A&A 480, 409–419 (2008)
DOI: 10.1051/0004-6361:20078989

Astronomy & Astrophysics

IPHAS and the symbiotic stars

I. Selection method and first discoveries[⋆,⋆⋆]

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Received 4 November 2007 / Accepted 10 December 2007

ABSTRACT

Context. The study of symbiotic stars is essential to understand important aspects of stellar evolution in interacting binaries. Their *observed* population in the Galaxy is however poorly known, and is one to three orders of magnitudes smaller than the *predicted* population size.
Aims. IPHAS, the INT Photometric Hα survey of the Northern Galactic plane, gives us the opportunity to make a systematic, complete search for symbiotic stars in a magnitude-limited volume, and discover a significant number of new systems.
Methods. A method of selecting candidate symbiotic stars by combining IPHAS and near-IR (2MASS) colours is presented. It allows us to distinguish symbiotic binaries from normal stars and most of the other types of Hα emission line stars in the Galaxy. The only exception are T Tauri stars, which can however be recognized because of their concentration in star forming regions.
Results. Using these selection criteria, we discuss the classification of a list of 4338 IPHAS stars with Hα in emission. 1500 to 2000 of them are likely to be Be stars. Among the remaining objects, 1183 fulfill our photometric constraints to be considered candidate symbiotic stars. The spectroscopic confirmation of three of these objects, which are the first new symbiotic stars discovered by IPHAS, proves the potential of the survey and selection method.

Key words. surveys – Galaxy: stellar content – stars: binaries: symbiotic – stars: emission-line, Be – stars: pre-main sequence – ISM: planetary nebulae: general

1. Introduction

Symbiotic stars are the interacting binaries with the longest orbital periods. They are composed of a compact star, in most cases a hot white dwarf, accreting from the wind of a cool giant companion. Part of the giant's wind is ionized by the white dwarf, producing the composite spectrum containing both absorption features from a cool stellar photosphere and emission lines from highly excited ions: these characteristics originally caused these objects to be named "symbiotic". Depending on their near-IR colours, symbiotic stars are divided into "stellar" (S) types, if colours are typical of red giant branch (RGB) stars, or "dusty" (D) types, if their near-IR emission shows a significant contribution from the warm dust known to be typical of evolved asymptotic giant branch (AGB) stars. S-types account for around 80% of the sample of known symbiotic stars. The presence of an RGB or an AGB star also determines the orbital separation at which the symbiotic phenomenon occurs; orbital periods for the S-types are between 200 and 6000 days, while they are longer for the D-types (>20 yr, but no single robust determination exists so far). For more details on the properties of symbiotic stars, see e.g. Corradi et al. (2003).

A variety of phenomena occur in symbiotic stars that are relevant to a number of important astrophysical problems. For example, symbiotic stars have been proposed as potential supernova Ia progenitors (Munari & Renzini 1992; Hachisu et al. 1999). Also, symbiotic stars are excellent laboratories for studying (i) thermonuclear outbursts (nova-like accretion instabilities) under a wide range of conditions (cf. Munari 1997); (ii) the powering mechanism of supersoft X-ray sources (cf. Jordan et al. 1996); (iii) the collimation of stellar winds and the formation of jets (cf. Tomov 2003) and (iv) bipolar (planetary) nebulae (cf. Corradi 2003).

A crucial figure in the discussion of some of these topics is the total number of symbiotic stars in the Galaxy. This is

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[⋆] Based on observations obtained at the 2.5 m INT telescope of the Isaac Newton Group of Telescopes in the Spanish Observatorio del Roque de Los Muchachos of the Instituto de Astrofísica de Canarias. This publication makes use of data products from the Two Micron All Sky Survey, which is a joint project of the University of Massachusetts and the Infrared Processing and Analysis Center/California Institute of Technology, funded by the National Aeronautics and Space Administration and the National Science Foundation. This research has also made use of the SIMBAD database, operated at CDS, Strasbourg, France.

[⋆⋆] Table 1 is only available in electronic form at `http://www.aanda.org` basically unknown. In fact, no systematic search for symbiotic stars in the Milky Way has been done so far, and the present sample of 173 known Galactic systems (Belczyński et al. 2000), plus another 26 suspected ones, is mainly the result of occasional discoveries during the study of peculiar, variable or erupting stars, or of sparse objective prism surveys. This figure should be compared with the *predicted* total number of symbiotic stars in the Galaxy, which spans two orders of magnitude: 3×10^3 (Allen 1984), 3×10^4 (Kenyon et al. 1993), 3×10^5 (Munari & Renzini 1992), and 4×10^5 (Magrini et al. 2003).

IPHAS, the INT Photometric Hα survey of the Northern Galactic plane (Drew et al. 2005), gives us the opportunity to improve the determination of this basic number. The search for symbiotic systems in IPHAS takes advantage of the generally strong Hα emission that characterizes this class of objects. In this paper, we define our criteria for the detection of symbiotic stars using the data from the IPHAS project, complemented by near-IR colours from the 2MASS survey. The effectiveness of the method is illustrated by the spectroscopic confirmation of three new symbiotic stars.

2. The data

2.1. IPHAS

IPHAS is an international collaboration, whose aim is to produce a complete, fully photometric, and spatially detailed Hα map of the part of the Galactic Plane between latitudes $-5°$ and $+5°$ that is visible from the Northern hemisphere. The IPHAS observations are obtained using the Wide Field Camera (WFC) at the prime focus of the 2.5 m Isaac Newton Telescope (INT) on La Palma, Spain. The WFC consists of a mosaic of four 2k×4k EEV CCDs, providing a field of view of 34×34 arcmin^2 with a sampling of $0\farcs33$ per pixel. The IPHAS images are taken through three filters: a narrow-band Hα (λ_c = 6568 Å; $FWHM$ = 95 Å) and two broad-band Sloan r and i filters, with matched 120, 30, and 10 s exposures, respectively. In this way, the magnitude range $13 \leq r \leq 20$ is covered for point sources (the fainter end at 10σ). Pipeline data reduction and data distribution are handled by the Cambridge Astronomical Survey Unit. The presentation of the survey and further details can be found in Drew et al. (2005).

At the time of writing this article, more than 90% of the ∼1800 square degrees of the northern Galactic Plane to be covered by IPHAS has been observed. A first photometric catalogue, containing more than 200 million objects, is about to be released (González-Solares et al. 2008). From it, a list of 4853 Hα emitting stars with $r < 19.5$ mag has been extracted by Witham et al. (2008). This is the sample that we consider in this paper for our first search for symbiotic stars within IPHAS. Independently, we are employing other methods to select both point-like and extended Hα emitters from the IPHAS observations (see e.g. Viironen et al. 2008): we will consider these additional samples in following papers (note that most symbiotics have a stellar profile, but a small fraction of them might be extended in the Hα filter due to their resolved nebulosity, see Corradi 2003).

2.2. Reference samples of known objects

Unsaturated IPHAS data are available for only four known symbiotic stars from the general catalogue of Belczyński et al. (2000). They are DQ Ser, V352 Aql, V1413 Aql, and Ap 3-1. In order to build a meaningful reference sample of known symbiotic stars to be used to define our selection method, additional observations were obtained at the INT using the same instrumental setup as for IPHAS. Photometric data of 18 known symbiotic stars were taken on June 2, 2004, and April 20, and September 17 and 18, 2005. Exposure times were tuned so as to avoid saturation of the (generally bright) targets. Reduction was done with IRAF. Moreover, existing flux-calibrated spectra of 18 symbiotic stars (one of which is in common with the sample above), obtained at different epochs, were convolved with the WFC filters and instrument response curves to derive Hα, r and i magnitudes in the IPHAS photometric system. Where the i magnitude cannot be derived from the spectra, we adopted the $r-i$ colour from Munari et al. (1992). All together, we collected a sample of 39 known symbiotic stars (29 of the S type and 10 of the D type) with magnitudes and colours fully consistent with those produced by the photometric catalogue of IPHAS. This constitutes the primary reference sample to develop our selection method.

We have also investigated other classes of stars and nebulae which can potentially be confused with symbiotic stars according to their IPHAS colours, because of also having Hα in emission, or because their spectral type is similar to that of the cool component of symbiotic stars. Using IPHAS and additional observations, we have derived Hα, r and i magnitudes for 67 planetary nebulae (PNe, Viironen et al. 2008), 79 cataclysmic variables (Witham et al. 2006), and 518 Mira variables. As Be stars are a frequent class of Hα emitting bright stars in the Galactic plane (cf. Sect. 4.1), they deserve special attention: 18 of these stars in the low-reddening open clusters NGC 663, NGC 869 and NGC 884, as well as 22 objects in the more reddened cluster NGC 7419, turned out to have good IPHAS photometric data and were adopted as the comparison samples for this class of stars. Another frequent class of Hα emitters in star-forming regions are T Tauri stars; their characteristics derived from IPHAS data on Cyg OB2 are being investigated by Vink et al. (2008). Finally, Hα emission is also observed in late K to M dwarfs with enhanced chromospheric and coronal activity (dMe stars). However, their Hα emission is generally faint, with line equivalent widths[1] of a few Å (Hawley et al. 1996). These are much smaller than in symbiotic stars (see Sect. 4.3), and for this reason dMe stars are not further considered in this paper.

2.3. Near-IR 2MASS magnitudes

As symbiotic stars contain a luminous cool giant, near-IR magnitudes provide information both on their nature and support making distinctions between them and other classes of objects. The division in the two main groups of S and D types was indeed originally made using the $J-H$ and $H-K$ colours (Allen & Glass 1974). Recently, the position of symbiotic stars in the near-IR colour–colour diagram was discussed by Rodríguez-Flores (2006) and Phillips (2007).

We have therefore extracted from the Two Micron All Sky Survey (2MASS) database the J, H and K_S magnitudes of 187 known symbiotic stars, 288 PNe (most of them from Ramos-Larios & Phillips 2005), 95 cataclysmic variables, 1230 Be stars (1148 of which are from Zhang et al. 2005), 487 T Tauri stars (Dahm & Simon 2005), and 121 Mira variables (Rodríguez-Flores 2006).

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[1] According to the standard definition, the equivalent width of an emission line would be negative. However, in order to simplify the discussion, in this paper we use a positive sign, so that a larger Hα equivalent width corresponds to a stronger Hα emission, and to a larger $r-$Hα colour.

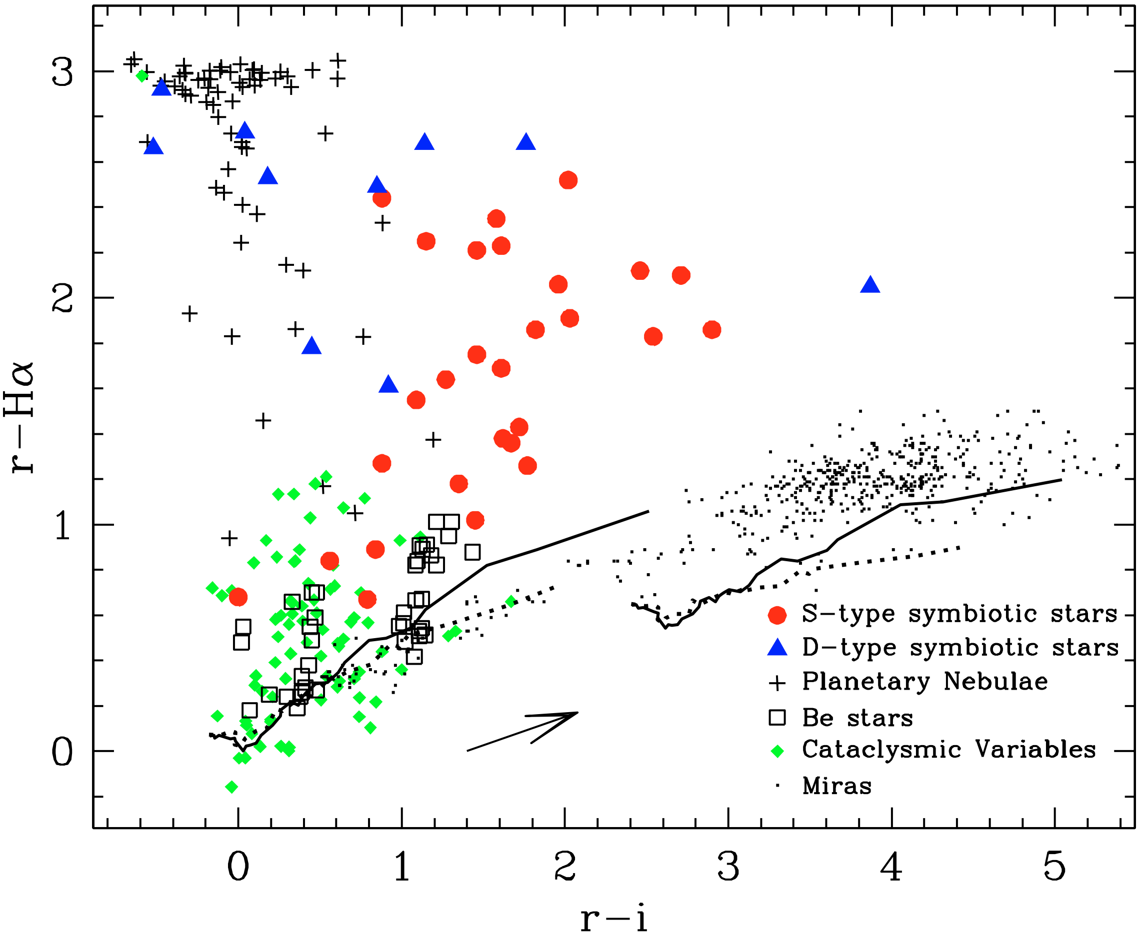

Fig. 1. IPHAS colour–colour diagram for different classes of objects. The locus of main-sequence and RGB stars is indicated by the solid and dotted lines, respectively. Two sequences are shown, corresponding to reddening values $E(B-V) = 0$ (*left*) and 4 (*right*), respectively. The arrow indicates the reddening vector for normal stars: its length corresponds to 3 mag extinction in V.

Similarly, we have searched for 2MASS counterparts of the 4853 Hα emitters in Witham et al. (2008). For 4330 of them, we found a 2MASS source within 1 arcsec from the IPHAS coordinates (note that the two sets of data are calibrated into the same astrometric system). Also, the 2MASS counterpart was identified for another 8 objects with slightly worse astrometric match. This makes a total sample of 4338 Hα emitters with 2MASS magnitudes.

It should be noted that the detection limits of IPHAS ($r \leq$ 19.5 mag for the objects in Witham et al. 2008) and of the 2MASS point-source catalogue ($K_S \sim$ 15 mag) roughly match the characteristic colours of symbiotic stars. We have considered a list of 71 known and bright symbiotic stars ($r \leq$ 14.5 mag): 70% of them have indeed an *observed* optical-to-near-IR colour $(r - K_S) \geq 4.5$. On the average, they are presumably closer and less reddened than the new symbiotics stars that we aim to detect with IPHAS, for which we then expect to be able to find a 2MASS counterpart. We are therefore confident that adding 2MASS data does not affect the completeness of our search for symbiotic stars within IPHAS.

2.4. Follow-up spectroscopy

As the present study was progressing, we started a campaign of spectroscopic follow-up of the Hα emitters detected by IPHAS. Accordingly a dozen candidate symbiotic stars, selected as described in the next sections, were observed at the INT using the IDS spectrograph, on nights of May 11, June 14, and September 9, 2006. Grating R300V was used, which gives a reciprocal dispersion of 1.87 Å per pixel of the 2k × 4k EEV detector, and a spectral coverage from 3800 to 8500 Å (these figures slightly vary from night to night). The slit width was 1.1 arcsec projected on the sky, providing a spectral resolution of 5 Å. Exposure times were 30 min for the two brighter sources discussed in Sect. 5, and 2 h for the faintest and more reddened one. Several spectrophotometric standards were observed during the night for relative flux calibration. Reduction was performed using the package *onedspec* in IRAF. Note that the EEV CCD suffers from significant fringing redward of ~7000 Å, which was not possible to remove with the calibration frames obtained during those nights. Also, the flux calibration is somewhat uncertain above 8000 Å because of significant optical aberrations at the edge of the large format CCD used with IDS.

3. Interpreting the IPHAS and 2MASS colour–colour diagrams

3.1. The IPHAS colour–colour diagram

Our primary tool for the selection of candidate symbiotic stars in the Galactic Plane is the IPHAS r–Hα vs. r–i colour–colour diagram, which is presented and thoroughly discussed in Drew et al. (2005). It is shown in Fig. 1 for the various classes of objects considered. In the diagram, the r–Hα axis mainly indicates

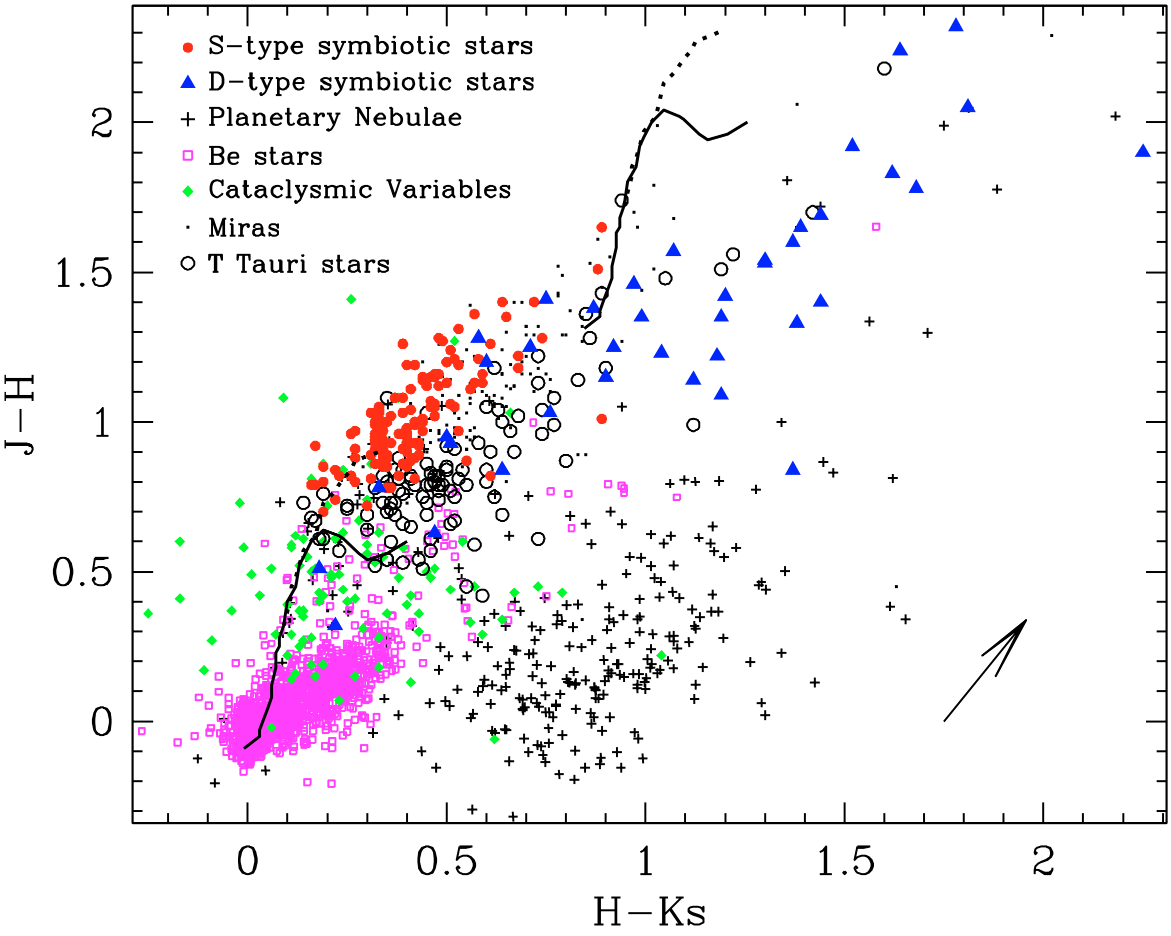

Fig. 2. 2MASS colour–colour diagram for different classes of objects. Symbols are the same as in Fig. 1, albeit smaller owing to the larger number of objects. In addition, T Tauri stars are indicated by empty circles. Like in Fig. 1, the locus of main-sequence and RGB stars is indicated by the solid and dotted lines, respectively, for reddening values $E(B-V) = 0$ (*lower-left sequence*) and 4 (*upper-right sequence*). The arrow shows the reddening vector for normal stars corresponding to 3 mag extinction in V.

increasing values of the Hα emission line equivalent width, while r–i, for normal stars, is essentially a sequence of increasing spectral types and/or reddening. In the figure, the locus of main-sequence and RGB stars is indicated by the solid and dotted lines, respectively (Drew et al. 2005). Two sequences are shown, corresponding to reddening values $E(B-V) = 0$ (left) and 4 (right), respectively. The reddening vector for normal stars, adopted from Howarth (1983) in the same way as by Drew et al. (2005), is indicated by the arrow: its length corresponds to 3 mag extinction in V. We note that, as shown by Drew et al. (2005), at the higher extinctions probed by IPHAS ($6 < A_V < 12$, roughly) this vector flattens progressively and in a mildly spectral-type dependent manner.

The positions of the different classes of object are indicated as follows. Symbiotic stars of the S type are shown as filled circles, and the D types as triangles. In the case that several measurements of the same object obtained at different epochs are available, we plot the mean colours as the dispersion of symbiotic stars in the graph is anyway large enough to cover their intrinsic variability. PNe are indicated by crosses; cataclysmic variables by filled diamonds; Be stars by empty squares; Mira variables by dots. In all cases, we show the *observed* colours.

As expected, given their emission-line spectra are superposed on relatively weak continua, PNe stand out in the graph for their extreme r–Hα colours. Most of them lie close to the r–H$\alpha \sim 3.1$ limit which is expected for pure Hα emission line stars (“ideal” sources for which all the flux in the Hα and r bands comes from the Hα line). With smaller Hα excesses than PNe (with some overlap), but still above the other classes of Hα emitters and normal stars, lie the symbiotic stars. They span a significant range in r–i colour. Be stars and cataclysmic variables are located closer to the locus of main-sequence stars with some moderate Hα excess (except for Nova Aql 1995, which is now in the nebular phase and shows a large r–Hα colour). Mira variables (which only sometimes show the Hα line in emission) are mainly found at the right of the diagram, owing to their cool photosphere and frequent large reddening by circumstellar dust. The class of T Tauri stars is not shown in the figure, as they are spread all over the diagram above the sequence of normal stars (e.g. Vink et al. 2008). They show a broad range of spectral types as well as Hα equivalent widths. The latter are in most cases smaller than 500 Å (see Fig. 5 in Dahm & Simon 2005), which is lower than for the most extreme symbiotic stars. Our strategy to separate them, at least in a statistical sense, from the evolved stars on which we are focusing our attention in this work, will be presented in Sect. 4.4.

The symbiotic stars with the smallest r–Hα colours belong to the rarer subgroup of the *yellow* symbiotics, containing G-K giants. Examples are BD-213873, AG Dra and LT Del. Also, the figure suggests that the D-types have r–Hα colours generally larger than the S-types, and more similar to PNe. This was already remarked upon in the past (cf. Kenyon 1986), and in fact the distinction between PNe and some D-type symbiotic stars is tricky (cf. Corradi 2003). However, our present sample is limited to ten objects.

Further information on the location of symbiotic stars in the IPHAS diagram, albeit limited to the $r-i$ colour, can be obtained from the literature. Munari et al. (1992) published R and I magnitudes for a large sample of symbiotic stars. We have transformed these data to the Sloan system for the INT+WFC, and in this case we are able to correct for interstellar extinction using the data in Whitelock & Munari (1992). The resultant range of intrinsic $r-i$ colours spanned by 56 symbiotic stars of S type is between −0.1 and +2.8 mag, while the range spanned by 19 D-type systems is even larger, from −0.7 to +3.6 mag.

3.2. The 2MASS colour–colour diagram

The previous section has shown the potential of the IPHAS colour–colour diagram to separate symbiotic stars from the vast majority of stars. However, some overlap is present with classes of Hα sources whose population in the Galactic Plane is much larger than that of symbiotic stars. In addition, mixing between classes is inevitably raised in the presence of photometric errors.

