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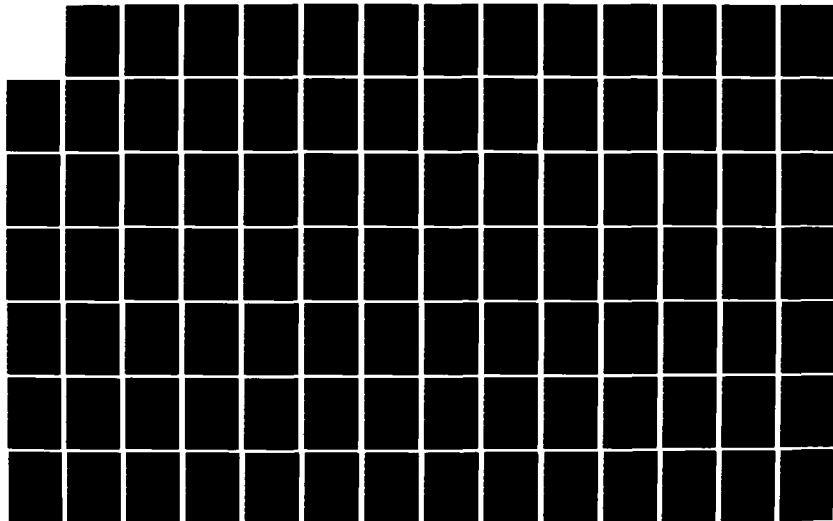
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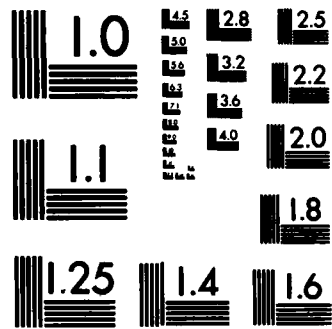
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FINAL REPORT ON INFRARED MEASUREMENTS
OF AFGL SOURCES

R.D. Gehrz
J.A. Hackwell
G.L. Grasdalen

The University of Wyoming
University Station, Box 3905
Laramie, Wyoming 83071

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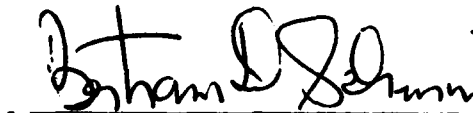
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> which might be explained by these stars' confinement to spiral arms.

The noise limited magnitudes for the AFGL Infrared Sky Survey have been estimated by direct comparison with ground based observations. Using these limiting magnitudes pruned versions of the AFGL catalog have been generated. Infrared observations of all the stellar objects seen at 11, 20 or 27 μm and a statistical sample of the stars seen only at 4 μm are reported. Analysis of the observations leads to estimates of the absolute 4 and 10 μm magnitudes and space densities for the two classes of objects. The expected results from the Infrared Astronomical Satellite are re-examined.

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The Stellar Component of the Galaxy
As Seen by the AFGL Infrared Sky Survey

by

Gary L. Grasdalen, R. D. Gehrz,^{*+} J. A. Hackwell,^{**}
M. Castelaz and C. Gullixson

Wyoming Infrared Observatory
Department of Physics and Astronomy
The University of Wyoming

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+ Guest Observer, University of Minnesota, University of California at San Diego, Mt. Lemmon Infrared Observatory.



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Abstract

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Key words; Infrared: sources, Stars; catalogs, circumstellar shells.

I. INTRODUCTION

A highly developed statistical understanding of the contents of the visible universe has emerged from intense study of the Palomar Observatory Sky Survey over the last three decades. Numerous radio surveys have given us nearly as complete an understanding of the radio universe. By comparison our current knowledge of the infrared contents of our galaxy is poor. However the Infrared Astronomical Satellite (IRAS) is expected to find approximately 10^6 new infrared sources. Fresh insight into the makeup of the infrared sky is essential if interesting populations of new objects are to be culled from among these 10^6 sources and if large numbers of stars from relatively well understood populations are to be rejected.

Currently, the only all-sky infrared survey from which to study the infrared populations in the universe at wavelengths longer than $2\ \mu\text{m}$ is the Air Force Geophysical Laboratory (AFGL) 4, 11, 20 and $27\ \mu\text{m}$ survey (Walker and Price, 1975; and Price and Walker, 1976). Gehrz and Hackwell (1976), Gosnell, Hudson, and Puetter (1979), Kleinmann et al. (1979), Lebofsky et al. (1976), Lebofsky et al (1978) and Low et al. (1976) have presented further infrared data confirming AFGL survey sources and delineating the statistical accuracy of the AFGL catalog. A consistent theme of these observational papers is that a large fraction of the reported AFGL survey sources cannot be confirmed by ground based observations. In particular the papers by the Arizona group have concentrated on the "new" AFGL sources, that is sources not identified with previously known objects. For this special class of objects they derive a confirmation rate of only 60% (Lebofsky et al 1978). It is remarkable that this poor rate of confirmation has not led to a more

careful examination of the sources identified with known objects. It seems clear that until the AFGL sources are verified from ground based observations statistical analyses based solely on the AFGL catalog (Lebofsky et al 1978 and Kleinmann, Gillett and Joyce 1981) are highly suspect.

Several authors have performed limited statistical analyses of the contents of the mid-infrared sky using the AFGL survey. Harris and Rowan-Robinson (1977), from a sample of 216 sources, concluded that surveys at 4 μm detect almost exclusively the red giant population of the galaxy. They also found that longer wavelength infrared surveys are dominated by stars with circumstellar shells and by HII regions. A drawback to their analysis is that it relies on a highly non-uniform data set compiled from observations made by many different observers who used a variety of telescopes and photometric techniques. Lebofsky et al. (1978) and Kleinmann et al (1981) derived a picture of the 11 μm sky which was broadly consistent with that obtained by Harris and Rowan-Robinson.

The Wyoming infrared group has for the past five years been engaged in an effort, along with groups at the University of Minnesota and the University of California at San Diego, to obtain complete infrared photometry of all the sources in the AFGL catalog. Each research group was assigned approximately one third of the sources in the AFGL catalog by dividing the catalog into three right ascension zones. The Wyoming Infrared Observatory (WIRO) zone includes sources in the 20 to 40 minute interval for each hour of right ascension. Rudy, Gosnell, and Willner (1979), Gehrz, Hackwell, and Grasdalen (1980), and Ney and Merrill (1980) have reported preliminary results of portions of the survey.

We report in this paper an analysis of the stellar populations in the mid-infrared sky based upon infrared photometry of AFGL sources in the WIRO zone. All sources associated with HII regions, extended sources, and external galaxies have not been considered in the present analysis; these results will be reported separately. The ultimate objective of this segment of the WIRO survey was to use a completely uniform and unbiased data set to develop a statistical picture of that stellar population of our galaxy which dominates the mid-infrared sky.

II. THE OBSERVATIONS

The infrared photometric data obtained during this survey are given in Tables 1, 2, and 3. All photometry was performed using the standard Wyoming multifilter infrared photometer equipped with Helium cooled Ga-Ge bolometers constructed at the University of Wyoming. Effective wavelengths, bandpasses, and magnitudes for standard stars and absolute calibrations for the 2.3-19.5 μm filter sets have been reported by Gehrz, Hackwell and Jones (1974). An additional filter with an effective wavelength at 23 μm has been added to the standard set and this filter was calibrated by assuming that the [19.5] - [23] color of all the standard stars was zero. Most of the measurements were made with the 234 cm telescope of the University of Wyoming Infrared Observatory. However, measurements made prior to 1977 November 1 were made either with the 127 cm and 213 cm telescopes at Kitt Peak National Observatory or the 152 cm telescope at the Mt. Lemmon Infrared Observatory operated by the University of Minnesota and the University of California at San Diego.

III Limits of the WIRO Survey

Initially the plan of the WIRO observations was to obtain photometry of the entire WIRO zone (20-40 minute interval for each hour of right ascension) of the AFGL catalog north of declination -35° . This would result in a fairly random selection of sources for observation. Analysis of the preliminary results indicated that the reliability limit of the AFGL catalog was at a substantially brighter level than the limiting magnitude of the catalog. This is demonstrated in Figures 1 and 2, where the WIRO magnitudes have been plotted against the AFGL catalog values. For the purpose of comparing the WIRO observations with the AFGL magnitudes at $4 \mu\text{m}$, the $3.5 \mu\text{m}$ and $4.9 \mu\text{m}$ WIRO magnitudes were averaged. In general these plots show a tight, nearly linear relation between the rocket and ground based observations. However, fainter than about 0 magnitudes for the $4 \mu\text{m}$ plot and about -2 magnitudes for the $11 \mu\text{m}$ plot, these correlations become much wider. This behavior is convincing evidence that the rocket measurements are inaccurate at low flux levels. Other phenomena cannot account for the scatter. Variability of the sources would produce a uniform broadening of the relation. Extended sources would be much fainter in the small angular aperture used for the ground based measurements and would produce a fringe of points to the left of the tight correlation. Both of these phenomena may be present in the plots, but not at sufficient levels to explain the large scatter at faint rocket magnitudes.

The appearance of figures 1 and 2 can be modeled by assuming the noise in the rocket measurements has a constant value in flux units: i.e. the noise is independent of signal level. The figures show lines which correspond to adding and subtracting a constant flux value from

the observed rocket flux. The noise constant has been taken as equivalent to an 11 μm magnitude of -0.8 and a 4 μm magnitude of +2.2. A similar analysis of the more limited 20 μm data implies the noise magnitude at this wavelength to be about -3.3. It is encouraging that the observed distributions are fit well by this simple noise model.

This analysis has provided us an estimate of the noise present in the verified photometric measurements reported in the AFGL catalog. It is more difficult to translate this into an estimate of the reliability limit of the survey. The limits used to sift out objects from the catalog for further study were arbitrarily set twice as large as the apparent noise levels and were taken as +1.3 at 4 μm , -1.5 at 11 μm and -4.0 at 20 μm . Because these limits were chosen before all the WIRO survey data was in hand, they are somewhat different from those given by the more complete data in figures 1 and 2. These reliability limits are not the same as completeness limits derived from source counts. We have not examined any expected behavior of the number of sources as a function of magnitude to derive these limits; they refer only to the mean photometric accuracy in the AFGL catalog. This is an essential step in any statistical study. Kelnmann et al (1981) derive a completeness limit for the AFGL survey based on the expected shape of the log N-magnitude relation. Since they have not made ground based observations to verify the existence of these sources as a function of magnitude their completeness limit has no physical meaning. It is entirely conceivable that all the sources at their limit are spurious. All that would be required is that the noise distribution mimic the expected log N-magnitude relation.

The object of deriving revised limiting magnitudes was to avoid spending large amounts of telescope time searching for sources which

were not reliably measured by the AFGL survey. Eliminating sources with observed magnitudes below the revised limits resulted in removing 173 of the 739 entries in the WIRO zone. Of the 173 sources only 57 had $11\ \mu\text{m}$ measurements; thus only a small number of the reported $11\ \mu\text{m}$ sources were entirely eliminated from the WIRO survey. It should be emphasized that many of the eliminated catalog entries are bona fide sources. Our efforts were aimed at producing a manageable statistical sample that might prove to be reasonably complete.

The major effect of pruning the catalog was to eliminate $11\ \mu\text{m}$ or $20\ \mu\text{m}$ observations of sources seen reliably at $4\ \mu\text{m}$. This means that the number of $11\ \mu\text{m}$ sources to be sought has been significantly reduced, and that only a small fraction of the catalog entries have been reliably detected at 11 , 20 or $27\ \mu\text{m}$. The AFGL catalog is dominated by observations of sources seen at $4\ \mu\text{m}$ only. Thus, the pruned catalog was divided into two categories; long lambda (LL) sources, seen at 11 , 20 , or $27\ \mu\text{m}$, and four micron only (FMO), sources seen reliably only at $4\ \mu\text{m}$. The rejected sources are referred to as the lost (LST) sources. There are 164 LL, 402 FMO and 173 LST sources in the WIRO zone of the AFGL catalog.

Our goal was to measure every possible LL source in the WIRO Zone, but complete photometry of the entire FMO group would have taken a prohibitively long time to complete. Thus we chose a statistically unbiased set of the FMO objects by selecting every eighth FMO entry as a candidate for photometry. This resulted in a group of 49 catalog entries named the WIRO 49 (W49). In summary our plan was to: (1) verify the reality of every LL and W49 source and (2) obtain infrared photometry of all of the verified sources.

IV The Tabulations

The results of our observations are given in Tables 1, 2 and 3. In our preparations for observing we found it very time consuming to gather all of the available information for the AFGL catalog entries. We have therefore decided to reproduce in a single place much of the relevant information about the sources regardless of whether we observed each source or not. Explanations of the columns in Tables 1, 2 and 3 as well as the sources of information are given below.

- IRC: The number assigned in the Infrared Catalog (IRC) of Neugebauer and Leighton (1969) to the source cross identified by the AFGL catalog with the AFGL entry.
- HR: The number in the Harvard Revised catalog (usually today taken from the Yale Catalog of Bright Stars, Hoffleit, (1964)).
- BD: The Bonner Durchmusterung catalog number. (Taken from secondary listings; we did not do a recomparison of the AFGL with the BD).
- OTHER: Here we report other names for the source: Flamsteed designations, variable star designations, stars suspected of variability, numbers from the Albany General Catalog (Boss 1937), prominent radio designations or descriptive comments. We attempted to choose the most relevant name; many stars are entered in several of these lists, but it hardly seems relevant to report all the designations.

TYPE: Here we have reproduced the variability type from the. General Catalog of Variable Stars (GCVS) [Kukarkin et al. (1969), Kukarkin et al. (1970), Kukarkin et al. (1971), and Kukarkin et al. (1976)].

PERIOD: Period of variability from the GCVS.

SP TYPE: This is our judgement of the most accurate spectral type available for the source.

SOURCE: This gives an abbreviation for the source of the spectral type.

DO The Dearborn Catalog of Faint Red Stars [Lee et al.(1943), Lee et al. (1944), and Lee et al. (1947)]

IRC IRC.

GCVS GCVS.

VOGT Vogt (1973).

H&B Hansen and Blanco (1975).

LWD Lockwood (1974).

HR Yale Catalog of Bright Stars. [Hoffleit, (1964)].

CK1 Cohen and Kuhi (1976).

CK2 Cohen and Kuhi (1977).

GC General Catalog [Boss (1937)].

CASE Case surveys for late type stars. [Nassau and Blanco (1954a), Nassau and Blanco (1954b), Nassau et al. (1954), Nassau et al. (1956), and Blanco and Nassau (1957)]

WWSJ Wisnienski et al. (1967).

H&L Harvey and Lada (1980).
GHB Gehrz et al. (1978).
HBG Herbig (1956).

LUM The luminosity class as coded by;
 2 = Luminosity Class I and II
 3 = Luminosity Class III
 4 = Luminosity Class IV
 5 = Luminosity Class V
 6 = Luminosity Class c
 7 = Luminosity Class g
 8 = Luminosity Class d

RA & Dec. The 1950 position for the source. Here again we attempted to reproduce the position from the best available source. The sources used are as follows:

SAO The Smithsonian Astrophysical Observatory Catalog of Positions for 1950.0.

JYCE Joyce et al. (1977).

G&H Gehrz and Hackwell (1976) (including unpublished positions).

WIRO Positions determined at the Wyoming Infrared Observatory.

GCVS General Catalog of Variable Stars.

SVS Catalog of Suspected Variable Stars.

IRC Infrared Catalog, Neugebauer & Leighton (1969).

LADA Lada et al. (1981).

GC General Catalog, Boss (1937).

AGK3 Catalog der Astronomischen Gesellschaft,
Dieckvoss (1962).

LKVR Low et al. (1976).

LKRL Lebofsky et al. (1978).

KLMN Kleinmann et al. (1979).

AFGL The position from the AFGL Catalog.

GLG Grasdalen (1974)

RIED Ried et al. (1980)

SSJ Simon et al. (1979)

BHR Baldwin et al. (1973)

HGSB Hackwell et al. (1978)

HGG Hackwell et al. (1982)

LSKR Lebofsky et al. (1978)

Comment A letter C in this column means that a comment about the source exists in Table 4.

V and Source Visual magnitude or in the case of data from the Dearborn Catalog of Faint Red Stars. (Lee et al. 1943, Lee et al. 1944, and Lee et al. 1947) and Joyce et al. (1977) the red magnitude, and the source of the information.

I' and K Magnitudes from the IRC, I' refers to a photometric band centered at 0.7 μ m. Asterisks denote saturated signals.

4, 11, 20 and 27 The magnitudes reported in the AFGL Catalog.

D/M/Y The date of any WIRO observations.

2.3 - 23.0 The observed magnitudes. The photometric

system was identical to that described by Gehrz, Hackwell, and Jones (1974).

OBSVR

The initials of the observer.

GG = Gary Grasdalen

JAH = John Hackwell

RDG = Robert D. Gehrz

BTA = Dan Briotta

G&H = Gehrz and Hackwell (1976)(and additional unpublished data).

Inspection of tables 1, 2, and 3 indicate we have come close to our goals. The survey of LL Sources is very nearly complete. Many of the LL Sources that do not have reported magnitudes are associated with well known dark clouds or HII regions. These associations are reported in Table 5. A listing of those LL sources that we deem to be spurious is given in Table 6. The only entry without photometry which is not present in tables 5 and 6 is GL 4250.

V. Discussion

a. The Completeness of the AFGL Survey

To assess the completeness limits of the AFGL survey we have formed the integral source counts as a function of the 4 and 10 μm magnitudes. These counts are based, for the first time, on a uniform sample of sources verified by ground based observations. The logarithm of the number of sources brighter than magnitude $[\lambda]$ is plotted against $[\lambda]$ in figures 3 and 4. The LL source counts are plotted as dots in these two figures.

From these figures we see that the $[10]$ counts exhibit a break in slope between $[10] = -1$ and -2 . This corresponds quite closely to the adopted reliability limit of the AFGL catalog (see § III). Because of the small number in the sample the estimate of the slope of the count-magnitude relation is rather uncertain. The line drawn on figure 3 has a slope of 0.6, the expected slope for a sample of uniform density: a slope as low as 0.4 is ruled out by the data. We conclude that the sample is very nearly uniformly complete down to $[10] = -1.5$. At $[10]$ a slope of 0.6 predicts 74 sources brighter than $[10] = -1.5$ in our sample. Thus, for the sky north of declination -30° , we would expect 220 sources brighter than $[10] = -1.5$. This estimate is a lower limit; some sources may have been missed. Because of the way in which the survey was done, we would not expect the missed sources to be solely the faint ones, that would badly skew the count-magnitude relation. Rather we would expect certain areas of the sky to be incompletely sampled.

The [4] counts of the LL Sources (figure 4) exhibit a break in slope between [4] = -0.5 and +0.5. The WIRO 49 sample has been used to extend the counts to fainter limiting magnitudes by multiplying the W49 sample counts by 8 and adding them to the LL sample. The results are plotted as x's in figures 3 and 4. Not unexpectedly the W49 counts extend the [4] counts smoothly through [4] = +1, there is only a marginal change of slope as the counts reach +2. The slope of the [4] count-magnitude relation is 0.54, close to the value of 0.6 expected from a uniform density sample. At [4] = +1.3 the straight line gives the total number of sources as 282. Thus the total number of 4 μ m sources north of declination -30° is expected to be 850.

It is interesting to compare the number of 4 μ m sources to the number of 2.2 μ m or K magnitude sources from the IRC. The IRC is thought to be a complete sample to K = + 2.8. Extrapolating the [4] count-magnitude relation to [4] = + 2.8 we obtain an expected number of 5500 sources, remarkably close to the observed number of 5612 IRC 2.2 μ m sources. Because the K - [4] color of almost all normal stars is between 0.0 and -0.5, this result 1) confirms our expectation that a survey at 4 μ m would include all sources seen to comparable magnitude limits at 2.2 μ m and 2) demonstrates that the survey at 4 μ m contains few sources not previously seen at 2.2 μ m. This conclusion is further bolstered by noting that 88% of the FMO sources are cross-identified with IRC entries. Thus, at flux levels brighter than about 2 magnitudes the sky does not appear to change substantially between 2.2 and 4 μ m, down to an apparent magnitude of +2.

The [10] distribution for the WIRO 49 begins at [10] = -0.5 (figure 4). This result could have been implied from the magnitude reliability

results of § III which predict that very few of the F10 entries should be strong sources at 10 μm . Thus the F10 objects are not strong 10 μm sources in contrast to the results expected on the basis of the 11 μm magnitudes reported in the AFGL catalog. When the [10] count-magnitude relation of figure 4 is extended using the W49 sample we find that it continues to fall substantially below the extrapolation of the brighter counts. We conclude that surveys at wavelengths of 4 μm or shorter must be extended to much fainter limiting magnitudes than the AFGL or IRC if they are to extend significantly the 10 μm sample.

To illustrate further the difference between the magnitude limited surveys at 4 and 10 μm we have plotted in figure 5 the distribution of the [4] - [10] colors for the magnitude limited samples of the [4] and [10] sources. The sources in figure 5 were taken entirely from the LL list; the upper panel contains these sources brighter than -1.5 at 10 μm , the lower panel those brighter than -0.1 at 4 μm . The two samples have dramatically different [4] - [10] color distributions. The 4 μm sample is dominated by sources with [4] - [10] colors \approx 1.0, while the 10 μm sample has a broad distribution which extends to [4] - [10] = 6 and has a median value of [4] - [10] = 1.9. Thus, to extend even approximately the [10] counts, we would have to survey at least 4 magnitudes fainter at 4 μm than at 10 μm . Therefore, a magnitude limited sample at 10 μm produces an entirely distinct source list from a 2 μm or a 4 μm survey, and the appearance of the sky undergoes a dramatic transformation between 4 μm and 11 μm .

The most likely explanation of the large [4] - [10] colors is that the 10 μm radiation is principally from circumstellar dust. To explain these large colors as being due to interstellar extinction is totally

implausible. The infrared extinctions would be much too large. Thus, we conclude that the 10 μm sample is entirely dominated by stars with extreme circumstellar dust shells. This is very important because surveys to fainter limiting magnitudes will continue to exhibit this pattern until the limiting distance of the survey extends beyond the physical limit of the galaxy. Therefore the critical factor in evaluating the appearance of the infrared sky at limiting magnitudes fainter than -1.5 is the absolute magnitude of the 10 μm sources detected by the AFGL survey.

b. Mean Absolute Magnitudes from the Galactic Distributions

By assuming the absolute distribution of the objects detected by the AFGL survey in the direction perpendicular to the galactic plane, we can use the observed distribution of the sources in galactic latitude as a measure of the absolute magnitudes of the sources. Figure 6 plots the [4] and [10] latitude distributions of the magnitude limited sample after correcting to refer to the entire sky. In order to model these distributions we have assumed an exponential density distribution in the z direction:

$$N(z) = N_0 \exp(-z/\beta) \quad (1)$$

In modelling the observed latitude distribution it is crucial to include any dispersion in absolute magnitude. Because the volume surveyed increases very rapidly with absolute magnitude, the relatively rare bright stars dominate the distribution. This effect is particularly important when assessing the galactic distribution because an increase in the dispersion in absolute magnitude leads to a much narrower galactic distribution. Vogt (1973) has already discussed this effect for the

IRC sources. Because so little information is available on the absolute magnitudes of infrared stars, we have arbitrarily assumed a dispersion in absolute magnitude of one magnitude. Thus:

$$N(M) = \frac{N(z)}{\sqrt{2\pi}\sigma} \exp \frac{(M-M_0)^2}{2\sigma^2} \quad (2)$$

This allows us to fit the observed galactic distribution with a single parameter R/β , which is the ratio of the limiting radius, R , of the sample for stars of the mean absolute magnitude to the exponential scale height, β , of the z distribution. We have found that the [4] distribution is best fit with $R/\beta = 2$ and the [10] distribution with $R/\beta = 4$. The predictions of the models for these parameters are drawn as solid lines on figure 6.

In order to obtain an absolute magnitude we must assume a value for β , the exponential scale height. The most reasonable guess is that these stars are closely related to normal giant stars for which a representative value of β is 300 pc. This implies $M_{[4]} = -9$ and $M_{[10]} = -12$.

Since we believe that we are observing the photospheres of more or less normal giant stars at 4 μ m, we can convert the value of $M_{[4]}$ into a bolometric luminosity by assuming an effective photospheric temperature. The results of this computation are summarized in Table 7. From examination of this table it seems probable that the luminosity of these stars exceeds $10^4 L_{\odot}$ which is an order of magnitude higher than that expected for solar type stars at the tip of the first red giant branch. We conclude that these objects are most likely on their second or later ascent of the red giant branch.

For the [10] sample we believe that the radiation is from a circumstellar dust shell. The characteristic temperature of these shells

estimated from the observed [4] - [10] color of 2.5 magnitudes is 700 K. In Table 8 we have computed the bolometric luminosity of the dust shell radiation for a range of assumed circumstellar dust temperatures. We infer that the luminosity of the dust shells is only slightly less than the luminosity of the [4] sample. It is plausible to assume that the [10] sample stars have the same total luminosity as the [4] sample, but that the [10] objects have a sufficiently thick dust shell to absorb most of the luminosity of the underlying star.

Although it seems that we have produced a very fragile structure involving a large number of assumptions, the numerical details of our assumptions do not have a profound effect on our conclusions. The assumed dispersion in absolute magnitude has decreased the derived mean absolute magnitude by about 0.8 magnitudes from that which would result if no dispersion were assumed. Similarly, changing the assumed scale height by 50% would alter the absolute magnitude by only 0.9 magnitudes. We conclude that the derived luminosities are accurate within a factor of three. In particular we can rule out a reduction in luminosity by the factor of ten required to bring these objects down to the luminosity at the tip of the red giant branch.

We can also estimate the local space density for the [4] and [10] star samples. These derived values are particularly uncertain because they depend on the cube of the assumed scale height. We find:

$$N([4]) = 3 \times 10^{-7} \text{ pc}^{-3}$$
$$\text{and } N([10]) = 9 \times 10^{-8} \text{ pc}^{-3}.$$

Kirton and Fitzgerald (1974) found the density of late M stars (M5-9) to be $7 \times 10^{-7} \text{ pc}^{-3}$. Considering the uncertainties in our determination, the [4] sample can be identified with the late type giants. The ratio

between the number density of [10] sources and [4] sources is largely independent of our assumptions if both types of sources have the same scale height in the galactic plane. We find that for each giant with a substantial $10\ \mu\text{m}$ excess there are three giants without such an excess. There are two straightforward interpretations of this ratio: 1) the development of a substantial dust shell takes about 75% of the time the star spends on the asymptotic giant branch, or 2) the presence of a dust shell indicates a basically different type of star. For the second hypothesis, the dust production might be controlled by the mass of the star and its chemical composition.

c. Predictions for the IRAS Survey.

One of the principal aims was to provide insight into the expected results of the IRAS all sky survey. A limiting flux at $10\ \mu\text{m}$ of 1Jy, corresponding to $[10] = +4$, will reach objects with $M_{[10]} = -12$ to a distance of 16 kpc, well beyond the galactic center. If we assume that the galactic plane is uniform within such a radius, our derived number density implies 5×10^4 $10\ \mu\text{m}$ sources within that volume. This represents the minimum number of sources expected in the IRAS survey. A more realistic calculation might be to compute a local mass to $10\ \mu\text{m}$ source count ratio and apply it to the entire mass of the galaxy. Using a projected local density of $25\ M_{\odot}/\text{pc}^2$ and the total mass of the Galaxy as $10^{11}\ M_{\odot}$, we predict the total number of luminous $10\ \mu\text{m}$ sources in the Galaxy as 2×10^5 . The ratio of mass to the $10\ \mu\text{m}$ source count may vary considerably within the Galaxy. If the luminous $10\ \mu\text{m}$ sources arise from stars with main sequence masses greater than $1\ M_{\odot}$ we would expect the ratio to be quite small in portions of the galaxy dominated

by old stars. Thus this estimate is probably an upper limit to the total number of luminous $10\ \mu\text{m}$ sources in the Galaxy. If we had extended the $10\ \mu\text{m}$ counts from $[10] = -1.5$ to $[10] = +4$ we would have predicted 6×10^5 and 5×10^4 using slopes of $+0.6$ and 0.4 . Since extrapolating the count magnitude relation with a slope of 0.4 corresponds to assuming a planar distribution, it is not surprising that this number agrees precisely with our previous estimate for a uniform galactic disk.

Our analysis for the absolute magnitude of the AFGL $10\ \mu\text{m}$ sources has given us a more secure estimate of the volume of the Galaxy surveyed. Since the limiting magnitude does not correspond to dimensions larger than the Galaxy, the mixture of sources seen by IRAS is unlikely to differ substantially from that seen in the AFGL survey. Local sources whose numbers continue to increase directly with the volume surveyed are not sufficiently numerous to overtake the luminous $10\ \mu\text{m}$ sources in a survey down to $[10] = +4$.

Thus the best current estimate for the expected IRAS sample is $\sim 10^5$ sources brighter than $[10] = +4$, with the majority of sources being luminous objects dominated at $10\ \mu\text{m}$ by radiation from dust shells. These sources will be relatively faint at shorter wavelengths, so that observations that reach 4 to 6 magnitudes fainter at $4\ \mu\text{m}$ will be required to reach all of the IRAS sample.

VI. Summary

The major conclusions of this study can be summarized as:

1. Using directly estimated noise limited magnitudes the published AFGL catalog can be pruned to reveal two virtually distinct lists of sources; those seen at 4 μm only (FMO) and those seen at 11, 20 or 27 μm (LL).

2. Statistical examination of the FMO source list reveals that the 4 μm survey presents a view of the sky virtually identical to that given by the 2.2 μm survey of Neugebauer and Leighton (1969). On the other hand, the sources seen at 10 μm represent a distinct stellar population with very red infrared colors.

3. Using the galactic distribution and an assumed galactic scale height the mean absolute magnitudes and local space density for the FMO and LL sources have been estimated as:

$$\text{FMO} \quad M_{[4]} = -9$$

$$N([4]) = 3 \times 10^{-7} \text{ pc}^{-3}$$

and $\text{LL} \quad M_{[10]} = -12$

$$N([10]) = 9 \times 10^{-8} \text{ pc}^{-3}$$

From reasonable estimates of the temperatures of these objects it seems unlikely that their bolometric luminosity is much less than $10^4 L_{\odot}$ for both classes of stars.

4. These parameters are used to estimate that the IRAS survey is likely to see 10^5 sources brighter than $[10] = +4$ and that the majority of these sources will be similar to the AFGL sample.

