	20.3	2	6	i
156	0.46	0.68	0.85	0.09	125	2.92	326.0	0.1	2	6	i
157	0.31	0.14	0.96	0.07	245	3.01	314.5	−15.8	2	4	i
158	0.44	0.22	0.98	0.24	70	2.92	328.3	−1.5	2	6	i
159	–	–	–	–	–	2.94	323.2	−8.2	2	6	i
160	0.22	0.75	0.90	0.23	74	2.94	324.1	−7.5	2	6	i
161	0.51	0.28	0.90	0.14	88	3.00	349.2	15.4	2	6	i
162	0.21	0.42	0.54	0.03	249	2.93	329.5	−4.7	2	4	i
163	–	–	–	–	–	2.92	334.4	−1.5	2	6	i
164	0.77	0.64	1.08	0.25	64	2.92	335.1	−0.9	2	6	i
165	0.48	0.37	0.81	0.22	167	2.96	348.9	11.3	2	6	i
166	–	–	–	–	–	2.94	329.9	−7.0	2	4	i
167	–	–	–	–	–	2.93	331.3	−5.9	2	6	i
168	–	–	–	–	–	2.95	327.9	−10.1	2	4	i
169	–	–	–	–	–	3.02	321.1	−16.7	1	2	e
170	–	–	–	–	–	2.96	329.3	−10.3	2	6	i
171	–	–	–	–	–	2.94	334.4	−6.3	2	5	i
172	–	–	–	–	–	2.93	348.0	3.5	2	5	i
173	–	–	–	–	–	2.93	353.0	4.4	1	2	e
174	–	–	–	–	–	2.95	1.3	8.5	2	5	i
175	–	–	–	–	–	2.93	346.3	−2.4	2	4	i
176	–	–	–	–	–	2.93	356.5	4.8	0	0	i
177	–	–	–	–	–	2.93	353.7	2.3	2	4	i
178	–	–	–	–	–	2.93	357.4	4.9	2	5	i
179	–	–	–	–	–	2.97	337.8	−11.8	1	2	e
180	–	–	–	–	–	2.92	0.9	−0.1	2	6	i
181	–	–	–	–	–	2.93	355.1	−3.8	2	5	i
182	–	–	–	–	–	2.93	360.0	−2.7	1	1	e
183	–	–	–	–	–	3.05	328.7	−19.4	1	1	e
184	–	–	–	–	–	2.92	4.5	−1.8	2	4	i
185	–	–	–	–	–	2.92	4.7	−1.5	2	4	i
186	–	–	–	–	–	2.94	355.1	−7.7	1	1	e
187	–	–	–	–	–	3.08	326.3	-21.0	1	2	e
188	–	–	–	–	–	2.94	355.9	−7.9	2	4	i
189	–	–	–	–	–	2.99	344.8	−14.4	2	2	e
190	–	–	–	–	–	2.95	0.4	−9.3	1	2	e
191	–	–	–	–	–	2.97	358.6	−11.6	2	6	i
192	–	–	–	–	–	2.97	0.0	−12.0	0	0	i
193	–	–	–	–	–	2.95	10.7	−8.7	1	2	e
194	–	–	–	–	–	3.09	358.5	−21.2	1	2	e
195	–	–	–	–	–	3.17	347.0	−24.8	2	6	i
196	–	–	–	–	–	3.18	7.9	−25.3	2	4	i
197	–	–	–	–	–	3.53	334.2	−32.9	2	4	i
198	–	–	–	–	–	3.49	355.4	−32.5	2	6	i
199	–	–	–	–	–	3.63	0.3	−34.1	1	2	e
200	–	–	–	–	–	4.47	350.7	−43.8	2	6	i
201	–	–	–	–	–	4.43	22.5	−45.4	1	1	e
202	–	–	–	–	–	4.25	350.2	−54.5	2	6	i
203	–	–	–	–	–	4.32	338.0	−51.3	1	2	e
204	–	–	–	–	–	4.17	349.4	−58.6	1	1	e
205	–	–	–	–	–	3.38	304.8	−30.7	1	2	e