The 2MASS $J-H$ vs. $H-K_S$ colour–colour diagram provides an additional resource to refine the selection of symbiotic stars (Rodríguez-Flores 2006). The various classes of objects, as well as normal main-sequence and giant stars (Bessel & Brett 1988), are indicated in Fig. 2 with the same symbols as in Fig. 1. In addition, we plot here as empty circles 104 classical T Tauri stars from Dahm & Simon (2005) with an Hα equivalent width larger than 40 Å (roughly corresponding to the smallest Hα equivalent width shown by the known symbiotic stars in Sect. 3.1). All these T Tauri stars belong to the young cluster NGC 2264, which has a low foreground extinction ($A_V = 0.22$ mag), and is rich in pre-main sequence Hα emitters (Dahm & Simon 2005). For all objects we plot the *observed* colours. As for the IPHAS diagram, the reddening vector is computed from Howarth (1983) for the 2MASS filters J, H, and K_s: the adopted shifts for a reddening of 1 mag in V are 0.113 and 0.069 for the $J-H$ and $H-K_S$ colours, respectively.

The bulk of PNe occupy a distinct locus at the bottom of the near-IR diagram (see also Ramos-Larios & Phillips 2005), to the right of normal stars. Most of the cataclysmic variables and Be stars are instead clumped closer to the locus of main-sequence stars. In particular, note the well-defined sequence at the bottom of the diagram displayed by Be stars, which extends to the right side of the unreddened main-sequence stars. We will come back to this important feature in Sect. 4.1.

S-type symbiotic stars, according to their original definition (Allen & Glass 1974), have colours typical of RGB stars, with an upper-right tail due to reddening. They form a compact cluster in the diagram, except for few objects. The most extreme case is UV Aur (a carbon star), which is displaced to the right of the S-types sequence, toward the broad region which is occupied by T Tauri stars, D-type symbiotic stars, and some extreme Mira variables. The location of D-type symbiotics is modeled by Phillips (2007) with a variable combination of stellar and warm dust continuum emission, plus some extinction. Three objects, AS 201, V471 Per, and StHA 190, have significantly smaller $J-H$ colours than the bulk of symbiotics. Again, these are yellow symbiotics, which tend to occupy the bottom part of the locus of symbiotic stars, as in the IPHAS diagram.

Some PNe fall in the region of D-type symbiotic stars. These are examples of possible misclassified PNe, which might instead be symbiotic stars with extended nebulae as frequently suggested in the literature (Corradi 1995; Schmeja & Kimeswenger 2001; Santander-García et al. 2007).

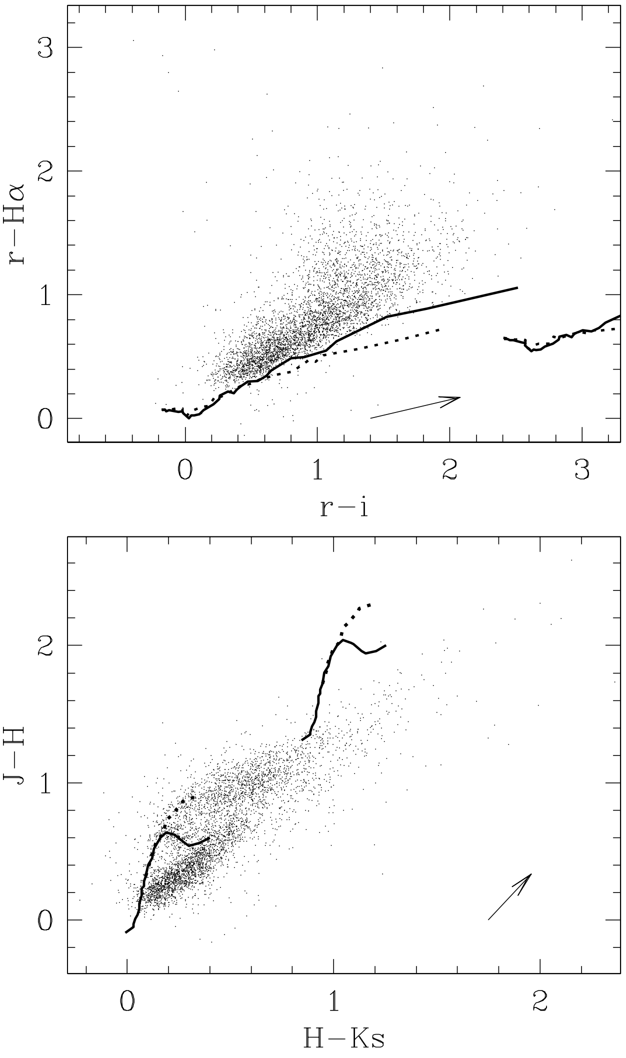

Fig. 3. The 4338 Hα emitters by Witham et al. (2008) in the IPHAS (*top*) and 2MASS (*bottom*) colour–colour diagrams. The loci of main-sequence and giant stars and the reddening vectors are also indicated (see Fig. 1 for a detailed explanation).

Finally, T Tauri stars form a broad sequence running parallel to, and on right side of, S-type symbiotics, that extends well into the locus of the D-type symbiotic stars. Note that T Tauri stars with smaller equivalent widths than those displayed, including the so-called weak-line T Tauri stars, would be clumped on the left-bottom end of this sequence (Dahm & Simon 2005). The significant overlap with symbiotic stars in both the 2MASS and IPHAS diagrams, makes T Tauri stars the most frequent "contaminants" in our search for symbiotics stars.

4. Application to the list of IPHAS Hα emitters by Witham et al. (2008)

The analysis of the IPHAS and 2MASS colour–colour diagrams presented in the previous section allows us to discuss the nature of the 4338 IPHAS Hα emitters by Witham et al. (2008) with 2MASS counterparts (Sects. 2.1 and 2.3). Their location in the colour–colour diagrams is shown in Fig. 3. Looking at the 2MASS diagram, there are some striking similarities with

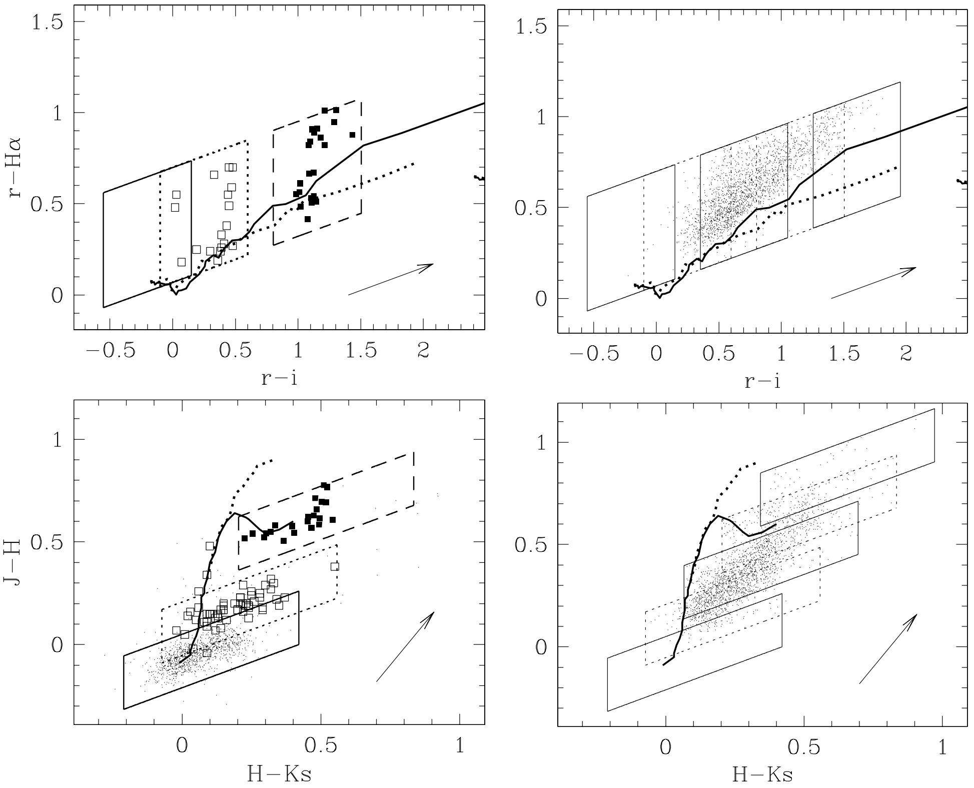

Fig. 4. *Left*: location of known Be stars in the IPHAS and 2MASS diagrams. The dots mark dereddened colours for the 1148 Be stars from Zhang et al. (2005). Open squares are the reddened data for the open clusters NGC 663, NGC 869 and NGC 884, and filled squares similar data for NGC 7419. The solid line is the adopted zero-reddening selection box for Be stars. *Right*: the 2035 candidate Be stars in the list of 4338 Hα emitters by Witham et al. (2008). The alternate solid/dotted boxes show the selection boxes (see text) for A_v = 0, 2, 4, 6, 8 mag, from *bottom-left* to *top-right*, respectively.

the plot of known objects in Fig. 2. First, the 2MASS diagram of Fig. 3 shows a main concentration of sources at its bottom, to the right of the unreddened main-sequence stars. They form a dense band with a slightly lower inclination than our adopted reddening vector. This is obviously similar to the sequence defined by known Be stars in Fig. 2. Second, another inclined sequence of objects can be seen in Fig. 3 at higher $J-H$ values, in the region where T Tauri stars (frequent in the Galactic Plane) and symbiotic stars (presumably less numerous) should be located.

We therefore start our discussion by considering what appears to be one of the most represented classes of objects in the list of Witham et al. (2008): the Be stars.

4.1. Be stars

In order to further investigate the similarities between Fig. 2 and 3, we have studied in more detail the location of Be stars in the colour–colour diagrams. Zhang et al. (2005) provide the reddening of 1148 individual objects: this allow us to identify the locus of unreddened Be stars in the 2MASS diagram, and to define a corresponding "selection" box. These are indicated by the dots and the solid line, respectively, in the lower-left panel of Fig. 4. When shifted to the reddening of the clusters NGC 663, NGC 869 and NGC 884 ($A_V \sim 2$ mag, dotted line) and NGC 7419 ($A_V \sim 6$ mag, dashed line), such a box includes the corresponding data points for these clusters (empty and filled squares, respectively).

Similar consistent results are obtained for the IPHAS colour–colour diagram. There, if we define the locus of Be stars from the position of the objects in the four open clusters considered, and correct for the corresponding reddening, we can determine a zero-reddening selection box for this class of objects, which is shown as a solid line in the upper-left panel of Fig. 4.

We have then done the exercise of extracting candidate Be stars from the 4338 IPHAS Hα emitters in Witham et al. (2008). An object is considered to be a good candidate Be star if it falls inside the selection boxes in *both* the IPHAS and the 2MASS diagrams. The combination of the selection boxes in the two diagrams, shifted so as to consider a range of reddening values from $A_V = 0$ to $A_V = 8$ mag (represented by the sequence of boxes in the right panels of Fig. 4), results in a total of 2035 candidate Be stars (also plotted in Fig. 4). The majority of them would have reddening values between 3 and 5 mag in V. Objects at zero reddening are virtually absent, presumably because such objects are in the main nearby and thus bright and saturated in IPHAS. Only for significant reddening values (i.e. at the largest $J-H$ colours, cf. the lower-right panel of Fig. 4 with Fig. 2), mixing of the Be stars candidates with low-reddening T Tauri stars is possible. An idea of the magnitude of the contamination can be gained considering that only 4% of the 450 T Tauri stars in Dahm & Simon (2005), including those with the lowest Hα equivalent widths, have $J-H \leq 0.55$. Adopting this figure, and the worst possible (and unlikely) scenario that *all* sources with $J-H > 0.55$ in our complete list of 4338 objects are T Tauri stars, it would be concluded that only one hundred objects of this class would be expected with a lower $J-H$ colour, at variance with the more than 1600 Be star candidates (80% of our list) lying below this colour limit.

A smaller amount of mixing is expected with other, less frequent classes of objects, like CVs, compact PNe, and symbiotic stars. We conclude that *somewhere between 1500 and 2000 Hα emitters in Witham et al. (2008) are likely to be Be stars*, which would therefore be the largest class of objects in this list of IPHAS Hα stars.

4.2. Planetary nebulae

In Sect. 3.1, we remarked on the overlap in the IPHAS diagram between PNe and symbiotic stars, especially those of the D-type. On the other hand, the 2MASS colours are generally different,

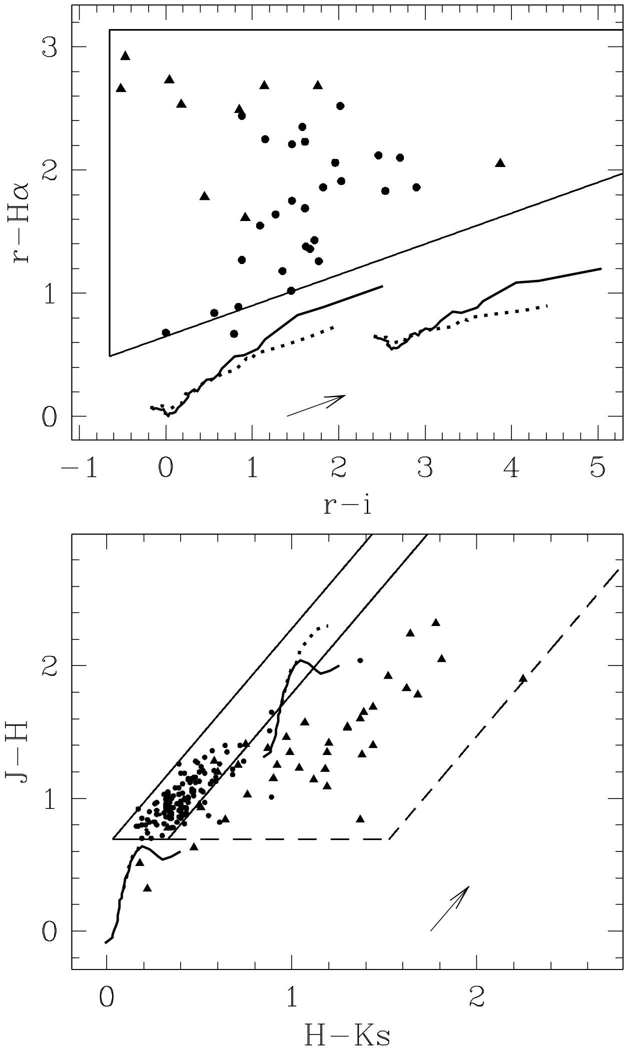

Fig. 5. *Top*: the selection box for symbiotic stars in the IPHAS colour–colour diagram, superimposed on the reference sample and the locus of main-sequence and RGB stars (see Fig. 1 for details). *Bottom*: the selection boxes for the S-type (continuous line) and the D-type (dashed line) symbiotics in the 2MASS diagram. Symbols as in Fig. 2.

allowing a neat separation of the two classes of objects (with notable exceptions which might be related to misclassification). A search for compact PNe from the list of Witham et al. (2008), resulting in a few new candidates, and a confirmation of their nature by spectroscopic observations, is presented elsewhere (Viironen et al. 2008).

4.3. Symbiotic stars

In a similar way as done for Be stars, based on the properties of our reference samples, we define selection boxes in the colour–colour diagrams to be used for our search for symbiotic stars in the Milky Way.

In the IPHAS diagram, the limited number of symbiotic stars of the D-type in the reference sample, as well as their significant overlap with the S-types (with possible differences, however, as outlined in Sect. 3.1), prevent us from defining separate boxes for the two classes. We prefer instead to use the same selection criterion, leaving to the near-IR colours the task of separating the two classes according to the original definition. Our selection box for symbiotic stars (Fig. 5, upper panel) is then defined as follows. In the $r-i$ axis, we allow the range of intrinsic colours spanned by known objects as discussed at the end of Sect. 3.1, and extend it to the right side of the graph to allow for the significant extinction that is expected when observing through the Galactic Plane.

In the vertical direction, we define a lower limit which is an inclined line, parallel to the reddening vector (Sect. 3.1), and defined by the formula $(r - \mathrm{H}\alpha) \geq 0.25 \cdot (r - i) + 0.65$, which includes all known symbiotic stars in the samples of Sect. 3.1 except for the yellow symbiotic BD-213873. This limit roughly corresponds to Hα equivalent widths of 50 Å (Drew et al. 2005). We decided to fix the lowest side of the selection box at this limit in order to avoid significant mixing with Be stars (see Sect. 4.1). The upper limit of the selection box for symbiotic stars is the $r-\mathrm{H}\alpha$ value for pure Hα emitters, namely $r-\mathrm{H}\alpha \sim 3.1$.

In the 2MASS diagram, the large number of objects available allows us to define separate boxes for the S and D-type symbiotic stars. For the S-types, we first set the lower limit for the $J-H$ colour which includes all known objects. Then the left and right limits for the $H-K_\mathrm{S}$ colours were chosen to run parallel to the reddening vector. They are chosen to include the vast majority of S-type systems, except for nine objects (7% of the whole sample) that are detached and on the right side – these will, in any case, be included in the selection box for D-types. We have decided to keep the right limit for S-types (the most frequent class of symbiotics) as leftward as possible, in order to minimize mixing with T Tauri stars (even if at the expense of the D-types). The selection box for S-type symbiotic stars is indicated by the solid line in the lower panel of Fig. 5. For the D-types, we use the same procedure, with the further assumption of setting the same lower limit for the $J-H$ colour as for the S-types, and the $H-K_\mathrm{S}$ left limit so as to have contiguous boxes with no gap or overlap. The selection box for the D-type symbiotics is indicated by a dashed line in Fig. 5.

In this way, the three yellow symbiotics AS 201, StHA 190, and V471 Per, fall out of both boxes in the 2MASS diagram. But they are located in the very populated region of the diagram where not only main sequence stars are found, but also other Hα emitters like Be stars and cataclysmic variables. With so much mixing, a search for this kind of object becomes very difficult.

When our selection criteria are applied to the list of Witham et al. (2008), 337 sources fall in both the IPHAS and 2MASS selection boxes for the S-types (Fig. 6, left), and 846 fulfill the criteria to be considered D-type candidates (Fig. 6, right). The complete list of all these candidates is reported in Table 1, which is only available electronically. In the 2MASS diagram, a good number of objects fall in the lower right part of the selection boxes for S-type symbiotic stars, while most of the objects in the D-type box fall in its left-bottom side. These are the regions where T Tauri stars are also expected to be found, indicating that significant mixing of the two classes of objects is likely to be present in the candidate list (Table 1).

Our selection method recovers the three known symbiotic stars included in the list of Witham et al. (2008), as well as two suspected ones. Out of the 29 objects listed by Witham et al. (2008) as known young stellar objects, 13 are included in the list of D-type candidate symbiotics, and 3 in the list of S-type candidates (note that none of them is classified as a Be star). This confirms that the mixing with young stellar objects is more severe for the D-types. Among the 9 known or newly discovered PNe included in the list of Witham et al. (2008), only one enters the list of D-type candidates. Its nature will be discussed in Viironen et al. (2008).

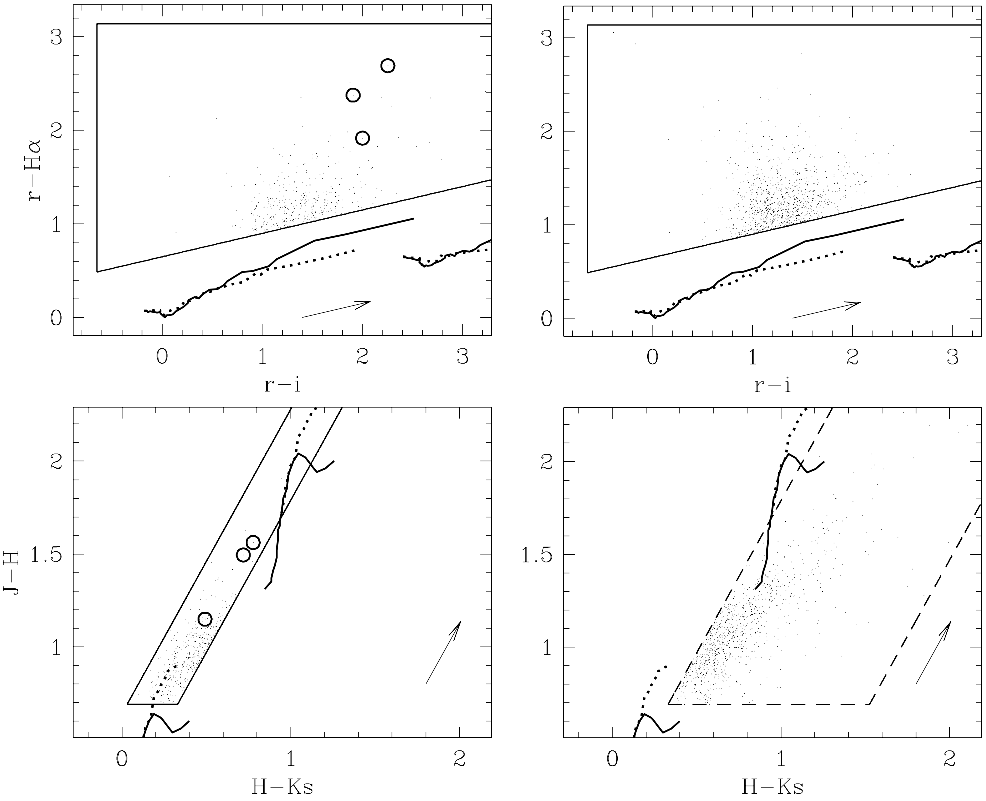

Fig. 6. *Left*: the 337 objects with IPHAS and 2MASS colours fulfilling our selection criteria for S-type symbiotic stars. The locations of the three new symbiotic stars discovered by IPHAS, for which we present spectroscopic confirmation in Sect. 5, are indicated by the circles. *Right*: the 846 candidate D-type symbiotic stars.

Note that if the lowest edge of the IPHAS selection box is lowered so as to include all known symbiotic stars in our samples, then another 152 candidates of S-type, plus 330 of D-type, would be added. At the same time, the confusion with other classes of object would also increase. In this respect, we stress that our aim is not to define absolute limits for the colours of symbiotic stars, but only to provide a practical way of selecting new candidates from the IPHAS survey, guided by the best reference samples that we were able to build from the literature, IPHAS itself, and from additional observations obtained in backup time during our observational campaign. As demonstrated below, the proposed selection method seems indeed to be promising.

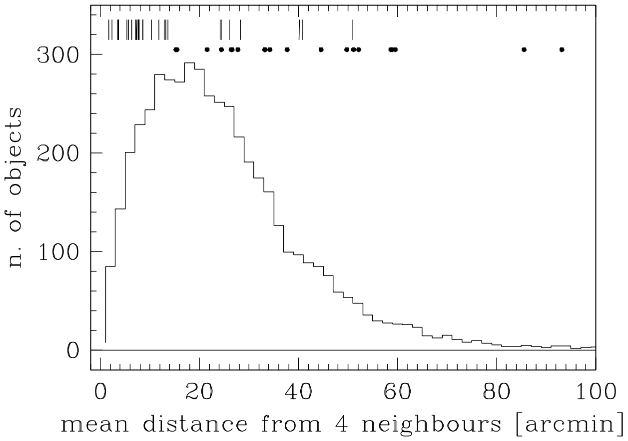

Fig. 7. Histogram of the mean distance to the four most nearby objects for each of the 4853 Hα emitters by Witham et al. (2008). 29 young stellar objects are indicated by the short lines at the top of the diagram, while 20 PNe and symbiotic stars are indicated by the dots.

4.4. Clustering as an additional criterion to separate young stars from symbiotics

Observations targeting a narrow band of the Galactic Plane must include a large number of star-forming regions, young clusters and associations. There, numerous objects, especially Be and T Tauri stars, are Hα emitters. We have shown that while Be stars can be separated from symbiotic stars because of their smaller r−Hα and J−H colours, T Tauri stars overlap with symbiotics in both the IPHAS and 2MASS diagrams. Therefore, they must be regarded as the most serious "contaminants" in our search for symbiotic stars using IPHAS and 2MASS data.

Our strategy for tackling the problem is to consider the spatial distribution of the Hα emitters selected by IPHAS. T Tauri stars are expected mainly to be concentrated in young clusters. On the other hand, symbiotic stars, which belong to an older Galactic stellar population (bulge/thick-disc, Munari & Renzini 1992), should be more isolated Hα sources (except for projection effects through the Galactic Plane).