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TABLE I

VIRO CATALOG OF AFGL SOURCES

FOUR MICRON ONLY SUBCATALOG

o

GL	IRC	HR	BD	OTHER	TYPE	PERIOD	SP	LUM	R.A.	DEC.	SOURCE	COMMENT	CLASS
56	40	8	37	DO 8341			M5		0 20 18.55	38 28 37.3	SAO		FHO
60	70	8		SVS 49			M6		0 24 13.00	69 52 42.0	SVS		FHO
66	-10	9	-7	UY CET	SRB	440.00	N7		0 24 33.57	- 6 52 52.4	SAO		FHO
68	40	10		AQ AHD	SR	346.00	C5		0 24 52.00	35 18 48.0	GCVS		FHO
71	20	7	103	TV PSC	SR	49.10	M3	3	0 25 26.27	17 36 59.1	SAO		FHO
72									0 25 29.00	- 4 14 18.0	AFGL		FHO
73	50	7	47	DO 23365			M8		0 26 14.26	48 8 15.2	SAO		M49
76				AD CEP	SR	166.00	M6	3	0 27 37.00	82 19 18.0	GCVS		FHO
75	0	10	117	12 CET			M0		0 27 29.16	- 4 14 .2	SAO		FHO
82	30	12	-4	TU AHD	M	316.54	M7		0 29 44.00	25 45 12.0	GCVS		FHO
88	50	10		SVS 5864			M5		0 33 59.93	48 40 36.7	SAO		FHO
39	40	11	48	GC 726			K5	3	0 34 2.86	44 12 47.3	SAO		FHO
40C5	50	12	44	B2 AND	LB		M5		0 34 53.18	45 19 45.1	SAO		FHO
94	30	14	30	DEL AHD			K3	3	0 36 38.86	30 35 15.8	SAO		FHO
100	60	17	168	ALF CAS	CST		K0	2	0 37 39.31	56 15 48.6	SAO		FHO
210	-10	21	402	THE CET			K0	3	1 21 31.36	- 8 26 27.2	SAO		M49
211	60	48	244	BT CAS	M	399.00	M8	3	1 21 44.00	60 49 18.0	GCVS		FHO
224	10	17	434	HUU PSC			K4	3	1 27 33.72	5 53 12.2	SAO		FHO
226	0	19	2	R PSC	M	344.04	M6		1 28 3.36	2 37 28.0	SAO		FHO
227	60	53	61	IN CAS	SRB	323.00	M5		1 28 37.78	62 4 19.6	SAO		FHO
228	20	26	437	ETA PSC			G8	3	1 28 48.20	15 5 19.4	SAO		FHO
231	70	29	65	SVS 5931			N7		1 31 16.46	65 32 31.4	SAO		FHO
237	50	41	464	51 AND			K3	3	1 34 54.64	48 22 32.7	SAO		FHO
243	10	20	489	HUU PSC			K3	3	1 38 49.56	5 14 7.1	SAO		FHO
327	60	90	56	DO 25684			M2		2 21 47.04	57 12 42.6	SAO		M49
4022	50	60	659	65 AHD			K4	3	2 22 16.47	50 3 13.0	SAO		FHO
332	60	91	60		M		M4	2	2 23 45.00	60 27 54.0	IRC		FHO
335	50	62	76	RR PER	M	390.14	M8		2 25 5.00	51 3 6.0	GCVS		FHO
340	80	6	81	GC 3033			M0		2 29 3.54	76 29 57.5	SAO		FHO
342									2 29 22.00	14 14 36.0	AFGL		FHO
350	50	69		EE PER	LB		M6		2 32 38.00	53 16 18.0	GCVS		FHO
351	30	43	34	15 TRI			M3	7	2 32 44.24	34 28 14.4	SAO		FHO
354	-10	37	759	80 CET			M0		2 33 32.23	- 8 2 53.2	SAO		FHO
355	30	44	758	R TRI	M	266.48	M4E	3	2 34 .05	34 2 51.4	AGK3		FHO
359	60	94	501	GP CAS	LB		M3	7	2 36 4.66	59 22 58.6	AGK3		M49
365	40	47	39	DO 9448			M7		2 36 52.79	39 37 13.3	SAO		FHO
367	30	46	30	Y ARI	SRB	109.00	M7		2 38 .68	30 59 10.5	SAO		FHO
487	50	95	1017	ALF PER			F5	2	3 20 44.44	49 41 6.0	SAO		FHO
491	70	43	1032	DO 27100			M1		3 25 5.92	71 41 32.5	SAO		FHO
492	50	98	1052	SIG PER			K3	3	3 27 2.28	47 49 27.8	SAO		FHO
494	0	46		DO 587			M6		3 28 8.00	- 2 6 30.0	IRC		M49
496									3 29 2.00	19 54 46.0	AFGL		FHO
497	-10	46	1084	EPS ERI			K2	5	3 30 34.36	- 9 37 34.8	SAO		FHO
506	60	125	1105	SVS 328			S5		3 37 47.68	63 3 24.9	SAO		FHO
507	-10	49	51	SYS 100294			M		3 38 53.00	-10 54 36.0	GCVS		FHO
511	-10	49		VY ERI	SRB	102.50	M6		4 24 35.37	69 16 9.3	SAO		FHO
4047	70	53	69	DO 28302			M1		4 25 33.46	10 3 8.9	SAO		FHO
561	10	60	9	R TAU	M	323.72	M6E						FHO

GL	VIS	SOURCE	I'	K	h	11	20	27	D/M/Y	2.3	3.6	4.9	8.7	10.0	11.4	12.6	19.5	23.0	OBSVR	
56	6.95	IRC	4.62	1.78	1.3															
60	12.20	DO	8.41	2.31	1.2															
66	9.10	IRC	4.75	.25	-3				17/12/78	1.53	1.09	1.24	.78	.55	.28	.32	-.22		JAH	
68	8.10	DO	5.81	1.64	1.0															
71	6.90	IRC	2.69	-.16	-.4				18/ 4/80	1.26	.99	1.46	1.27	.99	1.01	.80	.69		RDG	
72					.8															
73	7.52	IRC	4.35	1.19	1.0															
76					1.2															
75	5.72	IRC	.31	1.92	1.2															
82			6.05	2.05	.9															
88	8.40	IRC	4.89	1.26	1.0															
89	5.29	IRC	3.64	1.20	1.2															
4605	8.40	IRC	5.46	2.00	1.3															
94	3.21	IRC		.44	.2															
100	2.24	IRC		-.46	-.5				21/ 5/80	1.16	1.10	1.24	1.10	1.16	1.03	1.02			RDG	
210	3.61	IRC	2.74	1.20	.9				16/ 8/78	2.53	1.69	1.35	.71	.22	-.09	-.21			RDG	
211			6.73	2.28	1.2				1/11/78	2.25	1.44	.92	.31	-.09	-.22	-.35	-1.20	-1.14		RDG
211																				
224	4.86	IRC	3.68	1.52	1.1				19/11/78	2.30	1.66	1.36	.78	.55	.22	.30	-.06	.30		RDG
226	7.00	IRC	5.35	1.92	1.2				17/ 8/78	2.13	1.61	.86	1.48	1.44	1.26					RDG
227	7.80	IRC	5.66	2.11	1.3															
228	3.62	IRC	2.91	1.45	1.1															
231	8.90	IRC	4.97	1.28	1.1															
237	3.56	IRC	2.56	.79	.5															
243	4.43	IRC	3.27	1.26	.9															
327	8.40	IRC	5.58	1.95	1.2				1/11/78	1.78	1.45	1.51	1.06	.77	.54	.45	-.46			RDG
4022	4.70	IRC	3.37	1.13	.8															
332	9.50	BD	7.24	1.89	1.1															
332																				
335			6.45	1.55	.4															
340	6.86	IRC	4.76	1.50	1.1															
342					1.3															
350	11.30	DO	6.88	1.99	1.2				20/ 8/78	1.88	1.55	2.67	1.26	.96	.59	.51	-.25			JAH
351	5.45	IRC	3.45	.78	.3															
354	5.52	IRC	3.77	1.28	1.2															
355	5.30	IRC	5.47	1.07	-.1				30/12/77	1.13	.65	.39	-.06	-.21	-.45	-.43	-.91	-.95		JAH
359	11.90	AGE3	6.22	1.97	1.3															
365	8.10	IRC	5.21	1.84	.9															
367	8.90	IRC	5.25	1.39	.9															
487	1.79	IRC		.54	.1															
491	6.66	IRC	4.30	1.38	1.0															
492	4.37	IRC	3.20	1.13	.8															
494	9.70	DO	5.81	1.76	.9				20/10/80	1.67	1.41	1.68	1.40	1.21	1.07	1.03	.66			GG
496					1.0															
497	3.73	IRC	2.97	1.62	1.3															
506	5.10	IRC	2.79	.23	0.0															
507	8.40	DO	5.56	1.01	.3															
511			5.65	2.13	1.1															
4647	7.02	IRC/	5.06	2.54	1.3				17/12/78	2.46	2.33	2.46	2.62	2.84	2.24	2.46	1.35			JAH
541	7.40	IRC	5.07	1.15	.4				8/ 3/78	.96	.29	-.02	-.47	-.83	-1.03	-1.32	-1.43	-.88		JAH

CL	IRC	HR	BD	OTHER	TYPE	PERIOD	SP TYPE	SOURCE	LUM	R.A.	DEC.	SOURCE	COMMENT	CLASS
582	40	89		GI PER	LB		H			4 26 19.00	39 45 42.0	GCVS		F110
583	60	143	57	RV CAM	SRB	101.00	M7			4 26 31.90	57 18 12.7	SAD		W49
586	30	87		DO 10530			M5			4 28 1.00	27 23 6.0	IRC		F110
590	30	88					M7	VOGT		4 29 14.00	31 0 30.0	IRC		F110
592										4 29 29.00	8 51 0.0	AFGL		F110
593	50	121	48	DO 28391			M4	DO		4 29 48.35	48 36 29.4	SAD		F110
600	30	90		IU TAU	SRA	418.00	K1	DO		4 32 50.00	28 24 54.0	GCVS		F110
602	40	93	1454	58 PER	SPBI		K0	IRC		4 33 13.13	41 9 50.6	SAD		F110
605	30	38	-27	UU ERI	SRB	340.00	M7	IRC		4 34 32.84	-27 40 43.6	SAD		W49
606	70	54		T CAN	H	373.78	M5	DO		4 35 15.00	66 3 12.0	GCVS		F110
608	10	66		RX TAU	H	335.06	M7E	GCVS		4 35 32.00	8 14 13.0	GCVS		F110
610	-10	73	1481	53 ERI			K2	IRC	3	4 35 53.32	-14 24 1.6	SAD		F110
612										4 37 27.00	17 25 30.0	AFGL		F110
614	-20	59	1496	DH ERI	SRB	30.00	M4	IRC	7	4 38 15.15	-19 45 58.4	SAD	C	F110
615	-10	75	988	BX ERI	SR	165.00	M7	H&B		4 38 15.00	-14 17 54.0	GCVS		F110
619	10	68		BZ TAU	SR	400.00				4 39 43.00	6 46 18.0	GCVS		F110
740	-10	91	-6	EX ORI	LB		M7	GCVS	7	5 22 2.19	-6 11 28.9	SAD		W49
4053										5 22 45.80	38 19 56.0	G&H		F110
749	30	115	29	DO 11262			M1	DO		5 23 58.52	29 52 45.9	SAD		F110
751	20	106	22				M7	VOGT		5 24 16.96	23 3 55.2	AGK3		F110
752	20	107	1816	117 TAU			M1	HR	7	5 25 7.35	17 11 57.2	SAD		F110
753	60	157	1802	17 CAN			M1	HR	7	5 25 26.42	63 1 42.1	SAD		F110
754	30	117	32	DO 11278			M4	DO		5 25 37.09	32 26 17.2	SAD		F110
755	40	130	38	AD AUR	SRB	162.30	M2	DO		5 25 35.00	39 0 42.0	GCVS		F110
756	-20	71	1829	BET LEP			G5	HR	3	5 26 6.09	-20 47 52.9	SAD		W49
759	0	75	1834	31 ORI	CST		K4	IRC	3	5 27 11.52	-1 7 48.1	SAD		F110
769	10	88	12	DO 1158			M4	DO		5 30 5.42	13 1 3.4	SAD		F110
771	-20	73	1865	ALF LEP			F0	IRC	2	5 30 31.39	-17 51 24.2	SAD		F110
777	50	148	1866	DO 19463			M0	HR	7	5 32 28.74	54 23 53.4	SAD		F110
780	10	90	8	SVS 6229			M5	DO		5 32 32.78	8 40 9.0	SAD		F110
782	40	134		IX AUR	LB		M7	DO		5 32 46.00	37 59 18.0	GCVS		F110
787										5 35 26.00	42 35 42.0	AFGL		F110
789										5 35 54.00	18 25 48.0	AFGL		F110
793	-10	94		RV LEP	SR	149.90	M8	H&B		5 36 38.00	-14 3 48.0	GCVS		W49
796	-10	95		HO AUR			C	H&B		5 37 19.00	-8 11 24.0	IRC		F110
797	30	124	1939							5 37 26.94	31 53 43.3	SAD		F110
799										5 37 46.60	13 46 45.0	G&H		F110
800	30	125		AB TAU	SRA	141.97	M1	DO		5 37 54.00	28 5 0.0	GCVS	C	F110
801	10	94		DO 1241			M6	DO		5 38 21.00	12 16 0.0	IRC		F110
802	40	136		SZ AUR	H	453.38	M6	DO		5 38 30.00	38 54 42.0	GCVS		F110
803	20	118		DO 11484			M3	DO		5 38 27.88	17 29 52.3	SAD		F110
804	0	82	17	Y ORI	H	271.30	M5	H&B		5 39 6.00	-4 9 30.0	GCVS		W49
925	0	104	-2	V MOH	M	333.80	M5E	DO		6 20 12.43	-2 10 10.0	SAD		F110
927	50	164	2289	PSII AUR	LC?		M0	HR	2	6 21 2.88	49 18 56.9	SAD		F110
931	60	167	2293	5 LYH			K4	HR	3	6 22 27.09	58 26 49.9	SAD		F110
933	-10	122	-9				F0	IRC		6 22 37.96	-9 7 23.2	SAD	C	F110
934	10	121	2308	BL ORI	LB		C6	HR		6 22 36.93	14 45 4.2	SAD		F110
935							C	CK2		6 23 4.70	-9 30 21.0	JYCE		F110
936										6 23 15.00	5 35 6.0	AFGL		F110
945	60	168		V LYH	SRB		M7	DO		6 25 7.00	61 34 48.0	GCVS	C	W49

GL	VIS	SOURCE	I	K	A	11	20	27	D/M/Y	2.3	3.6	4.9	8.7	10.0	11.4	12.6	19.5	23.0	OBSVR
582	8.10	DO	6.78	1.63	1.0	-1.0	-3.2		20/ 8/78	1.46	.82	.89	.14	.03	-.70	-.37	-.20		JAH
583	8.20	IRC	4.45	.65	.3	-1.0			30/12/77	.58	.35	.44	-.06	-.36	-.74	-.38	-1.43	-1.40	JAH
586	11.50	DO	6.72	1.45	.7				1/11/78	1.35	.78	.63	.30	-.01	-.31	-.31	-1.40		RDC
590			5.68	1.38	.8														
592					1.0														
593	8.30	IRC	.30	1.17	.6				17/ 2/78	1.54	.92	.78	.29	.03	-.28	-.55	-.90	-.81	RDC
600	11.50	DO	7.25	1.37	.5	-.4													
602	4.27	IRC	3.24	1.32	1.1														
605	9.00	IRC	5.28	1.31	1.2				21/11/78	.61	.24	.41	.01	-.02	-.21	-.17	-.42	-.03	RDC
606			4.20	.48	-.1	-.5			8/ 3/78	1.43	.72	.27	-.08	-.47	-.69	-.99	-1.02		JAH
608			7.10	1.45	.6	-1.4													
610	3.86	IRC	3.07	1.33	.8														
612					.8														
614	4.30	IRC		-.35	-.5	-.7													
615			4.91	.50	0.0	-1.0													
619			6.26	1.99	1.2	-1.2													
740	9.10	IRC	5.39	1.18	.6														
4053					.8														
743	8.00	IRC	5.07	1.74	1.1				21/11/78	2.39	1.65	1.21	.65	.28	-.13	-.17	-.91		RDC
751	11.20	AGK3	5.84	1.75	.9				18/ 4/80	1.30	.89	.97	.49	.11	-.23	-.34	-.80		RDC
752	6.86	IRC	4.32	1.81	1.1				7/10/76	2.92	1.38	.87	-.23		-.55		-.80		G&H
753	5.53	IRC	3.58	.95	.8														
754	8.80	IRC	4.59	.75	.7	-1.2													
755			5.88	1.78	.9														
756	2.84	IRC		.96	.8	-.9			18/ 4/80	.80	.76	.99	.86	.71	.83	.85	.76		RDC
759	4.70	IRC	3.17	.90	.5														
769	0.80	IRC	5.14	1.42	.7														
771	2.59	IRC	2.35	1.87	1.3	-1.1													
777	5.79	IRC	4.21	1.68	1.3														
780	8.20	IRC	4.16	.80	.3														
782	10.90	DO	6.15	2.11	1.0														
787					.6														
789					1.0														
793			5.48	.68	.1	-.5			17/12/78	1.01	.58	.40	-.05	-.27	-.45	-.82	-1.42	-1.61	JAH
796			8.42	2.70	.7	-1.1			2/11/78	2.45	1.65	1.62	.45	.52	.29	.52			RDC
797	6.05	IRC	3.99	.86	.5														
799	15.50	CK2			1.0	-1.2			25/10/75	3.53	2.02	1.20	.08	-.08	-.45	-.44	-.95		G&H
800	9.70	DO	16	.88	.2														
801	11.20	DO	.69	2.11	.5	-1.0													
802			4.98	1.13	.4				21/12/77	1.24	.61	.31	-.19	-.39	-.81	-1.11	-1.23		G&H
803	7.50	IRC	4.81	1.78	1.1														
804			7.28	2.48	1.1				17/ 4/80	2.23	1.69	1.47	.93	.68	.35	.40	.56		RDC
925	6.00	IRC	4.84	1.23	.1				8/ 3/78	1.29	.69	.53	-.21	-.40	-.48	-.63	-.79		JAH
927	5.02	IRC	3.14	.59	.2	-1.2													
931	5.22	IRC	3.92	1.61	1.1														
933	9.30	IRC	7.28	2.64	.3	-1.2			2/11/78	2.55	.93	.15	-.92	-1.02	-1.36	-1.15	-1.86		RDC
934	6.32	IRC	4.29	.75	.1	-.7			21/12/77	.93	.68	.79	.29	.32	.09	.11	-.20		G&H
935					1.0	-1.3			2/11/78	5.34	2.73	1.40	-.16	-.37	-.78	-.71	-1.54		RDC
936					1.1														
945	11.50	DO	5.19	1.39	.8				30/12/77	1.22	.93	1.01	.44	0.00	-.40	-.33	-1.20	-1.22	JAH

GL	IRC	HR	BD	OTHER	TYPE	PERIOD	SP	SOURCE	LUM	R.A.	1950.00	DEC.	SOURCE	COMMENT	CLASS
							TYPE								
947	20	197		AQ GEN	LB		H6	DO		6 26	8.00	16 37	GCVS		F110
954				RT CAM	H	365.84	H8	DO		6 29	5.50	43 19	GAH		F110
959	20	152	16	CR GEN	LB		N	DO		6 30	32.00	64 8	GCVS		F110
962	50	170	45	TU AUR	SRD	73.00	M7	DO		6 31	30.82	16 7	AGK3		F110
964	10	126	5	DO 1635			M5	DO		6 31	55.72	45 39	SAD		F110
967	10	128	14	DY GEN	SRA		M4	DO		6 31	56.05	5 0	SAD		F110
970	20	153		AX GEN	LB		M6	DO		6 33	7.00	14 14	GCVS		F110
577	0	119		SY HON	H	422.17	M9	H&B		6 34	9.00	21 10	GCVS		U49
980	-20	98	2443	HU3 CHA			K1	IRC	2	6 35	0.00	-1 20	GCVS		F110
982	60	172	1492	U LYH	H	435.94	M6	DO		6 35	41.39	-18 11	SAD		F110
985	-10	135	2450	GC 8694			M3	IRC	3	6 36	21.00	59 55	GCVS		F110
988				SU LYH	SRB	126.00	M6	DO		6 36	59.52	-14 5	SAD		F110
994	40	161	2459	PS14 AUR			K5	IRC	3	6 38	34.00	27 6	AFGL		F110
995										6 38	45.74	55 31	SAD		F110
1108	-20	129	-20				M2	IRC		6 39	26.75	44 34	SAD		F110
1110			1889				M4	GCVS		6 39	23.00	8 50	AFGL		F110
1110			2742	VZ CAM	SR	23.70	M7	DO		7 20	12.70	-20 24	SAD		U49
1109	50	178	47	SVS 6578	IB		M7	DO		7 20	40.98	82 30	SAD		F110
1112	-30	90	2622	GC 9870			K2	IRC		7 20	49.96	47 16	AGK3		F110
1113										7 21	28.18	-27 44	SAD		F110
1114	30	183	2821	10T GEN			K0	IRC	3	7 22	26.00	-21 25	AFGL		F110
1117	30	184		XX GEN			M9	VOGT		7 22	37.38	27 53	SAD		F110
1118	-10	163		TT HON			M8	H&B		7 23	0.00	33 28	IRC		F110
1122	40	177		VX AUR			M8	DO		7 23	15.00	-5 44	GCVS		F110
1123	50	181	48	SVS 109869			M7	DO		7 25	5.00	41 4	GCVS		U49
1124										7 25	1.10	48 1	SAD		F110
1127	10	164	2854	GAH CHI			K3	IRC	3	7 25	4.00	-26 18	AFGL		F110
1129			9							7 25	26.45	9 1	SAD		F110
1131	-20	131					C	H&B		7 26	37.00	-10 15	AFGL		F110
1133	50	182	50	SVS 100875			M7	DO	2	7 27	1.00	-19 21	IRC		F110
1134										7 27	15.89	50 9	SAD		F110
1136	20	181		DO 13079			M6	DO		7 27	58.00	51 53	AFGL		F110
1144	30	166	2891	ALF GEN			A1	HR	5	7 28	13.00	20 39	IRC		U49
1145	-10	169	2902	KQ PUP	SPBI		M2P	HR	2	7 31	24.65	31 59	SAD		F110
1146										7 31	30.07	-14 24	SAD		F110
4073	50	184	2903	DO 31700			M0	HR	7	7 31	59.00	37 9	AFGL		F110
1150	30	190	2905	UPS GEN			M0	IRC	3	7 32	54.14	46 17	SAD		F110
1160	40	183	2935	DO 13215			M0	HR	7	7 32	50.60	27 0	SAD		F110
1161	10	170	2943	ALF CHI			F5	IRC	4	7 36	52.94	38 27	SAD		F110
4076										7 36	41.12	5 21	SAD		F110
1162										7 37	34.00	-8 45	AFGL		F110
1163	20	187		Y GEN	SRB	160.00	M7	DO		7 37	38.00	-21 35	AFGL		U49
1167	10	172	2965	DO 2303			M1	HR		7 38	14.00	20 32	GCVS		F110
1168	10	173	2967	SVS 1107			M3S	HR		7 39	3.64	13 35	SAD		F110
1169	0	161					M8	VOGT		7 39	14.11	14 19	SAD		F110
4083	10	188	3290	21 GNC			M2	HR	7	7 39	21.00	-4 3	IRC		F110
1249	50	191		DO 32264			M5	DO		8 21	11.21	10 47	SAD		F110
1253	0	175	-4				K5	IRC		8 21	54.00	52 26	IRC		F110
1253			2334							8 23	30.48	-4 43	SAD		F110

GL VIS SOURCE I' K 4 11 20 27 D/M/Y 2.3 3.6 4.9 8.7 10.0 11.4 12.6 19.5 23.0 OBSVR

GL	VIS	SOURCE	I'	K	4	11	20	27	D/M/Y	2.3	3.6	4.9	8.7	10.0	11.4	12.6	19.5	23.0	OBSVR
947	11.40	DO	5.63	1.06	.5	-1.4			25/10/75	3.52	1.80	.80	-.62		-1.37		-1.21		GLH
954	12.00	JYCE			1.2				28/12/78	1.44									RDC
958	12.00	DO	6.54	2.13	.9														
959	9.10	DO	6.04	1.45	.8														
962	6.50	IRC	4.91	1.17	.6														
964	7.20	IRC	4.46	1.45	1.1														
967	9.50	DO	5.84	1.64	1.3				17/12/78	1.97	1.69	1.72	1.50	1.08	.71	.22	.08		JAH
970	9.50	DO	5.40	1.69	1.2				17/12/78	1.77	1.53	1.46	.97	.59	.57	.95	-.22		JAH
977	12.60	DO	6.59	1.51	.2														
980	4.43	IRC	3.53	1.89	1.2				17/ 2/78	1.70	.93	.55	-.31	-.84	-1.33	-1.33	-1.62	-1.71	RDC
982	9.50	DO	5.95	1.12	.4				17/12/78	4.77	2.52	.89							JAH
985	4.83	IRC	3.71	1.55	1.0														
986					1.2				17/ 2/78	1.57	1.24	1.34	.79	.80	.60	.63	.71		RDC
991	8.30	IRC	5.16	1.56	.9														
994	5.02	IRC	3.81	1.55	.9														
995					1.1														
1108	7.30	IRC	4.18	1.03	.4				2/11/78	.93	.62	.70	.55	.55	.47	.58			RDC
1110	5.10	SAO			-.2														
1109	10.20	DO	6.18	2.07	1.4														
1112	5.13	IRC	4.01	1.70	1.2														
1113					1.3														
1114	3.80	IRC	3.03	1.46	1.3														
1117			7.55	2.19	1.3				17/ 2/78	1.80	1.49	1.23	.68	.33	.03	-.07	-.52	-.66	RDC
1116			5.35	2.31	1.1				17/12/78	1.75	1.28	.89	.35	-.19	-.24	-.22	-.91	-2.02	JAH
1122			6.26	1.71	1.1				18/ 4/80	1.62	1.18	1.14	.73	.50	.29	.19	-.06	-.14	RDC
1123	6.90	IRC	4.32	1.36	1.0														
1124					1.3														
1127	4.29	IRC	3.07	.86	.5														
1129					1.3														
1131	12.10	LVD	8.78	2.70	.7				2/11/78	2.28	.77	0.00	-.82	-1.00	-1.36	-1.25	-2.30		RDC
1133	8.10	IRC	5.22	2.08	1.3														
1134					1.2														
1136	10.50	DO	6.31	1.77	.9				18/ 4/80	1.88	1.68	1.81	1.43	1.05	.67	.77	.29		RDC
1144	1.99	IRC	1.46		1.1														
1145	4.98	IRC	2.89	.02	-.3				19/10/80	.04	-.19	.12	-.16	-.21	-.32	-.27	-.37		CG
1146					1.3														
4073	5.65	IRC	4.24	1.87	1.3														
1150	4.07	IRC	2.58	.27	.1														
1160	5.67	IRC	4.33	1.81	1.2				17/12/78	1.70	1.60	1.94	1.56	1.56	1.53	1.48	1.18		JFH
1161	-.34	IRC			-.8														
4076					-3.4														
1162					1.3														
1163	9.50	DO	5.12	1.22	.9				17/ 2/78	1.16	.88	.87	.51	.44	.27	.31	-.04		RDC
1167	5.93	IRC	4.04	1.39	1.0														
1168	5.56	IRC	3.46	.68	.8														
1169			5.76	1.82	1.3				2/11/78	1.67	1.28	1.28	.86	.52	.18	.32			RDC
4083	6.16	IRC	4.68	2.13	1.3														
1249	5.70	DO	5.45	1.61	1.2				17/12/78	1.61	1.39	1.68	1.34	1.73	1.04	1.09	1.09		JAH
1253	8.80	IRC	4.91	.83	.2				11/ 4/78	.96	.65	.83	.27	0.00	-.28	-.53	-.69		JAH
1253					.2				2/11/78	.80	.31	.41	-.04	-.21	-.56	-.52	-1.95		RDC

GL	IRC	HR	BD	OTHER	TYPE	PERIOD	SP	SOURCE	LUM	R.A.	DEC.	SOURCE	COMMENT	CLASS
							TYPE			1950.00				
1254										8 23 43.00	3 53 0.0	AFGL	C	W49
1255	10 189	3319	13 1912	DP CHC	H	203.50	M3	HR	7	8 23 58.08	12 49 15.7	SAO		FHO
1256	60 187	3323	61 1054	OHI UHA			C5	IRC	3	8 26 7.63	60 53 14.6	SAO		FHO
1262	20 200	3357	18 1963	THE CHC			M1	HR	3	8 28 44.80	18 15 53.3	SAO		FHO
1265	70 85		67 550	DO 32354			M8	DO		8 29 48.27	67 21 37.5	SAO		FHO
1271	-20 171			W PYX	SRA	166.00	M7	H&B		8 34 40.00	-17 48 36.0	GCVS		FHO
1274										8 35 44.60	-10 13 41.0	LKVR		FHO
1274														
1276	0 176	3418	3 2026	SIG HYA	SRC	116.00	K2	IRC	3	8 36 8.67	3 31 5.5	SAO		FHO
1278														
1280	-10 199		8 2612	RV HYA			M5	GCVS	2	8 36 23.00	-3 59 12.0	AFGL	C	W49
1348	10 205		8 2215	DO 2756			M5	DO		8 37 18.54	-9 24 32.9	SAO		FHO
1351	30 211	3731	26 1939	SVS 6712			K2	IRC	3	9 20 49.96	7 55 45.7	SAO		FHO
1353	-10 217	3746	-8 2680	ALF HYA			K4	IRC	3	9 21 44.78	26 23 55.3	SAO		FHO
1354	40 205		36 1963	RS LHI	LB		M7	DO		9 25 29.78	-8 26 27.5	SAO		FHO
1357	40 207	3769	35 2015	8 LKI			M1	IRC	7	9 28 30.18	35 19 31.3	SAO		FHO
1358	20 211	3773	23 2107	LAM LEO			K5	IRC	3	9 28 52.25	23 11 22.2	SAO		FHO
1363		3751	81 302	DO 32868			K3	HR	3	9 30 7.39	81 33 .3	SAO		FHO
1366	30 213	3820	31 2011	GC 13265			M2	IRC	7	9 33 45.14	31 23 13.1	SAO		W49
1369	0 190	3845	-0 2231	IOT HYA			K3	IRC	3	9 37 18.15	-0 54 53.8	SAO		FHO
1371	30 214	3850	31 2026	GC 13369			K6	IRC	7	9 38 37.98	31 30 22.2	SAO		FHO
1416	-20 210	4094	-16 3052	HUU HYA			K4	IRC	3	10 23 40.21	-16 34 49.6	SAO		FHO
1419	10 231	4127	14 2255	46 LEO			M2	HR	7	10 29 31.73	14 23 40.1	SAO		FHO
1423	70 95		70 618	SVS 6789	L		M6	DO		10 30 41.00	70 1 24.0	SVS		FHO
1423														
1428	-10 243			FF HYA	SR	20.00	M6	H&B		10 35 26.00	-11 45 54.0	GCVS		FHO
1431	70 98	4181	69 586	GC 14713			K3	IRC	3	10 39 31.06	69 20 18.4	SAO		FHO
1431														
1463	-10 254	4402	-10 3260	EPS CRT			K5	IRC	3	11 22 4.91	-10 35 5.4	SAO		W49
1463														
1466														
1488	20 229			AF LEO	SRB	107.00	M5	GCVS		11 23 2.00	-12 14 6.0	AFGL		FHO
1489	50 211		45 1924	ST UHA	SRB	81.00	M7	DO		11 25 19.00	15 25 48.0	GCVS		FHO
1492	0 206	4432	-2 3360	HFE 56			K4	IRC	3	11 25 6.89	45 27 37.7	SAO		FHO
1494	70 107	4434	70 665	LAIH DRA			M0	HR	3	11 27 45.52	-2 43 38.7	SAO		FHO
1495	-10 256		-11 3114	RR CRT	SRB		M5	IRC	3	11 28 27.55	69 36 26.1	SAO		FHO
1497	-30 177	4449	-30 9303	GC 15844			M0	HR	3	11 29 9.36	-12 6 19.9	SAO		FHO
1502	10 243	4483	8 2532	OHE VIR			M6	HR	3	11 30 25.42	-30 48 39.6	SAO		FHO
1502										11 35 52.90	8 24 40.4	SAO		W49
1503	-20 230	4491	-15 3323	GC 16006			M2	IRC	7	11 37 18.50	-16 20 34.7	SAO		FHO
1547	-10 268		-11 3291	GC 16886			M0	IRC	7	12 20 43.89	-11 32 5.8	SAO		FHO
1549	0 217			SS VIR	H	354.66	N	DO		12 22 43.00	1 2 30.0	GCVS		FHO
1550	60 217	4726	57 1373	71 UHA			M3	HR	7	12 22 40.21	57 3 16.9	SAO		FHO
1551	30 232	4737	29 2288	GAH COU			K1	IRC	3	12 24 26.87	28 32 46.1	SAO		FHO
1552	60 218	4745	56 1556	73 UHA			M2	HR	7	12 25 12.80	55 59 21.7	SAO		FHO
1555	70 113	4765	70 700	CQ DRA			M4	DO	7	12 27 55.84	69 28 40.8	SAO		FHO
1556	-20 240	4786	-22 3401	BET CRV			G5	IRC	3	12 31 45.34	-23 7 13.6	SAO		W49
1556														
1564	30 241			DO 14615			M5	DO		12 34 26.00	27 19 54.0	IRC		FHO

GL	VIS	SOURCE	I'	K	h	11	20	27	D/M/Y	2.3	3.6	4.9	8.7	10.0	11.4	12.6	19.5	23.0	OBSVR	
1254																				
1255	5.50	IRC	3.43	.66	1.2															JAH
4085	3.36	IRC	2.81	1.43	1.0															JAH
1262	5.32	IRC	3.84	1.42	1.2															JAH
1265	9.00	IRC	5.20	1.74	1.3															JAH
1271			5.33	1.65	.9															JAH
1274					1.2	-1.4			17/12/78	1.69	1.48									JAH
1274									27/ 3/78	3.31	2.35	1.91	.71	-.01	-.50	-.41	-1.07	-1.50		JAH
1274									12/ 6/78	3.60	1.96	.94	-.43	-.92	-1.48	-1.39	-3.09	-3.39		RDC
1274									17/ 4/80	4.03	2.43	1.57	.05	-.24	-1.25	-.28	-.43			RDC
1276	4.44	IRC	3.56	1.80	1.2				21/12/77	.49	.28	.35	-.13	-.58	-1.04	-1.00	-1.20			G&H
1278					1.3															
1260	7.70	IRC	4.01	.54	.2															
1308	7.25	IRC	4.70	1.65	1.1															
1351	4.46	IRC	3.50	1.61	1.2															
1353	1.99	IRC		-1.36	-1.5	-1.2			8/ 3/78	-1.08	-1.21	-1.00	-1.23	-1.32	-1.18	-1.45	-1.19			JAH
1354	6.00	IRC	5.18	1.49	.9				21/12/77	1.44	1.18	1.24	.74	.83	.34	.34				G&H
1357	5.37	IRC	4.02	1.53	1.0															
1358	4.31	IRC	2.87	.66	.2	-.5														
1363	4.44	HR			.7	-.8														
1366	5.50	IRC	4.02	1.50	1.2	-.6			18/ 4/80	1.52	1.36	1.53	1.33	1.30	1.27	1.38	1.49			RDC
1369	3.89	IRC	2.83	.91	.7	-.9			8/ 3/78	1.06	.96	1.03	.96	.93	.85					JAH
1371	5.91	IRC	4.44	1.88	1.3															
1416	3.62	IRC	2.45	.40	1.1	-.3														
1419	5.54	IRC	3.71	1.04	.6															
1423	10.00	DO	5.73	1.48	.9	-1.1	-3.3													
1423									7/ 3/78	1.44	1.09	1.06	.70	.37	.12	-.03	-.57			JAH
1428									5/ 4/78	1.53	1.16	1.12	.56	.42	.03	-.02	-.25			RDC
1431	5.00	IRC	4.43	.69	0.0	-1.0			21/12/77	1.07	.80	.80	.24	.07	-.52	-.62	-.77			G&H
1431			3.87	1.71	1.3	-1.2			27/ 3/78	1.68	1.53	1.69	1.50	1.61	1.34	1.45				JAH
1453	4.80	IRC	3.28	.98	.6				5/ 4/78	1.74	1.59	1.77	1.68	1.65	1.52	1.50	1.41			REC
1463									19/ 5/79	1.11	.90	1.19	1.10	.91	.88	1.00	.73			JAH
1486									18/ 4/80	.92	.77	1.02	.84	.79	.70	.79	.61			RDC
1488	9.30	DO	5.33	1.36	-.8															
1489	6.50	IRC	3.88	.58	.1	-.5			28/12/77	1.38	1.11	1.17	.62	.13	-.33	-.27	-.93	-1.07		G&H
1494	4.77	IRC	3.42	1.17	1.0				20/12/77	.55	.20	.19	-.04	-.26	-.47	-.74	-.95	-.92		G&H
1494	3.80	IRC		-.20	-.2															
1495	9.30	IRC	5.55	1.69	.9	-.9			27/ 3/78	1.63	1.33	1.21	1.02	.75	.52	.32	.36			JAH
1497	5.03	IRC	3.40	1.14	.9				19/ 5/79	-.11	-.18	-.11	-.12	-.44	-.44	-.43	-.45			JAH
1502	5.37	IRC	2.75	-.27	-.2				26/ 5/79	-.18	-.30	.04	.36		-.04					CC
1502																				
1503	6.46	IRC	4.09	1.28	1.0															
1547	6.66	IRC	4.39	1.60	1.2				8/ 3/78	.37	-.01	-.24	-.86	-1.06	-1.28	-1.23	-1.10			JAH
1549	9.10	DO	4.30	.73	-.1	-.9														
1550	5.81	IRC	3.89	1.24	1.1															
1551	4.37	IRC	3.53	1.91	1.3															
1552	5.61	IRC	4.08	1.59	1.3															
1555	4.95	IRC	2.99	.37	.1				19/ 5/79	.91	.86	.92	.79	.68	.81	.64				JAH
1556	2.66	IRC		.67	.5				18/ 4/80	.68	.61	.61	.61	.55	.50	.55	.55			RDC
1555																				
1564	9.30	DO	5.46	.88	.5	-1.0														

GL	VIS	SOURCE	I	K	4	11	20	27	D/M/Y	2.3	3.6	4.9	8.7	10.0	11.4	12.6	19.5	23.0	OBSVR	
1565			7.79	2.31	1.2	-0.8			26/ 3/78	3.28	1.84	1.40	.61	.44	.04	-.07	.16		JAH	
1566	5.71	IRC	3.65	.97	.6	-1.2			29/12/77	2.54	2.01	1.69	1.07	.86	.63	.60	.35		G&H	
1567	6.20	IRC	5.77	2.24	1.2				18/ 4/80	2.01	1.49	1.25	.91	.59	.57	.21			RDC	
1568			4.08	1.02	.7				18/ 4/80	2.04			.92	.63					RDC	
1618	6.92	IRC	4.08	1.02	.7				19/ 5/79	.38	.27	.39	.44	.34	.21	.24	-.78		JAH	
1622	.96	IRC		1.62	1.3				26/ 5/79	.52	.33	.72	.30	.32					GG	
1624			2.80	.33	-.1				8/ 3/78	.03	-.29	-.73	-1.20	-1.40	-1.55	-1.63	-2.11	-2.17	JAH	
1631	4.68	IRC							12/ 6/78	.41	.22	.42	.26	.19	.07	.10	-.19		RDC	
1633	6.00	IRC	5.70	.57	-.2	-1.1	-3.2		12/ 6/78	.63	.52	.79	.66	.58	.65	.68	1.05		RDC	
1637	6.52	IRC	4.98	2.50	1.3				17/ 2/78	1.30	.52	.15	-.63	-.89	-1.24	-1.30	-1.91	-2.17	RDC	
1642	4.73	IRC	2.87	.42	.3				4/ 6/77	1.86	1.67	1.90	1.05	1.63	1.62	1.49			BTA	
1643	5.16	IRC	3.21	.64	.6	-1.3			19/ 5/79	.83	.76	.91	.83	.99	.64	.79			JAH	
1710	5.74	IRC	6.44	1.48	.4				17/ 4/80	.96	.85	1.05	.89	.89	.89	1.07	.97		RDC	
1711			4.18	1.94	1.3				4/ 6/77	.04	-.37	-.42	-.42	-.68	-1.19	-1.55	-1.65	-2.37	BTA	
1713			3.07	.97	.7				20/12/77	.37	.03	.29	.03	-.42	-.82	-.70	-1.11		G&H	
1714	4.25	IRC							17/ 4/80	.15	-.15	-.02	-.49	-.95	-1.41	-1.34	-2.17		G&H	
1716	3.57	IRC		.61	.4	-1.2			17/ 4/80	1.05	1.01	1.19	1.04	.96	.91	.87	.69		RDC	
1719	8.30	IRC	3.91	-.19	-.4				17/ 2/78	2.66	1.34	.66	-.74	-1.12	-1.61	-1.59	-2.27	-2.51	RDC	
1720	8.00	IRC	4.24	.33	0.0				17/ 4/80	.28	.22	.31	.20	.26	-.06	-.02	.41		RDC	
1721	8.70	IRC	4.14	.14	-.1	-1.3	-3.1		26/ 3/78	1.82	1.23	.91	.49	.17	-.22	-.61			JAH	
1722	5.17	IRC	3.60	1.07	.9	-1.2			18/ 4/80	-.53	-.74	-.50	-.78	-.85	-.98	-1.00	-1.01		RDC	
1723	13.60	LWD	8.02	1.94	.6	-1.4	-2.6		12/ 6/78	.81	.67	.81	.72	.72	.52	.51	.74		RDC	
1726	7.12	IRC	3.74	.37	.2				18/ 4/80	1.96	1.76	2.10	1.88	1.84	1.62	1.73			RDC	
1727			6.11	1.75	1.2				18/ 4/80	.88	.72	1.00	.85	.80	.70	.63			RDC	
1757	3.60	IRC	2.48	.50	.1				26/ 5/79										GG	
1790	7.12	IRC	3.30	-.39	-.9				19/ 4/78	2.87	1.90	1.35	-.01	-.58	-1.15	-.84	-1.92	-1.94	FDG	
1792	4.72	IRC	3.22	.81	.7				20/ 4/80	2.44	1.49	.88	-.34	-1.12	-1.61	-1.24	-2.10	-2.13	GG	
1831	7.50	IRC	5.19	1.95	1.2				4/ 4/78	.17	-.21	-.33	-.68	-.93	-1.84	-1.45	-1.73		RDC	
1853	5.32	IRC	3.46	.85	1.0				26/ 5/79	1.81	1.42	1.64	1.26	.70					GG	
1854	8.40	IRC	5.09	.84	.6				19/ 4/78										FDG	
4223	2.74	IRC		.62	.4				20/ 4/78										GG	
1859	6.90	IRC	6.49	1.71	.9	-1.4	-2.9		4/ 4/78										RDC	
1862			9.44	3.10	.9															RDC
1868	5.70	DO	4.77	.20	-.4	-1.4														RDC
1869			5.93	1.65	.6	-1.1	-3.0													RDC
1872	6.80	IRC	4.59	1.45	1.1	-.7														RDC
1873	7.30	IRC	4.41	1.19	.7															RDC
1874	6.75	IRC	4.84	1.91	1.1	-.7														RDC
1875			6.82	1.58	1.1															RDC
1876			6.09	1.19	1.0	-.8														RDC
1879	4.90	IRC	2.98	.29	.3															RDC
1860			6.34	1.29	.8															RDC
1863	8.60	IRC	4.70	.92	.4															RDC
1961	9.00	CASE	6.37	1.83	1.1	-1.3														RDC
1964			6.51	1.59	1.3															RDC
1965			8.59	2.75	1.2															RDC

GL	IRC	HR	BD	OTHER	TYPE	PERIOD	SP TYPE	SOURCE	LUH	R.A.	DEC.	SOURCE	COMMENT	CLASS
										1950.00				
1565	-20 242			T CRV	M	401.34	H6	H&B		12 34 32.00	-17 15 18.0	GCVS		FHO
1566	0 221 4807	2	2560	SVS	M		M3	HR	7	12 35 49.30	2 7 46.5	SAO		FHO
1567	10 256 4808	7	2561	R VIR	M	145.64	M4E	HR	7	12 35 57.67	7 15 47.0	SAO		FHO
1571														
1577														
1618	50 227		47 2053	DO 34360			M6	DO		13 20 57.03	47 15 44.3	SAO		FHO
1622	-10 286 5056	-10	3672	ALF VIR	ELL	4.0141600	D1	IRC	5	13 22 33.30	-10 54 3.4	SAO		FHO
1624										13 25 31.00	40 7 36.0	AFGL		FHO
1631	-10 288 5095	-5	3714	74 VIR			M3	IRC	7	13 29 21.72	-5 59 53.7	SAO		W49
1633	-10 290 5101	-6	3837	S VIR	M	377.43	H7E	HR	7	13 30 23.51	-6 56 18.8	SAO		FHO
1637	50 231 5131	77	516	GC 18390			K5	IRC		13 34 2.27	76 48 5.9	SAO		FHO
1642	50 231 5154	55	1625	83 UHA			H2	HR	3	13 38 50.56	54 56 3.0	SAO	C	FHO
1643	-10 293 5150	-7	3674	82 VIR			H2	IRC	3	13 38 59.05	-8 27 5.1	SAO		FHO
1710	0 243			RS VIR	M	352.80	H6E	GCVS		14 24 48.00	4 53 48.0	GCVS		FHO
1711	-10 306 5410	-6	4009	106 VIR			K5	IRC	7	14 26 3.24	-6 40 37.2	SAO		FHO
1713										14 26 33.00	38 9 36.0	AFGL		FHO
1714	80 28 5430	76	527	5 UHI			K4	IRC	3	14 27 36.19	75 55 5.8	SAO		W49
1714														
1716	30 259 5429	31	2628	RHO BOO			K3	IRC	3	14 29 40.45	30 35 24.1	SAO		FHO
1719	30 261	33	2482	RV BOO	SRB	137.00	H6	DO		14 37 9.31	32 45 15.3	SAO		FHO
1720	30 262	32	2504	RW BOO	SRB	209.00	H7	DO		14 39 6.20	31 47 6.6	SAO		FHO
1769	0 265	-1	3054	DO 3724			H7	DO		15 22 19.36	-2 3 34.5	SAO		FHO
1772	20 280 5739	15	2658	TAU1 SER	M	425.10	H1	IRC	3	15 23 28.12	15 36 9.7	SAO		FHO
1773	20 281			UX SER			H8	LVD	7	15 25 34.00	19 44 6.0	GCVS	C	FHO
1776	-20 288	-23	12359	GC 20870			H3	IRC		15 29 17.81	-23 42 40.9	SAO		FHO
1777	0 268			WH SER	M	366.60	H8	H&B		15 29 57.00	3 48 18.0	GCVS		W49
1787	-30 239 5794	-27	10464	UPS LIB			K5	IRC	3	15 33 58.97	-27 58 15.4	SAO		FHO
1790	20 283	24	2901	DO 15290			H2	DO		15 36 7.74	24 41 4.3	SAO		FHO
1792	-20 292 5838	-19	4188	KAP LIB			K5	IRC	3	15 39 3.64	-19 31 5.6	SAO		FHO
1851	-10 338	-6	4419				H8	IRC		16 20 18.07	-7 5 35.7	SAO		FHO
1853	30 288 6107	34	2773	HU1 CRB			H2	IRC	7	16 20 28.37	33 54 56.3	SAO		FHO
1854	-20 315	-22	11524				H3	IRC		16 20 53.45	-22 15 12.8	SAO		FHO
1859	60 242 6132	61	1591	ETA DRA			G8	IRC	3	16 23 18.46	61 37 37.6	AGK3		W49
1859	-10 339	-12	4510	V OPH	M	297.99	C6E	GCVS		16 23 56.58	-12 18 54.7	SAO		FHO
1862	30 292						H9	VOGT		16 25 59.00	34 54 36.0	IRC	C	FHO
1852														
1662	70 135			R UHI	SRA	324.40	H7	DO		16 30 40.00	72 22 48.0	GCVS	C	FHO
1869	-20 319			T OPH	M	366.69	H6E	GCVS		16 30 54.00	-16 1 48.0	GCVS		FHO
1872	60 243	60	1688	TX DRA	SRB	78.00	H7	DO		16 34 17.45	60 34 9.7	SAO		FHO
1873	20 303	22	2958	DO 15566			H6	DO		16 35 29.74	22 32 38.3	SAO		FHO
1874	-10 344	-8	4262	GC 22375			K5	IRC		16 36 4.57	-8 31 13.1	SAO		W49
1875	-20 321						M6	H&B		16 36 16.00	-21 46 24.0	IRC		FHO
1876	-20 322						H6	H&B		16 36 43.00	-20 46 54.0	IRC		FHO
1879	50 253 6200	49	2531	42 HER			H2	HR	7	16 37 23.25	49 1 31.3	SAO		FHO
1880	-20 324						H7	H&B		16 38 19.00	-19 52 6.0	IRC		FHO
1883	-30 269	-26	11477	AX SCO	SR	138.00	H5	IRC		16 38 43.89	-27 0 37.0	SAO		FHO
1961	-30 293	-29	13477				C	H&B		17 20 50.00	-29 16 54.0	IRC		FHO
1964	-30 294						H6	H&B		17 22 27.00	-26 48 24.0	IRC		FHO
1965	0 303			AH OPH	M	353.20	H7	H&B		17 23 0.00	-3 1 42.0	GCVS		W49

GL	IRC	HR	BD	OTHER	TYPE	PERIOD	SP	SOURCE	LUH	R.A.	DEC.	SOURCE	COMMENT	CLASS
							TYPE			1950.00				
1966	70 139		841	DO 35751			H6	DO	7	17 24	3.36	71 54 48.4	SAD	FHO
1967	20 323	6495	17 3241	V640 HER			H4	HR	2	17 23	40.75	16 57 35.3	SAD	FHO
1969	0 304	6496	4 3422	SIG OPH			K3	IRC		17 24	1.90	4 10 56.1	SAD	FHO
1971	-20 364			TW OPH	SRC	185.00	>H7	GCVS		17 26	48.00	-19 26 12.0	GCVS	FHO
1974	-30 301						H&B	H&B	3	17 27	19.00	-26 43 6.0	IRC	FHO
1976	30 307	6526	26 3034	LAN HER			K4	IRC		17 28	42.95	26 8 49.5	SAD	FHO
1983	0 307			DO 4308			H7	H&B		17 31	23.00	-1 57 0.0	IRC	FHO
1985	-20 370						H7	H&B		17 31	47.00	-23 41 54.0	IRC	W49
1987	50 267			SY DRA	M	390.50	H7E	GCVS		17 33	7.00	53 59 54.0	GCVS	FHO
1993	60 251			TY DRA	LB		H8	DO		17 36	13.00	57 45 42.0	GCVS	FHO
1995	0 313	6578	-2 4425	DO 4452			H4	HR	7	17 37	35.66	-2 7 36.2	SAD	FHO
1996	-20 378						H8	H&B		17 38	56.00	-20 46 6.0	IRC	FHO
1998	0 315	-4	4332	GC 24016			H0	IRC		17 39	55.71	-4 49 36.2	SAD	FHO
2137	20 362	6882	23 3316	GC 25082			H1	DO	7	18 20	3.48	23 15 30.5	SAD	FHO
2138	50 279	6891	49 2782	DO 36186			H2	HR	7	18 20	15.81	49 5 44.0	SAD	FHO
2142	0 349			SVS 4075			H9	VOGT		18 21	22.00	3 35 30.0	SVS	W49
2146	40 315			TV LYR	M	376.63	K2	IRC	2	18 22	18.00	39 33 0.0	GCVS	FHO
2149	-20 478	6896	-20 5134	21 SGR						18 23	22.29	-20 34 12.9	SAD	FHO
2150										18 23	2.20	5 44 16.0	KLKH	FHO
2156	0 350		3 3713	V988 OPH	SR	63.20	H7	DO		18 24	23.52	3 52 57.0	SAD	FHO
2158	0 351			DO 4822			C	H&B		18 24	26.00	1 7 6.0	IRC	FHO
2159	10 357			V585 OPH	SRB	135.00	H6	DO	3	18 24	45.00	7 29 24.0	GCVS	FHO
2163	-30 386	6913	-25 13149	LAN SGR			K2	IRC		18 24	53.06	-25 27 4.2	SAD	FHO
2164	-10 424		-8 4612				H4	H&B		18 25	1.00	-8 42 24.0	IRC	W49
2166	-10 425						H5	H&B		18 25	17.00	-13 5 0.0	IRC	FHO
2167	-20 467						H8	H&B		18 26	7.00	-17 49 6.0	IRC	FHO
2168	-10 426									18 27	44.00	-1 24 12.0	AFGL	FHO
2173										18 28	56.50	-10 1 24.0	JYCE	FHO
2179				TY OPH	LB		C	H&B		18 28	55.00	4 20 30.0	GCVS	FHO
2180	0 353			KP LYR	SRB	146.00	H8	DO		18 29	11.02	38 36 13.8	SAD	FHO
2181	40 320		38 3200	GC 25310			C	H&B	6	18 29	51.90	-14 54 12.5	SAD	W49
2182	-10 433	6959	-14 5099	HD 17109A			H3	LUD	7	18 30	32.58	-14 8 46.5	SAD	FHO
2186	-10 435		-14 5105	T LYR	LB		H	DO		18 30	36.19	36 57 38.9	SAD	FHO
2187	40 321		36 3168							18 31	23.00	14 12 6.0	AFGL	FHO
2189										18 31	29.00	-11 31 47.0	LKVR	FHO
2192														
2192														
2196	-20 497		5077	ALF SCT			H3	IRC		18 32	26.62	-19 18 33.7	SAD	FHO
2197	-10 438	6973	-8 4638				K3	IRC	3	18 32	29.11	-8 16 50.5	SAD	FHO
2198	50 282		51 2404				H5	DO		18 33	21.11	51 44 29.3	SAD	FHO
2201	-20 500						H5	H&B		18 33	47.00	-19 56 24.0	IRC	W49
2203	-10 441		-7 4633	RX SCT	LB		C	H&B		18 34	22.00	-7 39 54.0	GCVS	FHO
2204	0 359		-2 4676	CZ SER	LB		H6	H&B		18 34	45.00	-2 42 0.0	GCVS	FHO
2208	40 322	7001	38 3238	ALF LYR			A0	IRC	5	18 35	14.66	38 44 9.7	SAD	FHO
2215	-20 505		-15 5043	GC 25494	I	334.39	K5	IRC		18 36	11.04	-15 5 4.2	SAD	FHO
2217	40 323	7009	39 3476	XY LYR	LC		H4	HR	6	18 36	27.28	39 37 22.8	SAD	FHO
2218	20 365		18 3763	DO 16917			H6	DO		18 37	31.72	18 22 33.6	SAD	FHO
2219	10 367		11 3548				H5	DO		18 37	17.62	11 48 52.6	SAD	FHO
2224										18 37	53.00	-25 46 46.0	AFGL	FHO

GL	VIS	SOURCE	I	K	4	11	20	27	D/M/Y	2.3	3.6	4.9	8.7	10.0	11.4	12.6	19.0	23.0	OBSVR	
1968	7.05	IRC	4.31	.90																
1967	6.12	IRC	3.61	.49	.2															
1969	4.34	IRC	3.10	1.00	.7				11/ 8/80	.58	-.07	.76	-.59	-.70	-.79	-.59	-1.00		GG	
1971			4.69	.26	-.3															
1974			8.01	1.54	1.2															
1976	4.41	IRC	3.19	1.10	1.1															
1953	12.00	DO	6.31	1.74	1.1															
1935			6.68	1.58	.9				26/ 5/79	1.76	1.36	1.60	.92	.12					CC	
1967	9.80	DO	7.05	2.48	1.1															
1993			5.00	.91	.5															
1995	6.44	IRC	4.15	1.23	.7				4/ 8/78	.85	.48	.75	.24	-.57	-1.11	-.77			RDC	
1936			7.97	3.00	.9															
193E	6.79	IRC	4.41	1.28	1.1															
2137	10.80	DO	3.85	1.37	.9															
2138	5.05	IRC	3.23	.62	.4															
2142			8.25	2.35	.9				26/ 5/79	2.87	2.78	2.99	2.93						GG	
2146			5.36	1.68	1.1				4/ 8/78	1.79	1.06	.90	.44	-.01	-.26	-.51			RDC	
2149	4.81	IRC	3.56	1.28	1.1															
2150					.9															
2156	8.20	IRC	4.35	.66	.4															
2158	12.50	DO	8.26	2.25	1.1				24/ 5/80	2.33	1.60	2.05	.81	.71	.45	.45			GG	
2159	10.90	DO	5.83	1.42	.9															
2163	2.84	IRC		.47	.5															
2164			6.65	2.10	1.1				20/ 4/80	2.12	1.84	2.07	1.93	1.72					GG	
2166			7.17	2.04	1.2															
2167			6.13	1.35	.6															
2168			0.94	2.73	1.2															
2173					1.3															
2179					1.0															
2180			6.47	1.80	1.0															
2181	8.60	IRC	5.76	2.07	1.2				17/ 8/78	2.21	1.87	2.03	1.92	1.66	1.48	1.39			FDC	
2182	5.88	IRC	3.69	1.02	.9				20/ 4/80	1.10	.86	1.13	.77	.72	.84				CC	
2186	9.00	IRC	5.20	1.72	1.1															
2187	7.80	IRC	4.89	.45	-.5															
2187					.4															
2192					1.3				23/ 6/78	3.64	2.02	1.28	-.30	-.80	-1.20	-1.18			FDC	
2192									30/ 8/79	2.65	1.47	.88		-1.18					RDC	
2192									16/ 4/80	3.72	1.89	1.04	-.43	-.91	-1.38	-1.35	-2.01		RDC	
2196	7.19	IRC	3.93	.72	.7															
2197	3.84	IRC	2.73	.87	.8															
2198	6.71	IRC	4.48	1.49	1.1				11/ 8/80	1.66	1.39	1.65	1.46	1.45	1.32	1.17	1.20		GG	
2201			5.86	1.89	1.3				21/ 5/80	1.84	1.68	1.77	1.53	1.65	1.29	1.42	1.17		RDC	
2203			6.22	1.74	1.0				11/ 8/80	1.86	1.29	1.56	.92	.81	.73	.55	.40		CC	
2204	10.10	DO	5.73	1.04	.4															
2206	.04	IRC			.4															
2215	7.75	IRC	5.11	1.93	1.2															
2217	5.80	IRC	2.95	.35	-.6															
2218	9.00	IRC	5.71	2.00	1.1															
2219	10.40	DO	5.88	1.72	.9															
2224					1.2															

GL	IRC	HR	BD	OTHER	TYPE	PERIOD	SP	SOURCE	LUM	R.A.	DEC.	SOURCE	COMMENT	CLASS
							TYPE			1950.00				
2225	40	324	40	3449	DO	16943	H6	DO		18 38 21.65	40 17 2-3	SAO		W49
2230	0	364					H7	LWD	7	18 39 32.00	-2 48 0-0	IRC	C	FHO
2382	-10	511	-13	5345			H3	IRC		19 22 19.34	-13 32 17-8	SAO		FHO
2384	80	36	76	734	UX	DRA	N	DO		19 23 22.41	76 27 41-7	SAO		FHO
2391	-20	563					H8	H&B		19 24 49-00	-17 22 24-0	IRC		FHO
2392							C2	CK2		19 24 49-00	6 57 36-0	LKRL		FHO
2395	20	407	24	3759	ALF	VUL	MO	IRC	3	19 26 37.41	24 33 44-9	SAO		FHO
2396	50	295			AV	CYG	H	DO		19 27 17-00	45 56 0-0	GCYS		FHO
2400	0	438			V374	AQL	H	DO		19 27 40-00	-0 56 12-0	GCYS		W49
2404	50	296			DO	37347	N	DO		19 28 35-00	48 53 48-0	IRC		FHO
2406	30	370	27	3410	BET	CYG	N	IRC	2	19 28 42-22	27 51 12-4	SAO		FHO
2407	50	297	45	2913	AF	CYG	H8	DO		19 28 42-96	46 2 31-7	SAO		FHO
2412	0	443	4	4152	V1293	AQL	H7	DO		19 30 39-37	4 55 14-6	SAO		FHO
2415	10	428	5	4190	V450	AQL	H7	DO		19 31 18-04	5 21 23-9	SAO		FHO
2416	-20	568	-16	5360	AO	SGR	C5	GCYS		19 31 27-10	-16 29 2-2	SAO		FHO
2418	50	300	48	2914	DO	37447	MA	HR	7	19 32 18-94	49 9 9-8	SAO		FHO
2420	50	376	33	3507	GC	27069	M4	IRC		19 33 3-16	33 41 4-0	SAO		W49
2422	50	301	49	3064	R	CYG	SS	GCYS		19 35 28-69	50 5 11-5	SAO		FHO
2424	70	159	69	1058	DO	37579	H5	DO		19 35 35-91	69 41 33-6	SAO		FHO
2423	10	433			RT	AQL	H6	DO		19 35 40-00	11 36 18-0	GCYS		FHO
2426	30	379			DO	CYG	H7	DO		19 37 0-00	28 23 30-0	GCYS	C	FHO
2428							C3	CK1		19 38 7-60	33 15 27-0	JYCE		FHO
2428														
2428														
2428														
2429	40	355			V462	CYG	M6	DO		19 38 27-00	43 46 36-0	GCYS		FHO
2430	C	448	-4	4880	DO	6039	R	DO		19 36 29-56	-4 2 11-5	SAO		FHO
2432	30	382	32	3522	IT	CYG	G8	IRC	2	19 39 1-90	32 30 2-2	SAO		W49
2434	20	427	17	4048	BET	SGE	H2	HR	7	19 38 48-13	17 21 32-0	SAO		FHO
2435	40	356	42	3419	DO	37608	H6	H&B		19 39 3-89	42 57 36-9	SAO		FHO
2568	0	874			V865	AQL	H6	H&B		20 21 22-00	0 46 54-0	GCYS		FHO
2570	60	288					H9	VOGT		20 21 31-00	62 43 48-0	IRC		FHO
2571	30	430	31	4062		39	K3	IRC	3	20 21 51-68	32 1 39-9	SAO		FHO
2574										20 24 1-00	-2 12 42-0	AFGL		FHO
2577	-10	539	-6	5487			H8	IRC		20 25 6-95	-5 49 12-7	SAO		W49
2580	40	418			V441	CYG	H5	DO		20 25 14-00	36 23 6-0	GCYS		FHO
2581	80	40	74	661	UU	DRA	H7	DO		20 24 53-88	75 5 22-1	SAO		FHO
2582	60	291			V372	CYG	H6	DO		20 25 25-00	55 34 0-0	GCYS		FHO
2583	40	420			KZ	CYG	H3	DO		20 25 36-00	40 54 12-0	GCYS		FHO
2585	40	422	37	3946	SYS	102001	H7	DO		20 26 36-06	37 37 21-0	SAO		FHO
2586	20	470	15	4172	RS	DEL	H8	DO		20 26 51-23	16 6 21-7	SAO		FHO
2589	10	470	9	4549	CT	DEL	H7	DO		20 27 1-82	9 43 49-0	SAO		FHO
2592	0	477	-5	5288	TZ	AQL	H6	IRC		20 27 40-20	-4 55 22-7	SAO		W49
2597	30	437	32	3850	AD	CYG	HP	IRC		20 29 36-43	32 23 40-3	SAO		FHO
2598	50	331	48	3154	OH2	CYG	H2	HR	7	20 29 46-15	49 3 3-0	SAO		FHO
2601	40	429			V397	CYG	H2	DO		20 30 16-00	35 16 54-0	GCYS		FHO
2604							H2	DO		20 31 9-00	42 22 24-0	LKRL		FHO
2606	50	333			DO	38576	H3	DO		20 31 46-05	54 17 6-6	SAO		FHO
2607	40	432			CIT	10				20 31 50-00	38 30 0-0	IRC		FHO

GL	VIS	SOURCE	I'	K	4	11	20	27	D/M/Y	2.3	3.6	4.9	8.7	10.0	11.4	12.6	19.5	23.0	OBSVR	
2225	6.40	IRC	5.16	1.56	1.2	--9			18/ 4/80	1.62	1.43	1.57	1.35	1.29	1.19	1.27	.99	1.21	RDC	
2230	13.30	LMD	8.57	2.16	1.2															
2382	7.60	IRC	5.12	1.84	1.3	--6														
2384	5.80	IRC	3.85	.18	--1															
2391			6.00	.87	.3	-1.3														
2392	15.20	CK1			.8	-1.1														
2395	4.41	IRC	2.89	.57	.2	.1														
2396	8.10	DO	6.19	2.02	1.1	--6														
2400	11.10	DO	8.90	2.67	.5	-1.3			26/ 5/79	2.52	1.40	1.08	.22		--.42					GG
2404	11.10	DO	6.53	1.73	1.2															
2406	3.99	IRC		.11	--1	--9														
2407	6.40	IRC	3.63	.29	--2	-1.0														
2412	6.82	IRC	3.97	.78	.5		-2.8													
2415	6.73	IRC	3.24	.14	--3															
2416	8.50	IRC	4.74	.78	.1	-1.1														
2418	6.06	IRC	3.63	.65	.4															
2420	6.73	IRC	4.60	1.50	1.3				26/ 5/79	1.51	1.35	1.70	1.45		1.51					GG
2422	5.60	IRC	4.64	1.90	.8	-1.1	-2.9													
2424	7.10	IRC	4.10	.82	.4	-1.4	-3.7													
2423			6.54	1.40	.3	--9														
2426	11.20	DO	5.97	1.08	1.1	-1.0														
2428	15.40	CK1																		
2428																				
2426																				
2428																				
2428																				
2429			6.14	1.71	1.2															
2430	6.00	IRC	4.67	.90	.8															
2432	8.00	IRC	5.52	1.93	1.0	--5			26/ 5/79	1.78	1.22	1.48	.91		1.18					GG
2434	4.37	IRC	3.63	2.09	1.0															
2435	6.22	IRC	4.34	1.51	1.2															
2568	9.60	DO	5.44	1.52	1.1															
2570			7.72	2.56	1.2															
2571	4.40	IRC	3.34	1.38	1.1	--8														
2574					1.3															
2577	7.30	IRC	4.40	1.26	1.1		-2.4		20/ 5/80	1.24	1.12	1.30	1.03	.97	.92	.95	.74			RDC
2580	10.20	DO	5.94	1.73	1.2															
2581	9.40	IRC	4.89	.38	--1	-1.2														
2582	11.50	DO	6.29	1.80	1.3															
2583	10.50	DO	7.12	1.84	1.1	--7			17/ 8/78	1.53	.97	.89	.46	--0.2	--.31	--.47	--.62			RDC
2585	7.50	IRC	5.08	1.80	1.2															
2588	6.10	IRC	4.26	.50	.1	--9														
2589	7.80	DO	4.30	1.07	.7				17/ 8/78	.43	.17	.35	.08	--.15	--.28	--.15	--.74			RDC
2592	9.00	IRC	5.15	1.12	.9	--8		-6.4	17/ 8/78	.99	.72	.97	.56	.35	.08	.25	.41			RDC
2597	9.10	IRC	5.00	1.24	.9				20/ 5/80	1.14	.97	1.06	.55	--.04	--.50	--.12	--.84			RDC
2598	5.42	IRC	3.85	1.25	1.2															
2601	11.20	DO	6.83	1.83	1.1	--8	-3.1		24/10/78	1.74	1.32	1.45	1.14	.85	.39	.43	--.11			JAH
2604					1.3	-1.3														
2606	7.06	IRC	4.84	1.90	1.1															
2607			8.07	2.26	1.0	--7														