A first step in exploring this issue was taken by measuring the degree of clustering of the objects in the list of Witham et al. (2008). For each of the 4853 Hα emitters, the mean distance to the n most nearby objects (with n from 1 to 12) was computed. We show in Fig. 7 the distribution of the distances for $n = 4$, that we find to be a good compromise between having a sufficient number of neighbours to detect the existence of a group, while avoiding the limited statistics that the requirement of a large number of neighbours might suffer from, given the size of the global sample.

The 29 objects listed by Witham et al. (2008) as young stellar objects, as well as 20 known, suspected or confirmed new PNe (Viironen et al. 2008) and symbiotic stars (to be presented in Paper II) were then considered. They confirm the expected trend: young stars (the vertical short lines at the top of Fig. 7) tend to occur with smaller angular separations than do PNe and

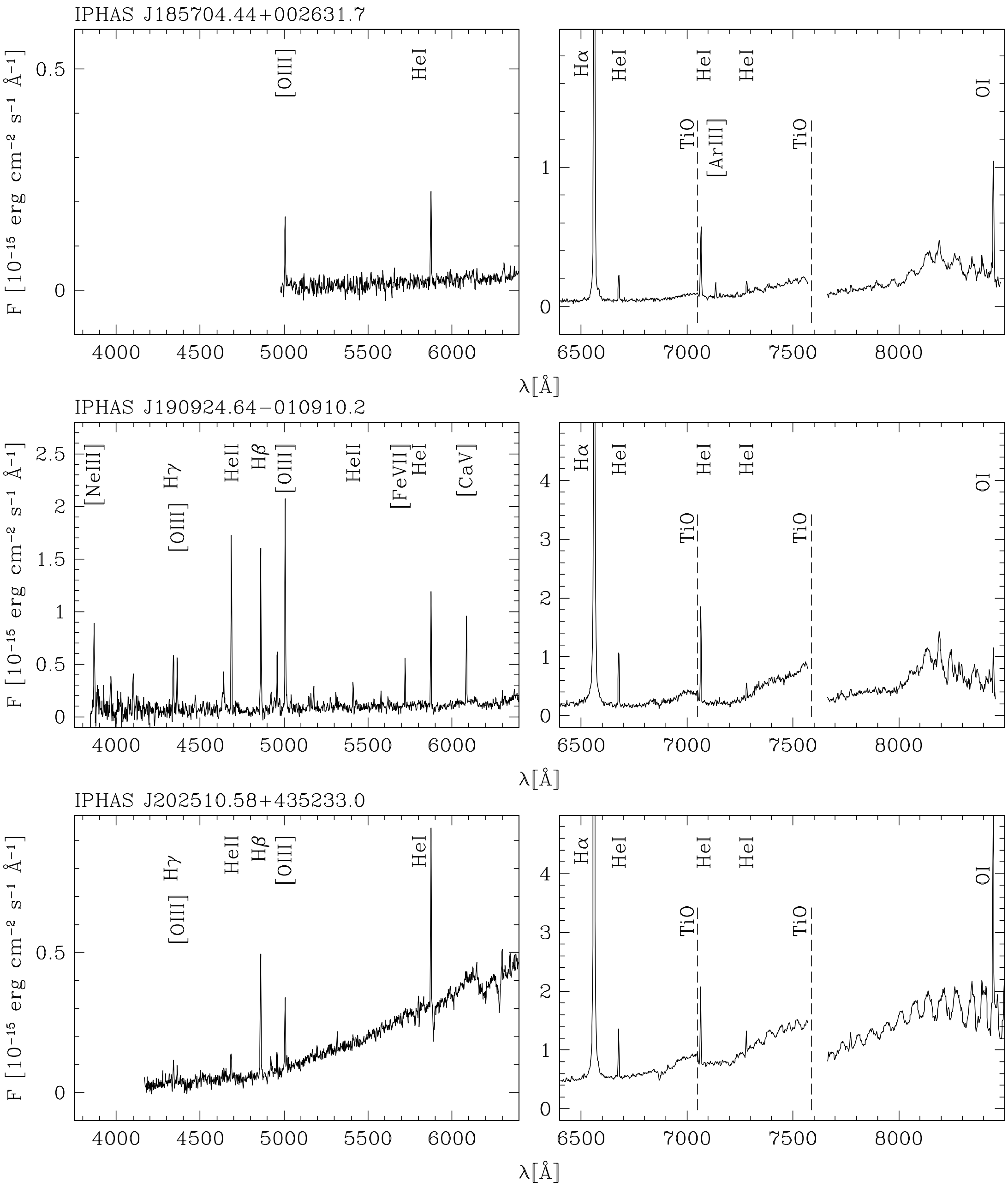

Fig. 8. Spectra of the first three new symbiotic stars discovered by IPHAS. The region around 7600 Å with the strong oxygen atmospheric absorption band is not plotted. The main low and high excitation emission lines and the heads of the TiO bands, which demonstrate the symbiotic nature of the objects, are labeled. The oscillations in the very red part of the spectra are due to fringing in the detector.

symbiotic stars (the filled circles). Therefore, this additional parameter seems to be a useful one to distinguish, at least in a statistical sense, young stellar objects from stars belonging to older Galactic populations like symbiotic binaries. We expect that the significance of this parameter will improve further as the sample of Hα emitters detected by IPHAS grows in number; this would allow a better definition of clustering in the area observed by IPHAS. For the time being, we add the mean distance to the four nearest neighbours as a further datum in the list of candidate symbiotic stars in Table 1; the weight to be given to this parameter is left to the discretion of the user. In any case, we note that about 50% of both the S-type and D-type candidates in Table 1 have a mean distance to their four nearest neighbours that exceeds 15 arcmin: these candidates are our preferred initial targets for spectroscopic follow-up.

5. Spectroscopic confirmation: the first symbiotic stars discovered by IPHAS

As an illustration of the potential of IPHAS and the selection method proposed in the previous sections, we present here the spectra of the first three new symbiotic stars discovered by IPHAS. Data for more stars and a deeper analysis of the individual objects will be presented in Paper II.

In the following, we use both the standard nomenclature for IPHAS point sources ("IPHAS J" followed by the J2000 coordinates, see Drew et al. 2005), as well as the name "IPHAS-Sy *nn*" to indicate the *nn*th symbiotic star discovered by the survey.

The INT spectra are shown in Fig. 8, and the location of the objects in the IPHAS and 2MASS diagrams is indicated by open circles in Fig. 6. The three objects have large r−Hα colours and fall in the selection box for S-type symbiotics. In the latter, two of them have colours characteristic of strongly reddened red giants, as confirmed by the INT spectra.

5.1. IPHAS J185704.44+002631.7 (IPHAS-Sy 1)

The IPHAS and 2MASS magnitudes of IPHAS-Sy 1 are: $r = 18.28$, $i = 16.03$, $\mathrm{H}\alpha = 15.59$, $J = 10.42$, $H = 8.86$, and $K_\mathrm{S} = 8.09$. No objects are listed in the SIMBAD database, within a radius of 2 arcmin about the source coordinates, and the nearest known radio HII detection is over 30 arcmin away. There is no evidence to link this object to a known star-forming region.

The Hα equivalent width is 800 Å, which corresponds to $r{-}\mathrm{H}\alpha = 2.69$. This is the faintest objects of the three in the optical (but not in the near-IR), and the one with the highest $J{-}H$ colour. This can be mainly ascribed to reddening, as shown by the steep decrease of the flux below 5000 Å (no emission is detected blueward of the [OIII]5007 Å line) and the large $r - K_\mathrm{S}$ colour amounting to 10.2 mag. The symbiotic nature of IPHAS-Sy 1 is indicated by the simultaneous presence of high excitation emission lines of [OIII] and [ArIII], and the TiO absorption bands of a M-type star (Fig. 8, upper panel).

5.2. IPHAS J190924.64-010910.2 (IPHAS-Sy 2)

IPHAS-Sy 2 has the following magnitudes: $r = 17.16$, $i = 15.26$, $\mathrm{H}\alpha = 14.79$, $J = 11.44$, $H = 10.29$, and $K_\mathrm{S} = 9.80$. Its Hα equivalent width is 650 Å ($r{-}\mathrm{H}\alpha = 2.38$).

In SIMBAD, it is indicated as a possible PN (K 4-17), but the spectrum described by Stenholm & Acker (1987) does not allow its real nature as a symbiotic star to be identified. This is instead revealed by our INT spectroscopy, which captures a rich set of high excitation emission lines ([NeIII], [OIII], HeII, and even [FeVII]), accompanied by the red continuum of an M4 giant (Fig. 8, middle panel). No star formation regions are catalogued in the vicinity of IPHAS-Sy 2.

5.3. IPHAS J202510.58+435233.0 (IPHAS-Sy 3)

Its magnitudes are: $r = 15.34$, $i = 13.34$, $\mathrm{H}\alpha = 13.42$, $J = 9.94$, $H = 8.45$, and $K_\mathrm{S} = 7.73$. The Hα equivalent width is 250 Å ($r{-}\mathrm{H}\alpha = 1.92$).

IPHAS-Sy 3 is listed in SIMBAD as a misclassified planetary nebula (PN K 3-59), but the spectrum of Sabbadin et al. (1987) only reveals weak Hα line emission superimposed on a very red continuum. Our observations show the composite spectrum defining a symbiotic star, with the simultaneous presence of the continuum of an early M star and high excitation emission lines.

In projection, the star is located in the Cygnus X complex, a little over 3 arcmin from the HII region DWB 137 (Dickel et al. 1969). The vicinity of young stars might cast some doubt on the nature of IPHAS-Sy 3 as a symbiotic star. Even if it shows some of the typical spectral signatures of these interacting binaries, such as the TiO bands together with highly ionized HeII and [OIII] in emission, some extreme examples of T Tauri stars also present them (see e.g. Beristain et al. 2001).

However, there are several arguments pointing toward IPHAS-Sy 3 as most likely being a symbiotic star. First, its spectrum lacks evidence of other features typical of T Tauri stars: e.g. the strongest resonance Li doublet at 6708 Å in absorption; any of FeII or NaI lines in emission; apparent broadening of the HeI emission line profiles. Second, T Tauri stars, being closer to the main sequence (MS), have radii just 2–3 times larger than their MS descendants, whereas symbiotic stars must contain a red giant with radii two orders of magnitudes larger than MS values. Playing devil's advocate, we can see if a typical T Tauri star radius works for IPHAS Sy 3 if placed at a plausible distance to be in a young Cygnus-X cluster. The distance to the young cluster containing the Herbig Be star V1685 Cyg, some 3 degrees away on the sky, is given as 980 pc (Davies et al. 2001), with the other nearby HII regions in Cygnus X being mostly at 1–2 kpc (Straizys et al. 1993). For a distance of ~1 kpc, an M0 spectral type (compatible with the strength of the TiO and VO absorption bands), a reddening $E(B-V) \sim 2{-}2.5$ (estimated from HI and HeI emission line ratios, the $J - K_\mathrm{S}$ colour, and a fit of the optical and near-IR spectral energy distribution), we apply the Barnes-Evans relation (e.g. Beuermann et al. 1999) to derive a radius $\sim 30\ R_\odot$. This is too large for a T Tauri star, but consistent with the presence of a red giant. The estimated radius increases if the distance is larger than 1 kpc.

6. Summary and perspectives

Searching for a relatively rare and old family of stars in a narrow band in the Galactic plane, where young stellar objects dominate the population of Hα emitters, might seem a hard challenge. Our motivation to embark in such an enterprise is the poor knowledge of the total population of symbiotic stars in the Galaxy: the IPHAS survey gives us the opportunity to tackle this problem by performing, for the first time, a complete search of these objects in a magnitude limited volume.

As symbiotic systems contain a cool giant star, the near-IR data from the 2MASS survey have been added to the IPHAS photometry. Then, a discussion of the location of the different classes of Hα emitters in the combined IPHAS and 2MASS colour–colour diagrams has been presented. This allows us to define selection criteria for symbiotic stars which separate them from the vast majority of normal and Hα emitting stars.

The only exception are T Tauri stars. They overlap with symbiotic stars in the IPHAS diagram. In the 2MASS one, they form a sequence very close to (and partially overlapping with) the main subclass of symbiotic stars (S-types), and fully overlap with the other, less frequent group of symbiotics (the D-types). In fact, even when a spectrum is available (see Sect. 5.3), it is sometimes difficult to distinguish a symbiotic star from those T Tauri stars which display high excitation emission lines. As an additional criterion to separate symbiotic from T Tauri candidates in our survey, we have considered the spatial distribution of the Hα emitters detected by IPHAS. T Tauri stars are expected to be found in groups in star forming regions. In contrast, symbiotic stars should be more isolated objects. With this aim, we have introduced a "clustering" parameter which is the mean distance to the four most nearby Hα emitters in the IPHAS list that we have considered (Witham et al. 2008).

We expect that all these criteria for the search for symbiotic stars within IPHAS will improve as soon as additional information is gathered from the survey itself. A better fix on the number of Hα emission line stars above specified, more exacting equivalent width thresholds, might improve our estimates of the clustering parameter – or further follow-up spectroscopy of the selected candidates can improve our understanding of the IPHAS and near-infrared colour–colour planes.

With this second aim in mind, we have started an intensive spectroscopic campaign. With it, we hope that the number of symbiotic stars in the IPHAS area, so far limited to only 11 objects listed in the catalogue of Belczyński et al. (2000), will significantly increase. The confirmation in this paper of three new systems out of a small sample of candidates observed in the first nights of the spectroscopic follow-up, seems to be a good start in this direction.

Acknowledgements. We are grateful to many of our collaborators in the IPHAS project, for continuous discussion about the properties of the variety of objects that are involved in the analysis of the survey data. R.L.M.C., E.R.R.F., A.M., and K.V. acknowledge funding from the Spanish AYA2002-0883 grant, and JM funding from Polish KBN 1PO3D 017 27 grant.

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Table 1. 1183 candidate symbiotic stars extracted from the list of Witham et al. (2008) using the photometric constraints defined in Sect 4.3. Columns contain: the coordinates, the IPHAS and 2MASS magnitudes, and the mean distance d_4 (in arcmin) from four neighbours (see Sect. 4.4). Part A contains the candidate S-type symbiotics, and Part B the candidate D-types.

RA (J2000.0)	Dec	*r*	*i*	Hα	*J*	*H*	K_s	d_4
Part A: S-type candidates								
00 07 40.09	+65 40 10.6	17.07	15.80	15.56	13.98	13.14	12.84	6.7
00 08 34.71	+65 28 32.8	18.54	17.06	17.12	14.75	13.87	13.55	10.8
00 10 33.27	+58 40 21.1	16.00	14.40	14.51	12.34	11.45	11.00	4.7
00 10 36.41	+58 50 05.0	14.66	13.70	13.06	11.89	11.09	10.74	7.2
00 13 01.79	+65 34 45.7	18.89	17.23	17.00	14.72	13.80	13.38	15.2
00 14 28.55	+65 49 34.5	19.42	17.32	17.82	15.11	14.19	13.78	5.8
00 15 20.95	+65 49 41.1	18.59	16.61	17.14	14.28	13.36	12.98	6.1
00 15 22.04	+65 45 30.4	16.68	15.49	15.13	13.47	12.54	12.09	6.2
00 19 09.80	+62 34 01.5	19.16	17.82	17.97	16.10	15.34	15.17	11.6
00 21 06.03	+62 10 49.1	19.37	17.93	18.33	15.99	14.94	14.55	17.9
00 22 05.18	+62 36 11.1	18.57	17.06	17.54	14.45	13.39	13.08	14.1
00 27 18.55	+64 44 31.3	19.48	17.95	18.21	15.30	14.23	13.72	22.6
00 30 31.28	+65 32 02.1	18.51	16.84	16.79	14.71	13.65	13.16	4.6
00 30 47.88	+65 21 22.1	18.65	17.00	17.58	14.32	13.20	12.61	6.9
00 31 52.06	+65 28 08.3	18.38	16.94	17.24	14.95	13.82	13.34	8.3
00 34 24.83	+65 59 30.9	17.69	16.12	16.57	13.47	12.36	11.82	25.3
00 36 01.76	+62 32 35.6	18.56	17.18	17.39	14.76	13.52	12.91	33.7
00 39 27.23	+60 19 00.3	18.67	17.55	17.62	15.89	14.99	14.66	33.4
00 41 10.36	+62 10 54.0	17.72	15.59	16.44	13.38	12.60	12.25	20.2
00 41 53.24	+61 49 42.8	18.15	16.23	16.82	13.89	13.03	12.64	9.3
00 42 12.35	+61 54 43.2	17.31	15.33	15.92	12.85	12.07	11.71	7.7
00 42 52.37	+61 10 39.3	18.24	16.62	16.90	14.04	12.99	12.58	6.1
01 23 05.28	+61 42 00.8	18.24	16.83	16.96	14.80	13.96	13.68	14.6
01 23 41.80	+61 50 01.0	17.24	15.99	16.26	13.77	12.75	12.26	15.1
01 27 01.54	+62 33 07.3	19.26	17.83	18.06	15.24	14.16	13.83	19.2
01 38 37.90	+64 57 47.3	17.97	16.59	16.75	14.61	13.57	13.06	28.4
02 23 07.88	+56 58 07.2	18.35	17.43	17.42	15.47	14.73	14.49	34.0
02 27 59.30	+58 51 47.9	19.20	18.00	17.48	15.93	14.85	14.30	28.3
02 28 16.91	+62 09 50.8	18.67	17.46	17.49	15.38	14.35	13.86	14.1
02 29 01.93	+62 07 25.2	18.81	17.72	17.42	15.78	14.92	14.64	17.3
02 31 42.96	+61 04 53.0	19.30	18.10	18.29	16.13	15.15	14.89	10.3
02 32 51.54	+61 43 46.8	18.69	17.48	17.26	15.20	14.23	13.74	7.6
02 32 53.77	+62 15 28.9	17.70	16.76	16.71	15.10	14.25	13.96	20.6
02 36 57.74	+61 28 57.1	18.26	16.96	17.24	15.04	13.94	13.53	10.5
02 37 01.50	+61 28 23.6	17.90	16.73	16.67	14.72	13.67	13.17	10.8
02 37 49.30	+60 51 07.3	19.24	17.99	18.08	15.99	14.83	14.26	14.9
02 38 14.81	+61 52 14.6	18.23	17.13	17.06	15.21	14.38	14.11	11.3
02 41 48.15	+57 23 37.1	19.03	17.85	17.87	16.30	15.34	14.93	15.3
02 50 45.30	+60 28 09.4	18.04	16.80	17.01	14.76	13.74	13.27	10.3
02 52 11.62	+60 29 51.5	18.41	17.20	17.38	15.30	14.34	14.01	8.2
02 52 48.11	+60 16 09.6	18.71	17.54	17.20	15.35	14.25	13.78	7.5
02 55 26.52	+57 20 50.6	18.07	16.85	17.09	14.77	13.93	13.58	25.5
02 57 19.80	+60 21 41.3	19.47	18.20	18.21	16.37	15.34	15.01	10.7
02 57 49.09	+60 46 17.9	18.78	17.62	17.76	15.61	14.72	14.38	6.7
02 58 20.50	+60 35 58.4	18.95	17.72	17.69	15.67	14.61	14.07	4.8
02 58 45.13	+60 29 42.1	19.12	17.80	17.96	15.49	14.66	14.29	4.4
02 59 17.69	+60 34 11.0	19.43	17.90	18.16	15.53	14.46	13.98	2.8
02 59 31.03	+60 40 25.5	18.75	17.54	17.36	15.25	14.15	13.63	5.0
03 00 07.58	+60 25 36.8	19.08	17.91	17.84	15.70	14.56	14.12	4.4
03 00 43.98	+60 30 59.0	18.76	17.55	17.53	15.45	14.43	13.97	3.8
03 11 47.12	+56 34 30.2	18.76	17.29	17.42	14.94	13.77	13.26	29.1
03 17 04.34	+60 15 00.0	16.65	15.33	15.21	13.33	12.35	11.91	11.8
03 19 37.54	+59 11 14.4	18.82	17.43	17.64	15.31	14.36	14.05	25.4
03 20 20.46	+60 16 32.9	18.59	17.12	17.17	14.89	14.07	13.69	4.1
03 20 46.82	+60 20 33.0	17.96	16.58	16.69	14.63	13.62	13.13	4.2
03 20 48.19	+60 20 19.0	16.70	15.59	15.51	13.63	12.74	12.38	4.1
03 25 42.41	+58 57 30.0	18.68	17.21	17.43	15.26	14.39	14.05	14.5
03 26 47.39	+58 55 38.3	17.95	16.51	16.60	14.05	12.89	12.31	9.1

Table 1. continued.

RA (J2000.0)	Dec	r	i	Hα	J	H	K_s	d_4
03 32 32.97	+60 08 25.2	18.93	17.31	17.77	14.84	13.80	13.32	20.7
03 43 35.34	+53 09 40.6	18.25	16.72	17.13	14.37	13.29	12.86	37.9
03 44 22.86	+54 07 29.0	18.64	17.32	17.19	15.09	14.06	13.76	30.6
03 44 23.39	+56 46 36.3	18.51	17.15	17.41	15.27	14.41	14.19	32.5
03 59 22.23	+51 54 15.1	17.09	16.09	16.12	14.35	13.54	13.37	13.5
04 02 32.14	+51 39 58.1	18.20	16.78	17.14	14.75	13.68	13.24	25.5
04 07 32.70	+57 38 31.4	16.74	15.73	15.74	14.05	13.23	13.02	20.4
04 16 42.06	+55 14 44.2	18.59	17.90	17.18	16.51	15.77	15.48	23.2
04 23 34.84	+50 18 22.5	18.39	17.22	17.42	15.51	14.34	13.74	41.5
04 26 04.19	+45 34 22.7	19.26	17.64	17.71	15.22	13.95	13.28	29.4
04 29 07.66	+45 26 47.1	18.42	17.53	17.28	15.67	14.96	14.68	9.2
04 31 00.52	+44 55 59.6	19.25	18.02	18.13	16.09	14.84	14.46	27.3
04 36 29.20	+45 17 50.4	18.08	16.86	17.04	15.18	14.31	14.04	18.7
04 47 07.00	+43 43 39.0	18.30	17.07	17.24	15.44	14.62	14.36	24.7
04 56 30.88	+43 57 48.9	18.84	17.40	17.77	15.31	14.37	13.96	40.2
04 56 38.58	+45 02 25.9	15.08	14.30	14.12	12.90	12.09	11.71	36.5
05 03 15.64	+43 41 43.5	15.91	14.90	14.73	12.16	11.46	11.15	34.1
05 11 05.67	+42 36 21.3	18.18	16.87	17.13	15.39	14.67	14.49	35.9
05 12 01.82	+38 43 34.0	18.97	18.03	17.93	15.70	14.67	14.24	12.9
05 18 27.42	+30 08 49.7	13.76	12.40	12.70	10.59	9.89	9.64	65.0
05 20 53.15	+38 08 45.8	19.06	17.78	18.05	15.49	14.47	14.10	51.8
05 22 41.49	+33 20 50.1	18.44	17.39	17.42	15.54	14.38	13.91	7.4
05 22 45.78	+33 28 16.4	18.30	17.06	17.19	15.05	14.04	13.54	3.5
05 23 00.06	+33 30 39.0	17.07	16.13	16.14	14.34	13.42	12.97	3.7
05 25 44.57	+34 50 17.9	17.73	16.63	16.76	14.71	13.72	13.23	10.3
05 26 30.69	+34 50 14.8	17.94	16.97	16.86	15.26	14.21	13.74	7.4
05 26 52.58	+40 33 06.2	18.86	17.91	17.90	16.33	15.48	15.22	54.9
05 27 12.33	+34 32 19.8	18.99	18.05	17.80	16.12	15.25	15.01	5.8
05 27 16.23	+35 13 39.6	19.01	17.77	17.81	15.85	14.59	14.10	15.7
05 27 25.89	+34 42 41.7	18.15	17.22	16.99	15.44	14.59	14.31	4.7
05 27 43.83	+34 40 27.9	18.82	17.84	17.30	16.12	15.36	15.08	3.2
05 27 54.45	+34 46 22.2	17.29	16.55	16.30	15.23	14.49	14.22	3.8
05 27 54.76	+34 45 30.7	18.50	17.49	17.49	15.36	14.39	13.91	3.2
05 30 18.12	+31 35 58.9	16.95	16.02	16.01	14.32	13.50	13.21	33.7
05 32 58.06	+25 54 37.8	17.86	16.30	16.55	14.32	13.42	13.09	20.1
05 34 06.31	+25 38 22.5	17.29	16.21	16.11	14.10	13.10	12.59	9.9
05 34 26.31	+25 38 50.4	19.25	17.44	17.43	14.98	14.09	13.71	8.9
05 34 56.79	+27 47 36.4	18.00	16.95	17.00	15.10	14.24	13.88	13.2
05 36 11.81	+32 14 37.9	16.92	16.10	15.51	14.68	13.96	13.68	13.6
05 36 12.82	+27 34 10.8	18.09	16.60	16.96	14.10	12.89	12.29	12.7
05 36 41.46	+31 46 27.8	18.19	16.90	17.10	14.91	13.93	13.57	4.5
05 37 14.05	+27 48 57.8	18.89	17.46	17.64	15.24	14.12	13.69	7.0
05 38 44.29	+26 16 41.7	17.58	16.15	16.36	14.25	13.43	13.18	21.4
05 39 11.84	+26 42 18.8	17.07	15.89	16.11	14.19	13.39	13.19	21.5
05 39 29.60	+31 23 49.5	18.55	17.21	17.00	15.10	14.14	13.75	27.7
05 40 50.08	+35 23 49.1	17.70	16.41	16.49	14.44	13.50	13.09	21.8
05 42 23.90	+22 49 15.4	19.15	17.87	17.73	15.97	14.62	14.02	31.7
05 43 33.43	+33 24 11.8	18.44	17.51	17.41	15.97	15.07	14.64	34.8
05 47 06.78	+20 59 13.0	18.68	17.02	17.35	14.93	13.83	13.34	40.0
05 49 14.66	+33 23 29.3	16.97	16.01	15.74	14.32	13.47	13.12	20.1
05 52 04.78	+20 07 33.8	17.20	16.29	16.25	14.84	14.08	13.84	65.1
05 58 37.29	+32 04 38.1	19.32	18.28	18.38	16.44	15.70	15.40	34.3
05 58 45.75	+20 10 12.6	17.79	16.77	16.76	14.95	14.11	13.90	11.4
05 59 36.44	+20 31 49.0	19.01	17.61	17.82	15.58	14.62	14.30	12.4
06 00 05.82	+20 18 17.8	19.11	17.59	18.04	15.51	14.62	14.34	9.2
06 01 34.22	+16 13 45.8	15.37	14.44	14.21	12.98	12.28	12.04	22.9
06 08 21.91	+29 52 55.7	17.80	16.35	16.39	14.41	13.37	12.84	44.2
06 11 20.03	+13 20 58.1	18.96	17.75	17.78	15.70	14.68	14.16	42.9
06 13 08.11	+23 05 23.1	17.77	17.64	16.86	15.45	14.59	14.34	19.7
06 13 17.70	+23 08 14.1	17.74	17.67	16.23	15.27	14.49	14.12	20.2
06 13 28.37	+16 04 55.1	18.11	16.37	16.46	13.74	12.93	12.58	28.5

Table 1. continued.