GL	IRC	HR	BD	OTHER	TYPE	PERIOD	SP TYPE	SOURCE	LUM	R.A.	1950.00	DEC.	SOURCE	COMMENT	CLASS
2608	40	433	7866	34	4079	47	CYG		2	20 31 57.39	35	4 43.3	SAO		FHO
2610	-10	541								20 32 19.00	-7	37 6.0	IRC		FHO
2613										20 34 4.40	53	38 57.0	G&H		W49
2614	0	483	7873	-3	4961	70	AQL		3	20 34 7.41	-2	43 27.2	SAO		FHO
2617	40	435								20 35 3.00	37	42 6.0	IRC		FHO
2623	-20	592	7900	-18	5738	UPS	CAP		3	20 37 12.31	-18	18 57.8	SAO		FHO
2626	40	439				CIT	11			20 37 43.00	39	1 30.0	IRC		FHO
2627	50	336				V1202	CYG			20 37 38.00	53	21 0.0	IRC		FHO
2633	50	337	7924	44	3541	ALF	CYG		2	20 39 43.54	45	6 3.1	SAO		FHO
2753	-20	600	8172	-23	16877	GC	29923		7	21 20 8.71	-22	53 .4	SAO		W49
2754	20	506				SM	PEG			21 20 12.00	21	46 54.0	GCVS		FHO
2755	40	478				YX	CYG			21 20 33.00	42	10 42.0	GCVS		FHO
2759	40	479				SRA	388.00			21 20 51.73	40	43 6.1	SAO		FHO
2761	80	47	4502			SR?				21 21 31.73	79	33 12.3	SAG		FHO
2764	-20	602	8204	-22	15388	DO	39574		2	21 23 48.94	-22	37 44.3	SAO		FHO
2765	60	317	61	2134	ZET	CAP				21 24 32.33	62	21 24.9	SAO		FHO
2767	60	318	8224	59	2383	SW	CEP			21 26 2.40	59	31 55.0	SAO		W49
4275						GC	30065			21 26 17.00	-2	58 6.0	AFGL		FHO
2769	20	511	8223	21	4555	SYS	102104		7	21 26 42.61	21	57 36.1	SAO		FHO
2768	70	170				AX	CEP			21 26 10.00	70	0 6.0	GCVS		FHO
2771	70	171								21 26 59.00	71	36 6.0	IRC		FHO
2772	20	512	8225	23	4325	2	PEG		3	21 27 40.86	23	25 7.7	SAO		FHO
2776	-10	565	8232	-6	5770	BET	AQR		2	21 28 55.65	-5	47 31.7	SAO		FHO
2779	50	383								21 31 13.00	54	5 48.0	IRC		FHO
2782	0	504				DO	7488			21 32 10.16	1	36 21.4	SAO		FHO
2784	30	476				AB	CYG			21 34 24.51	31	52 39.0	SAO		W49
2763	40	468	8264	42	4177	75	CYG		3	21 38 13.14	43	2 46.2	SAO		FHO
2792	10	502	8269	5	4850	7	PEG		7	21 39 45.35	5	27 5.3	SAO		FHO
2793	40	489	8297	34	4500	V460	CYG			21 39 54.35	35	16 53.3	SAO		FHO
2794	50	392	8298	45	3637	V1339	CYG			21 40 13.52	45	32 13.9	SAO		FHO
2593	-20	618				RT	AQR			22 20 27.64	-22	18 35.6	SAO		FHO
2895	30	491				DO	21445			22 21 39.17	31	0 29.6	SAO		FHO
2896	60	353				RV	CEP			22 21 13.98	55	42 36.3	SAO		FHO
2908	40	511				DO	21501			22 26 1.00	35	18 6.0	IRC		W49
2910	60	355				DO	41440			22 26 26.00	58	58 36.0	IRC		FHO
2912	50	432				DO	41442			22 26 43.06	49	52 55.4	SAO		FHO
2913	50	433	8572	46	3719	5	LAC		2	22 27 26.54	47	27 1.7	SAO		FHO
2916	60	357				ST	CEP			22 28 16.47	56	44 38.9	SAO		FHO
2918	50	435				DO	41530			22 30 23.14	52	58 .6	SAO		FHO
2919	60	359				HY	LAC		7	22 30 40.00	55	10 54.0	IRC		FHO
2921	20	532				SS	PEG			22 31 36.00	24	18 18.0	GCVS		FHO
2924										22 34 9.00	-9	0 42.0	AFGL		W49
2926	60	363	8621	56	2821	SYS	102195		7	22 36 39.53	56	32 8.1	SAO		FHO
2931	40	515				DO	41747			22 37 51.77	40	24 33.7	SAO		FHO
2932	50	440				GI	LAC			22 38 35.00	49	44 30.0	IRC		FHO
2934	20	534				BC	PEG			22 39 23.00	20	54 30.0	GCVS		FHO
2935	-10	585				GC	31678			22 39 29.94	-5	21 47.9	SAO		FHO
3023	-10	596				SV	AQR			23 20 9.00	-11	5 30.0	GCVS		FHO
3085	60	402				V398	CAS			23 20 13.00	59	2 42.0	GCVS		FHO
3087	60	401	8894	59	2710	DO	42962		2	23 20 18.07	59	51 32.7	SAO		FHO

GL	VIS	SOURCE	I'	K	A	11	20	27	D/M/Y	2.3	3.6	4.9	8.7	10.0	11.4	12.6	19.5	23.0	OBSVR	
2606	4.63	IRC	3.07	.72	.5															
2610			6.30	1.53	1.0				25/10/75	4.04	1.74	.08	-.35	-.55	-.77	-.70	-.72			GGH
2613					1.2															
2614	5.22	IRC	3.45	1.21	.7				25/ 6/78	1.75	1.11	1.14	.63	.04	-.37	-.46				GG
2617			8.47	2.37	1.1															
2623	5.10	IRC	3.32	.74	.6				24/10/78	.84	.69	.74	.57	.74	.50	.52				GG
2625	13.80	LWD	8.71	1.70	1.0				21/ 5/80	1.47	1.41	1.60	1.45	1.49	1.34	1.51				HDC
2627	11.00	DO	6.55	2.20	1.3				17/ 8/78	2.41	1.78	1.74	1.29	1.00	.78	.71	.42			RDC
2633	1.26	IRC		.84	.6															
2635	5.60	IRC	4.12	1.52	1.2															
2754			8.31	2.48	1.2															
2754	9.50	DO	7.15	2.61	1.0				21/ 5/80	.92	.75	.98	.80	.71	.65	.62	.38			RDC
2759	7.28	IRC	3.13	-.66	-.8															
2761	8.70	IRC	6.18	2.43	1.3															
2764	3.73	IRC	3.04	1.87	1.2															
2765	8.00	IRC	5.63	1.73	1.1															
2767	6.24	IRC	3.88	.98	.6															
4275					1.3															
2769	5.93	IRC	3.06	-.23	-.5															
2768	12.20	DO	8.23	2.46	.5															
2771			8.07	2.32	1.1															
2772	4.55	IRC	2.89	.52	.2															
2776	2.89	IRC		1.12	.8															
2779			5.70	.66	.2															
2752	6.75	IRC	3.61	.39	0.0															
2764	7.80	IRC	5.38	1.93	.9				21/ 5/80	1.84	1.61	1.79	1.24	.49	.02	.25	-.66			RDC
2785	6.20	IRC	3.51	.98	.6															
2792	5.29	IRC	3.51	1.04	.8															
2793	6.03	IRC	3.85	.23	-.4															
2794	6.47	IRC	3.43	.19	0.0															
2893	9.20	IRC	6.19	2.18	1.2															
2895	7.46	IRC	4.28	.92	.4															
2896	6.80	IRC	4.74	1.92	1.2															
2902	10.20	DO	5.83	1.71	1.3															
2910	11.20	DO	7.30	2.16	1.1															
2912	6.90	IRC	5.88	2.28	1.1															
2913	4.37	IRC		.10	-.1															
2915	8.10	IRC	5.41	1.80	.9															
2918	9.30	IRC	5.27	1.30	1.0															
2919			5.73	1.11	.7															
2921			5.90	1.00	.4															
2924					.8															
2928	5.23	IRC	2.69	-.22	-.5															
2931	7.07	IRC	4.77	1.68	1.5															
2932			6.25	1.74	1.1															
2934	9.40	DO	5.90	1.79	1.3															
2935	7.04	IRC	3.80	.87	.6															
3083			5.60	1.04	.6															
3065	6.50	DO	5.79	1.52	.7															
3087	5.55	IRC	4.15	1.72	1.3															
									17/ 8/78	1.81	1.45	1.56	1.17	.76	.44	.38	-.17			RDC
									21/11/78	1.22	.86	.79	.36	.09	-.40	-.29	-.84	-.37		RDC
									17/ 8/78	1.47	.80	.88	.02	-.24	-.70	-.60	-.84			RDC
									21/11/78	1.59	1.43	1.55	1.70	1.62	1.55	1.68				RDC

GL	IRC	HR	BD	OTHER	TYPE	PERIOD	SP TYPE	SOURCE	LUM	R.A.	DEC.	SOURCE	COMMENT	CLASS
										1950.00				
3086	-20 633 8892	-20 6587	98 AQR				K0	IRC	3	23 20 20.78	-20 22 25.5	SAO		W49
3088	40 536		BU AND				M4	DO		23 21 14.00	39 27 6.0	GCYS		FHO
3089	0 530	2 4684	DO 7994		M	382.50				23 22 1.64	3 26 22.3	SAO		FHO
3090										23 21 51.00	- 2 6 30.0	AFGL		FHO
3091	60 404 8904	61 2444	4 CAS				M1	HR	3	23 22 36.33	62 0 29.3	SAO		FHO
3093	-20 635 8906	-21 6420	99 AQR				K5	IRC	3	23 23 25.30	-20 54 58.5	SAO		FHO
3094	50 464	52 3440	DO 43042				H7	DO		23 23 15.94	52 42 16.9	SAO		FHO
4297										23 24 12.00	27 18 36.0	AFGL		FHO
4298										23 26 40.00	11 16 12.0	AFGL		FHO
3101	40 538	37 4852	DO 22260				H6	DO		23 27 9.48	38 22 3.9	SAO		FHO
3104	50 466	50 4056	DO 43142				M7	DO		23 27 9.10	51 24 34.6	SAO		W49
3107	60 408	58 2602	DO 43171				H7	DO		23 27 49.03	59 8 43.6	SAO		FHO
3113	20 550 8940	21 4952	71 PEG				H5	HR	7	23 30 57.62	22 13 21.5	SAO		FHO
3115	20 551 8942	20 5352	DO 22300				H3	HR	7	23 31 24.79	20 33 52.6	SAO		FHO
3118										23 32 23.00	- 5 34 30.0	AFGL		FHO
3120	20 552 8953	23 4769	GC 32814				M1	IRC		23 33 25.58	24 17 3.3	SAO		FHO
3122	50 474 8961	45 4283	LAH AND	SPBI		55.82	G8	IRC	3	23 35 6.52	46 11 13.8	SAO		FHO
3123										23 35 6.00	- 5 0 24.0	AFGL		FHO
3124	60 415						H8	CASE		23 36 1.00	61 38 0.0	IRC		W49
3126	30 515		SVS 8872				M7	LHD	7	23 36 54.00	32 3 36.0	SVS		FHO
3127	80 57 8974	76 928	GAH CEP				K1	IRC	4	23 37 16.53	77 21 11.7	SAO		FHO
3131										23 39 47.00	18 10 0.0	AFGL		FHO
3133	60 416 8989	63 2038	GC 32927				H2	IRC	3	23 39 58.45	64 14 17.4	SAO		FHO

CL	VIS	SOURCE	I'	K	4	11	20	27	D/M/Y	2.3	3.6	4.9	8.7	10.0	11.4	12.6	19.5	23.0	OBSVK
3086	3.95	IRC	3.09	1.38	1.1				21/11/78	1.25	1.19	1.12	1.16	1.25	1.05	1.47			RDG
3088			5.38	.83	-1	-1.0			21/ 5/80	1.29	1.31	1.33	1.20	1.29	1.14	1.17	.97		RDG
3099	8.80	IRC	5.60	2.05	.9				17/ 8/78	.48	-.06	-.23	-.81	-1.04	-1.39	-1.34	-1.71		RDG
3091	4.96	IRC	3.28	.77	.4	-.3			21/11/78	.71	.50	.75	.55	.51	.45	.55	.28		RDG
3093	4.40	IRC	3.12	.95	1.1	-1.3			21/11/78	.90	.95	.91	.72	.91	.67	.71			RDG
3094	6.94	IRC	4.64	1.83	1.2														
4297					1.1														
4298					1.0														
3101	7.50	IRC	5.34	2.33	1.3														
3104	8.20	IRC	4.98	1.67	1.3	-.4			21/ 5/80	1.74	1.56	2.01	1.55	1.46	1.35	1.42			RDG
3107	8.00	IRC	5.79	2.12	1.2				21/11/78	2.03	1.83	1.91	1.77	1.85	1.61				RDG
3113	5.34	IRC	2.78	-.33	-.4	-1.2													
3115	6.08	IRC	3.91	.99	.9	-1.3													
3118					.2														
3120	6.40	IRC	4.69	1.86	1.2														
3122	3.88	IRC	2.91	1.25	1.1														
3123					.3														
3124			6.96	2.26	1.3														
3126	10.40	DO	5.65	1.03	.6	-1.2			21/ 5/80	2.21	1.81	1.80	1.33	1.01	.72	.63	.55		RDG
3127	3.22	IRC		.89	.7	-.7													
3131					1.3														
3133	6.61	IRC	4.44	1.51	1.2														

TABLE 2

WIRO CATALOG OF AFGL SOURCES

LONG WAVELENGTH SUBCATALOG

GL	IRC	HR	BD	OTHER	TYPE	PERIOD	SP	SOURCE	LUM	R.A.	DEC.	SOURCE	COMMENT	CLASS
57	60	9	54	T CAS	M	MM-78	H8	DO		0 20 31.21	55 30 56.2	SAO		LL
59	40	9	58	R AND	M	409.16	S6E	HR		0 21 23.03	33 18 2.3	SAO		LL
67							K7	CK2		0 24 47.00	69 22 16.0	LSKR		LL
85										0 32 57.00	-11 46 0.0	AFGL	C	LL
230										1 30 27.20	62 11 31.0	KLHN		LL
326				W 3						2 21 53.20	61 52 21.0	HGSB	C	LL
326				W 3 M						2 23 10.00	62 3 6.0	AFGL	C	LL
328				W 3 OH						2 23 16.46	61 38 57.8	RIED		LL
331				R FOR	H	387.85	CE	GCVS		2 27 2.00	-26 19 24.0	GCVS		LL
337	-30	21		UX AND	SRB	400.00	H8	DO		2 30 13.07	45 26 6.4	SAO		LL
347	50	68	624	CIT 4			H9	H&B		2 31 43.00	64 56 36.0	IRC		LL
349	60	92								2 35 8.00	-27 11 24.0	IRC		LL
357	-30	23								2 36 16.00	60 12 18.0	AFGL	C	LL
361				DO 27024			H0	HR	2	3 20 18.58	64 24 34.1	SAO		LL
459	50	95	391	V384 PER	SRA	540.00	H0	DO		3 22 59.00	47 21 42.0	GCVS	C	LL
500	-20	43		RT ERI	M	370.80	H7E	GCVS		3 31 54.00	-16 20 0.0	GCVS		LL
505	60	124	596	U CAN	SRB	400.00	N	DO		3 37 29.09	62 29 18.8	SSJ	C	LL
585	40	91		V346 PER	INS?					4 26 57.30	35 9 56.0	SSJ	C	LL
595	60	144		DO 28489			H6	DO		4 30 49.00	62 10 12.0	IRC		LL
598	-10	70	887	47 ERI			H3	IRC	7	4 31 46.97	-8 20 4.6	SAO		LL
601	20	87	629	ALP TAU			K5	IRC	3	4 33 2.90	16 24 37.5	SAO	C	LL
618										4 39 34.00	36 1 9.0	G&H		LL
739	40	126	36	GC 6640			K2	IRC		5 21 22.85	36 9 19.2	SAO		LL
746	50	145	1122	DO 29288			H5	DO		5 23 46.00	48 40 36.0	IRC		LL
748	30	114	1044	S AUR	SRA	590.10	H3E	GCVS		5 23 50.00	34 6 36.0	GCVS		LL
757	0	74	-4	S ORI	H	419.20	H5E	DO		5 26 32.68	-4 43 51.7	SAO		LL
761	20	111	867	DV TAU	LB		H6	DO		5 28 10.41	18 31 26.5	SAO		LL
767	20	112	1845	CE TAU	SRC	165.00	H2	IRC	2	5 29 16.76	18 33 32.0	SAO		LL
767														
761										5 32 36.00	-4 56 24.0	AFGL		LL
779	-10	93		M 42						5 32 50.00	-5 24 42.0	IRC		LL
766	0	80		X ORI	M	422.20	H9	H&B		5 35 8.00	-1 48 6.0	GCVS		LL
788	20	116	898	GP TAU	SRB	90.00	H6	DO		5 35 27.99	24 58 10.0	AGK3		LL
791	50	149	24	DO 29520			K5	DO		5 36 8.00	46 43 48.0	IRC		LL
794	40	135		RU AUR	M	466.47	H8E	GCVS		5 36 44.00	37 36 48.0	GCVS		LL
805	30	126		U AUR	M	408.73	H8E	GCVS		5 38 54.00	32 1 12.0	GCVS		LL
806				HGC 2023						5 39 6.00	-2 17 0.0	AFGL		LL
807				HGC 2024						5 39 14.27	-1 55 59.0	GLG	C	LL
937	20	145		AB GEN	LB		H3	GCVS		6 23 19.00	19 6 12.0	GCVS		LL
950	30	153		DW GEN	LB		H7	DO		6 27 53.00	27 29 24.0	GCVS		LL
955	40	156		DO 12285			K5	DO		6 29 45.00	40 44 54.0	IRC		LL
956	60	169		DO 30551			H7	DO		6 30 .30	60 58 48.0	JYCE		LL
966	40	158	1539	UU AUR	SRB	235.00	C5	HR		6 33 6.64	38 29 16.1	SAO		LL
968	-10	131	-5	GL NON	SRB	104.00	H4	H&B		6 33 21.00	-5 20 18.0	GCVS	C	LL
971										6 34 16.50	3 28 4.0	JYCE		LL
1111	-30	87	4441	VY CIA	LC		H0	IRC		7 20 54.60	-25 40 11.9	SAO		LL
1120	50	180	46	Y LYH	SRC	110.00	H7	DO		7 24 33.51	46 5 35.8	SAO		LL
1135				U NON	RVD	334.07	*	GCVS		7 28 26.00	-9 40 30.0	GCVS		LL
1135														

GL	VIS	SOURCE	I'	K	4	11	20	27	D/M/Y	2.3	3.6	4.9	8.7	10.0	11.4	12.6	19.5	23.0	OBSVR	
57	6.70	IRC	4.03	-.97	-1.7	-2.6			17/12/78	-1.02	-1.49	-1.51	-1.98	-2.31	-2.64	-2.83	-3.26	-2.88	JAH	
59	7.39	IRC	4.28	.34	-.9	-2.9	-3.5		17/12/78	.52	-.25	-.71	-1.77	-2.19	-2.67	-2.70	-3.23		JAH	
67	17.00	CK2			.6	-2.1			15/ 7/80	4.06	1.14	-.36	-1.90	-2.07	-2.43	-2.64	-2.77	-2.74	JAH	
85																				
230					1.6	-1.6	-3.5		16/ 7/80	7.76	3.01	.90	-.94	-1.03	-.78	-2.22	-3.40		GG	
230					1.0	-3.6	-6.9		30/12/80	8.29	3.48	1.42	-.37	-.67	-.46	-1.74	-2.90	-3.64	RDG	
326						-1.6	-4.6													
328						-2.0	-3.5													
331						-2.6														
337						-2.1														
347	8.60	IRC	6.72	1.30	-.8	-2.6			20/10/80	1.90	-.20	4.45	1.66	1.16	1.07	.40	-2.28	-3.49	GG	
349			4.03		-.3	-2.1	-2.8		19/11/78	.02	-.31	-.12	-.64	-1.15	-1.62	-1.56	-2.57	-2.66	JAH	
357			8.15	2.68	.2	-2.8	-4.4		20/ 8/78	2.27	.40	-.56	-2.20	-2.81	-3.27	-3.19	-4.20		GG	
357			6.33	1.11	-.3	-2.7	-3.4		16/ 7/80	1.34	.41	-.04	-1.32	-1.94	-2.33	-2.09	-2.40	-2.60	GG	
361						-2.0	-3.1		19/10/80											GG
465	5.22	IRC	3.14	.33	.1	-1.5			17/12/78	-.27	.07	.39	.14	.15	-.02	-.10	.79		JAH	
469	12.20	DO	8.57	2.18	-.9	-3.3	-3.9		17/12/78	1.61	-.29	-1.41	-2.60	-2.75	-3.23	-3.13	-3.35	-3.67	JAH	
500			5.76	.11	-.4	-1.9	-2.5		19/10/80	.51	-.02	-.30	-.88	-1.26	-1.57	-1.67	-1.90	-1.80	GG	
505	7.60	IRC	4.65	.38	-.6	-1.5			30/12/77	.59	-.03	.23	-.88	-1.12	-1.50	-1.39	-1.53		JAH	
585	17.00	HBG	4.69	2.97	-.2	-2.9	-4.4		17/12/78	2.88	.46	-.79	-1.97	-2.05	-2.39	-2.69	-2.91	-3.15	JAH	
595	12.00	DO	8.95	2.04	-.1	-1.9	-3.0		17/12/78	1.56	.09	-.82	-1.75	-1.88	-2.37	-2.25	-2.37	-2.60	JAH	
598	5.11	IRC	3.19	.69	.4	-2.1			1/10/80	.62	.51	.76	.48	.50	.38	.38	.31		GG	
601	.86	IRC			-3.2	-3.2				-2.86	-2.98	-2.81	-2.98	-2.97	-3.05	-3.07	-3.16		GG	
618						-2.5	-4.8		25/10/75	9.22	5.29	2.06	-1.52	-2.18	-2.56	-3.19	-5.05		G&H	
739	6.74	IRC	5.28	2.68	1.6		-4.7		1/10/80	2.51	2.38	2.55	2.47	2.45	2.44	2.42			GG	
746	10.60	DO	6.71	2.70	1.4		-4.1		17/12/78	2.63	2.36	2.32	1.67	1.72	1.11	.95	.80		JAH	
748			8.22	1.97	-.1	-1.6			21/12/77	1.61	.35	-.33	-1.26	-1.43	-1.69	-1.54	-1.40		G&H	
757	7.50	IRC	4.92	-.11	-.7	-1.7			8/ 3/78	-.05	-.56	-.67	-1.26	-1.62	-1.83	-1.94	-2.52	-2.21	JAH	
751	8.40	IRC	4.95	1.39	1.2	-1.7			17/ 2/78	1.34	1.11	1.30	.93	.90	.68	.55	.18	.31	RDG	
757	4.35	IRC			-1.2	-1.5			12/ 8/80	-.97	-1.22	-1.13	-1.29	-1.16	-1.28	-1.54	-2.41		GG	
767									1/10/80	-1.05	-1.27	-.99	-1.31	-1.31	-1.50	-1.53	-1.66		GG	
781					1.5	-2.4														
779			3.30	1.58	-1.1	-5.1	-7.3													JAH
756			7.23	1.55	.4	-1.8			23/10/78	1.35	.63	.13	-.57	-.87	-1.42	-1.38			RDG	
788	11.30	AGK3	4.84	.35	-.1	-1.7			17/ 2/78	.37	.03	0.00	-.45	-.89	-1.27	-1.29	-2.01	-2.27	JAH	
791	11.10	DO	6.51	2.89	-.1	-1.9	-3.5		17/12/78	2.93	2.29	1.31	-.95	-1.21	-1.77	-1.88	-2.79	-3.16	JAH	
794			8.32	1.39	.1	-2.0			21/12/77	.66	.14	-.11	-.81	-1.34	-1.83	-1.78	-2.26		G&H	
805			4.96	.98	-.4	-1.9			21/12/77	.99	.33	-.08	-.57	-1.08	-1.35	-1.46	-1.77		G&H	
806						-1.9	-3.1													
627	9.70	DO	6.68	2.55	.4	-3.5	-6.3													RDG
937					1.5		-4.1		17/ 2/78	2.53	2.02	2.45	1.30	1.26	1.13	.99			JAH	
950	10.10	DO	4.70	.42	-.2	-1.5			8/ 3/78	1.07	.31	.13	-.69	-1.32	-1.77	-1.69	-2.31	-2.43	JAH	
955	12.50	DO	9.56	2.73	1.1	-1.5			17/12/78	3.76	2.35	1.48	-.17	-.55	-1.21	-1.16	-2.15	-2.23	JAH	
956	11.50	DO	7.58	1.32	-.5	-2.8	-3.7		17/12/78	.78	-.28	-.85	-2.21	-2.56	-3.29	-3.08	-3.83	-4.02	JAH	
966	5.29	IRC	3.04	-.71	-1.3	-2.1			17/ 2/78	-.58	-1.05	-.92	-1.62	-1.75	-2.06	-1.92	-1.94	-2.02	RDG	
963			4.08	.02	-.3	-1.5	-3.7		17/12/78	.25	-.01	-.11	-.37	-.69	-.71	-.81	-1.52	-.60	JAH	
971					.4	-2.2			10/11/76	5.00	2.09	.52	-1.11	-1.29	-1.57	-1.75	-1.60		JAH	
1111	7.50	IRC	4.87	-.69	-3.0	-6.0	-7.7		19/10/80	-.69	-2.52	-3.56	-5.32	-5.85	-6.15	-6.13	-7.26	-6.83	GG	
1120	6.90	IRC	3.16	-.48	-.8	-1.6			22/ 1/78	-.50	-.80	-.54	-.95	-1.29	-1.68	-1.46	-2.16	-2.42	JAH	
1135					1.7	-1.6			19/10/80	3.70	2.81	1.76	-.40	-.86	-1.26	-1.12	-2.01	-1.93	GG	
1135									30/10/80	3.89	2.92	1.93	-.23	-.55	-1.23	-.50	-1.20	-1.37	RDG	

GL	IRC	HR	BD	OTHER	TYPE	PERIOD	SP	SOURCE	LUM	R.A.	DEC.	SOURCE	COMMENT	CLASS
							TYPE			1950.00				
1138	10 167		8 1800	S CHZ	H	332.56	H7	DO	7 30	.29	8 25 35.5	SAO		LL
1140	-20 133			Z PUP	H	509.98	H9	H&B	7 30	29.00	-20 33 18.0	GCVS		LL
1141	30 187				H		H9	VOGT	7 30	44.00	30 37 18.0	IRC		LL
1151	-20 134			DU PUP	H	550.00	H	H&B	7 32	59.00	-23 52 42.0	GCVS	C	LL
1164				FK HYA	LB		MB	IRC	7 38	30.00	-23 21 0.0	AFGL		LL
1250	-10 194		-8 2343				MB	IRC	8 22	2.25	- 8 21 27.4	SAO	C	LL
1261	1261								8 28	8.00	9 18 24.0	AFGL	C	LL
1263				AK HYA	SRB	112.00	M4	GCVS	8 31	35.73	-17 7 23.4	SAO	C	LL
1281	-20 173		-16 2541						8 39	10.40	2 22 6.0	JYCE	C	LL
1283									10 24	21.00	5 52 54.0	AFGL	C	LL
1417									10 30	47.00	- 7 12 54.0	AFGL	C	LL
1424									10 34	31.00	- 3 47 36.0	AFGL	C	LL
1426				U HYA	SRB	450.00	C7	GCVS	10 35	4.97	-13 7 26.2	SAO	C	LL
1427	-10 242	4163	-12 3218	T CRT	SRB	70.00	M4	IRC	11 21	23.22	-19 37 59.9	SAO		LL
1482	-20 227		-19 3254						11 27	57.00	-22 21 6.0	AFGL		LL
1493				DO 14449			N7	DO	11 32	51.00	35 8 24.0	IRC		LL
1499				BK VIR	SRB	150.00	H7	DO	12 27	48.07	4 41 34.5	SAO	C	LL
1554	0 220		5 2634	Y UHA	SRB	168.00	H7	DO	12 38	4.42	56 7 14.8	SAO		LL
1554	60 220		56 1615	R HYA	H	389.61	H7E	HR	13 26	58.48	-23 1 24.5	SAO	C	LL
1627	-20 254	5080	-22 3601						13 30	47.00	-26 19 30.0	AFGL	C	LL
1634				DO 3372			M4	DO	13 32	56.38	- 4 8 5.4	SAO		LL
4173	0 235		-3 3501						14 21	56.69	25 55 48.5	SAO		LL
4173				RX 800	SRB	340.00	H7	DO	14 28	1.65	-29 52 34.5	SAO		LL
1706	30 257		26 2563	Y CEN	SRB?	180.00	H7	H&B	15 21	26.00	-22 44 12.0	GCVS		LL
1715	-30 222		-29 11116	RS LIB	H	217.65	H7E	GCVS	15 31	28.22	78 46 55.1	SAO		LL
1767	-20 266			S UNI	H	326.25	N8	DO	15 32	51.27	77 30 59.6	SAO		LL
1767	80 30		79 467	THE UHI			X5	IRC	15 34	9.07	15 15 56.0	SAO		LL
1783	80 31		5826 77 592	TAU4 SER	LB		H7	DO	15 35	5.00	-15 12 36.0	AFGL	C	LL
1783	20 282		15 2890						16 22	23.00	-24 17 54.0	AFGL		LL
4217				U HER	H	406.05	H7E	HR	16 23	14.00	-24 29 54.0	AFGL	C	LL
1855				U HER	H	406.05	H27	HR	16 23	34.86	19 0 18.0	SAO		LL
4222	20 298	6119	19 3098	ALF SCO	SRA		H1	IRC	16 25	1.60	- 7 29 6.9	SAO		LL
1861	-10 340	6128	-7 4292	30 HER			H16	HR	16 26	20.21	-26 19 22.0	SAO		LL
1663	-30 265	6134	-26 11359				H16:	H&B	16 26	59.84	41 59 26.7	SAO		LL
1664	40 283	6146	42 2714	DO 16032			>H8	H&B	17 26	33.00	- 7 25 24.0	IRC		LL
1970	-10 369			IIW HER	H	449.00	H2	DO	17 29	42.00	17 47 36.0	IRC		LL
1972	-30 300						H2		17 36	3.00	15 36 36.0	GCVS	C	LL
1977	20 326						N9	WNSJ	17 39	22.90	-30 4 23.0	JYCE		LL
1928	20 328			109 HER			H1:	H&B	17 39	22.90	-30 4 23.0	VIRO		LL
1992				SHARP. 53			H18	H&B	18 20	28.00	-13 44 6.0	IRC		LL
1997	-30 316			SHARP. 53			K2	IRC	18 21	33.94	21 44 44.4	SAO		LL
2139	-10 414								18 22	8.00	-13 16 6.0	AFGL		LL
2145	20 364	6895	21 3411						18 22	42.00	-13 18 0.0	AFGL		LL
2147														
4237														

GL	VIS	SOURCE	I	K	4	11	20	27	D/H/Y	2.3	3.6	4.9	8.7	10.0	11.4	12.6	19.5	23.0	OBSVR	
1138	7.00	IRC	4.75	.48	2.0	-1.6			19/11/78	.56	-.05	-.16	-.71	-.94					RDG	
1140			7.48	1.77	.5	-1.8			19/10/80	1.67	.77	.45	-.79	-1.38	-1.82	-1.54	-1.52	-2.00	GG	
1141			7.51	2.82	.8	-1.9			2/11/78	1.70	.58	-.14	-1.43	-1.86	-2.27	-2.03	-3.56		RDG	
1151			7.40	2.19	.9	-1.8			19/10/80	2.23	1.01	.60	-.54	-1.06	-1.37	-1.21	-2.10	-2.50	GG	
1164							-4.8													
1250	7.50	IRC	3.63	.36	-.3	-1.8			11/ 4/78	.38	.10	-.11	-.97	-1.62	-2.19	-1.91	-2.57	-2.41	JAH	
1261						-1.5														
1263						-1.8														
1281	7.04	IRC	2.80	-.57	-.7	-1.8			17/ 2/78	-.65	-.76	-.81	-1.22	-1.53	-1.84	-1.82	-2.10	-1.99	RDG	
1293	15.00	JYCE			1.5	-1.5	-4.7		27/ 3/78	3.31	2.35	1.91	.71	-.01	-.50	-.41	-1.07	-1.50	JAH	
1417																				
1424					1.8	-1.7														
1426						-1.4	-4.6													
1427	4.92	IRC	2.79	-.67	-1.4	-1.9	-2.8		21/12/77	-.40	-.64	-.57	-1.12	-.90	-1.53	-1.63			G4H	
1462	8.60	IRC	4.96	1.22	.6	-1.7			4/ 4/78	1.37	1.17	.91	.94	.27	.21	-.02			RDG	
1493						-2.8														
1459	8.70	DO	4.38	.01	-.5	-1.6			19/ 5/79	.96	.54	-.30	-.73	-1.25	-1.37	-1.53	-1.81		JAH	
1459									18/12/80	-.15	-.53	-.48	-.82	-1.13	-1.44	-1.54	-2.21	-2.45	RDG	
1554	8.20	IRC	3.12	-.90	-1.4	-2.2	-2.8		1/ 6/77	-.90	-1.30	-1.61	-1.70	-1.86	-2.11	-2.19	-2.64	-2.40	BTA	
1554									17/ 2/78	-.99	-1.33	-1.31	-1.64	-1.90	-2.26	-2.34	-2.62	-2.73	RDG	
157C	7.50	IRC	3.84	-.53	-1.2	-2.0			20/12/77	-.53	-.87	-.88	-1.14	-1.51	-1.69	-1.84	-2.36	-2.19	G4H	
1627	4.98	IRC	2.32	.6	-3.2	-4.2	-4.8		27/ 3/78	-2.51	-2.92	-3.03	-3.58	-3.80	-4.09	-4.32	-4.37	-4.29	JAH	
1634						-1.5														
4173	8.70	IRC	6.10	2.93	1.8	-2.1			19/ 5/79	3.02	2.77	2.83	2.72	2.65	2.71				JAH	
4173									21/ 1/81	2.94	2.80	3.07	2.79	2.78	2.63	2.66	2.22		RDG	
1706	6.50	IRC	2.77	-1.85	-2.3	-3.5	-4.4		17/ 2/78	-1.95	-2.36	-2.36	-2.90	-3.40	-3.74	-3.95	-4.34	-4.41	RDG	
1715	7.70	IRC	3.71	-.50	-.8	-2.0	-3.4		29/ 6/80	-.68	-.80	-.64	-1.19	-1.46	-1.39	-1.50	-1.53		JAH	
1757			4.92	-.28	-.9	-1.8			19/ 5/79	.09	-.43	-.70	-1.09	-.98	-1.58	-1.85	-1.78		JAH	
1767									21/ 1/81	-.29	-.63	-.88	-1.23	-1.35	-1.86	-1.98	-1.53		RDG	
1780	9.40	IRC	4.33	.26	-.5	-1.6	-2.7		4/ 4/78	.14	-.39	-.70	-1.13	-1.34	-1.83	-1.81	-2.13		RDG	
1783	5.14	IRC	3.68	1.33	1.0		-4.3		19/ 5/79	1.21	1.11	1.27	1.22	1.10	1.07	.80	.35		JAH	
1788	6.84	IRC	2.71	-1.06	-1.4	-1.9	-2.8		18/12/80	1.55	1.52	1.82	1.71	1.85	1.53	1.81	1.49		RDG	
4217									12/ 6/78	-.92	-1.26	-1.13	-1.48	-1.74	-1.94	-2.02	-2.65	-2.77	RDG	
1855					1.5	-1.9	-3.3													
4222						-2.0	-3.7	-6.5												
1858	6.70	IRC	3.87	-.31	-1.3	-2.8	-3.2		17/ 2/78	.25	-.50	-.76	-1.41	-1.77	-2.16	-2.30	-2.54	-2.59	RDG	
1861	5.45	IRC	3.25	.53	.2	-2.6	-3.4		24/ 5/79	.01	-.22	.01	-.13	-.15	-.31	-.34			GG	
1863	1.08	IRC	.6	.6	-3.6	-4.8	-4.9		24/ 5/80	-3.74	-4.01	-3.73	-4.34	-4.53	-4.58	-4.49	-4.30		GG	
1864	5.01	IRC	.6	.6	-2.4	-2.8			26/ 5/79	-2.01	-2.22	-1.97	-2.21		-2.32				GG	
1970			5.40	.24	-.6	-1.6			24/ 5/79	-.23	-.68	-.55	-1.06	-1.62	-2.13	-2.18	-2.70		GG	
1972	9.50	DO	8.20	2.34	.9	-1.5			24/ 5/80	2.60	1.53	1.24	.39	-.16	-.36	-.45			GG	
1977			8.20	2.64	-.7	-2.7	-3.3		26/ 5/79	2.51	.24	-.77	-1.98		-2.66				GG	
1928	12.75	MUSJ	7.29	1.58	.6	-1.9	-3.0		4/ 8/78	.98	.23	-.17	-1.34	-2.01	-2.52	-2.26			RDG	
1992					.3	-2.5			24/ 5/80	2.65	.70	-.10	-1.92	-2.35	-2.47	-2.61	-3.60		GG	
2139			7.58	2.20	.8	-2.4	-4.1		29/ 6/80	1.82	-.31	.01	-1.12	-1.79	-2.15	-2.37	-2.72		JAH	
2145			5.97	.78	-.1	-2.6	-3.7		24/ 5/79	.35	-.55	-1.05	-2.06	-2.90	-3.47	-3.61	-4.18		GG	
2147	3.82	IRC	2.87	1.09	.8	-1.6	-4.0		26/ 5/79	1.10	1.03	1.19	1.11		1.24				GG	
4237					1.6	-2.3	-4.6													

GL	INC	HR	BD	OTHER	TYPE	PERIOD	SP	SOURCE	LUN	R.A.	DEC.	SOURCE	COMMENT	CLASS
							TYPE			1950.00				
2151	-20 482			V2548 SOR	T		C	H&B		18 23 28.70	-22 6 11.0	WIRO		LL
2152										18 23 39.00	-11 51 18.0	AFGL		LL
2154										18 23 57.60	- 6 55 55.0	JYCE		LL
2154														
2154														
2155				DO 16793						18 24 .80	23 27 1.0	JYCE		LL
2155														
2155														
2157				W 39										
2162	-10 422	-12 5055		UY SCT	LC		HN	GCVS	2	18 24 22.00	-12 42 0.0	AFGL	C	LL
2165				SHARP. 62						18 24 49.00	-12 30 0.0	GCVS	C	LL
2169										18 25 1.20	- 3 51 45.0	WIRO		LL
2177				W 40						18 26 30.00	-10 55 12.0	AFGL		LL
2178										18 28 47.87	- 2 7 35.3	WIRO	C	LL
2178										18 28 52.40	- 0 37 27.0	JYCE		LL
2178														
2190										18 31 26.00	- 7 20 54.0	AFGL	C	LL
2200										18 33 30.00	- 7 11 48.0	AFGL		LL
2205										18 34 52.30	- 5 26 36.0	WIRO		LL
2206	10 365			V1111 OPH	H		H9	VOGT		18 34 59.00	10 23 0.0	IRC		LL
2210										18 35 33.70	- 6 50 33.0	WIRO	C	LL
2213	10 366 7002	8 3780		X OPH	H	334.39	H6E	HR	3	18 35 57.51	- 0 47 19.7	SAO	C	LL
2222										18 37 20.90	- 0 21 27.0	JYCE		LL
2223	-10 450									18 37 35.00	- 5 45 48.0	IRC	C	LL
2227	0 363			DO 5003			N:	H&B		18 38 48.00	- 4 23 30.0	IRC	C	LL
2232	20 370						<H0	H&B		18 39 41.00	-17 37 36.0	IRC		LL
2233	0 365						C2	CK2		18 39 51.00	- 2 21 12.0	IRC	C	LL
2376				HFE 59						19 20 9.00	13 58 30.0	AFGL	C	LL
2378										19 20 38.00	14 23 0.0	AFGL	C	LL
2379										19 20 44.00	14 10 0.0	AFGL	C	LL
2381										19 21 24.00	14 24 40.0	HGG	C	LL
2383	50 294	49 2999		CH CYG	SRA	97.00	H3	IRC		19 23 14.18	50 8 31.0	SAO		LL
2383														
2393	10 420			DO 5752			R	DO		19 24 26.00	11 15 12.0	IRC		LL
2398	0 437 7412	2 3904		SVS 101849			K5	DO		19 27 39.77	2 47 55.8	SAO		LL
2402	0 439 7414	-3 4612		36 AQL			M1	HR	3	19 28 2.91	- 2 53 40.3	SAO		LL
2409	40 348			UY CYG	SRB	135.50	H6	GCVS		19 29 38.00	43 31 30.0	GCVS		LL
4250				V1137 AQL	SR7					19 30 37.00	13 38 6.0	GCVS		LL
2414	20 413			EP VUL	INA		C	GCVS		19 31 11.00	23 32 30.0	GCVS	C	LL
2417	30 374						C	VOGT		19 32 12.00	27 57 0.0	IRC		LL
2425										19 36 8.70	-16 58 50.0	G&H		LL
2425														
2425														
2433														
2565	40 411 7796	39 4159		GAM CYG			F8	IRC	2	19 38 58.00	39 56 12.0	AFGL	C	LL
4265										20 20 25.93	40 5 44.6	SAO	C	LL
2575	40 415			KY CYG	LB		N	DO		20 22 41.00	- 7 19 18.0	AFGL	C	LL
2578										20 24 6.00	38 11 0.0	GCVS		LL
2584				SHARP. 106						20 25 17.00	39 15 30.0	AFGL	C	LL
2584										20 25 32.81	37 12 49.9	WIRO	C	LL

GL	VIS	SOURCE	I'	K	h	11	20	27	D/M/Y	2.3	3.6	4.9	6.7	10.0	11.4	12.6	19.5	23.0	OBSVR
2151			7.35	2.43	.6	-1.5			29/ 6/80	2.02	1.06	.70	-.37	-.71	-.87	-1.14	-1.06		JAH
2152					.6	-1.5			23/ 6/78	5.21	1.66	.09	-1.61	-1.83	-2.14	-2.12			RDG
2154						-1.9	-2.8		26/ 7/79					-2.23					RDG
2154									17/ 4/80	4.56	1.71	.17	-1.67	-1.89	-2.08	-2.31	-2.37		RDG
2154									18/ 4/80	4.55	1.60	-.01	-1.65	-1.87	-2.31	-2.38	-2.63		RDG
2155					1.2	-2.7	-3.6		23/ 6/78	5.79	1.66	-.31	-2.52	-2.88	-3.21	-3.24	-3.85		RDG
2155									26/ 7/79					-2.60					RDG
2155									17/ 4/80	5.68	1.79	-.29	-2.44	-2.71	-3.10	-3.32	-3.55		RDG
2155									18/ 4/80	5.79	1.86	-.20	-2.43	-2.75	-3.19	-3.40	-3.78		RDG
2157						-1.5	-3.3												GG
2162			5.50	.96	-.1	-2.2	-3.3		24/ 5/79	.41	-.24	-.40	-1.35	-2.23	-2.82	-2.85	-3.35		GG
2165					.8	-2.1	-3.2		24/ 5/80	3.01	1.37	.31	-1.00	-1.24	-1.45	-1.74	-2.56		GG
2169						-2.3	-3.9												
2177					1.6	-2.9	-5.5												
2178					.6	-2.3			23/ 6/78	5.09	1.50	-.05	-1.77	-2.04	-2.34	-2.39	-2.39		RDG
2178									18/ 4/80	4.99	1.53	-.12	-1.81	-2.02	-2.39	-2.51	-2.73		RDG
2190						-2.1	-4.6												
2200						-4.2													
2205						-1.5	-3.9		15/ 7/80	9.87	2.51	-.02	-1.70	-1.72	-1.60	-3.14	-3.68	-4.00	JAH
2206			6.85	.77	-.4	-3.4	-4.3	-6.7	24/ 5/80	.86	-.45	-1.17	-2.47	-3.00	-3.48	-3.21	-4.38		GG
2210						-2.9	-6.1												
2213	6.40	IRC	4.06	-.90	-1.3	-2.7	-2.9	-6.3	24/ 3/80	-.78	-1.31	-1.53	-2.06	-2.31	-2.53	-2.65	-3.02	-2.87	GG
2222						-1.7	-3.3		24/ 5/80	3.06	1.52	.65	-.78	-1.18	-1.58	-1.64	-2.69		GG
2223			9.33	2.94	.8	-1.7	-3.3		24/ 3/80	3.62	2.14	1.31	-.33	-.80	-1.19	-1.18	-2.19	-2.19	GG
2227	11.50	DO	7.00	2.06	.7	-2.4	-3.7		24/ 5/80	2.09	.99	.21	-1.24	-2.05	-2.57	-2.43	-3.70		GG
2232	12.90	CK2	6.78	1.87	-1.7	-3.5	-3.8		24/ 5/80	1.93	.05	-1.20	-2.47	-2.69	-3.06	-3.09	-3.46		GG
2233			7.98	2.67	-.9	-3.5	-3.6		24/ 5/80	3.37	.58	-.59	-2.22	-2.46	-2.72	-2.79	-3.15		GG
2376					1.3	-2.5	-5.7	-7.8											
2379						-1.7	-4.5												
2379						-2.1	-4.6	-6.5											
2381					1.7	-3.6	-6.9	-8.8											
2383	7.07	IRC	2.98	-.68	-1.4	-2.9	-3.5		7/ 6/80	-.69	-1.26	-1.58	-2.28	-2.51	-2.85	-2.57	-2.70		GG
2383									30/10/80	-.95	-1.47	-1.78	-2.28	-2.63	-2.95	-2.76	-3.15	-2.88	FDG
2390	11.70	DO	8.03	2.75	.1	-4.2	-6.2	-6.7	7/ 6/80	2.96	.84	-.60	-2.88	-3.80	-4.40	-4.39	-5.70		GG
2398	6.22	IRC	4.31	1.44	1.1	-1.6	-3.5		24/ 5/80	1.55	1.33	1.58	1.39	1.36	1.33				GG
2402	5.22	IRC	3.19	.62	.5	-3.2			24/ 5/80	.55	.36	.59	.47	.46	.34	.40			GG
2409	8.90	DO	5.20	.82	.4	-1.7	-3.6	-6.6	7/ 6/80	.82	.54	.63	-.01	-.67	-1.27	-1.19	-1.60		GG
2420						-1.8	-2.7												
2414	10.70	DO	5.58	.95	.5	-1.5			7/ 6/80	1.02	.65	1.04	.64	.44	.16	.06	-.10		GG
2417			7.81	2.89	-.4	-2.8	-3.4		7/ 6/80	2.67	.40	-.65	-2.12	-2.30	-2.66	-2.61	-2.70		GG
2425					1.6	-1.6	-3.0		12/ 6/78	2.88	1.96	1.34	-.26	-.87	-1.44	-1.17	-2.05		HDC
2425									30/ 8/79	2.48	1.71	1.13		-.86	-1.49				RDG
2425									18/ 4/80	2.98	2.09	1.67	.50	-.06	-.57	-.38	-1.33		
2425					1.7	-2.1	-2.2												
2465	2.23	IRC	.70	.3	-.3	-1.6	-4.0	-6.5	7/ 6/80	.75	.64	.59	.60	.59	.56	.56			GG
2465																			
2575	10.50	DO	6.00	.28	-.4	-2.6	-3.9		17/ 8/78	.10	-.58	-.61	-1.66	-2.67	-3.23	-3.24	-3.88		RDG
2578						-1.7	-4.1	-6.1											
2584					1.6	-2.5	-5.9	-7.3											

GL	JRC	HR	BD	OTHER	TYPE	PERIOD	SP TYPE	SOURCE LUN	B.A.	1950.00	DEC.	SOURCE	COMMENT	CLASS
2586									20 26	29.00	40 42	30.0		LL
2590	40 424			RM CYG	SRC	586.00	H6	DO	2		39 48	36.0	AFGL	LL
2591									20 27	15.90	40 1	5.0	GCVS	LL
2591									20 27	35.90	40 1	5.0	LKVR	LL
2593				M 69					20 27	42.00	38 50	18.0	AFGL	LL
2602									20 30	46.40	40 5	48.0	KLHN	LL
2603				HNC 349					20 30	56.86	40 29	20.4	BHR	LL
2605	40 431								20 31	7.00	40 35	6.0	IRC	LL
2609	40 434			DO 38592			K5	DO	20 32	14.00	42 15	12.0	IRC	LL
2618	20 474 7886	17	4370	EU DEL	SRB	59.50	H6	HR	7	20 35	37.75	18 5	SAO	LL
2618									20 36	51.34	42 27	19.0	WIRO	LL
2621				W 75 W					20 37	13.64	42 9	6.0	WIRO	LL
2624				DR 21					20 37	28.00	41 8	6.0	AFGL	LL
2625				DR 22					20 39	41.32	47 57	45.4	SAO	LL
2632	50 338		47	V CYG	H	421.43	H1	DO	21 20	36.00	77 37	42.0	GCVS	LL
2757	80 45			GH CEP	H	331.00	K5	DO	21 20	39.00	10 55	54.0	GCVS	LL
2775	10 498			UU PEG	H	456.50	H7E	GCVS	21 28	39.00	10 55	54.0	GCVS	LL
2781	40 485			V1426 CYG	H	470.00	N	DO	21 32	5.00	38 51	0.0	IRC	LL
2785	80 46		77	S CEP	H	486.99	H8E	IRC	21 35	52.65	78 23	58.7	SAO	LL
2787	0 507		-2	DO 7540			H5	IRC	21 37	44.76	- 2	0 48.0	SAO	LL
2790	50 390		53	RU CYG	SRA	233.85	H8E	IRC	21 38	58.51	54 5	49.3	SAO	LL
2900	30 492			RV PEG	H	389.97	H6E	GCVS	22 23	19.00	30 13	0.0	GCVS	LL
2901									22 24	8.10	68 5	25.0	GAH	LL
2922	60 361			DO 41575			H2	DO	22 31	43.00	58 38	6.0	IRC	LL
2925	60 362		57	V CEP	SRC		R	IRC	22 34	32.71	58 9	59.9	SAO	LL
2929	80 55 8625	74	978	DO 41729			H4	DO	22 36	8.77	75 6	41.6	SAO	LL
3099							C	GHB	23 25	45.00	10 38	8.0	JYCE	LL
3099									23 27	53.30	60 0	15.0	WIRO	LL
3099									23 28	0.00	57 42	42.0	GCVS	LL
3099									23 28	25.50	59 58	48.0	WIRO	LL
3099	60 409			DO 43188			H4	DO	23 30	31.06	45 50	50.2	SAO	LL
3110	60 410			V358 CAS	LB		H7	DO	23 32	1.00	43 16	30.0	IRC	LL
4299	60 411			SVS 5744			H4	DO						
3112	50 468		45	4259			H4	DO						
3116	40 540			DO 43251			C	LWD						
3116									23 32	33.00	2 49	54.0	AFGL	LL
3119									23 36	35.98	51 59	7.6	SAO	LL
3125	50 474		51	3676	SVA	276.30	H8	DO						
3125				SV CAS										

GL	VIS	SOURCE	I'	K	N	11	20	27	D/M/Y	2.3	3.6	4.9	8.7	10.0	11.4	12.6	19.5	23.0	OBSVR	
2586																				
2590	11.00	DO	4.86	.55		-1.9	-4.4	-6.2	7/ 6/80	.58	.07	.02	-.91	-1.97	-2.64	-2.42	-3.40		GG	
2591						-2.4	-3.6	-6.7	7/ 6/80	5.73	1.59	-.45	-1.71	-2.24	-2.23	-3.40	-4.40		GG	
2593						-2.6	-4.7		1/10/80	5.74	1.63	-.32	-1.78	-2.14	-2.25	-3.31	-4.43		GG	
2593						-1.4	-4.2													
2602						-2.4	-4.9	-7.3												
2603						-2.0	-4.0		7/ 6/80	3.40	1.43	.28	-1.23	-1.53	-1.72	-1.96	-2.60		GG	
2605						1.5			25/ 6/78	1.16	.43	.38	-.85	-1.38	-1.83	-1.82			GG	
2609	10.10	DO	7.55	1.14	.3	-1.6	-2.7		25/ 6/78	1.16	.38	.30	-.67	-1.40	-1.90	-1.76			GG	
2618	6.27	IRC	2.34	-1.10	-1.4	-1.8			1/ 6/77	-1.03	-1.32	-1.14	-1.44	-1.47	-1.61	-1.58	-2.00		ETA	
2618									17/ 8/78	-1.08	-1.43	-1.23	-1.50	-1.63	-1.67	-1.81			RDG	
2621						-1.1	-4.2													
2624						-1.0	-4.6													
2625						-1.4	-4.6													
2632	6.80	IRC	7.09	.82	-1.9	-3.5	-3.6		7/ 6/80	-.01	-1.54	-2.56	-3.26	-3.47	-3.84	-3.71	-3.94		GG	
2757	11.50	DO	8.35	2.37	1.0	-2.3	-4.0		8/ 6/80	2.59	1.60	1.16	.30	-.28	-.57	-.52	-1.31		GG	
2775	10.00	DO	7.05	1.53	0.0	-2.3	-3.3		8/ 6/80	1.10	.37	.16	-.83	-1.59	-2.03	-1.80	-2.66		GG	
2761	13.00	LWD	8.71	2.04	-2	-2.0			8/ 6/80	1.22	-.35	-1.17	-2.09	-2.43	-2.76	-2.64	-2.71		GG	
2785	7.00	IRC	5.25	-.15	-1.6	-2.9	-3.4		8/ 6/80	-.24	-1.25	-1.44	-2.32	-2.64	-2.90	-2.65	-3.01		GG	
2757	9.30	IRC	4.68	.76	.4	-2.1			8/ 6/80	.90	.53	.58	.15	-.03	-.46	-.53	-1.20		GG	
2793	6.90	IRC	3.96	-.30	-.8	-2.2	-3.3		8/ 6/80	.26	.11	-.01	-.78	-1.54	-1.90	-1.68	-1.69		GG	
2900						1.3	-1.7		8/ 6/80	1.72	.98	.54	-.79	-1.53	-1.99	-1.67	-2.42		GG	
2901	10.50	DO	7.21	2.01	.8	-2.0	-3.0		25/10/75	3.83	1.04	-.36	-1.97	-2.18	-2.46	-2.69	-3.24	-3.44	GH	
2922	6.90	IRC	5.43	2.56	1.2	-1.5	-4.0		8/ 6/80	1.97	1.39	1.34	.49	-.52	-1.06	-.86	-1.71		GG	
2925	5.90	IRC	4.33	1.83	1.1	-2.0	-3.8		26/ 6/78	2.56	1.66	1.15	-.51	-1.13	-1.61	-1.31			GG	
2929						1.6	-1.9		8/ 6/80	1.86	1.68	1.90	1.82	1.67	1.74				GG	
3099						1.1	-2.0		12/ 6/78	5.92	2.19	.22	-1.83	-2.13	-2.56	-2.67	-2.95		RDG	
3099									18/ 6/78	5.66	1.96	-.11	-2.11	-2.42	-2.71	-2.90	-3.33	-3.56	JAH	
3099									23/ 6/78	5.89	2.12	.19	-1.83	-2.18	-2.50	-2.61	-3.20		RDG	
3099									25/ 7/78	5.86	2.10	.20	-1.75	-2.06	-2.53				GG	
3099									4/ 8/78	5.92	2.04	.10	-1.81	-2.22	-2.56	-2.68	-3.17		RDG	
3099									16/ 8/78	6.47	2.50	.52	-1.62	-2.11	-2.41	-2.64	-3.39		RDG	
3059									20/10/78	6.59	2.54	.49	-1.68	-1.98	-2.42	-2.46	-3.05	-3.17		RDG
3099									26/ 7/79					-2.06						RDG
3099									27/ 7/79	6.50	2.63	.60	-1.57	-1.97	-2.26	-2.42	-2.80	-3.22		RDG
3099									30/ 8/79	7.08	2.47	.38	-1.68	-2.10	-2.42	-2.57	-3.15		RDG	
3099									4/10/79	5.71	2.03	.10	-1.95	-2.22	-2.57	-2.74	-3.15	-3.45		RDG
3099									17/ 4/80	7.27	3.31	1.05	-1.10	-1.48	-1.83	-1.89	-2.19		RDG	
3099									5/ 8/80	7.65	3.65	1.66	-.85	-1.28	-1.64	-1.85	-2.46	-2.75		RDG
3109	11.30	DO	7.36	2.68	.5	-1.8	-3.9		29/ 6/80	1.84	1.23	1.11	-.04	-.90	-1.48	-1.30	-2.15		JAH	
3110	11.80	DO	6.22	2.10	1.3	-1.5			17/ 8/78	2.09	1.50	1.55	.36	-.65	-1.13	-1.05	-1.93		RDG	
4299	11.30	DO	6.72	2.04	.9	-1.6			29/ 6/80	1.74	1.17	1.03	-.04	-1.04	-1.60	-1.45	-2.58		JAH	
3112	6.86	IRC	4.65	1.77	1.4	-1.0	-4.5		29/ 6/80	1.86	1.70	1.92	1.73	1.59	1.77	1.37	1.03		JAH	
3116						-3	-3.5	-4.6	18/ 6/78	2.81	.02	-1.64	-3.32	-3.60	-3.98	-4.02	-4.71	-5.24		JAH
3116									3/11/78	2.51	-.27	-1.78	-3.27	-3.44						RDG
3119																				
3125	6.70	IRC	3.86	.17	-.5	-1.7	-3.4		18/ 6/78	-.18	-.51	-.59	-1.04	-1.67	-2.23	-1.97	-3.05	-3.30	JAH	
3125									17/ 8/78	.32	-.02	-.15	-.58	-1.29	-1.76	-1.54	-2.32			RDG

TABLE 3

WIRO CATALOG OF AFGL SOURCES

LOST SOURCE SUBCATALOG

GL	IRC	HR	BD	OTHER TYPE	PERIOD	SP SOURCE TYPE	LUM	R.A.	DEC.	SOURCE COMMENT	CLASS
62								0 22 26.00	47 23 0.0	AFGL	LST
9003								0 25 35.00	31 19 48.0	AFGL	LST
4004								0 31 3.00	- 7 56 0.0	AFGL	LST
90	50	11		DO 23568		K5		0 34 34.00	53 25 30.0	IRC	LST
92	60	15		PZ CAS	LB	M8		0 36 17.00	59 24 0.0	IRC	LST
96	40	12		DO 8439		H6		0 36 53.00	37 56 36.0	IRC	LST
99	60	16	58	89		H		0 37 31.91	59 14 22.8	SAO	LST
104	40	13		MGC 224				1 39 59.00	41 0 30.0	AFGL	LST
214								1 24 26.00	16 40 30.0	AFGL	LST
216	20	25		ST PSC	LB	H5		1 25 10.00	16 26 18.0	GCVS	LST
220	50	36	50	282 DO 24371		H6		1 25 33.37	51 25 14.9	SAO	LST
225								1 27 44.00	15 25 0.0	AFGL	LST
236	10	19	7	240 SVS 100126		M0		1 34 6.09	7 34 36.4	SAO	LST
240	70	30	64	208 DO 24571		H7		1 35 27.74	65 15 44.8	SAO	LST
245								1 39 57.00	28 18 0.0	AFGL	LST
4021								2 22 6.00	38 34 48.0	AFGL	LST
333								2 24 13.00	61 18 6.0	AFGL	LST
339	-20	33	735 -23	947 GC 3015		H1	7	2 28 15.95	-22 45 58.7	SAO	LST
341								2 29 19.20	57 49 27.0	LKRL	LST
348	-10	35	-13	479 U CET	H	H3E		2 31 19.62	-13 22 2.5	SAO	LST
4023								2 32 11.00	21 38 54.0	AFGL	LST
360								2 36 40.00	80 55 42.0	GCVS	LST
363								2 36 8.00	6 8 18.0	AFGL	LST
4025								2 37 5.00	- 6 28 6.0	AFGL	LST
369								2 39 55.00	- 5 46 36.0	AFGL	LST
488	-10	47	-12	649 VX ERI	SRT	H3		3 22 47.07	-12 31 48.5	SAO	LST
490								3 23 38.80	58 36 39.0	JYCE	LST
4033								3 27 50.00	-19 24 18.0	AFGL	LST
4034								3 31 30.00	-12 57 48.0	AFGL	LST
4035								3 33 16.00	-18 52 18.0	AFGL	LST
574								4 20 42.00	-13 0 18.0	AFGL	LST
4048								4 25 41.00	-23 10 54.0	AFGL	LST
589								4 29 4.00	22 45 12.0	AFGL	LST
599	-10	71	1452 -9	930 GC 5577		K4	3	4 31 47.98	- 9 4 18.9	SAO	LST
603	-30	37	1464 -30	1901 UPS2 ERI		K0	3	4 33 36.32	-30 39 49.0	SAO	LST
604	-10	72				H7		4 33 47.00	- 5 22 0.0	IRC	LST
4051	0	71		V535 ORI	LB	H4B		5 20 53.00	- 4 37 12.0	GCVS	LST
4052								5 21 26.00	-20 35 18.0	AFGL	LST
744								5 23 36.00	- 0 40 48.0	AFGL	LST
768	70	63		DO 29388		H6		5 29 29.00	65 1 24.0	IRC	LST
776								5 31 57.00	- 5 14 48.0	AFGL	LST
778								5 32 26.00	67 25 24.0	AFGL	LST
795								5 37 11.00	-12 28 36.0	AFGL	LST
928	0	106				H8	7	6 21 41.00	- 0 4 0.0	IRC	LST
4060	0	105				H7		6 21 30.00	- 0 15 36.0	IRC	LST
938								6 23 32.00	68 57 24.0	AFGL	LST
940								6 23 59.00	9 2 54.0	AFGL	LST
941								6 24 12.00	3 42 0.0	GCVS	LST
943	10	124		BY NON SBB 85.00		H6		6 24 22.00	5 24 24.0	GCVS	LST
				SH NON SBB 112.00		H5	3				LST

GL	VIS	SOURCE	I'	K	N	11	20	27	D/M/Y	2.3	3.6	4.9	8.7	10.0	11.4	12.6	19.5	23.0	OBSVR	
62																				
4003					1.8															
4004					1.6															
90	10.60	DO	6.99	2.80																
92	10.50	LVD	6.08	1.81																
96	9.20	DO	5.95	2.33																
99	7.17	IRC	4.80	1.92																
104			5.20	2.82																
214					1.7															
216			5.84	1.75																
220	8.70	IRC	6.01	2.76																
225					1.5															
236	6.68	IRC	4.39	1.53																
240	8.80	IRC	5.51	1.93																
245					1.6															
4021																				
333																				
339	6.10	IRC	4.62	2.13																
341					1.4															
341																				
345	6.60	IRC	6.71	2.95																
4023					1.7															
360					1.5															
353					1.6															
4025																				
369					1.4															
468	8.70	IRC	6.26	2.91																
450					1.6															
4033																				
4034																				
4035					1.6															
574					1.6															
4048					1.8															
589																				
553	5.27	IRC	3.98	1.71																
603	3.81	IRC	3.11	1.73																
604			5.87	2.09																
4051	9.60	DO	6.10	2.27																
4052					1.6															
744					1.6															
768	10.30	DO	6.16	2.28																
776					1.5															
778					1.4															
795																				
928	11.70	LVD	7.13	2.09																
4000			6.57	2.45																
938					1.4															
940					1.8															
941					1.4															
943	9.80	DO	6.71	2.93																
					1.6															

GL IRC HR BD OTHER TYPE PERIOD SP SOURCE LUH R.A. 1950.00 DEC. SOURCE COMMENT CLASS

GL	IRC	HR	BD	OTHER	TYPE	PERIOD	SP TYPE	SOURCE	LUH	R.A. 1950.00	DEC.	SOURCE	COMMENT	CLASS
944										6 24 34.00	-19 35 18.0	AFGL		LST
4061										6 26 2.00	44 47 0.0	AFGL		LST
949	10 125			DO 1612			M5	DO		6 27 41.00	8 6 30.0	IRC		LST
4063										6 29 5.00	45 56 30.0	AFGL		LST
957	60 170 2376	55	1093	7 LYM			K0	IRC		6 30 23.29	55 23 32.1	SAO		LST
961										6 31 54.00	4 16 36.0	AFGL		LST
965										6 32 19.00	-12 26 24.0	AFGL		LST
969										6 33 57.00	17 46 18.0	AFGL		LST
975	20 154 2421	16	1223	GAM GEH			A0	IRC	4	6 34 49.40	16 26 37.4	SAO		LST
976	10 129	14	1365	UB GEH	M	433.00	K0	IRC		6 34 47.54	14 43 44.5	SAO		LST
981	10 130	5	1345	DO 1689			M5	DO		6 36 11.17	5 14 11.1	SAO		LST
986	0 122			DO 1697			HT	H&B		6 36 57.00	- 2 24 24.0	IRC		LST
989										6 38 25.30	9 32 29.0	JYCE		LST
990										6 38 48.00	2 48 30.0	AFGL		LST
996										6 39 38.00	1 24 6.0	AFGL		LST
1115										7 22 52.00	6 10 42.0	AFGL		LST
1130	30 186 2861	28	1400	65 GEH			K2	IRC	3	7 26 42.25	28 1 15.8	SAO		LST
1139	10 167			DO 2247			M5	DO		7 30 41.74	11 7 14.7	SAO		LST
1143	70 78	66	512	DO 31652			M6	DO		7 31 9.62	66 34 51.3	SAO		LST
4074	40 181	38	1798	DO 13184			M3	IRC		7 34 45.45	38 22 21.9	SAO		LST
1159										7 36 42.00	- 8 21 6.0	AFGL		LST
4084	-10 196	-5	2550	RT HYA	SRB	253.00	MC	IRC		8 25 41.00	72 33 12.0	AFGL		LST
1260										8 27 13.21	- 6 9 .6	SAO		LST
1273										8 27 44.00	-21 17 36.0	AFGL		LST
1275										8 34 40.00	- 8 39 24.0	AFGL		LST
4027										8 36 1.00	11 11 36.0	AFGL		LST
1282	0 177			DO 2576			M6	H&B		8 36 26.00	46 9 42.0	AFGL		LST
1350	60 194 3722	64	733	GC 12970			K2	IRC		8 38 25.00	- 0 30 36.0	IRC		LST
1352										9 21 44.00	64 9 26.8	SAO		LST
1355	40 206	45	1728	DO 32882			M6	DO		9 23 40.00	21 0 24.0	AFGL		LST
4094										9 27 42.27	44 54 15.5	SAO		LST
1360	70 90 3771	70	565	24 UHA			G2	IRC	4	9 28 21.00	44 56 6.0	AFGL		LST
4056	70 91 3824	67	602	DO 32923			K5	IRC		9 30 5.84	70 3 6.5	SAO		LST
1481										9 35 21.05	67 29 56.0	SAO		LST
4131	50 210	49	2050	DO 33683			M2	DO		11 20 29.00	24 24 18.0	AFGL		LST
1484										11 22 27.00	16 29 48.0	AFGL		LST
1467				IC 2811						11 23 20.00	9 30 30.0	AFGL		LST
1458										11 32 28.00	19 27 12.0	AFGL		LST
1500	80 24	78	392	DO 33752			M2	DO		11 34 36.65	77 52 21.4	AFGL		LST
4153										12 32 3.00	8 27 36.0	AFGL		LST
4155										12 32 49.00	8 22 42.0	AFGL		LST
4156										12 32 51.00	6 18 36.0	AFGL		LST
1571	0 223 4625	-0	2601	GAM VIR			F0	IRC	5	12 39 7.46	- 1 10 31.9	GC		LST
1620	40 245 5052	37	2404	DO 14749			M4	IRC	7	13 21 38.03	37 17 39.9	SAO		LST
1625										13 26 12.00	55 24 12.0	AFGL		LST
4214										15 20 56.00	16 32 12.0	AFGL		LST
4215										15 26 16.00	17 34 0.0	AFGL		LST
1762										15 34 4.00	21 48 12.0	AFGL		LST
1852	30 287 6103	31	2845	XI CRB			K0	IRC	3	16 20 8.82	31 0 25.0	SAO		LST

C

GL	VIS	SOURCE	I'	K	4	11	20	27	D/H/Y	2.3	3.6	4.9	6.7	10.0	11.4	12.6	19.5	23.0	OBSVR	
944																				
4061																				
949		DO	6.76	2.73	1.4															
4063																				
957		IRC	5.24	2.52	1.4															
961																				
965					1.6															
969																				
975		IRC	1.88		1.5															
976		IRC	7.68	3.03	1.5															
981		IRC	4.94	1.86	1.4															
986		DO	6.91	2.64	1.4															
959																				
990					1.5															
996					1.5															
1115					1.6															
1130		IRC	4.32	2.59	1.4															
1139		IRC	4.63	1.81	1.5															
1143		IRC	5.07	2.01	1.5															
4074		IRC	5.25	2.26	1.5															
1159																				
4084																				
1258		IRC	3.69	-0.17																
1260					1.5															
1273					1.5															
1275					1.4															
4087					1.4															
1252		DO	6.46	2.13	1.5															
1350		IRC	4.97	2.70	1.6															
1352																				
1355		IRC	5.10	1.95	1.6															
4094																				
1360		IRC	4.03	2.72	1.7															
4096		IRC	4.59	2.34	2.3															
1481																				
4131		IRC	5.37	2.84	1.5															
1484					1.4															
1487																				
1498					1.7															
1500		IRC	5.11	2.45	1.7															
4153																				
4155																				
4156																				
1571		IRC	2.50	1.88	1.6															
1620		IRC	4.18	1.31	1.4															
1625					1.7															
4214																				
4215																				
1789					1.8															
1852		IRC	4.20	2.59	1.6															