RA (J2000.0) Dec		r	i	Hα	J	H	K_s	d_4
06 14 19.39	+21 28 05.7	18.28	17.64	16.74	15.55	14.75	14.56	27.4
06 15 40.34	+19 00 05.2	18.49	17.36	17.39	15.40	14.45	14.06	31.0
06 16 48.63	+20 56 33.1	18.84	17.61	17.48	15.64	14.58	14.15	36.0
06 16 56.26	+23 38 27.1	19.09	17.97	17.66	15.81	14.66	14.15	33.4
06 22 06.53	+22 34 36.7	18.61	16.86	17.40	14.48	13.37	12.93	10.2
06 31 24.23	+12 16 12.7	18.74	17.65	17.66	15.88	14.95	14.73	32.1
06 31 41.98	+04 54 18.2	16.45	15.58	15.56	13.89	13.18	12.90	4.4
06 31 54.87	+10 31 18.8	17.84	15.74	16.62	12.85	11.75	11.24	8.5
06 31 58.90	+04 58 11.1	18.16	17.06	16.89	15.09	14.19	13.74	4.7
06 32 05.29	+04 57 42.5	17.18	16.24	16.01	14.61	13.78	13.50	4.9
06 32 10.04	+12 08 17.8	19.07	17.83	18.01	15.78	14.67	14.16	37.0
06 32 16.30	+10 09 55.9	18.12	16.09	16.70	13.51	12.74	12.38	5.6
06 36 12.36	+03 43 33.7	18.09	16.88	16.79	14.84	13.71	13.15	38.8
06 36 59.97	+02 09 58.9	18.82	17.38	17.27	15.03	13.90	13.37	3.6
06 37 01.68	+02 10 46.7	17.41	16.08	16.43	14.06	13.12	12.72	3.6
06 37 03.18	+02 10 13.9	18.56	17.11	17.32	14.40	13.21	12.58	3.9
18 29 06.08	-00 34 57.2	17.53	14.87	15.66	10.97	9.61	9.05	51.1
18 33 34.49	+00 34 22.1	18.01	16.05	16.82	13.24	12.09	11.63	40.0
18 35 01.83	+01 46 56.0	16.34	14.47	13.83	10.74	9.48	8.92	26.4
18 37 48.03	-00 16 17.2	16.94	15.51	15.72	13.25	12.31	12.04	42.7
18 38 07.38	+00 11 13.6	18.47	17.08	16.11	14.20	13.24	12.79	36.0
18 39 43.08	-01 11 16.7	17.79	16.30	16.71	13.93	12.99	12.68	46.5
18 44 39.63	+05 02 49.1	14.01	12.27	12.67	9.39	8.29	7.81	53.1
18 44 46.08	+06 07 03.5	14.74	13.34	12.70	11.04	9.88	9.41	44.5
18 46 28.35	+00 25 54.5	18.32	16.81	17.04	14.31	13.08	12.46	25.9
18 47 33.03	+03 25 54.3	18.55	15.32	16.14	10.07	8.44	7.71	54.0
18 48 39.34	+00 23 42.9	15.54	14.43	14.47	12.48	11.57	11.25	38.9
18 50 39.20	+06 59 16.7	17.93	15.74	16.57	12.31	10.86	10.32	65.7
18 53 23.58	+08 49 55.1	16.54	14.25	14.28	10.32	9.04	8.52	85.5
18 56 07.26	+00 38 22.9	17.46	15.73	16.17	13.11	12.00	11.44	23.7
18 57 04.44	+00 26 31.7	18.28	16.03	15.59	10.43	8.86	8.09	24.4
19 01 06.87	+04 59 27.5	18.73	16.66	17.04	13.87	12.89	12.44	51.0
19 03 09.13	+02 04 31.8	18.85	17.53	17.66	15.23	14.21	13.74	74.9
19 03 56.19	+09 01 58.4	16.33	14.54	15.21	14.78	14.00	13.71	68.8
19 04 41.53	-00 59 57.2	15.88	13.08	14.19	8.89	7.75	7.17	25.9
19 09 24.64	-01 09 10.2	17.16	15.26	14.79	11.44	10.29	9.80	15.5
19 10 36.14	+02 49 28.2	15.32	12.79	13.50	10.08	8.94	8.51	37.7
19 19 17.89	+20 30 51.6	18.14	16.37	16.72	14.13	13.13	12.79	56.8
19 21 26.35	+10 53 40.2	18.39	16.03	16.46	12.61	11.52	10.95	38.9
19 22 04.55	+10 31 53.7	19.00	16.32	16.66	11.89	9.98	9.04	35.0
19 23 36.01	+10 00 09.4	18.71	16.57	17.34	14.52	13.70	13.40	46.3
19 25 06.46	+22 45 14.1	16.24	15.12	14.99	13.43	12.51	12.05	2.4
19 25 15.05	+22 47 20.3	16.40	15.29	14.60	13.38	12.57	12.24	3.3
19 25 56.60	+23 04 54.0	17.73	16.08	16.51	14.31	13.57	13.38	18.6
19 26 29.11	+21 04 07.4	15.18	14.15	14.26	12.69	11.92	11.70	9.7
19 26 35.81	+22 39 24.4	18.00	16.36	16.68	13.89	12.75	12.21	8.7
19 27 12.25	+22 39 36.9	16.56	15.11	15.46	12.95	11.83	11.31	8.9
19 27 42.36	+20 18 25.7	18.43	16.67	17.18	14.40	13.64	13.35	22.5
19 29 51.43	+21 54 11.3	18.33	17.09	17.34	15.08	14.29	14.11	27.4
19 34 36.06	+16 31 28.9	16.84	14.65	14.49	10.71	9.34	8.77	52.2
19 35 01.31	+13 54 27.5	14.04	12.51	12.81	10.05	8.98	8.58	36.6
19 35 30.04	+27 11 47.6	17.35	15.58	16.05	14.24	13.49	13.40	23.6
19 41 17.05	+22 01 32.3	18.68	16.89	17.19	14.61	13.75	13.44	24.4
19 41 20.78	+24 56 12.8	14.91	13.30	13.77	10.39	9.19	8.73	29.7
19 42 23.61	+22 55 30.8	19.41	18.04	18.30	15.62	14.34	13.66	12.1
19 44 50.12	+23 47 22.5	19.05	17.75	18.02	15.62	14.42	14.01	2.9
19 45 23.91	+23 55 13.1	17.91	16.50	16.88	14.21	13.10	12.56	9.6
19 45 29.73	+24 11 56.5	19.02	17.71	17.89	16.00	14.74	14.28	13.9
19 59 10.60	+29 19 40.3	16.38	14.43	15.14	11.04	9.67	9.10	18.5
20 02 23.56	+35 16 56.3	18.77	17.23	17.50	14.76	13.75	13.23	7.0
20 04 21.29	+35 41 49.6	19.10	17.95	17.63	15.56	14.65	14.22	6.7

Table 1. continued.

RA (J2000.0)	Dec	r	i	Hα	J	H	K_s	d_4
20 04 27.42	+34 37 35.3	19.36	18.10	17.71	16.00	14.86	14.48	29.5
20 07 22.57	+35 38 32.5	19.21	17.79	17.57	15.83	14.69	14.13	4.7
20 08 12.32	+35 59 22.7	18.89	17.92	17.56	15.96	15.03	14.55	12.0
20 08 50.48	+35 54 10.6	18.67	17.65	17.74	16.20	14.98	14.35	12.3
20 10 36.18	+30 01 27.8	18.50	17.09	16.86	15.37	14.63	14.38	31.9
20 11 42.77	+39 39 54.2	15.40	14.34	14.29	12.42	11.54	11.15	32.7
20 11 56.67	+37 00 22.9	17.61	16.59	16.43	14.81	13.80	13.31	19.9
20 13 16.45	+36 06 30.1	18.54	17.43	17.54	15.41	14.33	13.77	12.5
20 16 37.58	+40 18 47.1	16.14	15.19	15.05	13.85	13.06	12.81	18.1
20 17 03.42	+40 41 33.9	17.55	16.13	16.31	14.53	13.63	13.37	9.2
20 17 13.67	+40 30 31.2	18.71	17.12	17.59	14.70	13.56	12.96	15.1
20 17 43.66	+34 19 07.1	18.90	17.63	17.80	15.60	14.47	13.94	31.0
20 18 22.11	+39 10 42.7	18.80	17.58	17.31	15.46	14.65	14.47	8.9
20 18 23.03	+38 58 15.9	18.14	16.96	16.39	15.07	14.06	13.70	8.0
20 18 45.96	+40 55 53.2	16.94	15.80	15.94	13.98	13.14	12.93	4.3
20 18 58.45	+40 29 59.9	18.54	16.96	17.01	14.80	13.89	13.48	14.5
20 19 05.63	+39 23 51.3	18.40	17.22	17.05	15.11	14.17	13.78	5.9
20 19 13.93	+40 54 05.2	16.13	14.98	14.92	13.40	12.52	12.17	6.5
20 19 15.88	+40 35 42.3	17.74	16.44	16.64	14.68	13.68	13.30	11.4
20 20 02.64	+40 10 52.3	17.69	16.02	16.53	13.62	12.64	12.33	12.7
20 20 10.68	+37 09 03.7	18.14	17.09	17.19	15.01	14.07	13.60	14.3
20 20 20.60	+39 52 43.8	19.50	17.77	18.01	15.54	14.54	14.08	10.7
20 20 37.46	+39 56 44.9	16.46	15.54	15.36	13.98	13.20	12.85	11.3
20 20 41.50	+40 48 59.1	16.21	15.29	15.27	13.87	13.02	12.71	12.2
20 20 47.07	+38 55 42.2	18.30	17.02	17.27	14.75	13.75	13.30	13.4
20 21 25.58	+38 14 04.0	18.07	16.99	17.01	15.07	14.17	13.89	14.0
20 22 02.15	+38 50 50.2	17.20	16.28	15.92	14.53	13.49	12.98	11.6
20 22 25.44	+38 40 46.1	19.37	17.82	17.68	15.47	14.54	14.12	12.7
20 23 52.57	+40 46 05.8	17.25	16.32	16.21	14.88	14.06	13.75	15.0
20 24 26.35	+39 02 59.3	16.69	15.27	15.60	12.95	11.91	11.38	3.6
20 24 45.41	+39 00 20.9	17.52	16.00	16.32	13.85	12.95	12.55	4.5
20 24 46.60	+42 21 42.2	18.04	16.86	16.86	14.79	13.90	13.47	6.2
20 25 10.58	+43 52 33.0	15.34	13.34	13.42	9.94	8.45	7.73	26.6
20 25 15.11	+39 48 28.1	16.55	15.48	15.28	13.67	12.73	12.28	28.2
20 27 17.23	+39 09 42.7	17.00	15.93	15.59	13.81	12.85	12.56	14.2
20 29 09.03	+39 31 40.8	19.46	17.94	18.19	15.28	14.23	13.93	10.4
20 29 57.91	+39 19 13.5	18.62	17.20	17.54	15.06	14.21	13.96	18.8
20 30 52.48	+40 18 16.2	16.63	15.55	15.36	13.78	12.91	12.64	12.8
20 31 49.04	+40 15 38.0	17.50	16.45	16.22	15.30	14.33	13.90	15.0
20 32 59.66	+45 04 02.6	17.93	16.91	16.86	14.94	13.94	13.47	19.6
20 35 45.40	+40 03 32.6	19.46	17.50	17.86	14.93	13.96	13.51	40.8
20 36 56.75	+42 15 19.1	17.73	16.23	16.60	14.03	12.98	12.56	68.2
20 39 55.96	+49 48 14.4	18.79	17.77	17.33	15.89	14.86	14.47	20.0
20 40 31.77	+49 33 03.6	18.29	17.05	16.93	15.16	14.19	13.74	9.4
20 40 33.77	+39 48 38.8	18.85	17.26	17.70	15.01	14.07	13.85	17.5
20 40 53.55	+39 51 07.2	18.34	16.69	17.14	14.45	13.61	13.31	18.1
20 41 27.03	+39 37 30.0	17.02	15.85	15.61	13.90	13.00	12.70	14.1
20 43 08.84	+42 46 08.5	16.36	15.26	15.30	13.10	12.27	11.90	31.3
20 44 02.83	+39 31 16.3	17.77	16.36	16.45	14.34	13.55	13.25	29.7
20 44 33.07	+43 13 21.6	18.51	16.74	16.84	13.52	12.49	11.96	27.6
20 45 33.53	+41 07 27.8	18.01	16.13	16.64	13.63	12.68	12.26	19.0
20 45 46.40	+45 58 08.4	18.30	16.49	17.12	14.04	13.15	12.73	12.0
20 45 55.86	+46 12 01.9	19.28	18.29	18.32	16.43	15.39	15.03	10.7
20 46 48.46	+44 11 14.3	18.89	16.80	17.29	13.53	12.46	11.95	21.1
20 48 32.87	+44 11 59.7	17.89	16.39	16.16	14.16	13.23	12.75	21.9
20 50 21.10	+46 55 44.3	18.39	17.17	17.37	15.06	13.95	13.39	6.2
20 50 54.47	+43 46 23.8	16.51	15.61	15.27	14.00	13.21	12.97	28.8
20 51 12.11	+47 26 25.5	18.64	17.50	17.37	15.68	14.55	14.25	15.5
20 52 15.45	+44 28 10.8	16.82	15.48	15.47	13.20	12.21	11.73	9.6
20 52 25.79	+46 18 49.5	18.57	17.51	17.33	15.42	14.41	13.91	33.5
20 54 56.93	+44 39 24.5	17.85	16.21	16.59	14.11	13.21	12.81	8.7

Table 1. continued.

RA (J2000.0)	Dec	r	i	Hα	J	H	K_s	d_4
20 57 26.70	+43 35 29.6	17.22	15.78	15.93	13.41	12.40	12.01	16.1
20 57 55.03	+52 55 54.9	16.89	15.57	15.64	13.62	12.60	12.09	33.7
21 00 05.43	+52 17 05.1	15.54	14.46	14.34	13.06	12.06	11.63	8.7
21 00 24.07	+52 14 50.8	17.97	16.46	16.27	13.99	13.04	12.62	8.4
21 00 58.39	+52 28 56.3	17.41	15.87	16.27	12.33	11.08	10.48	6.5
21 01 35.60	+49 52 54.0	17.62	16.08	16.55	13.49	12.19	11.71	28.4
21 03 51.54	+48 03 35.1	18.95	17.05	17.72	15.22	14.53	14.43	19.7
21 15 51.96	+51 36 20.8	19.37	17.77	18.27	15.67	14.76	14.31	16.8
21 16 15.72	+43 36 58.4	19.44	17.52	18.10	15.52	14.81	14.51	34.3
21 19 22.95	+46 47 36.0	18.29	16.34	16.75	13.72	12.71	12.32	2.8
21 19 39.41	+51 44 12.6	18.56	17.01	17.22	14.78	13.90	13.51	5.7
21 20 54.77	+46 52 36.9	16.05	14.66	14.74	12.38	11.50	11.09	10.0
21 22 27.33	+52 35 55.7	19.21	17.67	17.86	15.19	13.91	13.25	23.7
21 22 40.17	+46 53 55.6	17.20	15.70	16.01	13.77	12.86	12.42	6.8
21 26 51.93	+47 34 13.9	16.85	15.43	15.54	13.41	12.51	12.15	13.8
21 28 20.10	+55 28 47.9	18.16	17.41	17.01	16.30	15.35	15.03	20.1
21 28 56.65	+47 47 42.0	15.92	14.98	14.50	13.29	12.56	12.39	27.9
21 35 16.28	+57 28 22.2	17.27	15.87	16.02	14.01	13.07	12.67	8.6
21 38 11.37	+58 53 17.2	18.54	17.02	17.49	14.70	13.63	13.24	35.6
21 39 35.62	+57 18 21.9	17.69	16.38	16.33	14.50	13.58	13.22	6.4
21 39 55.69	+57 16 38.2	18.06	16.65	16.80	14.78	13.95	13.73	6.9
21 39 56.13	+57 27 07.9	19.42	17.74	17.48	15.51	14.64	14.22	1.6
21 40 20.05	+57 50 44.3	19.46	17.12	18.13	14.49	13.58	13.27	10.2
21 40 25.37	+57 34 16.2	18.51	16.96	16.79	14.90	14.03	13.61	5.0
21 40 27.32	+58 14 21.3	18.22	16.78	16.65	14.30	13.30	12.88	3.3
21 40 37.61	+57 58 33.2	18.80	17.15	17.56	14.90	13.99	13.62	11.7
21 41 14.98	+57 38 14.8	17.24	15.64	16.11	13.14	12.32	11.92	7.2
21 42 16.79	+57 36 22.0	17.13	15.46	15.99	13.08	12.28	11.95	11.8
21 54 08.13	+59 45 35.3	18.90	17.22	17.50	15.13	14.31	14.04	14.0
22 06 16.35	+59 02 07.1	16.12	14.59	14.63	13.00	12.10	11.74	13.0
22 07 54.48	+59 06 57.1	15.46	13.88	14.29	12.30	11.50	11.24	8.4
22 12 14.28	+61 12 46.4	18.92	17.23	17.58	15.10	14.28	13.89	18.6
22 14 30.15	+61 32 13.2	18.45	16.94	17.33	14.52	13.46	12.93	5.8
22 14 31.30	+61 27 58.7	17.73	16.04	16.58	13.70	12.60	12.15	2.5
22 14 51.53	+61 40 12.8	16.37	15.24	15.38	13.39	12.48	12.15	11.0
22 15 30.21	+60 46 09.7	18.75	17.20	17.00	14.69	13.73	13.33	7.8
22 15 54.21	+52 17 27.5	18.12	17.32	17.07	15.86	14.99	14.82	8.3
22 16 00.81	+59 19 51.0	16.76	15.20	15.47	13.21	12.41	12.13	21.6
22 16 01.12	+56 14 50.5	18.35	16.80	17.10	14.51	13.61	13.25	11.2
22 16 06.52	+52 27 22.5	18.86	17.92	17.66	16.33	15.06	14.42	5.9
22 16 24.48	+61 59 19.0	18.60	17.09	17.51	14.61	13.53	13.12	18.1
22 25 35.13	+62 58 16.8	17.45	16.23	16.31	14.16	13.28	12.97	25.5
22 26 28.63	+61 20 49.0	18.68	18.13	16.55	14.62	13.75	13.42	24.2
22 28 43.00	+62 21 33.7	17.51	16.23	16.44	14.21	13.31	12.90	20.4
22 45 47.21	+57 50 53.9	15.87	14.88	14.90	13.09	12.13	11.68	8.0
22 46 04.51	+60 53 46.0	15.75	14.60	14.77	12.82	11.88	11.42	13.9
22 47 27.94	+60 58 53.5	18.50	16.87	17.24	14.39	13.42	12.97	13.1
22 47 34.41	+58 07 17.7	18.18	17.12	17.12	15.52	14.61	14.44	10.5
22 47 48.64	+63 21 55.1	17.34	15.91	16.28	13.62	12.58	12.10	29.7
22 47 59.08	+61 51 26.4	19.10	17.22	17.33	14.51	13.51	13.10	15.7
22 50 22.14	+61 53 28.9	17.16	16.27	16.05	14.99	14.04	13.72	12.0
22 51 43.33	+62 58 03.0	18.59	16.85	17.36	14.70	13.87	13.52	13.8
22 52 01.54	+57 03 22.4	19.08	17.81	17.92	15.80	14.79	14.28	21.4
22 53 18.88	+62 29 27.0	17.26	15.85	15.82	13.31	12.09	11.47	5.8
22 53 19.03	+62 26 31.7	18.29	16.79	17.13	14.13	13.08	12.62	7.6
22 53 45.86	+59 52 16.4	17.98	16.24	16.81	13.12	12.01	11.47	20.7
22 53 59.68	+62 37 49.7	16.31	15.11	15.27	12.99	11.92	11.38	1.3
22 54 07.90	+62 35 58.6	17.69	16.22	16.64	14.07	13.08	12.76	2.4
22 54 58.16	+62 41 32.7	18.07	16.45	16.84	14.12	13.05	12.55	3.6
22 55 28.19	+57 08 18.2	18.39	17.33	17.22	15.40	14.38	13.88	16.9
22 55 38.34	+63 02 31.6	17.47	16.19	16.48	14.16	13.17	12.79	6.6

Table 1. continued.