11/ 4/78 .09 .28 -.37 -.78 -.85 -1.02 -1.13 -1.34 -.85 JAH

11/ 4/78 2.04 1.82 1.93 1.21 .80 .37 .50 -1.01 -1.17 JAH

12/ 6/78 2.65 2.57 2.65 2.59 2.57 2.66 RDG

GL	IRC	HR	BD	OTHER TYPE	PERIOD	SP TYPE	SOURCE	LUM	R.A.	DEC.	SOURCE	COMMENT	CLASS
1857								16 23	28.00	- 1 19	24.0	AFGL	LST
4224								16 23	44.00	-24 17	48.0	AFGL	LST
4226								16 30	11.00	- 2 20	12.0	AFGL	LST
4227								16 32	48.00	- 8 19	42.0	AFGL	LST
1960	0 302	1 3425		DO 4277		M5	DO	17 20	22.49	0 55	9.9	SAO	LST
1963								17 22	0.00	-24 38	12.0	AFGL	LST
4231								17 28	14.00	4 49	54.0	AFGL	LST
1981	0 305	0 3717		DO 4306		M4	DO	17 30	43.37	0 8	14.0	SAO	LST
1985								17 33	22.00	17 39	54.0	AFGL	LST
4232								17 33	46.00	36 0	12.0	AFGL	LST
1991								17 35	13.00	-20 50	24.0	IRC	LST
2143	-20 374			SVS 3315		M7	LWD	18 21	33.00	-16 15	24.0	AFGL	LST
2153								18 23	52.00	-12 26	48.0	AFGL	LST
2160								18 24	39.00	10 50	36.0	AFGL	LST
2161								18 24	29.30	-12 1	36.0	JYCE	LST
2171								18 27	34.40	62 36	52.0	JYCE	LST
2172								18 27	32.00	24 19	42.0	AFGL	LST
2174				SHARP. 56				18 28	26.40	- 9 46	54.0	JYCE	LST
2174								18 21	21.82	89 3	3.5	SAO	LST
4238		7394	88 112	LAM UHI		M1	HR	18 31	48.30	86 37	43.2	GC	LST
2184				GC 25364		MA	GC	18 30	30.00	- 7 29	0.0	IRC	LST
2185	-10 434					M7:	H&B	18 30	53.00	- 9 10	42.0	AFGL	LST
2188								18 31	32.00	-21 3	30.0	AFGL	LST
2191								18 31	46.00	- 8 45	42.0	AFGL	LST
2193				W 41				18 31	49.00	- 7 59	18.0	AFGL	LST
2194								18 32	2.00	- 8 36	6.0	AFGL	LST
2195								18 33	19.60	5 33	17.0	JYCE	LST
2199								18 33	51.00	- 7 23	24.0	AFGL	LST
2202								18 35	4.00	- 6 22	18.0	AFGL	LST
2207								18 35	39.00	- 5 32	30.0	AFGL	LST
2211								18 36	3.15	-13 49	20.0	SAO	LST
2214	-10 446		-13 5060			K5	IRC	18 37	17.69	- 7 50	13.1	SAO	LST
2220	-10 449	7007	-7 4648	GC 25524		K4	IRC	18 39	31.00	28 45	42.0	GCVS	LST
2228	30 339			SY LYR		M6	GCVS	18 39	26.00	- 5 4	42.0	IRC	LST
2229	-10 454					M2	H&B	19 20	55.00	14 47	42.0	AFGL	LST
2380						M8E	GCVS	19 24	19.00	71 35	6.0	GCVS	LST
2388	70 156			YZ DRA		M6	DO	19 24	10.00	36 5	8.4	SAO	LST
2399	40 347		35 3614	DO 17754				19 28	5.00	18 11	36.0	AFGL	LST
4249				SHARP. 82				19 28	18.00	19 44	21.0	KLHN	LST
2403								19 29	24.00	18 36	48.0	AFGL	LST
2408								19 30	3.00	13 15	12.0	AFGL	LST
4251								19 32	47.55	30 24	20.3	AGK3	LST
2436	50 304		30 3639	PLANETARY				19 39	27.00	48 40	18.0	GCVS	LST
4264				V391 CYG				20 20	9.00	39 46	6.0	AFGL	LST
2566	60 28C	1805	63 1618	GC 28340		K5	IRC	20 20	29.04	63 49	10.6	SAO	LST
2567	0 473		-0 3991	DO 6706		M4	DO	20 20	44.89	- 0 36	50.6	SAO	LST

GL VIS SOURCE I' K 4 11 20 27 D/M/Y 2.3 3.6 4.9 8.7 10.0 11.4 12.6 19.5 23.0 OBSVR

1857																					
4224				1.9	-1.3	-3.4	-7.0														
4226							-3.1	-6.2													
4227				1.9																	
1960	9.10	IRC	5.89	2.35	1.4	--4															
1963																					
4231																					
1981	9.80	DO	5.24	1.07	1.5																
1985					1.7																
4232						-1.2	-3.2														
1991	11.30	LMD	8.97	2.69	1.5																
2143					1.6	-1.4	-3.3														
2153						-9	-3.7														
2160							-3.1														
2161						-1.1	-3.8														
2171	12.00	JYCE			1.5	-1.2	-3.1														
2172					1.4																
2174					1.4	-1.1	-3.1														
2174																					
4238	6.32	HR			1.6																
2184	6.82	GC			1.4																
2185			8.83	2.47	1.6	-1.1															
2188					1.6	-1.0															
2191					1.5																
2193						-1.2	-2.7														
2194						-1.0	-3.5														
2195					1.8	-7	-3.6														
2199					1.8	-1.3	-3.5														
2199																					
2199																					
2202																					
2207																					
2211						-1.3	-3.5														
2211						-1.2	-3.8														
2211						-1.1	-3.1														
2214																					
2214	8.20	IRC	5.13	1.54	1.4																
2220	6.08	IRC	4.55	2.16	1.4																
2228	10.10	DO	6.09	1.70	1.5																
2229			7.26	2.02	1.5																
2380						-1.0															
2380						-1.4															
2388																					
2388	6.60	DO	7.25	1.96	1.5																
4249			5.11	1.91	1.5																
2403					1.4																
2408						-1.4	-3.2														
2410						-1.0	-3.0														
4251	9.30	AGK3				-9	-3.2														
4251			7.80	2.76	1.6	-1.3	-3.6														
4264						--4															
2506	5.79	IRC	4.52	1.98	1.4	--8	-3.0	-6.4													
2567	7.50	IRC	4.99	2.08	1.7	--9															

23/ 6/78 4.12 2.63 1.68 .44 -.22 -.68 -.96 RDG
 26/ 7/79 -.29 RDG
 18/ 4/80 4.04 2.57 1.83 .48 -.03 -.37 -.77 -1.10 RDG

23/ 6/78 2.42 .51 -.40 -2.20 -2.62 -2.93 -2.94 -4.03 RDG
 5/ 8/78 2.50 .51 -.43 -2.17 -2.31 -2.95 -3.03 -3.64 RDG
 18/ 4/80 2.76 .67 -.47 -2.23 -2.60 -3.02 -3.16 -4.10 RDG

GL	IRC	HR	BD	OTHER	TYPE	PERIOD	SP	SOURCE	LUN	R.A.	DEC.	SOURCE	COMMENT	CLASS
							TYPE			1950.00				
2569	50 326									20 21 13.00	51 51 24.0	IRC		LST
2579				V1324	CYG					20 24 2.00	- 6 28 6.0	AFGL		LST
2596	40 420	39	4223	DO	19093		M5	DO		20 25 19.00	39 53 6.0	AFGL		LST
2600	40 427						M2	DO		20 29 46.38	39 42 36.0	SAO		LST
4267										20 29 41.00	40 29 6.0	IRC		LST
2599	60 292			BF	CEP	427.00	M7	GCVS		20 29 58.00	38 48 0.0	AFGL		LST
2612										20 30 29.00	62 47 12.0	GCVS		LST
4268										20 33 32.00	41 4 18.0	AFGL		LST
2620										20 33 49.00	- 8 44 18.0	AFGL		LST
2629	0 467			SVS	103015		M4	DO		20 35 0.00	41 24 54.0	AFGL		LST
2631										20 36 31.00	41 55 42.0	AFGL		LST
2756	20 507			BH	PEG	426.00	M6	GCVS		20 38 21.00	1 0 18.0	SVS		LST
4274										20 39 26.00	41 40 24.0	AFGL		LST
2777				V645	CYG					21 21 3.00	23 15 18.0	GCVS		LST
2789										21 25 34.00	10 15 48.0	AFGL		LST
4276										21 29 34.00	-27 47 36.0	AFGL		LST
2789										21 29 39.00	60 39 36.0	AFGL		LST
4290										21 38 10.61	50 0 42.6	LADA		LST
2904	50 430			DO	41372		M5	DO		22 20 37.00	- 2 46 0.0	AFGL		LST
2911	10 518	8562	8	4874	36	PEG	K5	IRC	7	22 24 53.00	45 9 6.0	IRC		LST
4231	20 54		76	865	DO	41700	M4	DO		22 26 38.19	8 52 23.2	SAO		LST
2936	40 518				DO	41783	M7	DO		22 35 43.78	77 20 22.9	SAO		LST
3102	50 465		50	4054	SVS	8858	F8	IRC		22 39 32.00	42 17 0.0	IRC		LST
3111										23 26 57.70	50 56 39.2	SAO		LST
3114	30 513	8943	30	4978	SVS	103124	K4	IRC	3	23 30 20.00	31 57 0.0	AFGL		LST
3128										23 31 28.03	31 2 57.2	SAO		LST
4300	40 542						M7	VOGT		23 38 18.00	70 7 12.0	AFGL		LST
										23 38 13.00	44 31 36.0	IRC		LST

GL	VIS	SOURCE	I'	K	H	4	11	20	27	D/M/Y	2.3	3.6	4.9	8.7	10.0	11.4	12.6	19.5	23.0	OBSVR
2569			7.25	2.27	1.6															
4266								-3.9												
2579								-3.4												
2596	8.90	IRC	5.85	2.16	1.5		-1.2													
2600			8.34	2.44	1.5															
4267								-3.6												
2599	11.00	DO	6.97	2.25	1.6		-7		-5.8											
2612							-1.2													
4268								-3.3												
2616								-3.7												
2620							-1.3													
2629	11.00	DO	6.30	2.03	1.4															
2631							-1.3													
2756			6.62	3.12	1.4		-7													
4274								-3.6												
4276								-3.6												
2777					1.4															
2769	14.00	H&L						-1.4												
2789										12/ 6/78	4.67	2.25	.98	-.60	-.97	-1.26	-1.75	-2.86		RDG
2785										18/ 6/78	4.43	2.01	.61	-.93	-1.31	-1.56	-2.06	-3.51	-4.20	JAH
2769										22/ 6/78	4.60	2.22	.94	-.65	-.95	-1.26	-1.77			RDG
2789										4/ 8/78	4.60	2.15	.69	-.68	-1.19	-1.33	-1.89	-2.87		RDG
2769										5/ 8/78	4.45	2.02	.73	-.78	-.99	-1.28	-1.97	-2.83		RDG
2789										16/ 8/78	4.85	2.42	1.13	-.49	-.97	-1.24	-1.86	-3.40		RDG
2789										26/ 7/79					-1.14					RDG
2769										27/ 7/79	4.94	2.42	1.04	-.57	-1.03	-1.18	-1.73	-2.75		RDG
2769										4/10/79	4.73	2.37	1.01	-.61	-.98	-1.21	-1.79	-2.99	-3.43	RDG
2789										17/ 4/80	5.00	2.58	1.22	-.43	-.74	-1.00	-1.64	-2.85		RDG
4290					1.5															
2904	10.30	DO	6.02	1.90	1.4															
2911	5.58	IRC	4.24	1.85	1.4															
4291	8.00	IRC	5.63	2.28	1.6															
2936	11.10	DO	6.93	2.26	1.5															
3102	9.80	IRC	7.24	2.45	1.6															
3111					1.5															
3114	4.96	IRC	3.91	1.76	1.4															
3128					1.5															
4300			7.56	2.66	1.6															

TABLE 4

Comments on Individual Sources in Tables 1, 2, and 3.

<u>GL #</u>	<u>COMMENT</u>
85	A 8' x 8' box has been searched for point sources to $N \approx +0.5$, none found.
326	(W3) Has been mapped extensively, see Hackwell et al. (1978).
328	(W3-N) Extended object in AFGL catalog.
359	Sharpless 145.
361	A 8' x 8' box has been searched for point sources to $N \approx +0.5$, none found.
489	CIT 5.
505	(U Cam) The period of Variability is approximate (GCVS).
585	Sharpless 222.
601	(Alpha Tau) Used as a standard star, the standard magnitudes are given.
614	(DM Eri) A binary star, the difference of the magnitudes of the components is $.3^m$, the separation is $4''$ (GCVS).
800	Sharpless 240.
807	(NCG 2024) Has been previously mapped, see Grasdalen (1974).
933	I' magnitude is variable (IRC).
945	(V Lyn) Periods of 55 and 87 days replace one another. UU Her type. Slow nonperiodic oscillations also observed (GCVS).

- 968 (GL Mon) The period of variability is approximate (GCVS).
- 1117 (XX Gem) K magnitude is variable (IRC).
- 1145 (KQ Pup) Multi-component system, late component is a spectroscopic binary with a period of 27 years (GCVS).
- 1151 (DU Pup) The period of variability is approximate (GGVS).
M5 and M6 spectral type stars found near this position by Hansen and Blanco (1975).
- 1254 A 4' x 4' box has been searched for point sources to $M \approx +2.5$, none found.
- 1261 A 8' x 8' box has been searched for point sources to $N \approx +0.5$, none found.
- 1263 A 8' x 8' box has been searched for point sources to $N \approx +0.5$, none found
- 1278 A 4' x 4' box has been searched for point sources to $M \approx +2.5$, none found.
- 1281 (AK Hya) The period of variability is approximate (GCVS).
- 1282 Has an abnormally strong red end sharply cutoff by a deep absorption at $\lambda = 6195 \text{ \AA}$ (D0).
- 1417 A 12' x 12' box has been searched for point sources to $[Q] \approx -2.5$, none found.
- 1423 I' magnitude is variable (IRC).
- 1424 A 8' x 8' box has been searched for point sources to $N \approx +0.5$, none found.
- 1482 (T Crt) The period of variability is approximate (GCVS).
- 1554 (BK Vir) The period of variability is approximate (GCVS).
- 1627 (R Hya) Period varies strongly; SiO maser (GCVS).

1634 A 10' x 10' box has been searched for point sources to $N \approx +0.5$, none found.

1642 K magnitude is variable (IRC).

1773 CIT 7.

4217 A 6.5' x 6.5' box has been searched for point sources to $N \approx +1.0$, none found.

4222 A 6.5' x 6.5' box has been searched for point sources to $N \approx +1.0$, none found.

1862 K magnitude is variable (IRC).

1868 (R UMi) I' magnitude is variable (IRC).

1971 (TW Oph) This star is connected with a variable nebula (GCVS).

1988 CIT 9.

2162 (UY Sct) Has noticeable polarization (4%). Also has IR excess which is probably due to a dust envelope (GCVS).

2165 MWC 297.

2164 K magnitude is variable (IRC).

2166 I' magnitude is variable (IRC).

2168 IRC source was not found in survey by Hansen and Blanco (1975).

2177 (W40) See Zeilik and Lada (1978). WIRO coordinates are given for IRS 2.

2190 A 6.5' x 6.5' box has been searched for point sources to $N \approx +1.0$, none found.

2203 (RX Sct) Connected with the bright hydrogen nebula YM 13 (GCVS).

- 2208 (Alpha Lyra) Used as a standard star, the standard magnitudes are given.
- 2210 This source has been mapped and is seen to be a region of extended IR emission (unpublished).
- 2213 (X Oph) Visual binary with appreciable orbital motion; companion has spectral type K1 III (GCVS).
- 2215 I' magnitude is variable (IRC).
- 2223 Hansen and Blanco (1975) report that there are 4 faint M stars within 1.5' of this position.
- 2227 Hansen and Blanco (1975) report that this star is reddened.
- 2230 Vogt (1973) found many other possible late type stars in this field.
- 2233 IRC source was not found in survey by Hansen and Blanco (1975).
- 2376 A 6.5' x 6.5' box has been searched for point sources to $N \approx +1.0$, none found.
- 2378 A 6.5' x 6.5' box has been searched for point sources to $N \approx +1.0$, none found.
- 2379 A 6.5' x 6.5' box has been searched for point sources to $N \approx +1.0$, none found.
- 2381 (W51) Has been extensively mapped, see Hackwell et al. (1982).
- 2414 (EP Vul) The spectral type is alternatively K5e (GCVS).
- 4251 Also known as Campbell's variable nebula or Campbell's hydrogen envelope star.
- 2426 (BG Cyg) K and I' magnitudes are variable (IRC).

- 2433 A 8' x 8' box has been searched for point sources to $M \approx +2.3$, none found.
- 2565 Photometry is for Gamma Cyg.
- 2570 K and I' magnitudes are variable (IRC).
- 4265 A 8'x8' box has been searched for point sources to $[Q] \approx -2.5$, none found.
- 2578 A 6.5'x6.5' box has been searched for point sources to $N \approx +1.0$, none found.
- 2583 (KZ Cyg) K and I' magnitudes are variable (IRC).
- 2584 (Sharp. 106) Has been mapped and is seen to be a multiple source object in a extended region of IR emission, see Gehrz et al. (1982).
- 2586 A 6.5'x6.5' box has been searched for point sources to $N \approx +1.0$, none found.
- 2617 K magnitude is variable (IRC).
- 2624 W75 S
- 2771 K and I' magnitudes are variable (IRC).
- 2781 CIT 13.
- 2924 A 6.5'x6.5' box has been searched for point sources to $L \approx +3.7$, none found.
- 2925 (W Cep) There are features of a dust shell and a hot component in the spectrum (GCVS).
- 3099 This source has been discussed in Gehrz et al. (1978).
- 3119 A 10'x10' box has been searched for point sources to $[Q] \approx -1.6$, none found.

3122

(Lambda And) Spectroscopic binary with period of 20.52 days. Brighter component is a semi irregular variable with mean period of 55.82 days (GCVS).

3126

(SVS 8872) I' magnitude is variable (IRC).

TABLE 5
 Long Lambda Sources Associated With H II Regions
 or Dark Clouds

<u>GL #</u>	<u>Designation</u>
326	W3
328	W3N
781	involved in Orion Nebula
779	Orion Nebula (Trapezium Region)
806	NGC 2023
807	NGC 2024
1855	ρ Oph dark cloud
4222	ρ Oph dark cloud
2147	G 18.1 - 0.3
4237	G 18.3 - 0.4
2157	W 39
2169	G 20.7 - 0.1
2177	W 40
2190	G 24.5 + 0.5
2200	G 24.8 + 0.1
2210	W 42
2376	G 49.0 - 0.3
2378	G 49.4 - 0.3
2379	G 49.2 - 0.3
2381	W 51
2578	G 78.1 + 0.6

2584	Sharpless 106
2586	G 79.3 + 1.3
2593	W 69
2602	G 79.3 + 0.3
2621	W 75 North
2624	DR 21
2625	DR 22

TABLE 6

Rejected Long Lambda Sources.

<u>GL #</u>	<u>4</u>	<u>11</u>	<u>20</u>	<u>Reason for rejection</u>
85		-1.5		Search; this paper
361		-2.0	-3.1	Search; this paper
1164			-4.8	Seen only once by AFGL
1261		-1.5		Search; this paper
1263		-1.8		Search; this paper
1417			-4.7	Search; this paper
1424	1.8	-1.7		Search; this paper
1426			-4.6	Seen only once by AFGL
1493		-2.8		Search by Lebofsky et al (1978).
1634		-1.5		Search; this paper
4217	1.5	-1.9	-3.3	Search; this paper
2152		-1.5		Search by Lebofsky et al(1978).
2433	1.7	-2.1	-2.2	Search; this paper
4265			-4.0	Search; this paper
3119			-4.4	Search; this paper

TABLE 7
Luminosity of $M = -9$ Star as a Function
of Effective Temperature

<u>$T_{\text{eff}}(\text{K})$</u>	<u>$L/L_{\odot}(10^4)$</u>
4500	3.4
4000	2.5
3500	1.8
3000	1.3
2500	0.8

TABLE 8
Luminosity of $M_{10} = -12$ as a Function
of Effective Temperature

<u>T_{eff}(K)</u>	<u>L/L_{\odot}(10^4)</u>
1400	2.54
1200	1.77
1000	1.19
800	0.76
700	0.50
600	0.48
500	0.39
400	0.34
300	0.36

FIGURE CAPTIONS

Fig. 1 - The AFGL rocket observations at $4 \mu\text{m}$ have been plotted against the average of ground based measurements at 3.6 and $4.9 \mu\text{m}$.

Fig. 2 - The AFGL rocket observations at $11 \mu\text{m}$ have been plotted against the $10 \mu\text{m}$ ground based measurements.

Fig. 3 - The logarithm of the number of sources brighter than a given value of $[4]$ has been plotted as a function of $[4]$. The dots are from the LL list only. The crosses are the results expected from the FMO catalog based on our survey of every eighth entry in the FMO list.

Fig. 4 - The same as fig. 3 for $[10]$.

Fig. 5 - These two plots show the distribution of $[4]$ - $[11]$ colors for two magnitude limited samples drawn from the LL catalog. The upper panel is for a sample magnitude limited at $10 \mu\text{m}$, while the lower panel is for $4 \mu\text{m}$. The areas under the histograms are equal in the two panels.

Fig. 6 - The latitude distribution of the 10 and $4 \mu\text{m}$ magnitude limited samples from the LL catalog. Note that the $10 \mu\text{m}$ sample is more concentrated to the galactic plane than the $4 \mu\text{m}$ sample. The thin lines correspond to models of the galactic distribution of the two classes of sources.

M. CASTELAZ, R. D. GEHRZ, GARY L. GRASDALEN, C. GULLIXSON, J. A. HACKWELL:
Department of Physics and Astronomy, P.O. Box 3905, University Station,
University of Wyoming, Laramie, WY 82071

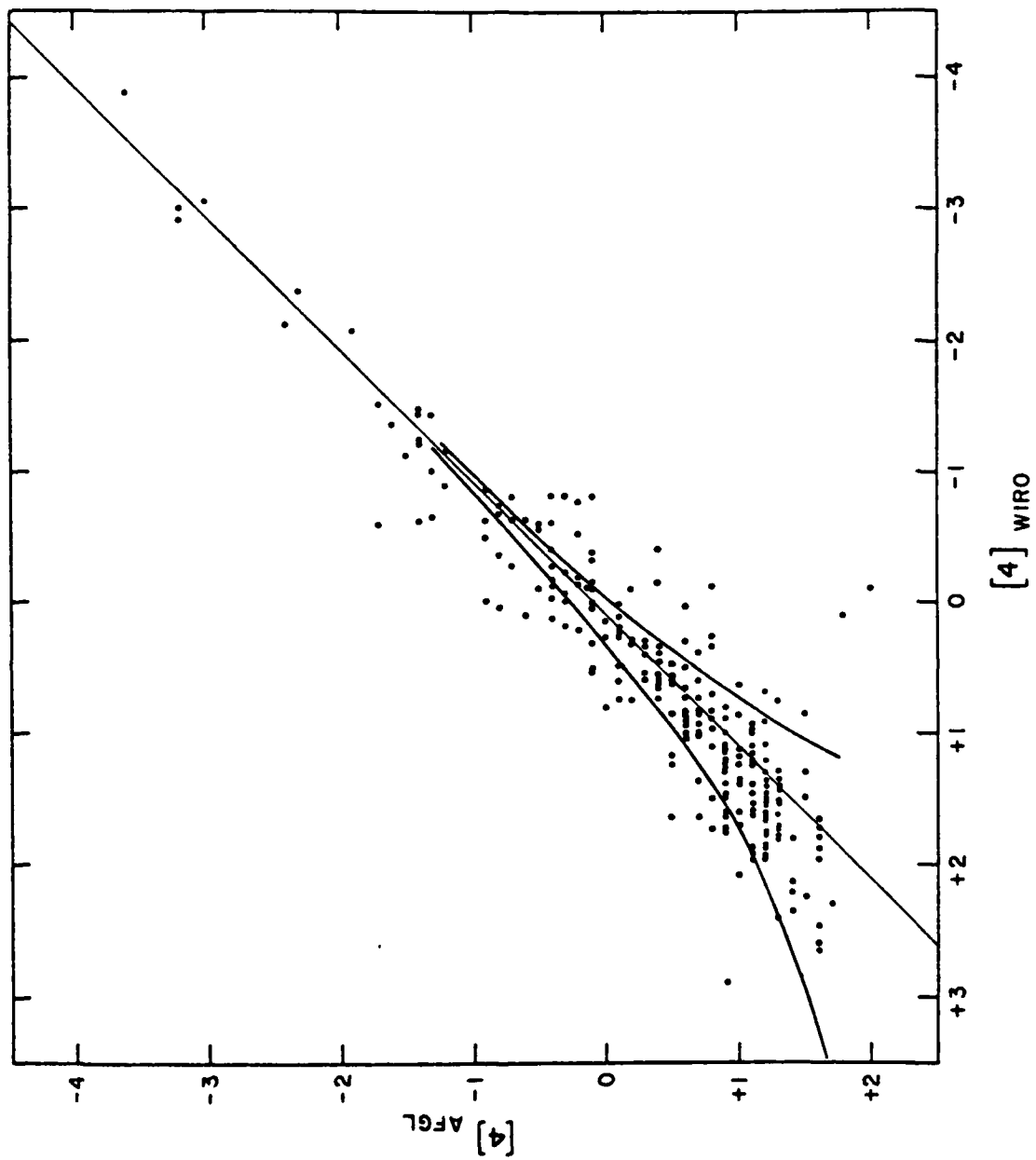


Fig. 1

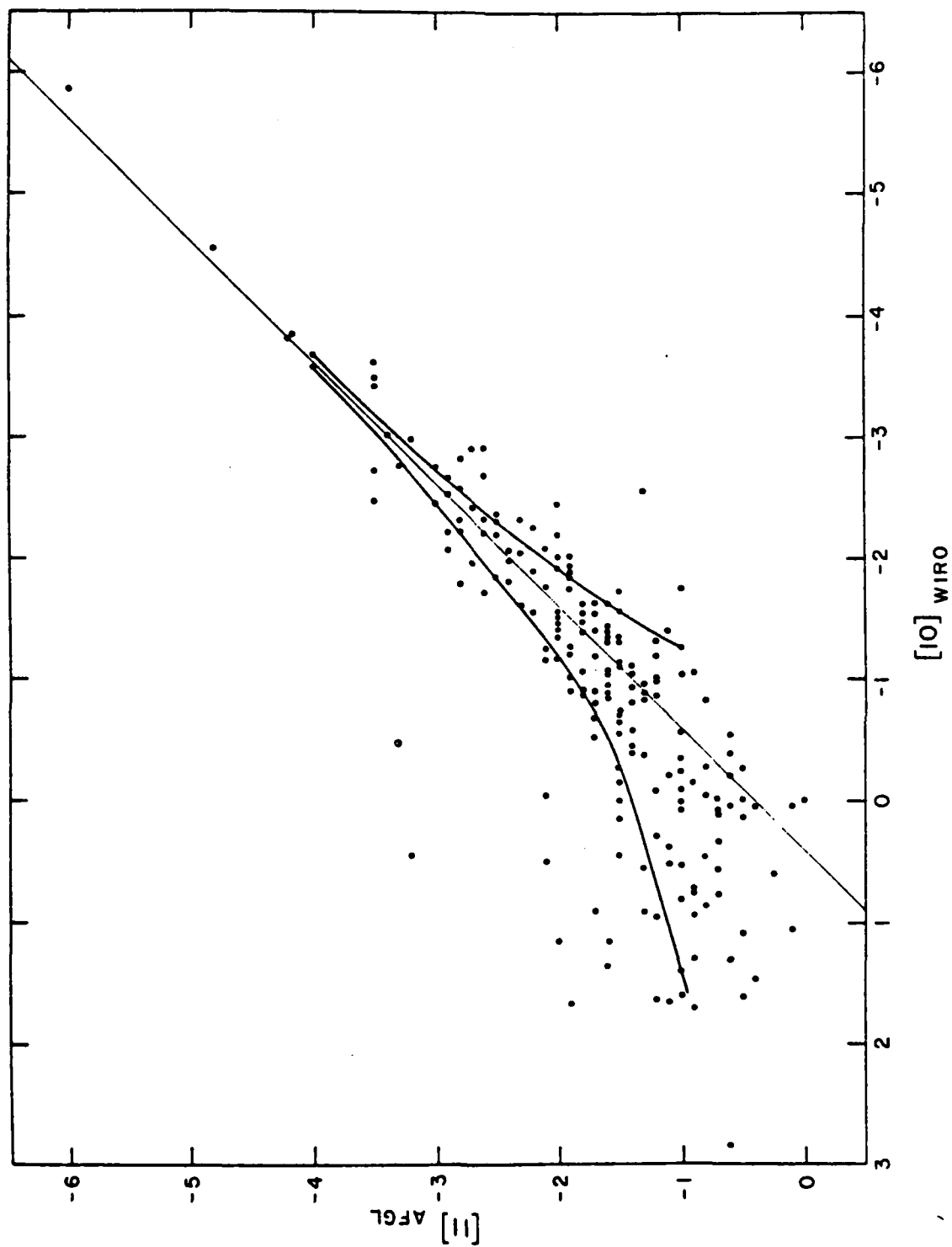


Fig. 2

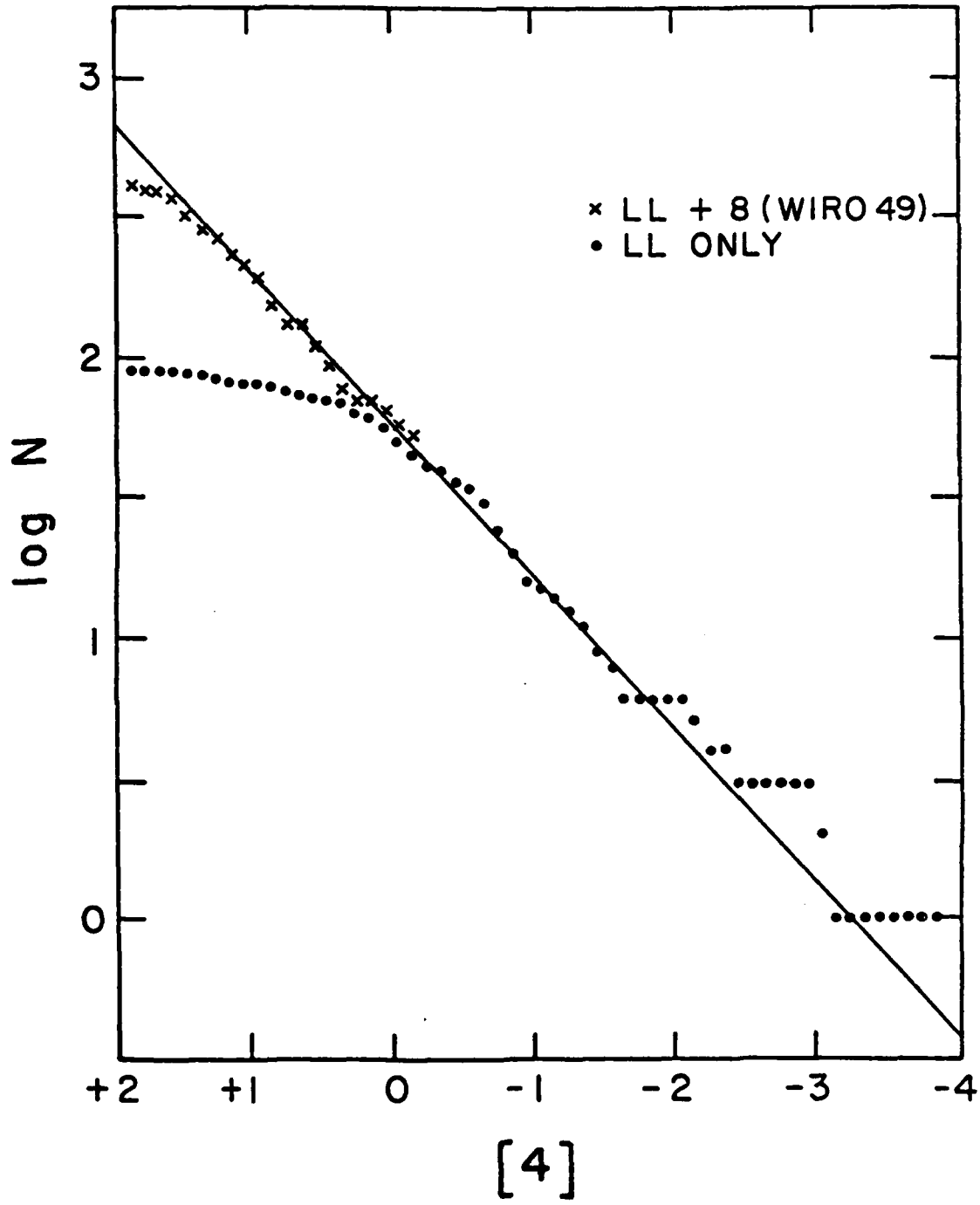


Fig. 3

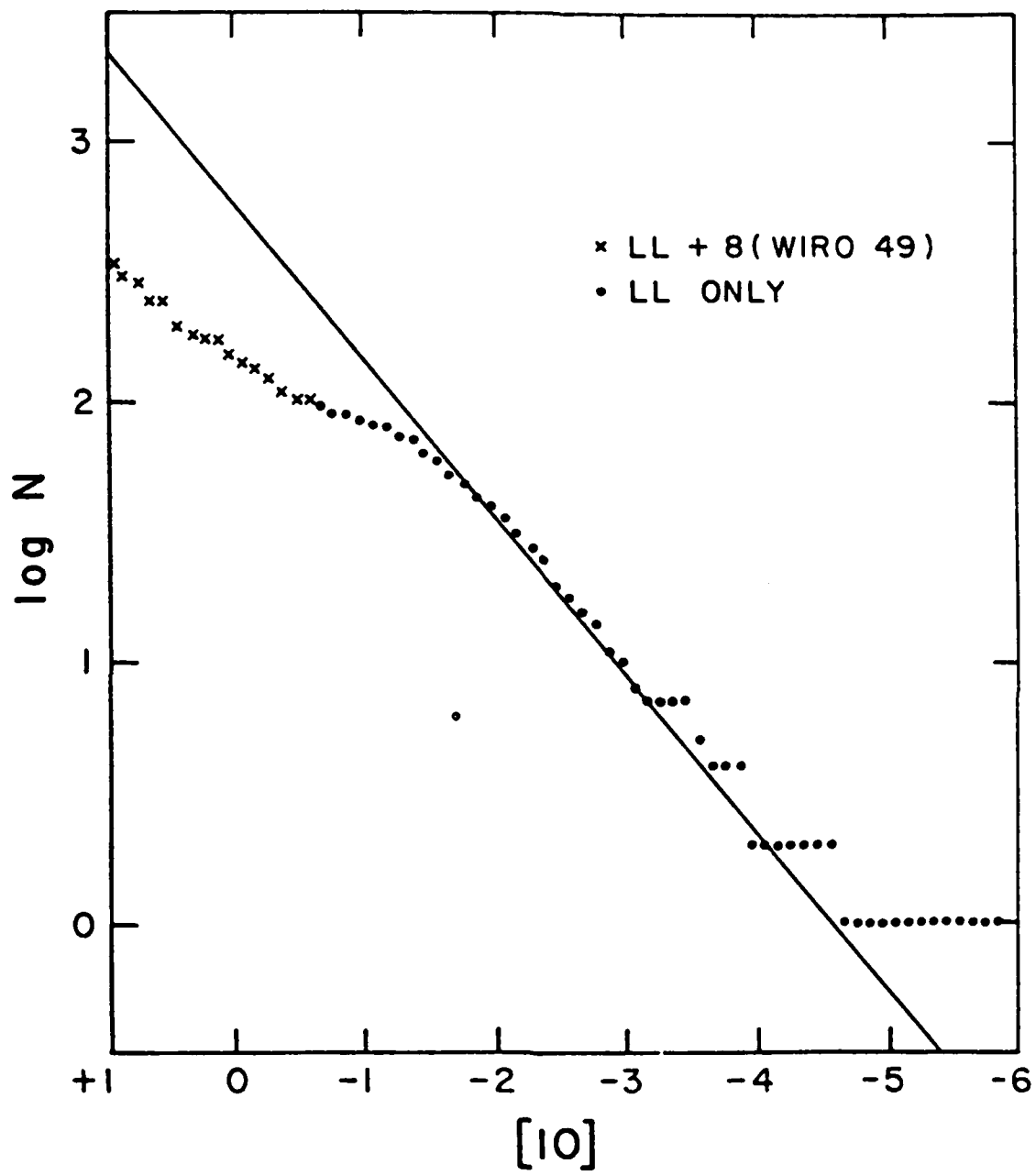


Fig.4

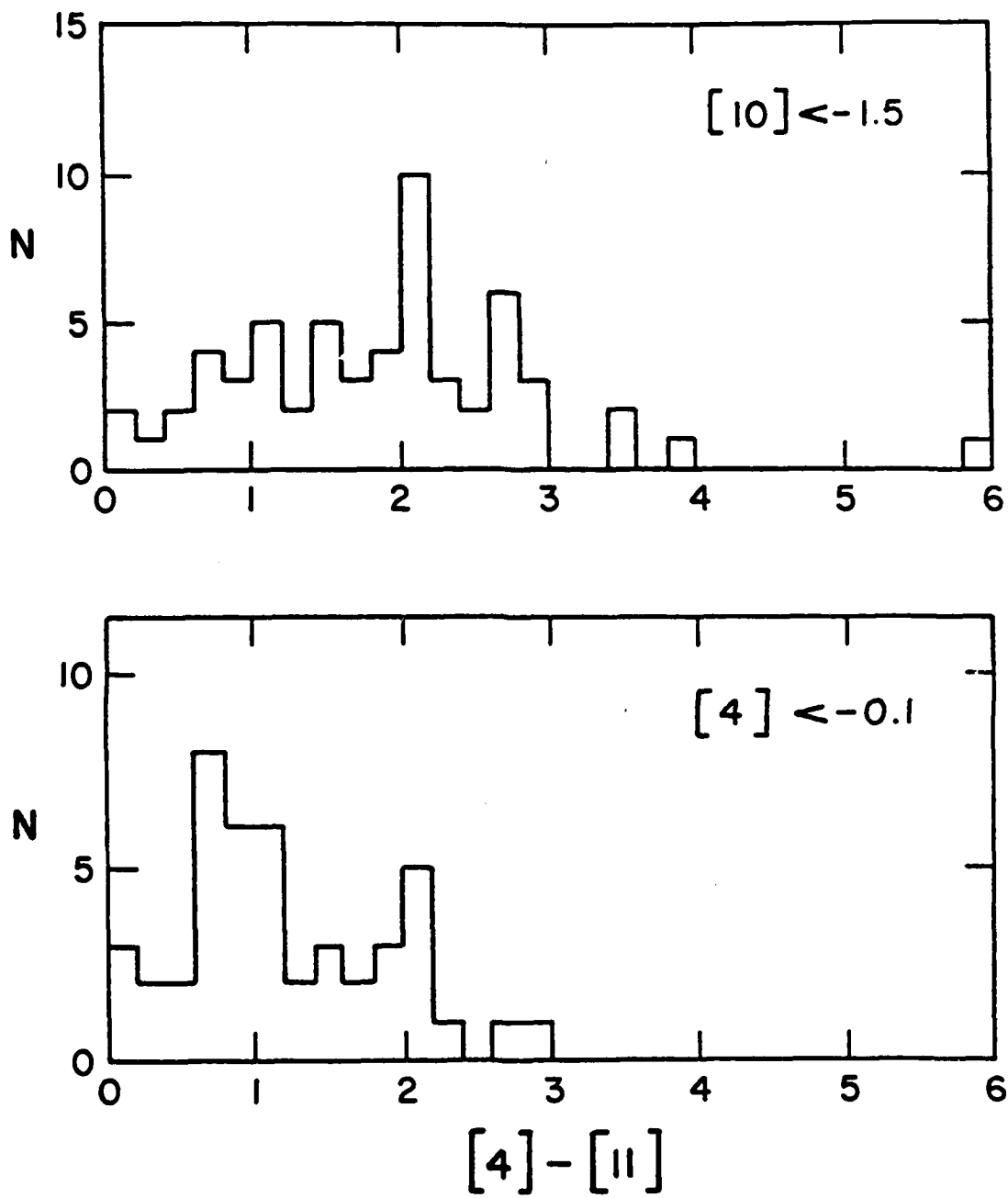


Fig. 5

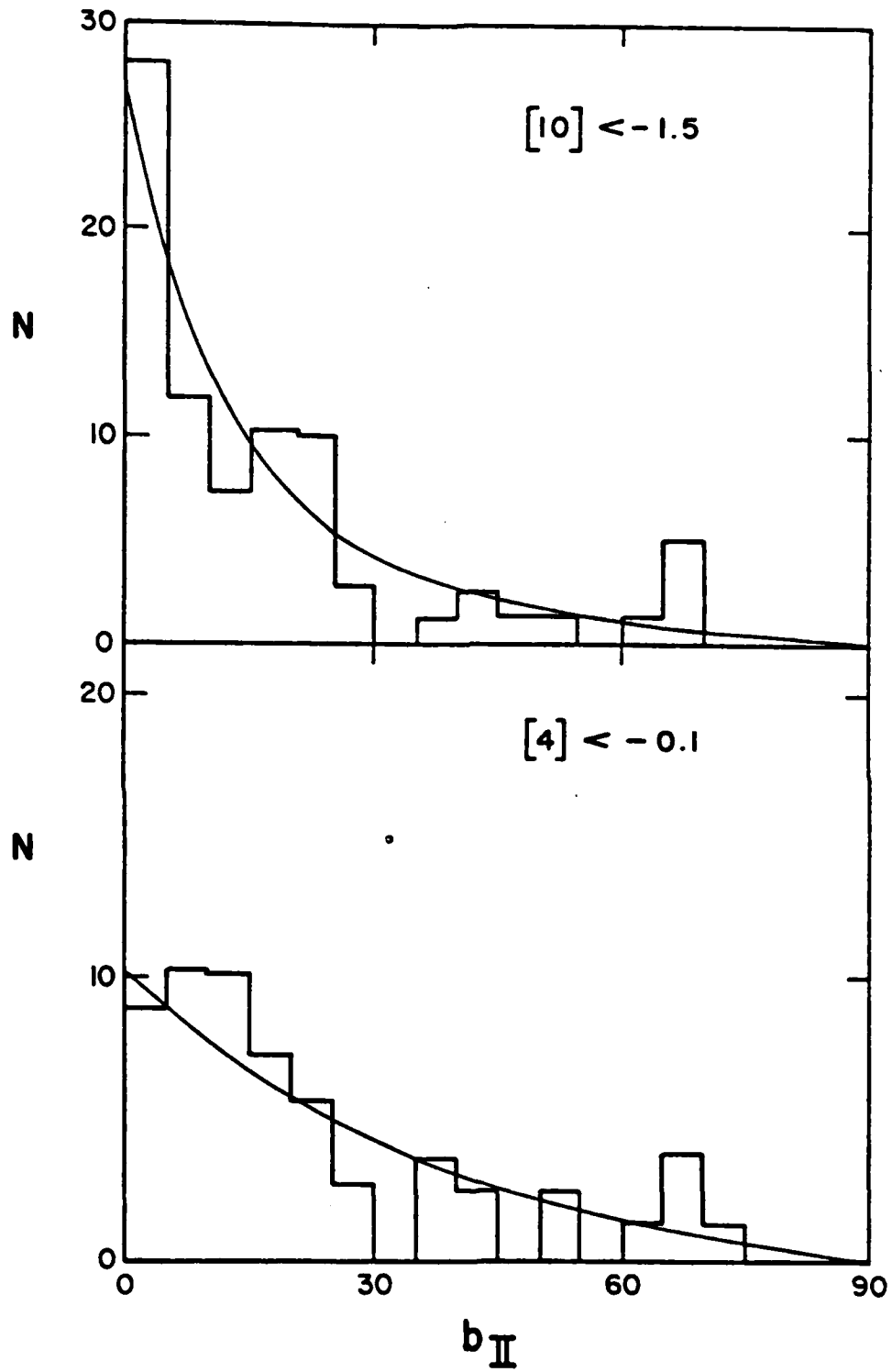


Fig. 6

Infrared Spectra and Interstellar
Reddening of Anonymous Type II OH/IR Stars

by

R. D. Gehrz¹, S. G. Kleinmann^{2,4}, S. Mason^{1,3}
J. A. Hackwell¹, and G. L. Grasdalen¹

¹ Wyoming Infrared Observatory, Department of Physics & Astronomy,
University of Wyoming, Laramie, Wyoming 82071.

² Center for Space Research, Massachusetts Institute of Technology,
Cambridge, Massachusetts 02139.

³ Current Address: St. Norbert College, DePere, Wisconsin, 54115

⁴ Visiting Astronomer, Kitt Peak National Observatory which is operated
by the Association of Universities for Research in Astronomy, Inc.,
under contract with the National Science Foundation.

ABSTRACT

We report infrared positions and multicolor infrared photometry for a sample of type II OH/IR stars. The infrared colors and $11.4\ \mu\text{m}$ silicate optical depths of the low-latitude sources in this group increase as a function of distance, suggesting that interstellar reddening must be taken into account in assessing their infrared energy distributions. Reddening gradients between 1 and 3 times higher than the mean gradient in the direction of the galactic center are required to account for the observed color-distance correlation, a fact which might be explained by these stars' confinement to spiral arms.

I. INTRODUCTION

All-sky surveys for Type II OH maser sources (e.g., Caswell and Haynes 1975; Johansson et al., 1977a and b; Bowers 1973a and b; Bowers and Kerr 1978; Baud et al. 1981) -- those radiating principally at 1612 MHz -- have shown that these objects are highly concentrated toward the galactic plane and the galactic center. For this reason, and because their double-peaked velocity structures suggest an origin in expanding circumstellar envelopes, it is thought that these masers are probably associated with late-type stars in a relatively young population.

Efforts to confirm hypotheses regarding their evolutionary status have included searches for the stellar sources which (it is presumed) excite the masers, along with spectroscopy and time series observations of the identified sources (Evans and Beckwith 1977; Schultz, Kreysa, and Sherwood, 1976; Engels 1982; Jones et al., 1982). The searches for these stellar counterparts have been carried out exclusively at infrared wavelengths, a strategy which is based on extrapolation of the properties of the stars already known to exhibit OH maser emission: the redness of their continua is correlated with the strength of their OH maser emission (Hyland et al. 1972), a phenomenon attributed to the fact that both parameters depended on the mass of the stars' circumstellar envelopes. In fact OH masers identified through these infrared searches have been found to be extremely red, sometimes exhibiting strong absorption features near 10 μ m, attributable to silicate dust in massive circumstellar envelopes (Evans and Beckwith 1979). This result suggests that the OH/IR stars found in radio surveys might represent a more advanced stage of evolution of Mira variable stars than Miras previously detected as OH maser sources.

Only a fraction of the OH sources found in the sky surveys have been identified in these studies. Partly because this number is so small, continued searches for stellar counterparts to OH masers along with efforts to determine the properties of identified sources are warranted. Such work should address the questions of (1) whether some OH masers may represent even more extreme states of Mira evolution than any that have so far been identified, and (2) whether the OH maser emission might also be produced by a different class of object.

In this paper, we report results of a program to search for additional stellar counterparts to OH masers, and to determine continuum properties for a number of previously identified masers. Our observations and analysis focus particularly on identifying the effects of interstellar dust on the observed properties of OH/IR stars, in order to permit a direct comparison of their properties with archetypical Miras and M-type supergiant stars.

II. Observations

Telescopes and equipment at Kitt Peak National Observatory and Wyoming Infrared Observatory were employed to search for infrared counterparts to OH sources found in radio sky surveys and listed by Bowers (1978b) as optically unidentified (anonymous) OH/IR sources having double-peaked velocity structure. Sources were selected on the basis of OH brightness, the precision of the best available radio position, and availability in the sky.

The observations at Kitt Peak were done on the 1.3-m telescope with a liquid-nitrogen-cooled InSb photovoltaic detector system in 1978 June and 1979 July. Several attempts were made to find an optimum combination of wavelength and beam-size to search for the infrared sources. Observations through a broad-band 2.2 μm filter provided good sensitivity even with relatively large beam sizes, but were often plagued by source confusion. On the other hand, observations through a broad-band 3.8 μm filter with a 22" aperture were severely background-noise limited. Ultimately, scans were made at as many wavelengths as time permitted; either an 11" or 22" beam was used, depending on the wavelength. Areas of ± 2 times the radio error boxes of the OH sources were raster scanned with the reference beam set greater than 30" south of the signal beam to increase the effective area searched. Beyond this positional selection, an attempt to avoid confusion of highly reddened field stars with bona fide OH/IR stars was made on the basis of near-infrared (1 to 5 μm) photometry of all sources detected in the radio error boxes: sources found to have K - L colors $\lesssim 1$ mag. were ruled out as possible counterparts to the OH masers. This somewhat arbitrary limit lies near the blue extreme of the

colors of stars that had previously been found to exhibit OH emission. Nonetheless, by combining this color limit with the brightness limit of our search ($K \lesssim 11$ mag.), we expect no chance detections of normal field stars earlier than spectral type K and reddened by diffuse interstellar clouds if these clouds cause $\lesssim 4$ mag kpc^{-1} of visual extinction.

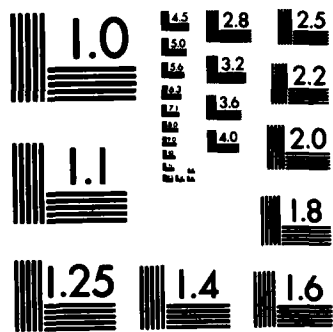
Further searches for infrared counterparts to the OH sources were done with a Wyoming multi-filter infrared photometer equipped with a Wyoming-constructed Ga: Ge bolometer mounted at the Cassegrain focus of the 2.34 m Wyoming Infrared Telescope. In this case, a 10 μm (N band) filter, a 5" beam and a 10" throw between source and reference beams were used. This work resulted in improved positions for several of the sources that had originally been found at Kitt Peak.

Positions for sources found in our searches were measured with respect to the nearest SAO stars. Since none of these OH sources were found to be extended with respect to our beam the largest uncertainty in these relative position measurements is the location of the beam center, which is estimated to be accurate to \pm one half of the beam size. The most precise positions measured for the sources are listed in Table 1, along with the photometric system and beam size used to obtain each measurement. For comparison, we have included the best available radio positions in the table.

Multi-color photometry of each of the OH/IR sources identified in this way, was obtained with the same telescopes and equipment used to carry out the searches (see table 2). These results are listed in Table 2. The Kitt Peak photometry was calibrated using standards from Johnson et al. (1966), while the calibration of the Wyoming system has been

given by Gehrz, Hackwell and Jones (1974). Except where noted, statistical uncertainties of the measurements and uncertainties in the air mass corrections are $\pm 5\%$ for measurements made at $\lesssim 5 \mu\text{m}$, $\pm 10\%$ for measurements from 8.7 to 12.6 μm , and 20% for measurements at 19.5 μm . Two additional OH/AFGL sources (see Price and Walker, 1976) for which we have obtained 2.3 -23 μ photometry at Wyoming have been included under a separate heading in Table 2 as comparisons for the anonymous Type II masers selected from Bowers' survey. These are OH 232.3 + 18.1 (GL1274) and OH 334.8 + 50.1 (GL 1686).

Repeated observations were obtained for most of the sources studied in order to test for Mira-like variations; i.e. characterized by large amplitudes ($\gtrsim 1$ mag.) and long periods ($\gtrsim 1$ year). Several of the sources were found to vary with amplitudes between 1 and 2 mag. at all wavelengths: OH 18.8+0.4, OH 23.1-0.3, OH 28.7-0.6, OH 32.0-0.5, OH 39.7+1.5, and OH 39.9-0.0. Evans and Beckwith (1977) have observed variations in OH 45.5+0.1 and their data combined with ours suggests an amplitude of $\gtrsim 1$ mag at all infrared wavelengths. Smaller amplitude but significant variations were recorded for OH 24.7+0.3, OH 35.6-0.3, and OH 127.8+0.0. If it is assumed that all light variations are roughly in phase, then the light amplitude was generally found to decrease with increasing wavelength for all variable sources observed. Our data for several sources measured more than twice are consistent with the rather long periods expected for OH/IR Miras (Dickinson et al., 1975; Engels, 1932). Shorter periods are, however, not necessarily ruled out by our data. Detailed studies of the temporal behavior of a number of stars in table 2, carried out by Engels (1982), confirm that their periods are long.



MICROCOPY RESOLUTION TEST CHART
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Engels (1982) has observed several sources which appear in our list for infrared variations and reports long period variations for them; periods for these are given in table 3.

III. Distances and Galactic Distribution of Observed Sources

Kinematic distances for each of the OH sources in our study were computed by assuming (1) that the velocity at the mid-point of their double-peaked velocity patterns represents the center of mass velocity V_{LSR} of each star, and (2) that the observed motion is due entirely to circular motion of a source about the galactic center. These are given in Table 3. The values taken for the distance and velocity of the sun with respect to the galactic center are from Schmidt (1955): $R_0 = 10$ kpc, and $\theta_0 = 250$ km/s. The ambiguity in distances deduced by this method in the first and fourth galactic quadrants was resolved by presuming that the near kinematic distance (NKD) is the appropriate value, an assumption which is justified by the lower probability of detecting objects at the far kinematic distance.

The expected accuracy of kinematic distances deduced from this galactic rotation model has been studied extensively. Most recently Baud et al. (1981), have found a correlation between the separation of OH velocity peaks and the r. m. s. deviation of the OH velocity centroid from that predicted using a galactic rotation model: sources with $\Delta V_{OH} \geq 29$ km/s were found to deviate by ≥ 10 km/s from circular galactic rotation. Most of the stars included in our study have such large OH velocity separations, and are therefore presumed to follow circular galactic orbits closely.

Using the derived kinematic distances given in table 3 our sources are shown projected on the galactic plane in Figure 1. Fourteen of the sources lie in the first quadrant along the tangential direction of the Scutum arm of the galaxy ($\ell^{II} \approx 30 \pm 15^\circ$), while one (OH 127.8+0.0) lies in the anti-center direction. The range of near kinematic distances

represented by these objects is large (1.3 to 7.7 kpc). Their galacto-centric distances (GCD) range only from 6 to 9 kpc. except for the single anti-center source OH 127.8+0.0 which has a GCD of 12.8 kpc.

Radio surveys have shown that the Type II OH maser sources can be characterized by the velocity separation, ΔV , between the two features in their OH maser spectra; that is, sources with similar separations tend to have similar galactic distributions and kinematics (see for example Habing, 1977). The mean of this parameter for all anonymous OH sources found in Bowers' survey was ~ 30 Km/s, and the half-width of the distribution was ~ 20 Km/s. The mean velocity separation for sources included in this study was ~ 32 Km/s, and the half-width of the distribution of velocity separation was ~ 10 Km/s. Thus, our sources are not an extreme subset of those found in radio surveys, and correlations of physical properties among them should be representative of the majority of sources found in those surveys.

IV. Apparent Spectral Energy Distributions

Infrared continua of two prototypical OH/IR stars, the Mira variable IK Tau and the supergiant VX Sgr, are shown in Figure 2. Continuum observations of the two high galactic latitude sources observed in this study are also included in the figure. The infrared energy distributions of these sources are similar: their 2 - 20 μm color temperatures exceed 1000 K, and all exhibit silicate emission features near 11 μm .

Energy distributions for all 15 of the low galactic latitude OH/IR stars in our study are plotted in Figure 3. These stars differ generally from those shown in Figure 2 by having significantly redder continua, with 2-20 μm color temperatures below 700 K; in addition, almost all of them exhibit the silicate feature in absorption.

It is not clear, a priori, to what extent the excess reddening and strong silicate absorption in these low-latitude OH/IR stars is caused by heavy obscuration due to intervening interstellar dust, or by emission and reddening due to dust in dense circumstellar envelopes; the interstellar medium contains dust grains that are similar to those present in the envelopes of late-type oxygen-rich stars. Anticipating our discussion of these alternatives in the following Sections, we have plotted the spectra in Figure 3 with vertical offsets in decreasing order of their distance. Interstellar effects are apparent, in that stars nearer than 3 Kpc are detected with silicate features having optical depths less than ~ 0.5 , while all the more distant stars have optical depths exceeding ~ 0.5 .

V. Effects of Interstellar Reddening

We have examined the possibility that the extreme redness of the previously unidentified OH/IR stars might be due to interstellar dust as suggested by figure 3. Three reddening-sensitive parameters are plotted against NKD in Figures 4a, b, and c; all of the sources listed in Table 3 are included in the figures. Two effects produce scatter in the data. One is the variability of the stars themselves; variations observed by us and Engels (1982) are indicated in the figures by "error bars" which show the maximum range in observed parameters for each source. Additional scatter in these figures results from the contribution to the stars' continua by the emission of circumstellar dust; one would expect, by analogy to the prototypical OH/IR stars (Figure 2), that this scatter should be particularly evident for the measures made at wavelengths $>5 \mu\text{m}$, i.e., Figures 4b and 4c. In the presence of scatter from these effects, the figures nonetheless show an apparent correlation between distance and all three of the reddening sensitive parameters plotted.

To test whether the extreme reddening of the OH/IR sources in our study resulted primarily from the reddening and long-wavelength emission of circumstellar dust, we must compare their colors to parameters which are related to the column densities of dust in their envelopes. In this respect, the available data, along with the derived NKD's, provide a direct measure of these sources' luminosities, which is presumably related to the mass-loss rates in their radiatively driven winds (Gehrz and Woolf, 1971). Unfortunately, the range in luminosities among the observed sources is small ($\log L/L_{\odot} \sim 2.8 - 4.2$), and correlations between color or optical depth and luminosity must be masked by variability effects and uncertainties in distance within this small

sample. Similarly, an attempt to seek a correlation between color and velocity separation between the sources' OH maser peaks (an indirect measure of the stellar luminosity) may be inhibited by the limited range in ΔV among the sources observed. In any case, there is no apparent correlation between parameters which might be expected to measure luminosity (M_K , L_{IR} , and ΔV) and NKD (see figure 5a-c).

As a further test that the redness of the observed sources is an intrinsic property rather than a results of interstellar reddening, we have compared their colors and silicate optical depths with galacto-centric distance (GCD). These parameters are found to exhibit a correlation with GCD similar to that observed in Figures 4a-c where they are compared to NKD; the implication of this correlation is ambiguous, however, since most of the sources observed lie within a narrow range in galactic longitude ($l_{II} \sim 30^\circ \pm 15^\circ$), resulting in a tight correlation between NKD and GCD. It is thus interesting that the single source in our sample, OH 127.8 + 0.0, which is not in the direction of the Scutum arm but in the anti-center direction at a GCD of 13 Kpc, is much redder than indicated by the apparent galactic gradient seen in the other sources. We conclude that our data provide no evidence for a galactic gradient in the observed colors of OH/IR stars.

VI. Discussion

The hypothesis that interstellar dust significantly affects the observed colors of OH/IR stars has been considered previously by others (Evans and Beckwith 1977; Engels 1982), but was rejected by them on the grounds that (1) the amount of extinction required to produce the red colors of the newly identified OH/IR stars was anomalously high, (2) there was insufficient evidence for any concentration of molecular clouds in the vicinities of the OH/IR stars, (3) the colors of the stars were found to vary, implying a local cause for at least a portion of their redness, and (4) the colors of the stars were found to be correlated with their periods, an effect attributable to the role that variability may play in the stars' mass loss and subsequent development of circumstellar dust envelopes.

The results presented in the preceding Section V suggest, however, that interstellar reddening may significantly affect the observed colors of OH/IR stars. The amount of reddening needed to produce the apparent correlations between observed infrared parameters and NKD is indicated in Figures 4a-c by three reddening lines, corresponding to three different values for the assumed visual extinction gradient $A_V = 2, 4,$ and 6 mag./Kpc . The reddening law used to obtain the infrared gradients shown in Figures 4a and b was derived by Sneden et al. (1978). The silicate extinction gradient shown in Figure 4c was obtained from measures of the interstellar silicate absorption against sources at the galactic center (Hackwell, Gehrz, and Woolf, 1970; Becklin et al. 1978), and in the direction of VI Cyg NO. 12 (Gillett, Jones and Merrill 1975; Rieke 1976).

The reddening gradients that are required if interstellar dust accounts for the infrared parameters of the OH/IR stars observed in this study, 2-6 mag./Kpc, significantly exceed the "mean" value for interstellar reddening in the galactic plane, $A_V \sim 2$ mag./Kpc (Allen 1973). We propose that the high reddening gradient deduced from the colors of OH/IR stars included in this study is a result of their being located along a line of sight tangent to the Scutum arm of the galaxy. The "mean" value for the interstellar reddening gradient includes inter-arm voids, and must therefore be less than that which would be expected from observations along a spiral arm. Further, it is derived from studies which rely on measurements of optically-selected luminous stars (e.g., Johnson 1968; Hackwell and Gehrz 1974; Barlow and Cohen 1977; Sneden et al. 1978); such studies may not apply to the most heavily obscured regions of the galaxy. If this interpretation is correct, then the redness of OH 127.8+0.0 must also be due to its lying along a highly obscured part of the galactic plane.

The occurrence of these sources in highly obscured regions may be a selection effect, in which case we suggest that the identified OH/IR stars are simply those that lie along unobscured lines of sight. Their location in dusty regions may, on the other hand, result from their youth: the more massive OH/IR stars may not have travelled far from the place where they were formed before evolving to the Mira or red supergiant stage. In the latter case, one expects that the "anonymous" OH/IR stars may have more massive circumstellar envelopes -- indicating that they are more luminous and more massive stars, compared to the optically identified OH/IR stars.

VIII. Observational Tests

The question of whether or not the apparent infrared energy distributions of some anonymous OH/IR stars are significantly affected by interstellar reddening has important implications.

A number of investigators (Forrest et al. (1978), Evans and Beckwith, 1977, Bowers et al., (1980), and Bowers, (1981)) have suggested that OH/IR stars have mass loss rates $\approx 10^{-5}$ to $10^{-4} M_{\odot} \text{ yr}^{-1}$ based largely upon the assumption that the silicate absorption feature is caused entirely by self-absorption in the outer layers of an extended optically thick circumstellar thick shell. If, as suggested by our observations, the silicate absorption feature at $11.4 \mu\text{m}$ is affected by interstellar silicates, then the intrinsic mass loss rates for these objects could be lower than suggested by the earlier calculations. Corrections for reddening would lower calculated mass loss rates by reducing the shell radius and shell dust optical depth. Mass loss rates in the range 10^{-7} to $10^{-5} M_{\odot} \text{ yr}^{-1}$ would be more consistent with the values currently associated with optically visible luminous M giant variables and supergiants (Gehrz and Woolf, 1971).

Although the correlations between infrared shell parameters and NKD presented herein are strongly suggestive of interstellar effects, the possibility that the effects are largely circumstellar cannot be completely ruled out. Further observational tests are required to distinguish quantitatively between the contributions of interstellar and circumstellar dust in anonymous OH/IR stars. High resolution CO measurements may help to establish the amount of molecular material along the lines of sight as an additional test for anomalous interstellar extinction. Measurements of the infrared angular diameters

of OH/IR stars would provide a definitive means for comparing the intrinsic shell parameters of anonymous sources with those of other classes of OH/IR stars. Long term studies of temporal variations will be required to distinguish between the interstellar and circumstellar contributions to the apparent spectral distributions. Finally, long term proper motion studies using infrared interferometric techniques might be expected to provide an improved understanding of the distances and galactic distribution of these sources.

Summary

Our analysis of multi-color photometry of a sample of anonymous OH/IR stars shows that their colors are extremely red, by comparison to prototypical OH/IR stars, a result which was also obtained in previous studies of this class of objects. However, we find, in contrast to earlier work, that their redness seems to be correlated with distance rather than with any intrinsic property of the stars, such as luminosity. This effect can be explained if their redness is due, at least in part, to interstellar extinction and reddening expected for A_V between 2-6 mag./Kpc along our lines of sight. These stars, thought to be younger than prototypical OH/IR stars, may tend to lie in obscured regions of the galaxy because they have not moved far from the places where they were formed.

Our results have a number of implications. First, the galactic plane has extinction over long distances that are much higher than expected from previous observations, and this fact must be taken into account in assessing its stellar structure. Second, the effects of interstellar extinction must be taken into account in determining the intrinsic properties of OH/IR stars. This means that the actual mass loss rate may be much less than other investigators have suggested. Third, unsuccessful efforts to identify OH/IR stars at infrared wavelengths $\leq 10 \mu\text{m}$ may have resulted from heavy obscuration of these objects; thus searches at longer wavelengths at levels of sensitivity not much greater than the observed brightness of the identified sources, are not likely to result in many new identifications of OH/IR stars.

The results reported here can be tested further by direct observations. Long term studies of temporal variations will be required to distinguish between the interstellar and circumstellar contributions to the apparent spectral distributions.