RA (J2000.0)	Dec	r	i	Hα	J	H	K_s	d_4
22 55 56.25	+62 45 40.5	17.25	15.91	15.86	13.86	12.80	12.34	2.3
22 55 59.62	+62 47 44.8	16.09	14.75	15.03	12.65	11.60	11.11	3.4
22 56 14.14	+62 43 43.5	18.60	16.94	16.98	14.46	13.41	12.97	2.1
22 56 15.81	+62 39 32.8	19.17	17.02	17.34	14.44	13.53	13.07	2.4
22 56 30.95	+62 41 38.6	18.78	17.08	17.40	14.36	13.20	12.60	2.1
22 57 02.73	+62 29 01.9	19.29	17.45	17.31	14.89	13.84	13.36	10.6
22 58 34.40	+61 38 38.5	18.74	16.75	17.57	14.06	12.88	12.31	20.5
22 59 15.83	+63 52 24.2	19.01	17.28	17.82	14.68	13.53	12.99	27.3
23 00 23.89	+62 48 51.6	17.70	16.24	16.43	14.04	13.04	12.70	5.4
23 00 26.92	+62 48 30.9	17.66	16.32	16.61	14.09	13.21	12.80	5.3
23 00 29.03	+62 44 14.0	18.09	16.77	16.96	14.53	13.46	13.05	7.1
23 00 35.60	+61 17 30.6	18.54	17.31	17.37	15.06	13.99	13.50	9.1
23 01 11.35	+62 53 25.3	18.90	17.10	17.65	14.51	13.58	13.19	6.9
23 01 44.02	+63 06 16.5	18.77	17.14	17.64	14.59	13.61	13.11	7.8
23 02 02.60	+64 03 22.7	18.59	17.05	17.34	14.88	13.92	13.50	20.1
23 02 16.34	+56 57 55.6	18.95	17.89	17.74	16.13	14.71	14.06	19.7
23 02 18.37	+61 46 19.5	17.27	15.54	16.15	13.21	12.15	11.70	10.1
23 02 47.08	+64 48 05.7	18.26	16.91	16.65	14.65	13.58	13.03	31.4
23 03 41.77	+61 47 36.1	19.11	17.20	17.71	14.31	12.85	12.07	4.8
23 05 01.79	+60 04 54.9	18.75	17.49	17.78	15.56	14.63	14.31	10.4
23 05 05.93	+62 08 20.1	18.62	16.93	17.39	14.51	13.48	13.05	19.8
23 05 31.15	+60 12 23.9	19.10	17.58	17.91	15.18	14.08	13.64	6.8
23 05 46.69	+63 50 17.1	18.64	17.15	17.46	14.80	13.62	13.00	26.5
23 12 44.96	+61 46 05.4	14.64	13.94	13.66	12.77	12.04	11.72	10.1
23 12 49.78	+59 20 54.5	19.01	17.57	17.78	15.51	14.70	14.43	21.4
23 13 34.92	+62 09 44.1	17.12	15.91	15.87	14.13	13.21	12.90	12.8
23 14 11.67	+62 18 00.0	18.28	16.65	17.08	14.66	13.82	13.51	8.8
23 16 27.57	+63 03 38.1	19.02	17.70	17.18	15.15	14.03	13.63	22.2
23 24 50.86	+63 38 15.1	18.73	17.09	17.38	14.79	13.94	13.81	24.1
23 27 44.89	+61 09 59.0	18.31	17.21	17.26	15.56	14.47	14.18	18.6
23 36 30.38	+63 48 16.4	18.56	17.09	17.08	14.76	13.88	13.44	30.5
23 46 28.69	+63 28 02.9	17.18	15.67	15.96	13.59	12.64	12.21	6.4
23 46 41.72	+66 53 16.6	17.29	16.01	15.56	13.88	12.91	12.51	56.0
23 47 40.63	+63 22 17.5	17.16	15.53	15.91	13.61	12.70	12.32	7.2
23 55 30.14	+65 56 57.0	17.05	15.07	15.78	12.65	11.85	11.52	24.4
Part B: D-type candidates								
00 02 13.37	+64 54 24.6	16.97	16.11	15.62	10.66	9.67	9.05	20.2
00 04 09.16	+67 22 37.6	16.48	14.92	15.42	12.04	10.86	10.02	47.3
00 04 32.31	+58 08 54.0	17.36	16.02	15.41	13.63	12.86	12.35	48.2
00 07 18.66	+65 36 42.1	16.59	15.17	15.30	12.82	11.76	11.11	6.0
00 09 36.91	+66 45 45.4	19.43	18.02	17.90	15.71	14.53	13.70	23.5
00 10 20.53	+58 37 08.6	19.36	18.20	17.02	15.74	14.28	13.22	7.3
00 10 41.20	+66 38 53.2	17.08	15.71	15.64	13.34	12.46	11.91	27.2
00 10 55.30	+58 45 53.4	17.80	15.98	16.28	13.47	12.42	11.71	3.9
00 11 02.24	+58 42 32.2	18.46	16.48	17.05	13.86	13.11	12.61	3.3
00 11 25.46	+58 42 09.6	18.19	16.15	16.83	14.02	13.19	12.76	5.1
00 12 59.13	+65 47 00.7	18.08	16.82	16.72	15.54	13.74	12.42	11.0
00 14 14.65	+61 00 09.6	18.39	17.34	17.43	15.35	14.53	13.87	21.2
00 16 36.19	+63 33 48.6	19.32	18.12	18.33	16.06	14.87	14.08	17.0
00 16 43.60	+64 31 38.7	17.98	16.85	16.77	14.91	13.98	13.48	17.7
00 18 01.43	+65 48 46.5	18.62	17.26	17.40	14.88	13.68	12.99	15.6
00 18 53.83	+62 20 13.3	18.59	17.41	17.42	15.27	14.41	13.91	15.2
00 19 03.83	+62 42 25.9	19.46	18.37	18.36	16.35	15.53	14.79	12.2
00 21 43.02	+61 47 52.4	18.37	17.24	17.39	15.13	14.18	13.61	13.5
00 22 08.28	+61 25 45.3	19.27	18.14	18.19	16.44	15.56	15.02	13.8
00 24 57.77	+65 51 34.1	19.28	17.70	18.15	14.49	13.33	12.57	19.8
00 26 30.19	+65 51 45.8	18.77	17.30	17.22	14.95	13.80	12.96	19.2
00 28 20.89	+65 09 26.3	19.30	17.21	17.77	14.93	14.14	13.72	16.3
00 30 13.46	+65 28 12.5	18.84	17.42	17.53	14.62	12.88	11.69	4.5
00 35 42.71	+58 59 19.4	15.82	14.92	14.51	13.73	12.61	11.73	72.2
00 36 17.42	+66 15 13.3	18.16	16.71	16.60	14.35	13.50	12.80	29.6

Table 1. continued.

RA (J2000.0) Dec		r	i	Hα	J	H	K_s	d_4
00 37 56.79	+63 04 59.1	17.57	16.63	15.48	14.56	13.59	12.97	20.2
00 38 14.97	+63 05 59.7	15.84	14.85	14.59	12.50	11.48	10.64	20.3
00 42 24.91	+66 59 31.9	19.47	18.13	18.31	16.29	15.12	14.24	37.6
00 42 32.04	+61 47 57.5	19.36	17.29	17.92	14.69	13.56	12.86	9.0
00 42 34.61	+61 17 16.1	16.76	15.60	15.78	13.69	12.74	12.23	4.4
00 42 54.48	+61 19 31.2	16.89	15.46	15.33	12.53	11.15	9.98	4.3
00 42 55.80	+61 23 47.0	18.39	16.95	16.91	14.32	13.24	12.54	5.3
00 43 02.63	+61 09 23.0	18.55	16.89	17.10	14.32	13.31	12.73	7.2
00 43 15.16	+61 25 01.4	17.72	16.27	16.61	14.29	13.27	12.70	6.8
00 44 17.91	+62 01 18.0	18.60	16.63	16.93	13.83	13.08	12.61	5.4
00 44 20.30	+61 58 59.2	17.10	15.56	15.98	13.58	12.69	12.18	5.6
00 44 20.78	+61 58 34.1	17.96	16.27	16.66	13.77	12.84	12.27	5.9
00 44 46.83	+66 57 06.3	18.44	17.26	17.21	15.35	14.48	13.67	40.9
00 54 43.63	+61 09 04.0	19.38	17.65	18.15	14.30	13.15	12.47	33.5
00 54 49.44	+63 35 42.6	19.26	17.98	17.90	15.34	14.13	13.03	31.7
00 59 30.32	+61 38 54.8	15.87	14.71	14.90	12.82	11.93	11.33	41.4
01 03 16.60	+61 37 01.1	15.30	14.33	14.22	12.18	11.26	10.70	43.9
01 07 22.27	+59 43 35.2	19.38	18.16	18.29	16.48	15.68	14.92	45.8
01 12 20.50	+64 39 17.2	17.07	15.63	15.91	13.30	12.17	11.48	16.5
01 19 35.82	+62 55 25.8	17.18	15.91	16.01	13.64	12.46	11.55	36.0
01 21 07.17	+61 29 19.5	18.13	16.78	16.73	14.02	13.03	12.47	8.6
01 21 09.27	+61 26 52.7	17.12	16.18	16.14	14.26	13.15	12.51	8.8
01 21 58.27	+61 30 18.6	18.22	16.77	16.84	14.50	13.51	12.85	8.0
01 24 44.28	+61 53 29.9	18.80	17.35	17.31	14.60	13.45	12.74	17.7
01 25 44.66	+61 36 11.7	18.87	18.20	16.86	15.48	13.22	11.49	21.5
01 37 20.01	+64 59 57.7	17.47	16.01	15.51	13.62	12.69	12.08	28.1
01 39 13.79	+62 21 45.3	17.84	16.48	16.54	13.79	12.48	11.51	30.5
01 42 03.40	+61 20 52.9	18.68	17.54	17.53	15.29	14.14	13.41	30.0
01 43 49.54	+62 29 52.6	19.33	17.97	18.02	15.44	14.14	13.26	17.7
01 45 01.50	+64 12 16.5	19.36	18.28	17.99	15.91	14.94	14.30	13.6
01 45 50.34	+57 34 03.1	16.23	15.59	15.29	12.49	10.92	9.72	39.8
01 45 51.20	+64 16 05.5	19.03	17.86	17.34	15.65	14.50	13.28	17.5
02 00 39.48	+60 32 59.1	14.73	14.12	12.79	12.45	11.26	9.88	33.6
02 10 08.00	+59 37 32.6	17.95	16.77	16.93	14.57	13.35	12.53	27.4
02 16 23.72	+60 16 57.6	19.28	17.98	18.05	15.56	14.47	13.65	30.6
02 17 45.54	+66 00 22.3	17.73	16.54	16.44	14.37	13.17	12.31	33.3
02 21 03.83	+62 09 58.4	18.74	17.45	17.65	15.36	14.32	13.66	26.5
02 21 06.39	+59 01 13.6	17.03	16.02	16.08	13.77	12.46	11.32	41.0
02 22 26.45	+61 25 03.3	18.48	16.95	16.98	14.17	12.85	11.99	31.8
02 25 25.64	+62 11 57.7	18.69	17.33	17.63	15.17	14.01	13.25	17.1
02 26 22.40	+61 33 08.7	18.35	17.05	17.18	14.64	13.49	12.73	17.2
02 26 39.54	+62 02 40.0	18.21	17.00	17.07	14.90	13.85	13.20	11.8
02 26 53.83	+60 05 43.3	18.94	17.17	17.69	14.78	13.91	13.41	10.4
02 27 43.09	+58 11 58.3	17.87	16.93	16.95	15.17	14.30	13.74	36.3
02 29 02.78	+61 15 27.7	17.76	16.46	16.69	14.24	13.18	12.57	10.3
02 29 14.18	+61 33 25.5	17.81	16.52	16.83	14.37	13.28	12.59	9.1
02 29 24.29	+61 13 54.9	18.29	16.83	17.13	14.41	13.21	12.48	8.7
02 29 35.91	+61 15 56.8	13.83	12.98	12.76	11.14	9.91	8.94	9.2
02 30 24.71	+56 36 57.6	17.08	16.25	16.18	14.68	13.90	13.42	63.4
02 31 02.00	+61 07 57.2	17.84	16.45	16.76	13.88	12.67	11.81	10.2
02 31 09.66	+60 54 38.9	18.71	17.30	17.62	14.14	13.03	12.33	9.5
02 34 10.28	+61 24 40.4	13.64	12.97	12.46	11.44	10.41	9.51	9.3
02 34 25.20	+62 21 08.9	18.27	17.06	17.23	14.88	13.70	12.83	19.0
02 34 50.40	+62 25 18.5	18.96	17.68	17.64	15.48	14.60	14.00	20.1
02 35 03.66	+61 54 52.4	16.78	15.83	15.89	14.06	13.17	12.57	12.2
02 35 15.33	+61 48 03.3	16.75	15.67	15.63	13.54	12.51	11.77	9.1
02 38 23.48	+61 51 05.2	18.09	17.06	17.17	15.26	14.33	13.86	12.0
02 38 28.34	+59 40 01.3	18.85	17.71	17.76	15.89	14.96	14.23	18.2
02 39 40.51	+59 04 01.6	17.54	16.23	16.38	13.86	12.69	11.91	22.1
02 41 35.93	+57 37 38.0	18.82	17.88	17.68	16.42	15.14	13.30	7.0
02 41 47.73	+60 11 09.1	16.13	14.79	14.99	12.53	11.83	11.26	19.3

Table 1. continued.

RA (J2000.0) Dec		r	i	Hα	J	H	K_s	d_4
02 43 26.34	+59 06 31.1	16.64	15.57	15.39	13.68	12.73	12.20	23.7
02 44 39.54	+60 59 54.8	16.24	15.22	15.11	13.17	12.10	11.25	9.1
02 44 42.09	+60 34 27.5	19.05	17.71	17.95	15.67	14.44	13.78	9.0
02 45 07.00	+61 07 44.0	19.01	17.60	17.69	15.52	14.35	13.63	10.5
02 47 48.61	+60 57 50.4	14.02	13.49	13.14	12.04	10.94	9.96	23.8
02 48 34.20	+60 27 55.5	18.64	17.41	17.57	15.24	14.16	13.30	17.6
02 49 49.77	+60 17 15.2	18.39	17.13	16.96	15.03	13.81	13.04	10.7
02 49 53.35	+60 13 28.3	16.78	15.77	15.51	13.72	12.73	11.95	11.2
02 51 51.96	+60 13 09.3	18.73	17.53	17.44	15.33	14.31	13.71	4.8
02 51 58.30	+60 23 59.2	18.49	17.58	17.29	15.39	14.36	13.57	4.8
02 52 07.87	+60 14 55.6	17.41	16.35	16.48	14.37	13.35	12.57	4.2
02 53 38.45	+60 41 16.0	18.68	17.64	17.40	15.36	14.45	13.87	3.9
02 53 56.29	+60 39 20.7	18.16	17.11	16.79	15.04	14.09	13.39	2.1
02 54 00.78	+60 36 39.5	19.43	18.14	18.41	16.05	15.24	14.82	2.0
02 54 06.19	+60 38 33.5	17.79	16.71	16.85	14.89	13.73	12.85	1.6
02 54 17.67	+60 38 14.7	18.52	17.39	17.27	15.61	14.61	13.88	1.8
02 54 56.86	+60 38 13.7	19.45	18.23	18.37	15.86	15.06	14.54	2.2
02 55 45.29	+59 04 38.2	17.25	16.50	16.28	14.43	12.91	11.65	30.8
02 56 02.38	+61 11 59.9	17.91	16.58	16.85	13.90	12.62	11.62	12.7
02 57 20.41	+60 44 46.6	19.32	17.91	17.95	15.58	14.70	14.19	6.7
02 57 21.57	+60 53 09.5	19.02	17.62	17.66	14.07	12.81	11.79	8.1
02 57 57.37	+60 20 40.7	17.55	16.50	16.39	14.42	13.57	13.02	8.4
02 58 24.52	+60 34 16.4	18.51	17.36	17.25	15.41	14.62	14.13	4.3
02 58 51.22	+60 39 54.5	18.68	17.40	17.49	15.22	14.18	13.49	5.1
02 59 02.08	+60 36 24.4	17.60	16.60	16.23	14.70	13.73	13.07	3.9
02 59 25.87	+60 28 59.4	19.19	17.96	18.20	15.58	14.45	13.83	1.8
02 59 40.84	+60 34 53.6	18.37	17.23	16.99	15.07	13.99	13.29	1.7
02 59 42.81	+60 28 21.2	18.27	17.27	17.07	15.59	14.65	13.95	2.0
03 01 05.20	+60 31 55.4	15.85	14.77	14.91	12.85	11.90	11.29	3.0
03 01 34.36	+60 30 08.6	19.30	17.60	17.99	14.78	13.43	12.56	3.1
03 04 11.04	+60 55 04.1	18.89	17.61	17.50	15.16	13.90	13.06	21.4
03 05 55.54	+60 37 09.4	18.79	17.41	17.40	15.00	13.81	13.02	22.9
03 06 14.52	+58 39 35.0	19.26	17.62	17.67	15.19	14.20	13.61	21.5
03 09 02.19	+58 29 52.3	18.42	17.30	17.18	14.62	13.51	12.73	26.5
03 10 46.27	+59 30 03.6	15.08	14.51	14.29	12.82	11.75	10.65	29.5
03 14 05.39	+58 44 53.4	19.00	17.66	17.61	15.70	14.65	14.02	26.5
03 16 53.16	+60 03 05.5	19.43	17.97	18.06	15.55	14.34	13.66	10.9
03 16 53.27	+60 16 59.9	18.05	16.61	16.77	13.34	12.12	11.25	12.8
03 16 56.98	+59 57 39.3	18.97	17.51	17.12	15.14	13.80	12.88	13.3
03 17 41.86	+53 08 50.2	18.15	17.04	17.11	15.04	14.04	13.40	42.0
03 18 07.44	+59 03 39.7	17.75	16.34	16.52	14.38	13.43	12.62	22.0
03 19 12.06	+59 40 09.5	18.78	17.14	17.59	15.41	14.29	13.53	18.4
03 20 36.40	+60 18 18.3	15.85	14.52	14.85	12.10	10.81	9.86	3.5
03 20 39.49	+56 23 58.2	14.68	13.40	13.07	10.95	9.57	8.22	35.3
03 25 08.89	+60 56 54.6	19.28	18.76	18.26	16.87	15.50	14.44	26.5
03 25 36.55	+56 05 33.2	16.63	15.30	15.64	13.21	12.46	11.88	35.6
03 26 38.60	+58 51 25.1	18.77	17.04	17.20	14.22	13.00	12.31	10.6
03 27 55.71	+58 18 06.0	18.01	16.81	16.96	14.38	13.41	12.90	22.7
03 28 35.36	+58 56 56.0	18.48	17.23	16.84	14.59	13.57	13.02	12.9
03 28 57.92	+58 40 50.3	19.35	17.64	17.99	14.99	14.01	13.36	19.8
03 30 13.60	+58 04 23.6	18.60	16.98	17.35	14.17	12.92	12.12	23.1
03 31 32.99	+60 35 55.9	16.71	15.94	15.54	13.98	13.20	12.76	23.0
03 31 55.48	+58 22 32.7	18.24	16.64	16.96	13.95	12.81	12.21	19.6
03 32 02.36	+59 32 00.7	17.75	16.33	16.50	13.76	12.66	12.06	34.7
03 35 40.02	+57 58 35.7	18.37	16.76	17.22	14.35	12.94	11.93	25.4
03 45 13.72	+54 35 25.9	16.93	15.49	15.83	13.25	12.47	11.84	25.9
03 46 09.84	+54 55 50.8	17.59	16.18	16.50	14.10	13.33	12.76	25.9
03 50 01.78	+53 07 56.2	18.93	17.36	17.76	15.07	14.12	13.41	40.1
03 50 46.67	+54 01 09.3	16.87	15.34	15.67	13.14	11.90	11.09	21.3
03 55 30.05	+53 45 42.0	18.47	16.49	17.28	12.55	10.92	9.65	29.2
03 56 08.31	+53 45 26.0	15.78	14.18	14.73	11.62	10.73	10.17	28.9

Table 1. continued.

RA (J2000.0) Dec		r	i	Hα	J	H	K_s	d_4
03 56 19.88	+52 29 44.0	19.41	18.00	18.19	15.43	14.61	14.09	14.9
03 56 34.20	+51 48 33.2	17.88	16.37	16.39	13.98	12.84	12.18	15.6
03 57 00.59	+51 47 34.8	16.33	15.40	14.79	13.29	12.41	11.91	13.6
03 57 07.52	+57 41 42.7	19.25	18.33	17.47	16.00	15.12	14.48	24.5
03 57 19.39	+57 07 43.1	18.91	17.82	17.92	15.72	14.82	14.15	5.1
03 58 23.95	+52 23 12.6	18.96	17.77	17.05	15.74	14.83	14.30	13.2
03 58 41.02	+51 37 23.9	19.30	18.00	18.01	15.85	14.71	13.80	9.6
03 59 23.18	+51 42 50.8	18.62	17.23	17.49	15.10	14.18	13.63	8.0
04 00 06.20	+51 39 02.3	17.48	16.47	16.29	14.16	13.23	12.63	9.8
04 00 56.06	+58 45 29.0	19.09	18.04	17.48	15.93	14.85	14.00	47.6
04 02 20.91	+52 51 01.9	18.83	17.84	17.48	15.81	14.80	14.21	23.3
04 04 50.08	+54 27 44.8	18.43	17.23	17.30	14.95	13.82	12.79	27.6
04 08 10.62	+52 42 58.6	18.07	17.01	16.67	14.95	13.86	13.18	16.6
04 09 30.70	+52 44 50.6	19.47	18.26	18.43	15.86	14.96	14.50	18.8
04 09 36.51	+49 03 06.8	19.05	17.97	18.07	15.74	14.65	13.96	68.2
04 10 11.85	+50 59 54.6	16.82	14.71	15.38	10.92	8.90	7.12	40.8
04 18 47.61	+52 42 56.3	19.34	18.19	18.07	15.96	14.83	13.98	29.5
04 22 40.39	+46 17 46.3	18.66	17.51	17.33	15.24	14.15	13.42	47.5
04 22 56.11	+53 47 09.4	19.30	18.20	18.06	16.27	15.57	14.75	24.3
04 23 03.57	+43 26 51.0	18.37	17.68	17.25	16.34	15.62	15.06	53.9
04 24 04.10	+44 53 46.7	19.43	18.16	18.04	16.22	15.16	14.44	37.6
04 25 04.65	+50 49 57.7	18.10	16.61	16.85	13.82	12.99	12.49	43.3
04 27 54.38	+48 10 08.6	19.34	18.09	17.80	15.51	13.54	11.94	38.1
04 29 14.20	+45 24 34.8	17.03	16.05	15.82	14.47	13.46	12.68	8.7
04 29 26.85	+45 16 10.2	17.23	15.94	15.74	14.04	12.62	11.44	12.2
04 30 22.43	+53 48 53.4	18.53	17.22	16.70	14.98	13.92	13.10	47.8
04 32 28.30	+46 20 17.1	19.33	17.79	17.68	15.48	14.63	14.19	44.6
04 32 36.68	+42 41 21.1	18.45	17.27	17.19	15.02	13.77	12.82	32.6
04 33 47.04	+44 31 32.7	18.45	17.32	17.32	15.38	14.30	13.53	26.0
04 41 12.44	+47 16 52.3	18.29	17.05	16.88	14.86	13.80	13.06	26.2
04 43 38.64	+41 09 41.5	15.02	14.02	13.83	12.25	11.19	10.17	42.7
04 45 39.97	+42 02 29.9	19.31	18.18	18.27	16.33	15.45	14.84	3.0
04 45 42.71	+42 02 13.8	18.67	17.20	17.26	14.68	13.46	12.53	3.2
04 54 32.84	+43 21 23.8	17.72	16.54	16.68	15.06	14.13	13.51	42.1
04 56 25.15	+43 49 31.8	18.13	17.13	16.29	15.25	14.08	13.04	36.8
04 57 17.54	+40 21 21.7	16.26	15.14	15.01	12.82	11.77	11.10	30.7
05 01 24.25	+46 48 47.7	15.07	13.80	14.06	12.30	11.22	9.99	36.6
05 02 19.46	+48 03 37.6	18.68	17.63	17.35	16.12	15.32	14.44	55.4
05 07 47.35	+40 23 55.3	18.57	17.69	17.12	15.43	14.45	13.62	29.0
05 08 00.97	+42 42 12.5	17.57	16.58	16.25	14.88	13.90	13.24	25.6
05 08 05.09	+40 24 40.3	18.25	17.20	17.12	15.09	14.00	13.28	28.7
05 08 10.23	+40 53 51.8	19.17	18.30	17.17	16.46	15.60	15.07	36.9
05 13 48.76	+32 42 06.7	18.82	17.73	17.50	15.27	14.21	13.43	45.0
05 22 43.78	+33 25 25.8	16.51	15.09	15.24	12.38	10.77	9.42	4.2
05 22 54.80	+33 27 18.7	19.10	18.22	17.78	16.59	15.53	14.76	3.3
05 24 43.05	+35 01 23.3	18.42	17.28	17.13	15.11	14.10	13.50	17.2
05 25 14.61	+43 15 49.4	17.62	16.86	16.65	15.21	14.30	13.51	60.6
05 25 27.71	+43 14 07.1	18.14	17.28	16.94	15.17	14.20	13.43	59.1
05 26 10.73	+33 37 50.8	18.24	17.18	17.30	15.22	14.21	13.62	32.3
05 27 07.61	+34 57 24.8	18.66	17.66	17.24	15.33	14.11	13.13	7.2
05 27 07.83	+34 57 27.6	18.38	17.41	17.27	15.69	14.75	14.27	7.2
05 27 32.45	+35 02 40.7	17.22	16.36	16.30	14.56	13.54	12.90	9.4
05 27 42.63	+34 41 52.9	18.76	17.56	17.07	15.67	14.77	14.21	2.9
05 27 46.99	+34 44 01.1	18.77	17.83	17.64	15.95	15.24	14.85	2.7
05 28 08.59	+34 25 38.4	16.01	15.25	14.95	13.51	12.50	11.83	1.8
05 28 29.01	+35 01 38.8	18.92	17.82	17.36	15.66	14.85	14.31	6.5
05 28 29.06	+31 03 24.4	17.91	16.71	16.96	14.60	13.48	12.87	36.1
05 28 32.58	+34 59 22.6	18.98	17.90	17.96	16.15	15.12	14.50	7.4
05 28 57.93	+35 09 37.0	17.66	16.82	16.70	15.19	14.31	13.85	8.3
05 30 29.55	+33 32 20.8	18.48	17.12	17.39	15.44	14.35	13.74	9.6
05 31 13.16	+38 20 06.6	16.53	15.68	14.94	12.54	11.74	11.14	31.0

Table 1. continued.

RA (J2000.0)	Dec	r	i	Hα	J	H	K_s	d_4
05 32 04.48	+30 17 31.3	18.90	17.63	17.65	15.34	14.28	13.64	8.0
05 32 09.27	+30 18 53.0	18.68	17.37	17.40	15.20	14.25	13.37	8.3
05 33 09.32	+32 50 30.1	17.72	16.67	16.22	14.93	13.98	13.47	25.0
05 33 50.71	+30 42 54.0	17.62	16.32	16.50	14.10	12.88	12.16	32.4
05 34 23.83	+25 39 10.5	18.53	17.04	17.05	14.88	13.93	13.38	8.6
05 34 40.77	+25 42 38.2	17.48	16.28	15.63	14.09	12.12	10.58	11.3
05 35 17.98	+27 47 58.1	18.12	17.04	16.64	15.25	14.27	13.65	13.2
05 35 23.89	+32 17 21.7	17.93	16.77	16.97	15.01	14.09	13.60	11.2
05 35 38.79	+32 21 15.2	18.82	17.66	17.02	15.81	15.00	14.56	10.1
05 35 44.51	+36 49 40.1	19.08	17.78	18.00	15.64	14.74	14.12	30.6
05 36 11.80	+27 34 36.0	15.53	14.49	14.28	13.46	12.31	11.32	12.5
05 36 31.98	+31 49 39.6	18.37	16.94	17.29	14.44	13.16	12.44	4.3
05 37 06.57	+27 47 24.2	19.40	17.85	18.04	15.41	13.87	12.81	6.5
05 37 12.44	+27 48 04.0	16.42	15.45	15.23	13.43	12.38	11.66	6.7
05 37 13.51	+26 56 59.2	18.66	17.47	17.65	15.88	14.75	13.70	16.2
05 37 28.60	+32 00 01.5	17.70	16.70	16.32	14.99	13.82	13.00	13.0
05 37 51.20	+27 03 46.0	18.40	17.38	16.98	15.20	14.18	13.49	12.0
05 38 17.88	+31 39 34.8	16.23	15.19	14.88	13.46	12.63	11.71	22.5
05 38 21.92	+27 28 32.4	18.24	17.14	17.09	15.00	14.03	13.33	11.0
05 38 23.09	+23 02 18.3	17.38	16.51	16.22	14.13	13.05	12.29	42.9
05 39 06.05	+30 49 33.0	17.92	16.90	16.43	15.22	14.36	13.72	18.9
05 39 17.83	+27 27 47.0	18.50	17.26	17.00	14.80	13.73	13.04	11.7
05 39 23.87	+27 26 50.4	18.94	17.64	17.43	15.43	14.15	13.26	12.8
05 39 27.29	+30 51 51.0	19.39	17.99	17.53	15.47	14.39	13.70	18.2
05 39 55.76	+33 24 12.8	16.30	15.27	15.32	13.20	12.00	11.00	46.8
05 40 40.97	+35 27 24.4	18.60	17.19	17.21	14.72	13.35	12.47	20.1
05 40 54.32	+35 25 54.9	16.40	15.59	15.03	14.05	12.94	12.18	21.1
05 41 32.75	+26 55 13.6	17.33	15.69	16.11	13.38	12.47	12.00	35.7
05 41 46.63	+27 27 48.0	18.37	17.17	16.75	14.99	14.03	13.46	22.8
05 42 13.34	+34 12 00.6	17.88	16.67	16.93	14.55	13.52	12.87	41.3
05 42 40.94	+33 45 15.2	18.91	17.90	17.47	15.98	15.03	14.27	34.8
05 42 52.04	+31 00 14.2	18.19	17.07	17.13	14.90	13.91	13.28	27.5
05 44 24.19	+31 20 31.4	16.36	15.21	15.38	13.33	12.24	11.61	38.8
05 46 21.54	+26 27 24.0	15.60	14.70	14.31	12.68	11.68	10.95	24.1
05 46 35.52	+26 19 09.8	17.68	16.63	16.73	14.61	13.60	12.96	26.4
05 47 03.77	+21 00 34.8	18.11	16.54	16.75	11.56	10.74	10.28	40.2
05 47 13.95	+22 11 00.5	18.88	18.09	17.81	16.45	15.56	15.09	29.4
05 47 45.79	+22 48 29.1	18.61	17.08	17.00	14.13	12.97	12.18	23.2
05 47 53.19	+30 36 50.4	18.53	17.44	16.93	15.31	14.37	13.76	32.1
05 48 07.74	+22 56 53.6	18.65	17.12	17.40	14.69	13.39	12.66	24.8
05 49 03.72	+22 27 08.7	18.10	17.05	16.91	14.87	13.63	12.90	29.6
05 49 12.30	+33 07 24.5	17.99	16.99	16.91	14.50	13.19	12.16	17.6
05 49 14.20	+27 00 21.7	19.20	17.37	17.84	13.81	12.55	11.59	13.3
05 49 34.57	+23 19 31.7	18.08	16.90	16.48	14.80	13.73	13.14	38.0
05 49 42.86	+28 23 15.6	18.42	17.26	17.25	15.37	14.38	13.68	18.2
05 49 45.05	+27 04 16.1	16.97	15.90	15.79	13.67	12.60	11.83	8.7
05 49 50.54	+27 07 01.5	16.42	15.38	15.48	13.90	13.00	12.36	8.6
05 50 28.14	+23 59 51.1	19.45	18.20	18.34	15.86	14.75	14.12	21.7
05 50 31.16	+31 27 46.0	17.98	17.17	16.98	15.57	14.61	13.99	31.9
05 50 38.56	+27 03 15.8	19.12	17.47	17.80	14.76	13.24	12.27	15.4
05 50 50.63	+24 06 11.9	17.65	16.76	16.59	14.65	13.60	12.85	19.7
05 51 12.18	+25 46 03.3	18.51	16.95	17.05	14.17	12.77	11.75	29.5
05 51 16.76	+25 42 13.9	17.99	16.64	16.66	13.78	12.45	11.51	29.4
05 52 01.57	+26 57 33.7	19.12	17.76	17.91	15.23	14.00	13.32	27.6
05 52 45.11	+17 11 19.1	16.40	15.27	15.16	13.78	12.95	12.51	51.8
05 52 54.08	+17 14 24.7	16.47	15.54	14.58	13.86	13.03	12.50	51.9
05 55 32.35	+27 44 51.4	17.25	16.31	15.89	14.77	13.86	13.31	44.6
05 57 24.37	+20 08 00.5	19.07	17.79	18.08	15.68	14.66	14.07	14.1
05 58 32.17	+19 57 12.6	19.09	17.65	17.88	15.49	14.53	13.99	16.2
05 59 20.12	+24 33 07.9	17.46	16.56	16.19	15.20	14.12	13.25	34.8
05 59 23.17	+16 56 33.5	19.41	18.19	18.26	15.84	14.87	14.02	36.0

Table 1. continued.

RA (J2000.0)	Dec	r	i	Hα	J	H	K_s	d_4
06 00 04.54	+16 51 26.0	18.98	18.18	17.42	16.69	15.69	14.71	28.8
06 00 19.28	+20 11 59.2	18.16	17.09	16.66	15.26	14.29	13.73	13.8
06 00 35.17	+31 29 55.8	17.72	16.34	16.59	14.50	13.04	12.15	29.3
06 02 11.11	+26 22 32.1	18.66	18.16	17.89	16.76	15.54	14.22	50.3
06 02 36.34	+30 57 44.2	19.13	18.14	17.88	16.38	15.61	15.20	23.4
06 02 40.22	+31 21 40.2	19.44	18.51	18.49	16.90	15.95	15.34	21.2
06 05 15.15	+20 40 36.7	17.82	16.48	16.43	14.77	13.21	11.22	56.1
06 06 24.06	+23 32 35.1	17.77	16.69	16.61	14.70	13.49	12.65	64.4
06 06 33.01	+30 06 40.5	18.28	17.24	17.05	15.75	14.58	13.92	34.7
06 06 44.63	+19 50 38.6	17.94	16.91	16.79	15.19	14.21	13.65	40.7
06 07 15.86	+19 30 00.1	15.05	14.20	14.17	13.45	12.37	11.64	32.9
06 08 30.13	+16 27 39.6	15.92	15.13	15.04	13.61	12.59	11.96	45.6
06 08 52.63	+20 37 28.3	17.14	16.25	16.25	14.42	13.51	13.04	24.3
06 09 23.62	+21 02 35.8	17.74	16.29	16.60	13.17	11.84	10.91	30.2
06 09 26.79	+24 55 19.9	16.48	15.93	15.42	12.26	11.20	10.24	39.3
06 09 29.56	+20 41 26.3	18.80	17.67	17.34	15.59	14.76	14.27	24.4
06 09 35.23	+12 40 22.8	17.97	16.66	16.95	13.97	12.41	11.10	15.6
06 10 08.00	+12 17 34.8	18.88	17.75	17.42	15.35	14.03	13.08	22.7
06 10 24.41	+12 46 47.6	15.88	15.05	14.22	13.30	12.28	11.51	18.1
06 10 45.52	+19 48 17.0	17.83	16.61	16.73	15.05	13.89	13.21	31.9
06 12 49.24	+18 03 52.6	19.26	17.93	17.98	15.12	13.85	12.91	33.5
06 12 58.84	+15 18 35.4	18.12	16.94	16.95	15.05	13.80	12.93	5.0
06 13 02.76	+15 35 27.3	17.80	16.66	16.70	14.68	13.69	13.12	14.6
06 13 12.70	+15 20 36.7	14.79	14.01	13.87	12.44	11.44	10.57	4.2
06 13 14.30	+17 53 43.9	17.76	16.79	16.61	14.95	13.95	13.34	27.4
06 13 17.53	+15 19 57.8	19.48	18.34	18.12	16.07	15.29	14.29	4.6
06 13 22.66	+21 57 46.3	18.13	17.26	17.23	15.11	14.17	13.52	28.0
06 13 28.57	+16 05 56.9	16.10	14.95	14.99	13.11	12.05	11.47	29.2
06 14 17.27	+22 54 18.6	18.60	18.11	16.70	14.55	13.29	12.28	22.4
06 14 29.10	+20 09 56.5	18.49	17.26	17.32	15.61	14.43	13.68	18.1
06 15 22.28	+18 56 55.2	18.66	17.64	17.55	15.60	14.76	14.07	30.2
06 16 38.92	+20 01 51.6	19.37	18.14	17.99	15.80	14.23	13.25	29.9
06 17 19.51	+23 36 06.8	17.50	16.34	16.35	14.12	12.72	11.78	34.9
06 17 19.67	+24 51 25.0	18.05	17.01	16.71	15.42	14.52	13.73	43.3
06 17 29.17	+22 21 52.4	17.26	16.36	16.32	14.85	13.85	13.31	30.6
06 17 58.15	+24 11 49.2	19.16	18.12	17.90	16.27	15.32	14.47	34.0
06 18 04.17	+18 30 10.3	18.50	17.34	17.15	14.96	14.11	13.50	38.8
06 18 05.61	+17 40 43.0	19.12	18.01	17.76	15.96	14.89	14.10	36.1
06 18 06.94	+13 02 03.7	17.82	16.87	16.26	15.39	14.41	13.80	57.7
06 20 21.71	+11 07 10.2	18.62	17.45	17.44	16.22	15.07	13.99	40.1
06 20 47.11	+10 57 25.7	19.17	18.12	17.65	16.26	15.04	14.15	39.5
06 22 06.60	+22 34 29.5	17.99	16.83	16.65	15.08	13.80	12.94	10.2
06 23 11.57	+23 42 51.3	18.85	17.59	17.63	15.36	14.28	13.37	30.6
06 23 35.18	+23 10 41.0	19.35	18.05	17.92	14.86	13.76	13.02	15.2
06 23 41.27	+22 58 05.9	18.71	17.41	17.62	15.08	14.12	13.42	11.3
06 23 52.13	+14 26 19.2	17.36	16.35	16.15	14.60	13.59	12.92	13.1
06 24 21.99	+14 33 15.3	18.31	17.17	17.29	15.16	14.14	13.45	12.1
06 24 38.78	+09 18 25.9	18.14	17.15	16.72	15.34	14.53	13.79	10.6
06 28 42.43	+09 32 09.2	15.26	14.22	14.28	12.68	11.84	11.35	36.6
06 30 37.20	+04 54 02.7	16.70	15.51	15.59	12.93	11.66	10.71	14.0
06 30 39.33	+05 21 42.1	17.11	15.89	15.96	13.70	12.66	12.08	20.3
06 30 48.17	+09 46 04.2	16.62	15.45	15.04	13.53	12.62	12.09	15.9
06 30 56.81	+04 38 34.1	16.82	15.83	15.65	13.83	12.80	12.08	15.3
06 31 01.43	+10 41 02.0	18.30	16.46	17.11	13.74	12.59	11.95	14.2
06 31 02.58	+09 59 20.6	17.82	16.45	16.34	15.66	14.22	13.43	7.9
06 31 05.43	+10 01 26.3	18.68	17.14	17.38	14.88	14.14	13.73	8.2
06 31 09.62	+10 25 57.5	17.35	15.43	15.73	12.85	11.88	11.27	1.7
06 31 10.28	+09 59 17.2	14.44	13.51	13.51	11.60	10.76	10.25	7.8
06 31 13.16	+10 26 57.2	19.38	16.94	17.97	14.32	13.63	13.21	1.3
06 31 13.55	+10 27 00.0	16.87	15.31	15.14	12.93	11.90	11.25	1.3
06 31 16.26	+05 06 51.1	17.18	16.26	16.25	14.67	13.82	13.37	9.3

Table 1. continued.

RA (J2000.0)	Dec	r	i	Hα	J	H	K_s	d_4
06 31 19.11	+10 22 46.5	19.10	17.59	17.81	14.37	12.81	11.91	3.5
06 31 19.66	+04 52 41.9	18.06	16.91	16.77	15.09	14.13	13.58	6.0
06 31 27.85	+04 50 02.9	16.44	15.62	15.26	13.79	12.80	12.01	4.8
06 31 29.67	+10 23 23.1	17.18	15.86	15.78	13.39	12.32	11.74	3.2
06 31 30.96	+05 06 58.5	15.17	14.37	14.21	12.88	12.08	11.60	7.4
06 31 46.86	+10 07 48.5	17.09	15.40	15.96	13.54	12.69	12.26	7.3
06 31 47.05	+04 48 11.0	18.30	17.17	17.07	15.24	14.36	13.81	4.4
06 31 48.05	+04 50 48.3	17.58	16.28	16.48	14.15	13.25	12.76	3.0
06 32 06.21	+10 36 27.7	14.80	13.30	13.73	11.01	10.22	9.61	12.8
06 32 14.59	+10 07 37.1	17.50	16.33	16.03	13.82	12.86	12.35	6.3
06 32 21.34	+04 46 19.2	17.41	16.29	16.44	14.27	13.34	12.79	9.0
06 32 31.50	+04 54 53.4	18.83	17.74	16.71	15.80	14.75	14.12	7.8
06 32 43.35	+05 02 20.6	17.34	16.49	16.02	14.77	13.90	13.29	10.9
06 32 46.98	+10 16 38.1	17.78	16.49	16.12	12.77	11.46	10.62	7.1
06 33 22.32	+04 36 38.2	16.70	15.76	15.56	14.09	13.10	12.49	19.7
06 33 32.26	+04 57 39.5	18.24	17.04	16.73	15.12	13.78	12.73	12.4
06 33 32.39	+04 57 49.2	16.32	15.34	15.05	13.57	12.56	11.87	12.4
06 34 16.90	+04 24 19.2	17.13	15.93	15.97	13.78	12.75	12.05	31.3
06 36 25.88	+02 16 16.2	16.93	15.79	15.74	13.91	12.65	11.83	10.1
06 36 42.85	+05 37 36.8	17.70	16.78	16.39	14.85	14.01	13.35	24.2
06 36 54.07	+04 00 46.8	18.18	16.86	17.14	14.79	13.83	13.27	37.5
06 38 49.77	+06 23 35.4	17.85	16.95	16.91	15.35	14.26	13.54	19.6
06 39 34.25	+06 21 16.9	18.80	18.31	17.48	16.77	15.79	14.79	13.0
06 42 22.19	-02 26 28.6	19.22	17.77	17.94	15.85	14.90	13.75	26.2
06 58 50.75	-01 40 43.3	18.93	17.64	17.77	15.67	14.59	13.82	64.5
18 28 15.04	-00 02 59.0	18.35	16.26	17.14	13.69	12.14	11.09	48.8
18 28 50.22	+00 09 49.6	17.86	15.78	16.43	13.01	11.33	10.30	48.2
18 37 53.26	+00 18 49.2	19.06	16.48	17.52	13.05	11.84	11.16	37.6
18 38 14.63	-01 22 13.8	17.30	15.30	15.75	12.16	10.98	10.10	47.0
18 40 28.54	+00 07 16.5	19.27	17.40	18.14	14.57	13.35	12.64	43.7
18 42 22.67	+02 58 07.0	16.03	15.04	15.08	13.32	12.36	11.80	46.7
18 44 31.46	-00 16 52.4	17.21	15.76	16.00	12.54	10.87	9.56	42.1
18 46 27.71	+00 28 17.8	18.94	17.23	17.57	14.06	12.79	12.02	26.0
18 46 35.85	+00 55 21.4	14.86	13.69	13.70	11.73	10.04	8.72	37.4
18 50 05.71	-00 40 41.2	16.95	15.59	15.72	13.00	11.87	10.65	36.1
18 51 38.28	-02 14 26.0	15.14	13.54	13.88	10.62	9.15	8.02	38.2
18 51 56.32	+06 19 46.1	17.81	16.00	16.28	13.27	12.17	11.55	44.3
18 52 31.44	+02 15 25.3	18.91	16.78	17.45	13.78	12.34	11.53	40.0
18 53 49.55	+05 23 53.7	18.48	17.08	16.70	14.34	13.06	12.26	51.4
18 54 03.70	+03 55 26.7	19.30	17.62	18.05	14.28	12.71	11.63	57.9
18 54 24.82	+04 19 05.0	18.29	16.46	17.10	13.13	11.92	11.20	59.8
18 55 06.04	+00 54 26.9	19.02	17.15	17.63	15.36	13.54	12.23	25.3
18 55 26.72	-04 05 37.5	19.30	16.76	18.00	14.23	13.51	13.12	17.2
18 57 07.14	+02 22 26.0	18.79	17.19	17.43	14.30	12.97	12.08	66.1
19 00 15.86	+00 05 17.3	14.94	13.96	13.99	12.18	11.30	10.30	32.6
19 00 21.58	+05 20 01.1	17.90	16.73	15.95	13.73	12.09	10.83	56.8
19 02 29.97	-02 27 57.0	16.13	16.30	13.19	13.42	11.22	9.34	12.8
19 03 46.84	+16 26 16.9	13.98	11.95	12.08	8.73	7.92	7.50	49.8
19 08 57.31	+05 36 20.6	16.89	15.82	15.95	12.83	11.47	10.35	42.1
19 10 17.43	+06 52 58.1	15.81	13.89	14.10	10.42	8.71	7.22	84.3
19 12 33.23	+11 46 31.2	18.60	16.86	17.09	13.99	12.67	10.92	33.2
19 17 01.33	+15 59 47.8	17.70	16.20	16.34	13.43	12.06	10.76	27.0
19 19 30.75	+13 32 42.5	19.48	18.05	18.29	15.91	15.15	14.65	60.5
19 20 33.79	+23 10 40.3	16.89	15.39	15.85	13.43	12.65	12.22	56.9
19 22 49.80	+14 22 36.3	16.96	15.32	15.62	12.61	11.19	9.88	66.5
19 22 57.72	+11 38 54.8	18.63	17.28	17.50	14.28	12.50	11.07	59.8
19 24 00.05	+23 02 53.1	15.79	14.68	14.56	12.82	11.97	11.34	22.1
19 25 04.10	+22 44 38.5	19.04	17.17	17.67	14.82	14.09	13.66	2.8
19 25 14.31	+22 41 44.1	16.84	15.39	15.69	13.33	12.43	11.91	3.5
19 25 17.16	+22 33 55.9	16.14	14.69	14.88	12.77	11.83	11.33	7.4
19 25 38.41	+22 34 14.6	14.68	13.70	13.65	11.79	10.54	9.61	7.6

Table 1. continued.

RA (J2000.0)	Dec	r	i	Hα	J	H	K_s	d_4
19 25 47.52	+22 26 51.3	17.56	16.56	15.71	14.71	13.92	13.23	12.5
19 26 19.04	+22 45 46.6	17.36	15.77	16.28	13.52	12.52	11.90	10.6
19 26 39.93	+21 07 05.3	14.66	13.82	13.79	12.32	11.47	10.95	8.1
19 27 01.88	+22 45 42.0	17.02	15.49	15.98	12.38	10.97	10.04	6.7
19 27 08.06	+22 46 22.5	16.12	14.60	14.93	11.90	10.68	9.90	7.5
19 27 17.94	+08 14 29.4	17.20	17.03	16.28	15.32	13.99	12.76	44.4
19 28 02.95	+17 16 43.3	19.25	17.57	17.53	14.17	12.57	10.88	35.5
19 28 19.52	+21 55 37.9	18.73	16.88	17.56	14.74	13.82	13.25	16.3
19 28 41.27	+17 48 19.9	16.70	15.49	15.47	13.67	12.43	11.48	21.3
19 29 13.09	+17 59 23.4	16.91	15.70	15.87	13.78	12.73	12.06	14.0
19 29 54.41	+18 10 26.0	17.68	16.15	16.21	13.54	12.16	11.20	10.4
19 30 00.51	+18 21 23.0	18.96	17.20	17.74	14.87	13.36	12.49	7.6
19 30 12.69	+17 48 36.5	18.74	17.27	17.18	14.37	13.02	12.07	17.3
19 30 24.47	+18 19 38.3	19.27	17.51	17.90	13.80	12.16	10.96	7.2
19 30 38.84	+18 39 09.8	13.26	11.35	11.95	8.21	7.28	6.60	15.0
19 30 56.09	+22 22 28.3	17.16	15.45	15.97	12.72	11.94	11.36	36.3
19 31 08.67	+16 49 50.5	19.34	16.97	17.80	13.20	11.77	10.70	19.5
19 32 32.88	+15 17 11.5	14.16	13.27	13.24	11.73	10.98	10.20	79.8
19 33 11.62	+17 56 59.0	17.94	16.69	16.87	14.61	13.51	12.77	21.6
19 34 31.49	+21 55 39.9	17.79	16.20	16.59	13.79	12.80	12.21	45.3
19 34 37.89	+18 25 59.3	17.23	15.87	16.22	13.38	12.20	11.41	34.1
19 37 09.65	+20 26 55.7	18.75	17.30	17.59	14.93	13.68	12.48	22.8
19 37 51.66	+24 44 08.0	19.32	17.72	18.08	15.40	14.55	14.01	19.7
19 38 52.27	+20 38 48.8	19.43	17.98	18.00	15.51	14.43	13.75	19.5
19 41 30.75	+21 56 50.2	18.34	16.73	16.90	14.04	13.08	12.47	23.0
19 42 06.83	+21 28 57.8	17.89	16.02	16.62	12.95	12.04	11.38	24.4
19 42 38.90	+22 53 24.1	18.86	17.07	17.50	14.29	12.81	11.79	13.5
19 42 54.98	+23 24 14.9	13.53	12.30	12.55	10.51	9.56	8.62	3.4
19 42 58.16	+23 24 27.7	18.55	17.30	17.48	15.24	14.43	13.86	3.1
19 43 25.03	+23 13 47.6	19.26	17.74	18.16	15.34	14.08	13.36	4.4
19 43 44.62	+23 14 44.7	18.55	17.20	17.52	14.75	13.36	12.28	5.0
19 44 05.25	+23 26 47.9	14.05	13.54	11.78	11.77	10.30	9.08	8.7
19 44 23.55	+23 59 46.4	19.17	17.50	18.08	14.76	13.72	13.11	8.3
19 44 29.90	+23 35 31.4	18.10	16.93	16.94	14.76	13.65	12.99	6.0
19 44 33.20	+23 44 30.2	18.82	17.60	17.77	15.63	14.37	13.65	4.3
19 44 42.55	+27 22 48.6	19.39	17.94	18.25	15.74	15.02	14.52	14.9
19 44 45.16	+23 44 39.5	19.33	17.94	18.19	15.75	14.33	13.36	2.5
19 45 04.72	+26 39 50.6	18.48	16.93	17.43	14.50	13.68	13.03	29.4
19 45 13.64	+23 47 09.4	19.18	17.64	17.95	14.76	13.57	12.92	5.5
19 45 13.87	+27 50 45.6	19.24	18.03	18.28	15.34	14.17	13.35	12.5
19 46 07.52	+22 31 12.3	17.54	16.04	14.70	9.22	7.19	5.97	33.2
19 46 09.56	+22 54 23.2	15.20	13.69	14.12	11.50	10.79	10.24	19.2
19 49 07.23	+21 17 42.0	16.77	15.99	15.05	13.58	11.88	10.49	39.2
19 49 28.58	+28 58 09.4	17.13	15.86	16.03	13.78	12.97	12.23	13.6
19 49 48.25	+23 53 31.8	16.03	14.94	14.94	13.03	11.97	11.25	33.9
19 50 01.48	+26 27 38.1	16.36	15.34	15.41	13.13	11.74	10.62	28.2
19 54 44.83	+33 51 53.9	18.69	17.34	17.67	15.27	14.20	13.54	30.2
19 56 12.57	+30 15 28.6	18.35	17.42	17.45	15.22	14.25	13.43	4.7
19 56 55.88	+31 56 37.0	16.39	15.30	14.95	13.04	12.19	11.58	7.5
19 57 12.42	+30 13 16.1	13.02	12.22	12.10	10.30	9.31	8.10	7.9
19 59 34.39	+32 08 48.7	16.03	15.00	15.03	12.81	12.07	11.53	14.2
19 59 35.55	+28 38 30.3	15.81	14.95	14.58	12.48	10.32	8.27	20.1
19 59 47.22	+35 30 52.9	17.05	16.25	16.09	14.80	14.01	13.04	32.9
19 59 56.42	+30 48 23.8	17.48	16.44	15.90	13.69	12.16	10.91	7.0
20 01 12.85	+28 22 11.3	17.72	16.55	16.40	14.27	13.05	12.20	26.5
20 01 53.90	+35 42 22.3	17.85	16.50	16.61	14.33	13.20	12.37	26.5
20 01 54.27	+29 28 48.4	18.81	17.39	17.55	15.11	14.12	13.53	32.3
20 01 59.69	+32 06 35.4	16.13	14.62	15.10	11.61	10.75	10.08	13.1
20 02 03.12	+32 32 45.5	17.41	16.73	16.26	13.67	12.80	11.98	19.1
20 02 33.05	+35 15 38.8	18.50	17.23	17.50	14.96	14.01	13.49	5.7
20 04 23.15	+35 40 07.1	18.10	16.60	16.97	14.32	13.25	12.56	6.5

Table 1. continued.

RA (J2000.0) Dec		r	i	Hα	J	H	K_s	d_4
20 04 47.02	+35 47 09.5	18.85	17.88	17.49	16.04	15.22	14.77	8.7
20 05 00.61	+35 37 52.2	19.34	17.75	18.06	15.67	14.76	14.26	4.9
20 05 14.59	+32 21 25.1	17.24	17.63	14.18	14.96	12.76	10.66	15.3
20 05 21.89	+29 51 56.6	17.41	16.39	16.49	13.76	12.37	11.25	35.9
20 06 51.26	+27 20 37.6	17.98	16.39	16.40	13.47	12.09	11.01	35.4
20 07 07.58	+35 50 06.3	17.95	16.96	16.83	15.14	14.15	13.50	9.1
20 07 14.83	+35 36 01.9	19.24	18.09	18.03	16.46	15.24	14.50	3.9
20 07 26.84	+35 34 36.0	19.39	17.95	17.69	15.99	15.10	14.57	2.9
20 07 28.65	+36 18 29.3	18.20	17.16	16.66	15.06	14.26	13.64	23.6
20 08 11.53	+35 25 00.5	15.58	15.00	14.18	11.31	10.61	9.78	8.8
20 09 11.34	+30 34 11.7	18.39	17.02	17.10	13.86	12.66	11.77	36.7
20 10 22.77	+29 56 21.5	17.95	16.75	16.93	15.50	14.39	13.76	31.3
20 10 24.42	+31 45 16.6	17.82	15.97	16.36	12.87	11.81	10.90	31.0
20 10 57.51	+34 37 32.4	15.68	14.36	14.64	12.08	10.84	9.75	20.1
20 11 26.20	+33 16 06.8	18.93	17.55	17.58	14.34	12.94	11.70	19.1
20 11 52.98	+28 15 17.0	17.39	15.33	15.93	12.30	10.71	9.50	35.6
20 12 31.94	+32 22 14.0	15.27	14.56	14.42	13.13	12.18	10.82	25.8
20 13 07.52	+31 18 51.5	18.36	16.82	16.95	13.96	12.63	11.59	27.1
20 13 58.71	+31 42 10.8	19.31	17.38	17.94	13.66	12.15	10.97	27.8
20 14 28.69	+32 09 09.5	18.06	16.67	16.98	14.24	13.03	12.25	14.9
20 14 42.32	+32 09 03.9	17.39	16.01	16.31	13.38	12.11	11.26	14.4
20 15 50.96	+37 30 04.2	18.07	16.40	15.91	13.08	11.46	9.96	8.6
20 16 03.23	+37 14 50.6	19.01	17.76	17.42	15.45	14.11	13.10	7.9
20 16 22.09	+38 10 14.2	17.40	16.31	16.06	14.84	13.91	13.35	13.8
20 16 23.18	+37 37 04.6	19.34	17.33	17.81	14.06	12.66	11.48	9.9
20 16 48.91	+29 30 58.2	18.80	16.86	17.25	13.86	12.53	11.60	68.3
20 17 04.88	+40 48 34.2	18.36	16.95	17.35	14.85	13.78	13.20	6.6
20 17 08.12	+41 07 27.0	14.29	12.74	13.04	10.15	9.27	8.65	18.1
20 17 13.88	+42 10 44.2	16.76	15.38	15.67	13.06	11.81	10.95	31.7
20 17 15.03	+31 01 01.3	16.00	15.13	15.08	13.54	12.58	12.06	9.8
20 17 45.30	+41 50 33.2	18.12	16.82	16.81	14.72	13.28	12.30	24.1
20 17 51.21	+31 00 52.0	18.52	17.43	16.68	14.67	13.03	11.75	13.8
20 18 35.83	+40 55 08.0	17.24	16.22	15.61	14.75	13.81	12.88	3.7
20 18 43.67	+40 47 27.8	16.97	15.81	15.29	13.94	13.10	12.49	6.3
20 18 49.29	+39 35 32.0	17.04	16.00	15.55	13.59	12.64	11.88	12.4
20 18 59.19	+39 24 42.3	17.58	16.48	16.25	14.76	13.68	13.02	6.8
20 19 09.01	+33 32 40.1	16.34	15.38	15.40	13.70	12.83	12.22	45.7
20 19 11.27	+36 03 59.3	18.27	16.61	17.16	13.16	11.28	9.71	42.6
20 19 18.94	+38 14 48.5	18.61	17.68	16.64	16.04	14.87	14.19	12.6
20 19 33.95	+36 41 10.6	17.97	16.97	16.81	15.10	14.08	13.22	26.7
20 19 35.95	+39 24 43.5	19.35	17.73	17.98	15.43	14.40	13.78	5.6
20 19 45.44	+39 44 00.9	16.36	15.17	14.45	12.98	11.83	10.97	14.6
20 19 52.07	+32 41 32.3	18.29	16.86	17.15	14.18	13.04	12.25	63.6
20 20 07.87	+40 05 08.3	17.96	16.85	16.48	14.85	14.11	13.55	9.2
20 20 24.83	+38 43 17.5	19.18	17.77	18.07	15.17	14.05	13.44	17.1
20 20 58.52	+38 09 49.8	16.20	14.67	14.60	11.88	10.38	8.87	14.2
20 21 12.98	+41 01 13.1	18.03	16.57	16.83	14.24	13.33	12.84	14.7
20 22 10.20	+33 50 34.6	14.38	12.90	13.34	10.58	9.84	9.28	44.6
20 22 34.45	+40 55 46.4	18.73	17.12	17.36	14.87	14.15	13.63	15.0
20 23 41.92	+43 25 38.5	18.38	17.12	17.14	14.64	13.40	12.65	33.3
20 23 45.75	+39 04 40.2	19.25	17.58	17.95	15.32	14.44	13.87	6.9
20 24 07.29	+42 35 52.1	16.98	15.58	15.56	13.16	12.04	11.33	11.2
20 24 11.20	+42 17 09.1	16.33	15.49	15.11	13.61	12.64	11.97	6.8
20 24 21.82	+42 25 54.3	17.43	16.28	16.09	13.59	12.23	11.25	6.5
20 24 27.02	+38 55 39.0	18.11	17.15	16.29	13.40	11.89	10.78	7.0
20 24 27.13	+38 30 54.9	17.87	16.74	16.59	14.85	13.90	13.29	3.2
20 24 29.12	+39 02 27.1	15.07	14.17	14.01	12.42	11.42	10.66	3.2
20 24 31.08	+42 13 07.6	17.75	16.60	16.47	14.85	13.81	13.10	6.4
20 24 39.32	+39 56 55.2	19.03	17.76	17.32	15.42	14.41	13.55	33.3
20 24 39.59	+42 21 09.0	15.90	14.77	14.73	12.65	11.54	10.75	5.5
20 24 55.53	+42 45 04.0	18.90	16.99	17.38	14.43	13.55	12.88	17.9

Table 1. continued.

RA (J2000.0)	Dec	r	i	Hα	J	H	K_s	d_4
20 25 30.03	+34 45 17.5	18.37	17.04	16.88	14.94	13.60	12.70	49.0
20 25 49.86	+41 23 08.1	18.89	18.06	16.99	15.42	13.85	12.30	17.9
20 27 07.14	+39 32 48.6	16.67	15.45	15.43	12.69	11.53	10.76	17.6
20 27 09.33	+39 14 21.5	17.76	16.45	16.54	13.93	12.76	12.04	13.2
20 27 42.17	+40 30 11.1	18.21	16.86	17.09	14.05	12.94	12.26	17.9
20 27 57.89	+39 23 32.5	16.33	15.20	15.29	12.77	11.48	10.42	12.7
20 28 31.45	+39 53 20.1	14.74	13.82	13.45	11.49	10.43	9.56	18.3
20 28 34.25	+35 54 17.4	15.89	14.42	13.81	11.50	10.08	8.29	45.6
20 28 44.46	+40 11 36.7	16.83	15.57	15.27	13.68	12.69	12.12	7.0
20 28 47.71	+40 33 49.3	16.88	15.56	15.74	13.00	11.71	10.74	14.5
20 28 50.31	+40 35 49.8	17.84	16.25	16.70	13.66	12.09	10.91	14.9
20 29 16.22	+40 11 06.2	17.22	15.91	15.94	13.96	12.99	12.42	6.9
20 29 32.28	+40 13 07.5	15.68	14.80	14.76	13.16	12.31	11.85	8.7
20 29 47.93	+35 59 26.5	14.75	13.74	12.98	10.96	9.44	8.14	48.1
20 30 18.58	+38 57 13.5	17.18	16.12	16.04	14.16	13.17	12.56	29.1
20 30 33.99	+40 43 25.6	18.67	17.00	17.37	13.98	12.60	11.67	23.1
20 31 11.04	+40 20 46.5	16.64	15.45	15.24	13.24	12.04	11.21	13.7
20 31 13.75	+41 15 17.5	19.34	17.67	18.04	14.56	13.36	12.66	30.8
20 33 00.81	+40 18 00.3	17.44	16.27	16.00	14.21	13.17	12.62	22.8
20 33 01.84	+39 03 42.7	16.73	15.31	15.33	12.78	11.54	10.53	42.6
20 33 53.45	+40 54 48.9	18.77	16.92	17.33	13.04	11.70	10.86	18.4
20 34 13.39	+41 01 57.9	19.00	17.75	16.54	13.23	11.29	9.86	20.5
20 35 06.32	+47 03 22.8	16.44	15.23	15.48	12.73	11.38	10.15	32.1
20 35 26.03	+46 49 56.1	18.54	17.17	17.53	14.72	13.66	12.95	31.5
20 41 14.48	+46 01 55.9	18.93	17.98	17.32	15.74	14.91	14.28	18.0
20 41 21.02	+41 17 21.3	19.07	17.53	17.49	15.55	13.87	12.74	34.7
20 41 22.99	+45 55 41.6	18.84	17.72	17.91	15.71	14.87	14.33	14.4
20 41 34.22	+39 32 39.0	15.16	14.11	13.39	12.12	10.99	10.20	15.6
20 41 40.07	+41 12 27.9	17.35	15.74	15.99	12.82	11.43	10.46	32.7
20 45 02.36	+43 05 20.6	15.29	14.13	14.08	12.51	11.35	10.57	28.6
20 45 16.51	+41 35 26.8	17.25	15.78	15.99	13.18	12.03	11.34	24.1
20 45 29.31	+41 06 22.3	16.61	15.47	15.59	13.38	12.05	11.08	19.8
20 46 26.87	+46 18 17.8	18.83	17.71	17.58	15.99	14.92	14.26	8.1
20 46 32.98	+46 40 56.9	17.72	16.48	16.61	14.10	13.26	12.60	16.7
20 46 45.49	+41 06 59.6	18.54	17.46	17.14	15.61	14.22	13.03	21.8
20 47 04.82	+43 49 11.4	18.76	17.53	16.71	15.34	14.34	13.76	1.6
20 47 13.69	+46 35 17.5	14.46	12.85	13.13	10.05	8.93	7.48	14.6
20 47 14.21	+47 14 16.6	17.99	17.08	16.52	15.14	14.29	13.66	16.8
20 47 25.22	+43 48 32.2	17.82	16.57	16.10	13.35	12.21	11.35	3.4
20 47 33.97	+41 31 36.7	18.19	16.88	16.38	14.92	14.09	13.58	27.4
20 48 19.32	+47 20 47.3	16.67	15.87	15.82	14.29	13.48	12.95	14.7
20 48 57.79	+43 49 55.1	18.33	16.84	17.27	13.60	12.26	11.40	18.7
20 49 07.37	+45 55 18.0	16.46	15.49	15.07	13.72	12.93	12.53	15.3
20 49 56.23	+46 50 37.8	16.50	15.46	15.38	13.51	12.59	12.04	9.5
20 50 18.22	+46 53 56.4	19.02	17.50	17.65	15.29	13.96	12.88	6.3
20 50 19.55	+45 47 37.0	18.72	17.20	17.67	15.78	14.67	13.77	17.9
20 50 20.65	+45 47 21.5	17.09	15.94	16.01	13.81	12.80	12.22	18.1
20 50 22.42	+44 19 17.6	18.94	16.97	16.79	13.91	12.73	12.09	14.5
20 50 40.29	+44 30 49.1	14.96	13.83	13.78	11.52	10.42	9.55	11.7
20 50 44.99	+47 12 44.7	18.61	17.55	17.48	15.40	14.26	13.58	6.4
20 50 50.39	+44 50 11.7	14.80	13.44	13.69	15.41	13.10	11.10	17.4
20 50 53.17	+44 50 36.4	18.66	16.78	17.09	14.02	12.89	12.28	17.6
20 51 02.14	+47 12 37.4	18.44	16.62	17.21	13.80	12.36	11.46	6.7
20 51 20.99	+44 26 19.6	15.25	14.10	14.09	11.88	10.96	10.30	7.3
20 51 32.79	+44 23 48.0	16.65	15.43	15.31	13.34	12.27	11.63	7.7
20 52 00.99	+44 28 41.4	16.94	15.60	15.60	13.55	12.49	11.90	7.9
20 52 40.84	+49 58 04.1	18.48	17.00	17.45	14.18	13.34	12.68	39.9
20 52 56.75	+39 08 30.2	18.12	16.59	17.01	14.71	13.82	13.31	57.0
20 53 15.64	+43 44 22.8	17.00	15.93	15.30	14.07	13.21	12.54	29.4
20 53 56.92	+44 51 31.9	18.28	16.56	16.96	13.90	12.80	12.20	12.3
20 54 07.40	+41 34 58.0	15.12	13.77	13.77	14.62	12.82	11.28	40.6

Table 1. continued.

RA (J2000.0)	Dec	r	i	Hα	J	H	K_s	d_4
20 54 33.18	+48 46 30.8	16.47	15.34	15.39	13.39	12.68	12.10	36.8
20 54 38.00	+49 13 30.9	19.39	17.86	18.07	15.49	14.21	13.13	29.2
20 54 46.91	+44 48 19.9	17.02	15.63	15.88	12.88	11.52	10.31	7.1
20 54 54.34	+44 43 43.0	17.79	16.21	16.04	14.04	13.18	12.74	6.0
20 54 58.07	+47 45 51.7	14.69	13.76	13.66	12.28	11.54	10.77	20.2
20 55 03.02	+44 10 52.1	16.41	14.95	15.15	12.43	11.11	10.25	26.3
20 55 03.99	+44 44 26.6	17.80	16.39	16.35	14.31	13.31	12.59	6.5
20 56 47.90	+46 24 34.5	17.33	15.77	16.15	13.14	12.19	11.59	13.1
20 57 20.26	+42 23 19.4	17.12	15.54	15.91	12.90	11.82	11.24	51.2
20 57 30.09	+49 32 58.0	16.21	14.87	15.16	13.15	12.46	11.84	18.6
20 57 36.62	+52 21 17.1	15.78	14.58	14.37	12.45	11.44	10.76	24.4
20 57 37.30	+44 06 44.0	17.94	16.49	16.40	13.85	12.91	12.16	16.3
20 57 40.95	+46 59 45.1	15.79	14.43	14.62	12.26	11.57	10.99	21.9
20 57 59.87	+43 53 26.1	14.68	13.75	13.54	11.85	10.87	10.25	7.7
20 58 01.38	+43 45 20.2	16.52	15.26	15.23	13.11	11.87	11.05	9.5
20 58 02.67	+46 35 02.6	19.05	17.73	17.80	15.62	14.34	13.20	14.2
20 58 12.19	+46 21 49.0	18.31	16.73	17.21	14.24	13.33	12.72	7.6
20 58 21.54	+43 53 44.9	16.69	15.23	15.35	12.80	11.49	10.71	7.3
20 58 27.02	+43 53 20.1	17.42	16.14	16.04	14.02	12.92	12.25	7.8
20 58 42.07	+46 24 59.8	16.42	15.13	15.17	13.04	12.32	11.74	10.4
20 59 06.70	+44 18 23.9	17.20	16.17	16.15	14.22	13.29	12.75	21.8
21 00 19.06	+52 27 28.3	14.61	13.60	13.55	11.69	10.63	9.81	5.8
21 00 21.42	+52 27 09.6	14.06	12.88	12.84	11.15	10.22	9.40	5.6
21 01 10.58	+52 15 12.9	17.07	15.54	15.49	13.06	12.04	11.29	11.2
21 03 32.56	+47 48 39.4	16.81	15.66	15.39	13.62	12.59	11.81	20.5
21 03 50.13	+50 10 23.7	18.80	16.67	17.45	13.85	12.80	12.23	6.5
21 03 58.92	+50 14 51.4	15.85	14.39	14.80	12.24	11.06	10.35	4.0
21 04 04.87	+53 51 24.4	18.21	16.63	15.81	13.43	12.40	11.61	54.6
21 04 06.83	+50 13 18.0	16.33	15.12	15.16	12.71	11.78	11.10	3.9
21 04 27.91	+52 22 03.3	16.88	15.37	15.65	12.16	11.10	10.42	33.6
21 04 28.81	+50 18 24.6	19.01	16.75	17.35	13.98	12.96	12.42	4.8
21 04 54.56	+50 17 51.9	16.48	15.24	14.89	13.29	12.07	11.14	7.1
21 05 28.26	+51 36 00.8	18.09	16.07	16.66	12.91	11.84	11.06	38.0
21 06 12.87	+51 21 41.3	18.83	17.00	17.38	14.52	13.20	12.39	35.3
21 06 13.61	+50 23 22.8	17.60	16.34	16.42	14.24	13.37	12.80	18.4
21 07 10.22	+48 57 29.3	15.06	13.60	14.01	11.35	10.55	9.97	16.5
21 10 28.25	+44 58 41.8	16.70	15.76	15.22	14.02	13.10	12.60	34.2
21 10 53.52	+51 13 44.0	17.06	15.62	15.99	13.35	12.63	12.05	37.1
21 11 25.36	+46 57 53.1	16.45	15.34	15.33	13.51	12.46	11.76	17.0
21 13 17.53	+51 14 30.2	17.39	15.89	16.02	13.34	12.10	11.29	29.9
21 13 18.30	+46 20 17.9	19.33	17.98	18.33	15.04	13.91	13.24	25.1
21 15 58.05	+47 57 46.5	18.32	16.77	17.18	14.48	13.25	12.20	27.3
21 16 22.51	+51 34 41.8	19.48	17.55	18.16	15.25	14.30	13.79	14.6
21 16 41.03	+51 30 05.4	18.88	17.45	17.72	15.35	14.29	13.58	14.2
21 16 45.67	+47 15 36.5	17.33	16.17	15.82	14.58	13.66	13.12	25.2
21 18 18.24	+42 53 52.3	17.62	16.15	16.13	13.58	12.62	11.98	24.4
21 19 34.02	+46 47 45.5	16.54	15.39	15.38	13.12	12.19	11.69	1.7
21 19 36.96	+46 49 09.0	16.79	15.28	15.52	12.09	10.88	10.04	1.4
21 19 38.96	+46 49 13.6	18.84	17.63	17.15	15.06	13.56	12.29	1.5
21 19 47.43	+53 22 25.1	16.13	14.64	14.94	12.08	11.16	10.56	29.4
21 19 56.24	+51 47 04.2	18.97	17.51	16.92	15.20	14.03	13.01	5.0
21 20 25.15	+51 46 30.7	18.30	16.80	17.11	14.69	13.78	13.30	5.1
21 20 36.52	+51 51 26.0	18.55	17.39	17.40	14.87	13.53	12.51	1.3
21 20 48.00	+53 40 51.3	17.03	15.39	15.84	12.72	11.85	11.24	30.8
21 21 24.55	+52 49 55.1	17.68	16.19	16.59	13.99	13.23	12.71	29.2
21 21 45.31	+46 54 57.9	17.45	15.94	16.24	13.79	12.69	12.07	5.0
21 21 54.68	+46 38 56.7	16.89	15.68	15.76	14.28	13.18	12.40	15.1
21 21 59.94	+49 26 24.2	18.17	16.05	16.72	13.58	12.78	12.29	16.6
21 22 00.51	+46 54 32.7	15.69	14.25	14.54	11.21	9.79	8.59	4.6
21 22 09.02	+49 26 24.6	16.09	14.79	15.12	12.25	10.27	8.71	16.6
21 22 14.73	+49 05 38.8	19.07	17.43	17.51	14.01	12.89	12.25	19.4

Table 1. continued.

RA (J2000.0)	Dec	r	i	Hα	J	H	K_s	d_4
21 22 18.11	+46 57 11.2	18.20	16.17	16.23	13.55	12.76	12.32	5.9
21 23 50.19	+50 08 18.2	19.07	17.45	17.62	14.38	12.83	11.73	28.4
21 26 20.32	+55 25 51.8	16.80	15.89	15.81	13.74	12.47	11.36	11.9
21 29 55.57	+55 39 04.1	17.81	16.52	16.15	14.19	12.74	11.38	26.7
21 31 05.96	+51 25 31.8	18.07	16.33	16.86	13.83	12.88	12.21	34.9
21 31 08.81	+51 59 45.3	19.05	17.32	17.79	14.60	13.29	12.34	41.5
21 31 25.07	+49 18 35.5	18.04	17.50	16.36	14.85	13.71	12.88	34.7
21 31 29.48	+48 09 54.7	15.97	14.77	14.96	13.28	12.37	11.82	24.0
21 33 17.78	+57 48 13.5	14.63	13.96	13.68	12.25	10.96	9.83	12.7
21 34 31.56	+54 16 11.8	15.41	13.94	14.31	11.97	11.21	10.63	23.3
21 34 51.70	+57 51 40.5	18.49	16.77	17.22	14.33	13.25	12.65	9.4
21 34 53.08	+57 51 25.1	18.73	17.20	17.38	14.71	13.48	12.68	9.5
21 35 16.89	+57 32 42.3	17.93	16.50	16.16	14.44	13.56	13.07	7.4
21 38 06.68	+55 20 46.4	16.16	14.78	15.16	12.73	11.99	11.46	20.0
21 38 10.00	+57 23 52.8	18.99	17.06	17.50	14.87	14.09	13.70	10.1
21 38 12.64	+57 20 33.7	17.73	16.37	16.02	14.53	13.64	13.17	10.0
21 39 29.40	+57 06 30.7	18.13	16.54	16.96	14.50	13.72	13.33	13.6
21 39 51.88	+57 26 58.3	19.36	17.23	17.90	14.93	14.16	13.56	1.6
21 39 52.16	+58 14 12.9	17.12	15.91	15.79	13.90	12.86	12.29	4.7
21 39 52.23	+52 25 15.2	19.04	17.93	18.08	15.60	14.60	13.85	44.5
21 39 54.07	+57 29 33.5	17.76	16.36	16.65	14.72	13.87	13.28	2.1
21 39 58.44	+58 12 14.8	17.37	15.70	16.12	13.42	12.35	11.76	4.3
21 40 11.35	+57 39 51.8	17.65	16.15	16.61	14.31	13.44	12.97	7.1
21 40 21.30	+57 26 57.9	16.95	15.92	15.93	14.50	13.40	12.62	3.6
21 40 36.90	+58 14 37.9	14.85	13.77	13.87	11.90	10.89	10.23	3.7
21 40 42.81	+58 19 37.4	19.00	17.08	17.25	13.94	12.54	11.64	6.7
21 40 55.93	+57 17 59.2	17.78	16.16	16.06	13.81	12.83	12.24	7.3
21 41 15.97	+58 08 26.5	18.20	16.71	16.72	14.47	13.30	12.53	8.4
21 41 39.49	+50 17 49.8	17.84	16.93	16.76	15.41	14.72	14.33	29.8
21 42 02.30	+54 43 31.9	19.36	17.86	18.04	15.29	13.97	13.06	20.7
21 42 17.63	+56 55 50.2	16.69	15.32	15.64	12.43	11.53	11.02	8.6
21 43 06.36	+51 06 10.6	18.12	17.63	17.29	15.07	14.15	13.54	28.0
21 44 18.19	+47 23 44.2	16.27	15.32	15.36	13.19	12.13	11.54	47.6
21 44 33.16	+57 37 32.7	17.98	16.54	16.94	14.34	13.44	12.86	14.3
21 44 41.34	+57 46 11.9	17.19	16.00	16.23	14.17	13.09	12.39	16.3
21 44 43.70	+57 14 19.8	18.14	17.33	17.13	16.35	15.05	13.80	12.6
21 45 47.74	+56 48 45.8	19.06	16.88	17.54	14.33	13.40	12.82	10.3
21 46 00.27	+57 23 09.6	17.15	15.72	16.06	12.65	11.46	10.63	10.9
21 46 25.99	+57 28 28.9	18.04	16.96	15.68	14.07	13.06	12.30	12.0
21 46 40.27	+47 13 27.6	17.25	15.84	16.07	13.37	12.25	11.50	50.2
21 48 11.78	+57 59 41.6	16.71	15.43	15.50	12.92	11.66	10.84	15.2
21 49 33.64	+57 45 02.2	16.70	15.35	15.66	13.14	12.43	11.86	17.4
21 53 31.40	+56 29 27.0	18.79	18.13	16.47	14.94	13.30	12.06	19.0
21 53 45.14	+59 43 42.0	18.25	16.84	17.12	14.82	13.91	13.35	13.9
21 54 47.24	+53 13 47.0	18.32	17.27	16.78	15.43	14.16	13.10	31.5
21 56 28.47	+57 14 45.5	15.14	14.38	13.48	12.97	11.83	10.31	24.5
21 58 12.70	+52 26 21.6	19.12	17.86	17.92	15.88	15.02	14.37	15.8
21 58 18.39	+55 26 31.9	19.31	18.08	17.87	15.71	14.42	13.64	10.6
21 58 20.72	+55 26 32.6	19.29	17.97	18.05	15.32	13.99	13.00	10.4
21 58 58.32	+52 46 03.0	19.17	18.37	17.68	16.47	15.43	14.63	13.4
21 59 36.96	+55 24 33.4	17.96	16.59	16.93	14.37	13.62	13.19	12.3
22 01 08.17	+55 54 41.4	16.14	15.36	14.99	13.03	11.62	10.43	11.0
22 02 10.21	+58 45 44.6	17.31	15.93	16.29	13.96	13.22	12.57	24.4
22 03 13.49	+59 39 57.2	17.62	16.20	16.43	13.85	12.88	12.29	7.5
22 03 30.08	+58 28 04.2	14.90	13.92	13.91	12.07	11.16	10.64	21.8
22 05 13.54	+57 25 53.5	19.10	18.04	17.56	15.12	14.09	13.55	22.4
22 06 09.07	+60 42 41.4	16.28	15.03	15.14	13.05	11.62	10.39	20.8
22 06 48.59	+54 11 47.5	18.67	17.42	17.22	16.48	15.44	14.46	20.3
22 07 15.51	+55 12 39.2	19.31	17.77	18.13	16.53	15.35	14.44	19.2
22 08 02.26	+60 59 05.6	17.92	16.50	16.51	15.13	14.16	13.55	7.5
22 09 43.15	+58 56 22.7	17.98	16.60	16.95	13.81	12.64	11.84	14.2

Table 1. continued.

RA (J2000.0)	Dec	r	i	Hα	J	H	K_s	d_4
22 11 00.10	+60 56 33.5	17.69	16.48	16.26	14.19	13.13	12.46	16.3
22 11 46.04	+60 42 03.6	17.25	16.22	16.07	14.32	13.42	12.81	9.3
22 11 54.94	+58 57 22.1	18.84	16.97	17.68	13.95	12.57	11.53	10.3
22 12 13.10	+58 52 02.8	17.34	16.30	15.65	13.41	11.96	10.83	10.4
22 12 32.53	+60 42 50.3	17.43	16.37	16.41	13.84	12.86	12.30	8.7
22 13 11.17	+54 25 31.4	17.80	17.64	15.89	16.59	15.14	14.19	26.6
22 13 16.57	+56 12 13.5	17.71	16.53	16.66	13.80	12.88	12.25	16.4
22 13 20.22	+60 29 29.2	18.04	16.74	17.03	14.69	13.49	12.84	8.3
22 13 34.04	+60 35 58.7	18.79	17.35	17.50	14.69	13.64	13.04	6.2
22 13 49.64	+55 54 07.3	19.08	18.34	17.57	15.97	15.02	14.32	15.0
22 13 51.53	+60 44 24.8	18.43	17.02	16.84	13.96	12.68	11.99	7.9
22 13 59.71	+60 35 06.2	16.40	15.30	15.45	12.98	11.94	11.35	6.0
22 14 11.56	+61 26 06.4	17.56	16.41	16.43	14.42	13.04	12.12	3.0
22 14 19.27	+60 38 06.7	19.32	18.04	17.96	15.62	14.33	13.27	5.9
22 14 28.89	+61 25 24.0	17.68	16.26	16.63	13.80	12.54	11.70	1.6
22 14 39.83	+61 25 58.8	17.69	16.20	16.57	13.65	12.50	11.81	1.2
22 14 40.31	+61 26 13.8	15.33	14.14	14.22	11.91	10.66	9.77	1.3
22 14 42.24	+60 44 02.5	19.43	17.57	17.79	15.23	14.31	13.84	7.3
22 15 08.95	+61 02 41.1	17.02	15.85	15.84	14.01	12.82	12.13	7.0
22 15 11.99	+57 52 51.4	17.83	17.08	16.14	14.98	13.47	11.97	14.3
22 15 18.87	+58 23 12.6	19.00	17.64	17.30	14.86	13.22	11.62	16.5
22 15 37.63	+61 06 55.1	16.81	15.61	15.66	13.48	12.50	11.89	4.3
22 16 02.80	+56 14 27.3	17.42	16.56	15.79	14.45	13.36	12.70	11.1
22 16 21.24	+60 06 30.4	18.58	17.47	17.59	15.14	13.94	12.78	28.5
22 16 39.34	+60 47 57.4	18.10	16.61	17.06	13.51	12.33	11.51	5.5
22 16 44.69	+60 48 42.1	18.81	17.39	16.98	14.85	13.77	13.15	5.5
22 16 55.98	+60 53 43.7	17.93	16.40	16.33	13.57	12.19	11.27	7.3
22 17 34.33	+61 14 08.8	19.43	17.92	17.61	15.28	14.06	13.39	11.2
22 17 40.25	+61 47 02.5	17.73	16.30	16.15	12.83	11.50	10.52	11.5
22 17 55.42	+61 02 05.9	18.67	17.01	17.36	14.69	13.70	13.13	12.2
22 18 08.49	+56 05 53.3	13.73	13.02	12.54	11.38	10.18	9.03	8.1
22 18 18.15	+56 06 09.7	17.78	16.64	16.72	14.56	13.52	12.80	7.2
22 18 25.73	+61 37 26.5	18.46	16.67	17.21	14.46	13.60	13.16	5.2
22 19 03.17	+61 37 56.4	15.70	14.65	14.69	12.98	11.79	11.11	4.0
22 19 11.20	+60 58 01.6	18.86	17.20	17.42	13.78	11.74	10.20	12.5
22 19 11.45	+56 02 53.3	19.11	18.03	17.85	15.83	14.92	14.26	9.0
22 19 14.69	+61 38 47.5	18.34	16.99	17.14	14.60	13.87	13.34	4.8
22 20 53.13	+58 48 43.9	15.46	14.10	14.30	11.29	9.84	8.63	19.1
22 25 48.46	+61 23 54.5	19.20	17.65	17.77	14.77	13.80	13.14	24.5
22 27 00.27	+56 17 32.5	16.51	15.64	15.12	13.78	12.86	12.11	23.6
22 28 00.09	+63 09 08.9	16.96	15.64	15.96	13.50	12.51	11.86	17.0
22 31 50.40	+59 12 46.0	16.09	14.80	15.01	12.77	11.54	10.85	19.8
22 31 51.98	+63 10 46.9	19.09	17.14	17.42	14.62	13.68	13.17	27.8
22 36 45.28	+61 52 52.2	19.50	17.64	17.72	14.70	13.49	12.80	21.7
22 37 03.73	+58 58 49.4	16.20	14.55	15.12	12.57	11.79	11.40	18.3
22 37 28.63	+58 37 53.1	18.53	16.17	16.76	13.33	12.43	11.88	19.6
22 38 19.84	+62 12 12.1	16.71	15.68	15.44	13.83	12.55	11.50	19.8
22 38 53.88	+61 56 28.9	16.72	15.48	15.60	13.52	12.43	11.69	22.6
22 40 55.96	+61 31 09.3	19.43	17.86	17.49	15.31	14.34	13.66	31.4
22 42 14.74	+59 49 52.6	17.91	16.82	16.98	14.94	14.15	13.73	29.4
22 44 13.21	+61 00 45.1	18.32	16.95	17.11	14.37	13.25	12.45	19.3
22 45 08.11	+59 11 23.0	18.30	16.66	17.17	13.98	12.44	11.11	26.8
22 45 18.08	+61 30 49.9	17.37	16.19	15.67	14.32	13.36	12.74	21.5
22 46 38.35	+61 08 09.0	17.03	15.79	15.46	13.83	12.84	12.28	10.5
22 47 14.25	+59 21 49.1	17.22	15.69	15.78	12.40	10.78	9.53	15.8
22 47 22.39	+58 01 21.5	14.00	12.95	12.85	10.80	9.76	8.85	8.3
22 49 06.90	+62 07 34.8	16.89	15.54	15.82	13.06	11.96	11.22	14.3
22 49 08.54	+61 24 06.8	19.40	18.07	17.88	15.53	14.48	13.83	15.7
22 52 50.89	+62 36 17.3	18.45	17.17	17.22	14.92	13.70	12.97	5.8
22 53 26.79	+62 35 31.7	18.43	16.58	17.07	13.85	12.75	12.14	3.1
22 53 31.30	+62 37 11.4	18.31	16.68	16.73	14.01	12.84	12.11	2.5

Table 1. continued.

RA (J2000.0)	Dec	r	i	Hα	J	H	K_s	d_4
22 53 50.55	+61 32 46.4	17.93	16.48	16.82	14.23	13.15	12.43	22.8
22 53 51.96	+62 34 35.7	18.42	16.78	16.57	14.24	13.09	12.38	3.0
22 53 52.02	+62 38 09.0	16.67	15.42	15.62	13.36	12.15	11.37	1.5
22 53 52.17	+62 37 46.3	18.39	16.81	17.02	14.02	12.91	12.20	1.4
22 54 07.57	+62 38 51.5	18.48	16.72	17.06	13.55	12.17	11.25	2.1
22 54 09.88	+62 57 42.9	18.56	17.35	17.47	14.35	13.27	12.58	12.2
22 54 37.74	+62 29 30.8	18.37	16.78	16.85	14.08	12.96	12.37	7.3
22 54 52.08	+61 59 03.0	18.94	17.12	17.50	14.09	12.75	11.98	23.7
22 55 09.51	+62 41 23.2	17.87	16.38	16.07	13.87	12.70	11.97	3.0
22 55 21.80	+62 37 53.5	15.96	14.81	14.71	12.69	11.38	10.44	2.5
22 55 22.50	+62 28 25.2	17.59	16.33	16.43	14.19	13.07	12.33	7.9
22 55 26.19	+62 39 34.0	19.31	17.26	17.75	14.57	13.66	13.06	2.6
22 55 36.82	+62 11 15.8	18.08	16.67	16.84	14.66	13.31	12.32	17.6
22 55 37.20	+63 00 04.9	18.95	17.34	17.33	14.46	13.17	12.24	6.7
22 55 38.17	+62 36 06.3	19.13	17.45	17.80	15.05	13.76	12.85	2.2
22 55 39.41	+62 37 39.0	19.06	16.93	17.33	14.08	12.97	12.29	1.9
22 55 52.04	+62 36 52.1	18.52	17.25	16.99	15.08	13.97	13.33	1.9
22 55 53.65	+58 14 31.3	18.44	17.28	16.32	14.98	13.90	13.33	20.3
22 55 58.51	+58 40 57.9	17.66	15.73	16.37	13.09	12.37	11.93	12.2
22 55 59.58	+62 37 57.5	17.95	16.83	16.44	14.82	13.95	13.34	2.3
22 56 02.82	+62 45 13.8	16.85	15.57	15.37	13.34	12.28	11.63	2.0
22 56 13.18	+62 35 33.1	15.24	14.04	14.19	11.80	10.78	10.12	3.4
22 56 17.55	+58 44 21.5	17.54	16.38	16.20	13.93	12.58	11.63	12.6
22 56 23.13	+62 43 54.2	18.76	17.00	17.38	14.45	13.32	12.68	2.0
22 56 26.03	+62 39 00.9	17.57	16.11	16.39	13.61	12.39	11.73	2.6
22 56 28.04	+63 08 34.1	19.24	17.89	17.87	15.61	14.51	13.68	10.2
22 56 30.87	+62 42 15.7	19.10	16.69	17.26	13.48	12.50	11.92	2.0
22 56 30.91	+58 24 47.4	18.26	16.60	17.03	13.57	11.95	10.66	14.1
22 57 12.85	+59 46 48.2	18.05	16.75	16.98	14.51	13.37	12.70	11.1
22 57 25.85	+62 56 29.0	19.34	17.80	17.76	14.53	13.54	13.01	11.6
22 59 06.10	+62 46 30.0	17.55	16.41	15.83	14.32	13.21	12.56	10.6
23 00 34.78	+62 34 36.3	18.56	17.01	17.13	14.86	13.37	12.47	13.4
23 01 37.10	+61 26 13.3	18.06	16.58	16.82	13.50	12.01	10.99	6.9
23 01 51.49	+61 40 54.2	18.11	16.54	16.99	14.62	13.76	13.26	12.9
23 03 14.95	+63 12 51.8	18.63	17.52	17.27	16.02	14.46	13.24	9.7
23 03 27.99	+62 31 06.8	17.09	15.43	15.90	12.52	11.15	10.29	19.1
23 03 42.17	+61 18 50.4	17.55	15.66	15.52	13.04	11.81	11.12	16.6
23 03 46.02	+61 48 46.2	14.61	13.50	13.54	11.36	10.18	9.33	4.6
23 04 03.38	+61 51 37.5	16.35	15.18	15.13	13.01	11.79	10.97	6.3
23 04 12.45	+59 39 54.0	17.92	16.55	16.90	14.54	13.40	12.79	17.5
23 04 13.56	+59 57 27.0	18.47	17.29	17.34	15.26	14.20	13.57	16.2
23 04 39.95	+62 26 19.8	18.42	16.77	17.27	14.33	13.02	12.22	16.4
23 06 02.00	+60 12 38.7	19.27	18.31	17.81	16.23	15.41	14.73	6.8
23 06 38.25	+62 32 04.1	16.35	14.89	15.24	12.25	10.93	9.99	14.5
23 07 56.11	+62 24 14.4	19.41	17.20	17.65	14.26	13.41	12.90	12.0
23 08 18.22	+58 34 14.9	19.43	18.35	18.51	16.44	15.58	15.13	11.7
23 08 45.42	+62 27 12.5	19.05	17.09	17.43	14.34	13.30	12.68	9.8
23 08 47.33	+58 25 07.5	18.25	17.14	17.23	15.00	13.97	13.22	13.6
23 10 47.31	+62 36 28.7	18.62	16.76	17.02	14.05	12.88	12.23	17.4
23 11 42.83	+66 00 11.3	17.84	15.99	16.64	13.66	12.81	12.28	48.5
23 11 59.45	+59 53 26.5	19.10	18.01	17.96	15.95	14.71	13.90	11.4
23 12 01.75	+63 41 05.7	18.50	16.88	17.37	13.91	12.12	10.79	38.5
23 12 03.04	+60 18 38.6	17.68	16.13	16.44	13.06	11.39	10.15	14.4
23 12 04.71	+62 46 00.3	15.23	14.01	14.18	11.92	11.20	10.65	24.9
23 12 23.26	+61 43 18.4	18.08	16.33	16.67	13.98	13.05	12.53	9.5
23 13 07.09	+59 02 47.9	14.49	13.66	13.62	11.79	10.54	9.39	19.4
23 13 19.53	+59 50 16.2	18.55	17.34	17.59	15.05	14.11	13.31	7.7
23 15 26.39	+64 22 25.2	18.48	17.15	17.32	14.61	13.59	12.83	32.1
23 15 56.90	+61 45 16.9	17.75	16.74	16.22	14.82	13.56	12.63	17.2
23 16 10.45	+62 13 03.4	19.38	17.68	17.65	15.35	14.58	13.93	6.7
23 16 40.86	+62 20 57.1	16.78	15.68	15.82	14.15	12.86	11.89	5.8

Table 1. continued.

RA (J2000.0)	Dec	r	i	Hα	J	H	K_s	d_4
23 17 35.92	+63 45 06.4	16.08	14.62	14.30	12.20	10.72	9.39	17.3
23 18 26.54	+59 53 46.6	19.18	18.10	18.11	16.10	14.92	14.15	19.4
23 18 36.35	+64 04 06.5	17.68	16.43	16.46	13.92	12.65	11.57	18.0
23 20 05.35	+62 18 41.7	17.59	16.22	16.32	13.91	12.81	12.19	20.8
23 22 27.11	+59 03 11.3	19.17	18.05	18.20	16.19	15.33	14.77	20.3
23 24 08.30	+59 17 52.9	19.45	18.12	18.12	15.93	14.85	13.97	19.4
23 26 40.12	+62 18 58.1	15.78	14.81	14.77	13.13	12.18	11.47	17.8
23 29 07.04	+59 34 30.4	17.36	15.79	16.07	12.41	10.70	9.43	24.3
23 29 37.83	+62 13 07.3	17.85	16.32	15.85	14.10	13.34	12.84	11.8
23 30 35.06	+59 55 26.0	19.15	17.69	17.71	15.36	14.34	13.74	28.9
23 32 44.44	+61 44 10.8	17.48	16.32	16.35	14.17	13.32	12.67	12.9
23 35 42.67	+62 12 28.5	18.18	16.48	17.08	14.44	13.58	13.15	15.6
23 36 18.62	+62 37 08.9	17.76	16.57	16.76	14.82	13.68	13.03	13.6
23 39 24.79	+61 59 40.9	18.57	16.89	17.37	14.34	13.08	12.18	10.8
23 40 39.28	+61 35 45.2	18.45	17.14	17.15	14.88	13.76	13.13	16.2
23 41 25.21	+65 40 42.6	15.03	13.39	13.55	10.50	8.82	7.45	50.9
23 41 33.78	+63 53 23.4	16.06	14.52	14.94	12.31	11.13	10.44	27.8
23 46 58.61	+59 01 43.2	17.32	16.19	16.23	14.38	13.30	12.54	18.8
23 47 32.55	+63 23 46.3	16.80	15.05	15.57	12.76	11.83	11.26	6.5
23 48 35.75	+66 30 53.4	15.71	14.71	14.67	12.95	11.91	11.29	44.3
23 51 05.38	+62 52 03.8	18.80	17.56	17.81	15.53	14.52	13.95	11.9
23 53 05.89	+60 21 12.7	19.27	17.51	17.99	14.41	13.01	12.03	23.4
23 56 09.52	+65 57 23.7	18.46	16.53	17.04	13.92	13.07	12.46	23.5
23 56 57.56	+58 30 34.9	16.75	14.64	15.22	12.18	11.31	10.83	29.0
23 57 27.29	+58 28 42.1	17.76	16.65	15.81	13.30	11.92	11.01	29.6
23 57 34.77	+64 46 49.1	14.43	13.44	13.47	11.49	10.55	9.88	20.6
23 58 12.52	+62 54 34.9	18.47	17.39	17.42	15.52	14.65	14.00	19.9
23 59 19.98	+66 23 12.0	14.63	13.32	13.32	11.06	9.82	8.99	29.9