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MAILING ADDRESSES

R. D. Gehrz, G. L. Grasdalen, and J. A. Hackwell
Wyoming Infrared Observatory
Department of Physics and Astronomy
University Station Box 3905
University of Wyoming
Laramie, Wyoming 82071

S. G. Kleinmann
37-275 MIT,
Cambridge, Massachusetts 02139

S. Mason
St. Norbert College
DePere, Wisconsin 54115

TABLE 1: Positional Identifications of OH/IR Sources

OBJECT	OH POSITIONS		NOTES	RA	DEC	IR POSITIONS		Date
	RA	DEC				System, beam for IR pos.		
18.8 + 0.4	$18^{\text{h}}21^{\text{m}}17^{\text{s}} \pm 0.25$	$-12^{\circ}28.0' \pm 0.25$	h	$18^{\text{h}}21^{\text{m}}21.5^{\text{s}}$	$-12^{\circ}27'57''$	KP	11"	07/06/78
	$18^{\text{h}}21^{\text{m}}07^{\text{s}} \pm 15$	$-12^{\circ}26'25'' \pm 15$	a	$18^{\text{h}}21^{\text{m}}21.4^{\text{s}}$	$-12^{\circ}27'58''$	W	5"	08/16/78
19.1 - 1.0	$18^{\text{h}}26^{\text{m}}39.9^{\text{s}} \pm 5$	$-12^{\circ}39.7' \pm 15''$	b	$18^{\text{h}}26^{\text{m}}39.9^{\text{s}}$	$-12^{\circ}40'00''$	KP	16"	07/03/79
23.1 - 0.3	$18^{\text{h}}31^{\text{m}}27.2^{\text{s}} \pm 0.25$	$-09^{\circ}00.9' \pm 0.25$	1	$18^{\text{h}}31^{\text{m}}27.2^{\text{s}}$	$-09^{\circ}00'20''$	KP	11"	07/07/78
				$18^{\text{h}}31^{\text{m}}27.1^{\text{s}}$	$-09^{\circ}00'28''$	W	5"	08/04/78
24.7 + 0.3	$18^{\text{h}}32^{\text{m}}45.5^{\text{s}} \pm 5^{\text{s}}$	$-07^{\circ}14'00'' \pm 1.25''$	e	$18^{\text{h}}32^{\text{m}}47.3^{\text{s}}$	$-07^{\circ}15'40''$	KP	22"	07/06/78
				$18^{\text{h}}32^{\text{m}}47.1^{\text{s}}$	$-07^{\circ}15'42''$	W	5"	08/04/78
				$18^{\text{h}}32^{\text{m}}46.8^{\text{s}}$	$-07^{\circ}15'37''$	KP	16"	07/06/79
26.2 - 0.6	$18^{\text{h}}38^{\text{m}}31.7^{\text{s}} \pm 15''$	$-06^{\circ}17'54'' \pm 15''$	d	$18^{\text{h}}38^{\text{m}}33.3^{\text{s}}$	$-06^{\circ}17'52''$	KP	22"	07/06/79
26.4 - 1.9	$18^{\text{h}}43^{\text{m}}45.0^{\text{s}} \pm 1^{\text{s}}$	$-06^{\circ}43.8' \pm 15''$	d	$18^{\text{h}}43^{\text{m}}45.4^{\text{s}}$	$-06^{\circ}43'51''$	KP	16"	07/03/79
				$18^{\text{h}}43^{\text{m}}45.2^{\text{s}}$	$-06^{\circ}43'51''$	KP	16"	07/06/79
27.3 + 0.2	$18^{\text{h}}37^{\text{m}}42.5^{\text{s}} \pm 0.25$	$-06^{\circ}00.6' \pm 0.25$	g	$18^{\text{h}}37^{\text{m}}41.5^{\text{s}}$	$-04^{\circ}58'49''$	KP	22"	07/06/78
28.7 - 0.6	$18^{\text{h}}43^{\text{m}}10.7^{\text{s}} \pm 0.7^{\text{s}}$	$-04^{\circ}04'00'' \pm 1.25''$	h,e	$18^{\text{h}}43^{\text{m}}10.7^{\text{s}}$	$-04^{\circ}04'00''$	W	5"	08/16/78
				$18^{\text{h}}43^{\text{m}}09.7^{\text{s}}$	$-04^{\circ}03'59''$	KP	16"	07/05/79
30.7 + 0.4	$18^{\text{h}}43^{\text{m}}16.5^{\text{s}} \pm 1^{\text{s}}$	$-01^{\circ}50'00'' \pm 15''$	d,f	$18^{\text{h}}43^{\text{m}}16.5^{\text{s}}$	$-01^{\circ}49'54''$	KP	16"	07/03/79

TABLE 1: (cont't)

OBJECT	OH POSITIONS		NOTES	IR POSITIONS		
	RA	DEC		RA	DEC	System, beam for IR pos.
31.7 - 0.8	18 ^h 49 ^m 25.5±1.5	-01° 30.5±15"	d	18 ^h 49 ^m 25.56	-01° 30' 27"	KP 10" 07/05/79
32.0 - 0.5	18 ^h 48 ^m 51.1±1.5	-01° 07.4±15"	d	18 ^h 48 ^m 51.1	-01° 07' 27"	KP 22" 07/06/78
35.6 - 0.3	18 ^h 54 ^m 56.5±0.25	+02° 07.7±0.25	g	18 ^h 54 ^m 56.53	+02° 08' 14"	KP 22" 07/07/78
39.7 + 1.5 (GL 2290)	18 ^h 56 ^m 04.2±0.2	+06° 38' 18 ±34"	f	18 ^h 56 ^m 04.0	+06° 38' 50"	KP - 10/75
33.9 - 0.0	19 ^h 01 ^m 43.2±0.25	+06° 08.8±15"	d	19 ^h 01 ^m 43.0	+06° 08' 46"	KP 22" 07/07/78
				19 01 43	+06 08 44	W 5" 08/16/78
42.3 - 0.2	19 ^h 06 ^m 43.7±1.5	+08° 11.8±15"	d	IR source within radio error box, position not measured more accurately		
45.5 + 0.1	19 ^h 11 ^m 58.3±0.3	+11° 05' 25 ±5"	c	IR source within radio error box, position not measured more accurately		
75.3 - 1.8	20 ^h 27 ^m 12.5±5	+35° 36' 50 ±1.25	e	20 ^h 27 ^m 12.59	+35° 35' 40"	KP 11" 07/01/79
127.8 - 0.0	01 ^h 30 ^m 27.7±0.5	+62° 11' 30 ±6"	f	01 ^h 30 ^m 27.2	+62° 11' 31"	KP - 10/75

Notes to Table 1

- a) Turner, 1970
- b) Winnberg et al., 1973
- c) Evans, Cruther, and Wilson, 1976
- d) Johansson et al., 1977b
- e) Bowers, 1978a
- f) Bowers et al., 1980
- g) Wilson and Barrett, 1972
- h) Winnberg et al., 1975
- i) Hardebeck, 1972

Table 2: New Infrared Photometry of OH/IR Sources

OBJECT	DATE	System Beam	[1.25]	[1.65]	[2.3]	[3.45]	[3.6]	[4.6]	[4.9]	[8.7]	[10]	[11.4]	[12.6]	[19.5]	[23]
LOW GALACTIC LATITUDE OH/IR SOURCES															
18.8 + 0.4	8/16/78	W 5"	-	-	+6.66	-	+5.07	-	+4.11	+2.64	+2.02	+1.67	+1.31	+0.16	-
	7/06/79	KP 11"	+8.49	+6.58	+5.22	+3.73	-	+2.72	-	-	-	-	-	-	-
	7/10/79	W 5"	-	-	+5.29	-	+3.76	-	+3.07	+1.54	+1.12	+0.48	+0.57	-	-
19.1 - 1.0	7/03/79	KP 16"	-	-	+10.40	+6.66	-	-	-	-	-	-	-	-	-
23.1 - 0.3	7/07/78	KP 11"	-	-	+10.70	+5.68	-	+3.79	-	-	-	-	-	-	-
	8/04/78	W 5"	-	-	-	-	5.60	-	+4.01	+2.56	+2.18	+2.36	+1.17	-	-
	7/06/79	KP 16"	-	+11.92	+8.10	+4.08	-	+2.57	-	-	-	-	-	-	-
	7/10/79	W 5"	-	-	+7.95	-	+3.98	-	+2.44	+0.72	+0.76	+0.66	-0.17	-1.00	-
24.7 + 0.3	7/06/78	KP 22"	-	+11.24	+8.38	+3.61	-	+1.73	-	-	-	-	-	-	-
	8/04/78	W 5"	-	-	+8.23	-	+3.45	-	+1.63	+0.30	+0.12	+0.26	-0.90	-	-
	7/06/79	KP 16"	-	+11.94	+7.92	+3.48	-	+1.72	-	-	-	-	-	-	-
	7/10/79	W 5"	-	-	+7.82	-	+3.37	-	+1.53	-0.04	-0.12	-0.24	-1.19	-2.20	-
26.2-0.6	7/06/78	KP 22"	-	-	+9.75	+4.54	-	+2.81	-	-	-	-	-	-	-
	7/06/79	KP 16"	-	-	-	+5.54	-	-	-	-	-	-	-	-	-
	8/16/79	W 5"	-	-	+9.44	-	+4.70	-	+2.50	+0.51	+0.42	+0.16	-0.75	-1.94	-

Table 2 (con't)

Page 2 of 4

OBJECT	DATE	System	Beam	[1.25]	[1.65]	[2.3]	[3.45]	[3.6]	[4.6]	[4.9]	[8.7]	[10]	[11.4]	[12.6]	[19.5]	[23]
26.4 - 1.9	8/16/78	W	5"	-	-	+6.57	-	+3.21	-	+1.48	-0.26	-0.45	-0.66	-1.26	-2.52	-
	7/03/79	KP	16"	-	-	+7.23	+3.75	-	-	-	-	-	-	-	-	-
	7/06/79	KP	16"	-	+10.30	+7.16	+3.57	-	+2.06	-	-	-	-	-	-	-
	10/05/79	W	5"	-	-	+6.66	-	+3.07	-	+1.39	-0.29	-0.50	-0.72	-1.17	-2.29	-
27.3 + 0.2	7/06/78	KP	22"	-	-	+10.18	+5.91	-	+4.43	-	-	-	-	-	-	-
	8/16/78	W	5"	-	-	+10.83	-	+6.10	-	+4.26	+2.44+	2.29	+2.36	+1.34	+0.22	-
	7/06/79	KP	16"	-	-	+12.31	+7.74	-	-	-	-	-	-	-	-	-
28.7 - 0.6	8/16/78	W	5"	-	-	+6.52	-	+3.58	-	+2.53	+0.46	+0.18	-0.17	-0.65	-2.10	-
	7/05/79	KP	16"	+9.57	+6.89	+4.71	+2.25	-	-	-	-	-	-	-	-	-
	7/06/79	KP	16"	+9.52	+6.83	+4.72	-	-	+1.21	-	-	-	-	-	-	-
	10/05/79	W	7"	-	-	+4.83	-	+2.37	-	+1.19	-0.54	-0.93	-1.38	-1.50	-2.71	-
30.7 + 0.4	8/16/78	W	5"	-	-	-	-	+4.53	-	+1.99	+0.39	+0.30	+0.38	-0.89	-1.96	-
	7/03/79	KP	16"	-	-	+10.56	+4.59	-	+2.26	-	-	-	-	-	-	-
	7/05/79	KP	16"	-	-	+10.63	+4.51	-	+2.28	-	-	-	-	-	-	-
	7/06/79	KP	16"	-	-	+10.63	+4.51	-	+2.28	-	-	-	-	-	-	-
31.7 - 0.8	10/05/79	W	7"	-	-	-	-	+4.77	-	+2.14	+0.49	+0.38	+0.55	-0.60	-1.86	-
	7/05/79	KP	10"	+10.04	+7.60	+5.80	+4.08	-	3.47	-	-	-	-	-	-	-

Table 2 (Con't)

OBJECT	DATE	System beam	[1.25]	[1.65]	[2.3]	[3.45]	[3.6]	[4.6]	[4.9]	[8.7]	[10]	[11.4]	[12.6]	[19.5]	[23]
32.0 - 0.5	7/06/78	KP 22"	-	-	-	+6.12	-	+3.54	-	-	-	-	-	-	-
	9/16/78	W 5"	-	-	+10.16	-	+6.29	-	+3.15	+1.11	+0.99	+1.44	-0.27	-1.47	-
	7/06/79	KP 16"	-	-	-	+7.96	-	+4.69	-	-	-	-	-	-	-
	10/05/79	W 7"	-	-	-	-	+7.83	-	+4.17	+2.14	+2.00	+2.41	+0.57	-0.17	-
35.6 - 0.3	7/07/78	KP 22"	-	-	+10.19	+5.24	-	+3.32	-	-	-	-	-	-	-
	8/16/78	W 5"	-	-	-	-	+5.32	-	+3.06	+1.12	+1.22	+0.98	-0.21	-1.73	-
	7/06/79	KP 16"	-	-	+11.55	+6.86	-	+4.86	-	-	-	-	-	-	-
	10/05/79	W 7"	-	-	-	-	+5.65	-	+3.44	+1.50	+1.37	+1.36	+0.20	-0.90	-
39.7 + 1.5 (GL 2290)	8/05/78	W 5"	-	-	+4.17	-	+0.87	-	-0.72	-2.46	-2.60	-2.85	-3.42	-4.08	-
	7/27/79	W 5"	-	-	+5.76	-	+1.94	-	+0.51	-1.46	-1.61	-1.81	-2.31	-2.29	-
	8/30/79	W 5"	-	-	+5.82	-	+1.88	-	+0.30	-	-1.61	-1.91	-	-	-
	4/13/80	W 5"	-	-	+5.62	-	+1.74	-	-0.01	-1.77	-1.84	-1.98	-2.73	-3.49	-
39.9 - 0.0	7/07/78	KP 22"	-	-	+9.21	+4.42	-	+2.54	-	-	-	-	-	-	-
	8/16/78	W 5"	-	-	+10.41	-	+4.61	-	+2.64	+0.83	+0.69	+0.48	-0.37	-1.91	-
	10/05/79	W 5"	-	-	-	-	+5.58	-	+3.42	+1.57	+1.44	+1.34	+0.41	-0.60	-
42.3 - 0.2	11/21/78	W 5"	-	-	-	-	+7.78	-	+4.64	+1.44	+1.32	+1.61	+0.24	-0.79	-1.28
	7/05/79	KP 16"	-	-	-	+8.38	-	+5.05	-	-	-	-	-	-	-

Table 2 (Cont)

OBJECT	DATE	System	beam	[1.25]	[1.65]	[2.3]	[3.45]	[3.6]	[4.6]	[4.9]	[8.7]	[10]	[11.4]	[12.6]	[19.5]	[23]
45.5 + 0.1	11/21/78	W	5"	-	-	+8.41	-	+4.89	-	+3.19	+1.46	+1.26	+0.90	+0.59	-0.36	+0.34
75.3 - 1.8	7/01/79	KP	11"	-	-	-	+6.09	-	+3.81	-	-	-	-	-	-	-
127.8 + 0.0	10/10/75	KP	-	-	-	+7.47	-	+2.24	-	+0.26	-	-1.47	-	-	-	-
(GL 230)	10//75	KP	-	-	-	-	-	+0.3	-	-	-1.5	-	-	-	-	-
	12/29/80	W	5"	-	-	+8.32	-	+3.51	-	+1.44	-0.35	-0.63	-0.48	-1.71	-2.95	-3.76
	1/07/81	W	5"	-	-	+7.76	-	+3.01	-	+0.90	-0.94	-1.03	-0.78	-2.22	-3.4	-

HIGH GALACTIC LATITUDE OH/AFGL SOURCES

235.3 + 13.1	6/11/78	W	5"	-	-	+3.51	-	+1.88	-	+0.83	+0.18	-0.99	-1.56	-1.46	-3.09	-3.39
(GL 1274)																
334.8 + 50.1	6/12/78	W	5"	-	-	+3.53	-	+2.25	-	+1.55	+0.16	-0.44	-0.88	0.85	-1.96	1.90
(GL 168G)	5/15/79	W	5"	-	-	+2.49	-	+1.48	-	+0.99	-0.54	-0.95	-1.88	-1.68	-2.64	-

Table 3: Physical Properties of OH/IR Sources*

OH Source Number	V_{LSR} Km s ⁻¹	V Km s ⁻¹	S_L^I x10 ⁻²² Mm ⁻²	S_H^I	MKD Kpc	GCD Kpc	K-L	Mean 11.4	IR PERIOD days	OH PERIOD days
18.8 ± 0.4	13	29	27.5	17.1	1.3	8.8	1.54	-0.20	—	—
23.1 - 0.3	35	30	17.0	13.0	3.0	7.3	4.34	+0.63	—	—
24.7 ± 0.3	42	40	17.0	12.6	3.4	7.1	4.61	+0.67	—	—
26.2 - 0.6	72	42	36.8	14.9	5.2	5.8	4.98	+0.51	1330	1295
26.4 - 1.9	28	24	5.0	9.5	2.2	8.1	3.51	+0.28	540	—
27.3 ± 0.2	51	25	28.0	14.0	3.9	6.8	4.52	+0.64	—	—
28.7 - 0.6	46	34	6.7	6.6	3.5	7.1	2.62	+0.05	640	—
30.7 ± 0.4	67	35	12.4	10.4	4.9	6.3	6.07	+0.81	1140	918
32.0 - 0.5	76	40	21.8	7.1	5.5	6.1	3.88	+1.23	—	—
35.6 - 0.3	78	28	20.2	13.8	6.2	6.1	4.82	+0.74	—	—
39.7 ± 1.5	20	32	43.8	66.2	1.3	9.0	3.74	+0.32	—	—
39.9 - 0.0	149	29	10.4	10.3	7.7	6.4	5.30	+0.50	770	—
42.3 - 0.2	61	29	11.4	20.8	4.6	7.3	3.87**	+0.92	1650	817
45.5 ± 0.1	36	35	8.0	6.0	2.5	8.4	3.52	+0.09	720	—
127.8 ± 0.0	-55	22	57.2	35.4	3.9	12.8	4.93	+0.87	—	—

* V_{LSR} , V , S_L^I , and S_H^I from Bowers, 1978b; IR and OH Periods from Engels, 1982.

** S_H^I from Engels, 1982

Figure Captions

Figure 1. The galactic distribution of our sample of "in-plane" sources as a function of l_{II} and NKD. The sources in the first quadrant have a large range of NKD's (1.3-7.7 Kpc) along the Scutum arm of the galaxy. Their GCD's range from 6-9 Kpc. OH 127.8+0.0, with a GCD of 13 Kpc, is the lone anti-center source.

Figure 2. Two proto typical OH/IR stars, IK Tau and VX Sgr compared with the high latitude anonymous OH/IR stars OH 235.3+18.1 and OH 334.0+50.1

Figure 3. Spectra of 15 OH/IR stars in the galactic plane arranged in order of increasing near kinematic distance showing the tendency of the infrared colors and the $11.4 \mu\text{m}$ silicate absorption optical depth to become large as NKD increases. OH 28.7-0.6 appears too blue and has too small an $11.4 \mu\text{m}$ optical depth for its apparent NKD.

Figure 4a). Mean observed K-L as a function of NKD for OH/IR stars in Table 3. Vertical bars indicate color variations observed in this study and by Engels (1982). Lines labelled .13, .26, and .39 give the reddening $E(K-L)$ in mag Kpc^{-1} for $A_V = 2, 4, \text{ and } 6$ mags respectively. Solid circle indicates K from Engels (1982).

Figure 4b). The quantity $K-[19.5]$ as a function of NKD for OH/IR sources in Table 3. Lines give $E(K-[19.5])$ in mag Kpc^{-1} for $A_V = 2, 4$ and 6 mag. Kpc^{-1} . Solid circle indicates K from Engels (1982).

Figure 4c). The quantity $\tau_{11.4}$ as a function of NKD for the sources in Table 3. Lines give $\tau_{11.4}$ per Kpc for $A_V = 2, 4,$ and 6 magnitudes Kpc^{-1} . Vertical bars indicate observed range of variations.

Figure 5a). Absolute K magnitude as a function of NKD for the sources in Table 3. Closed circle indicates K from Engels (1982).

Figure 5b). The quantity ΔV_{OH} as a function of NKD for the sources in Table 3.

Figure 5c). Infrared bolometric luminosity as a function of NKD for the sources in Table 3. As would be expected for a sensitivity limited search, there are no low luminosity representatives at the largest distances.

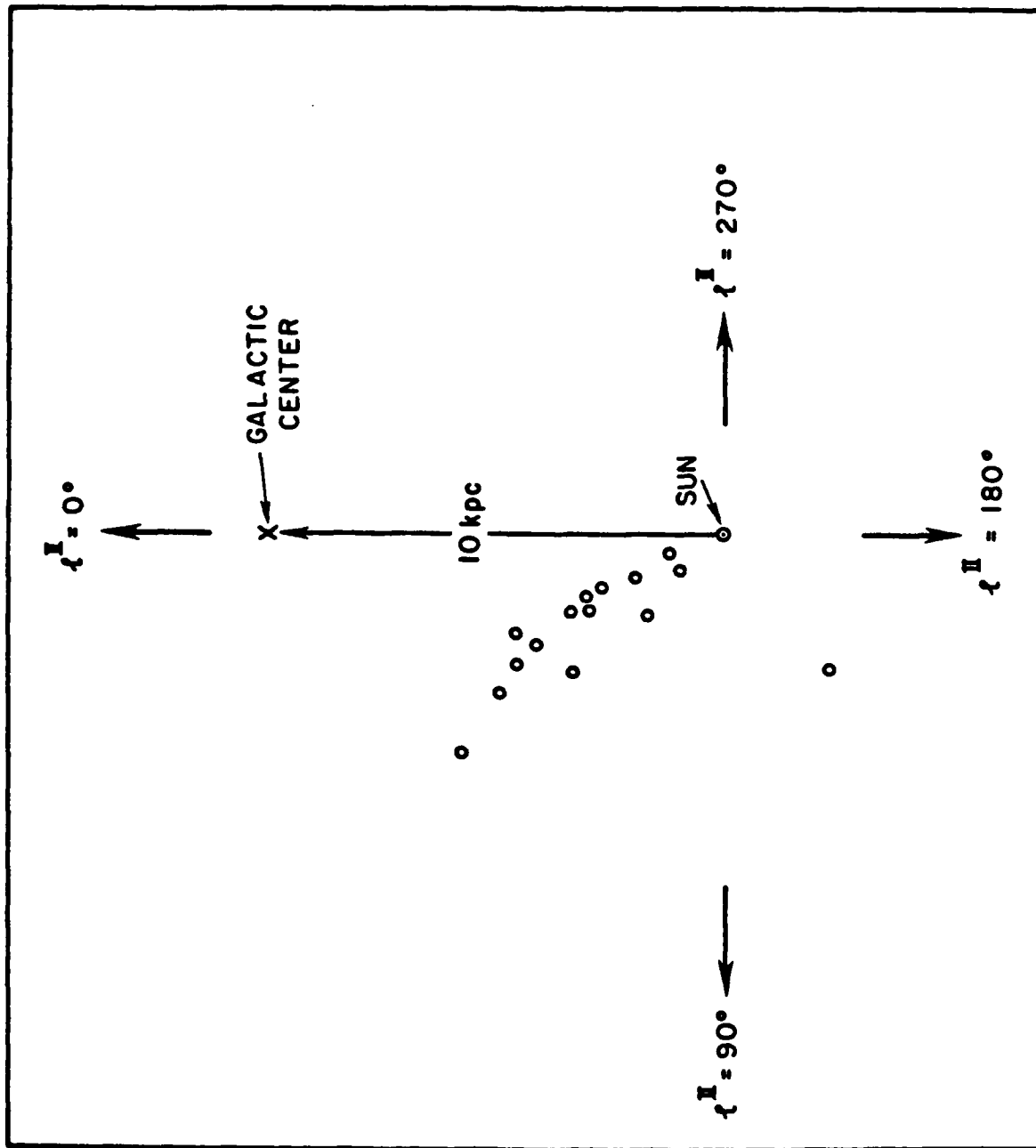


Figure 1

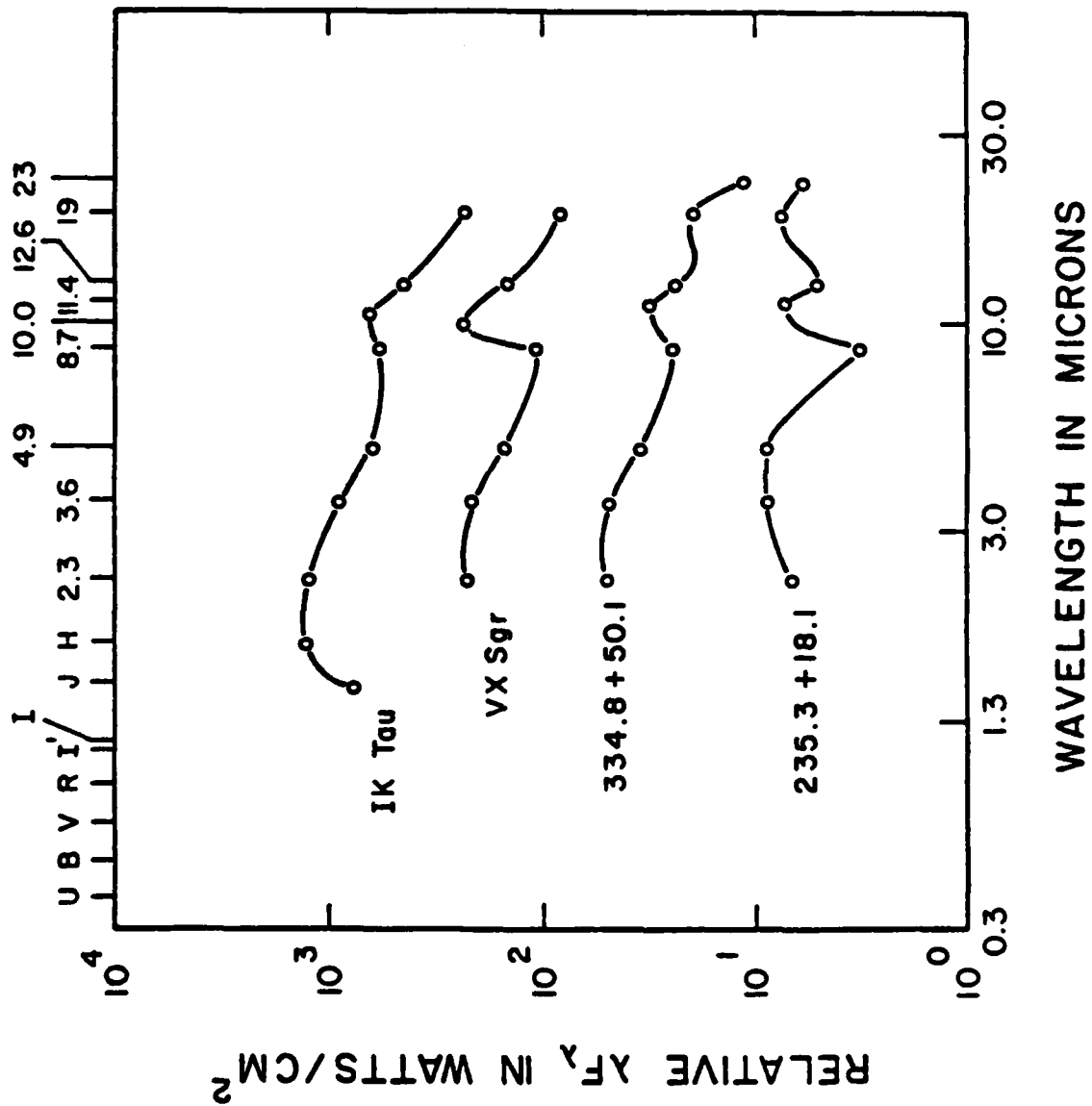


Figure 2

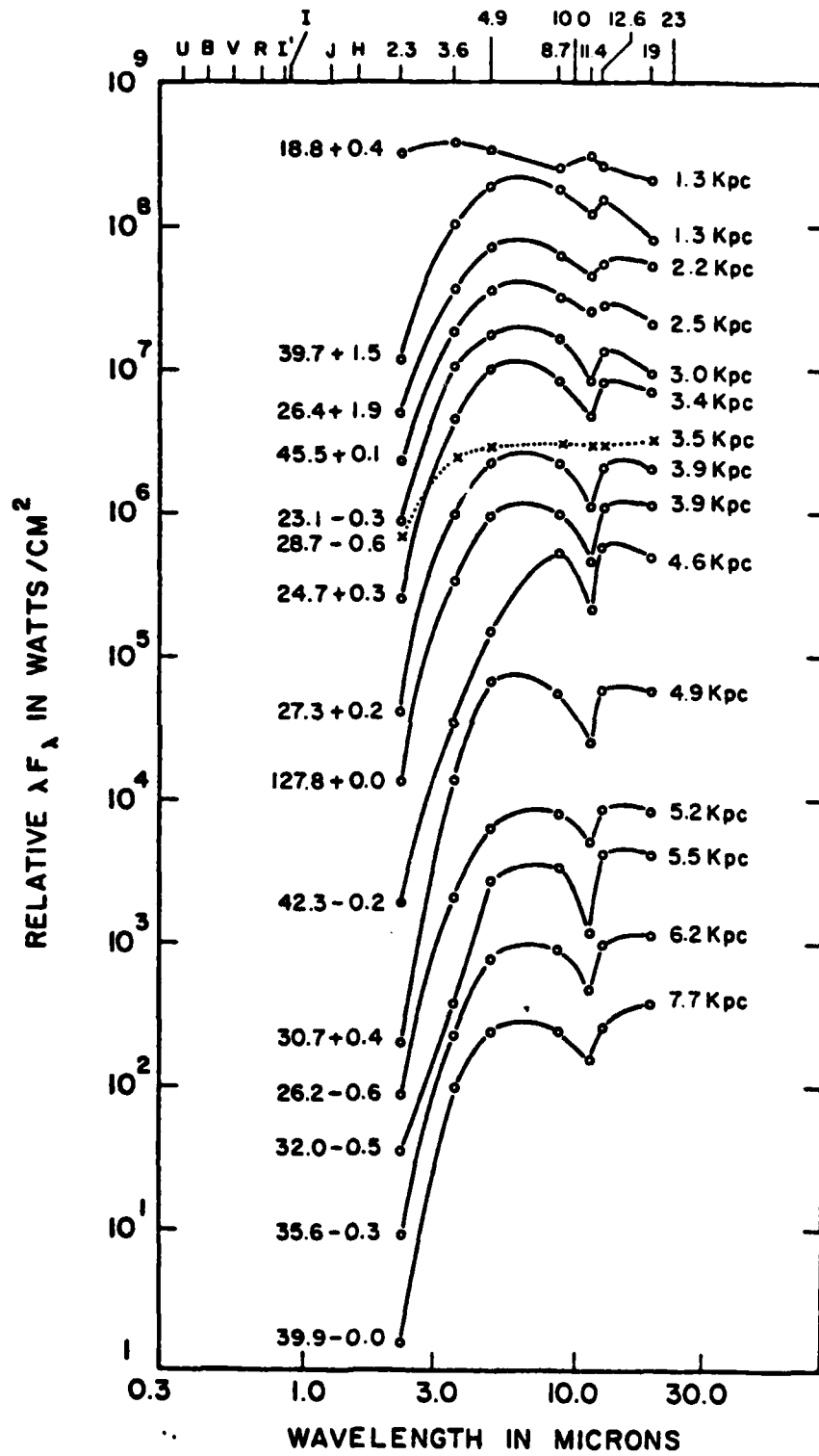
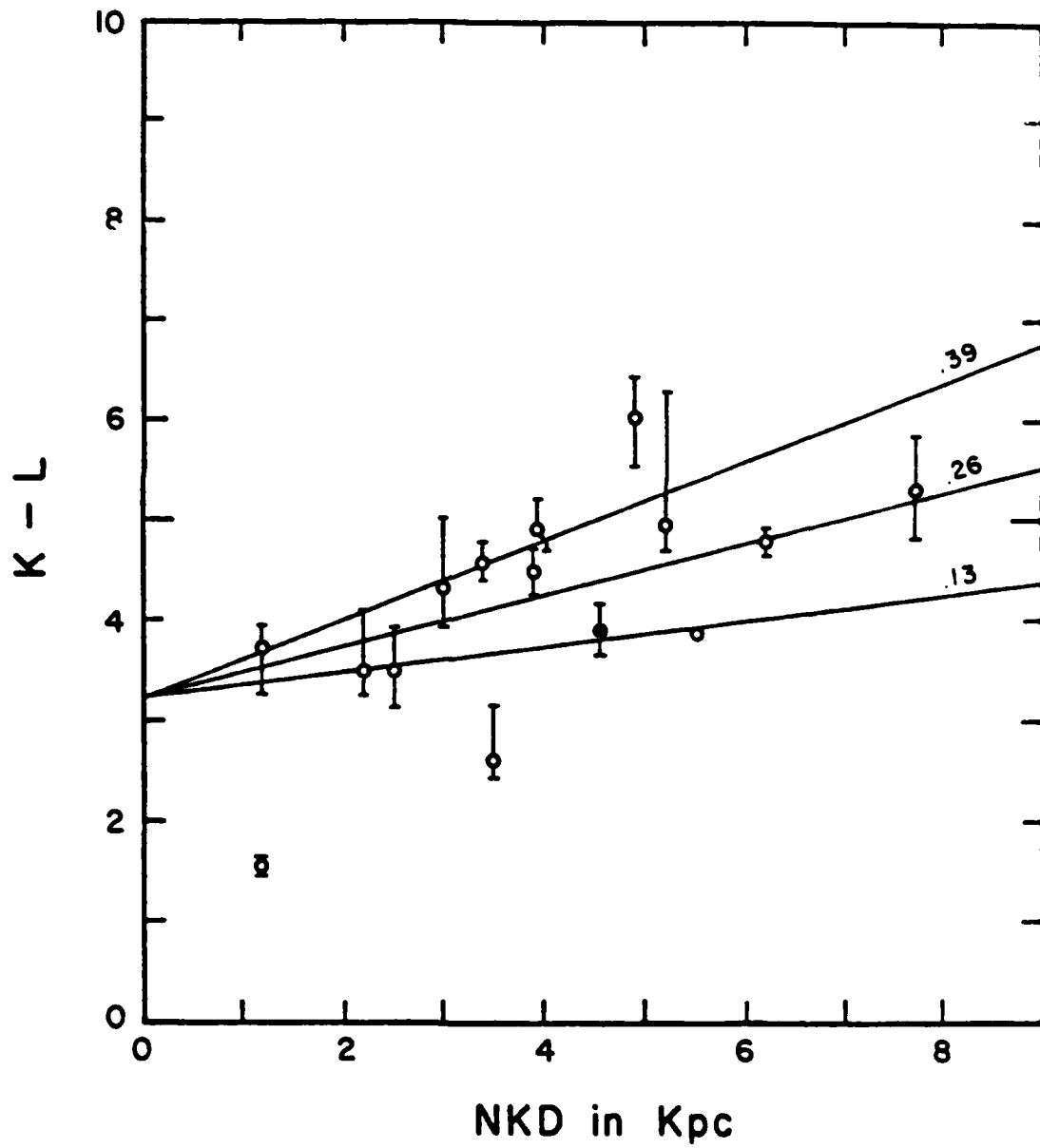


Figure 3



125 Figure 4a

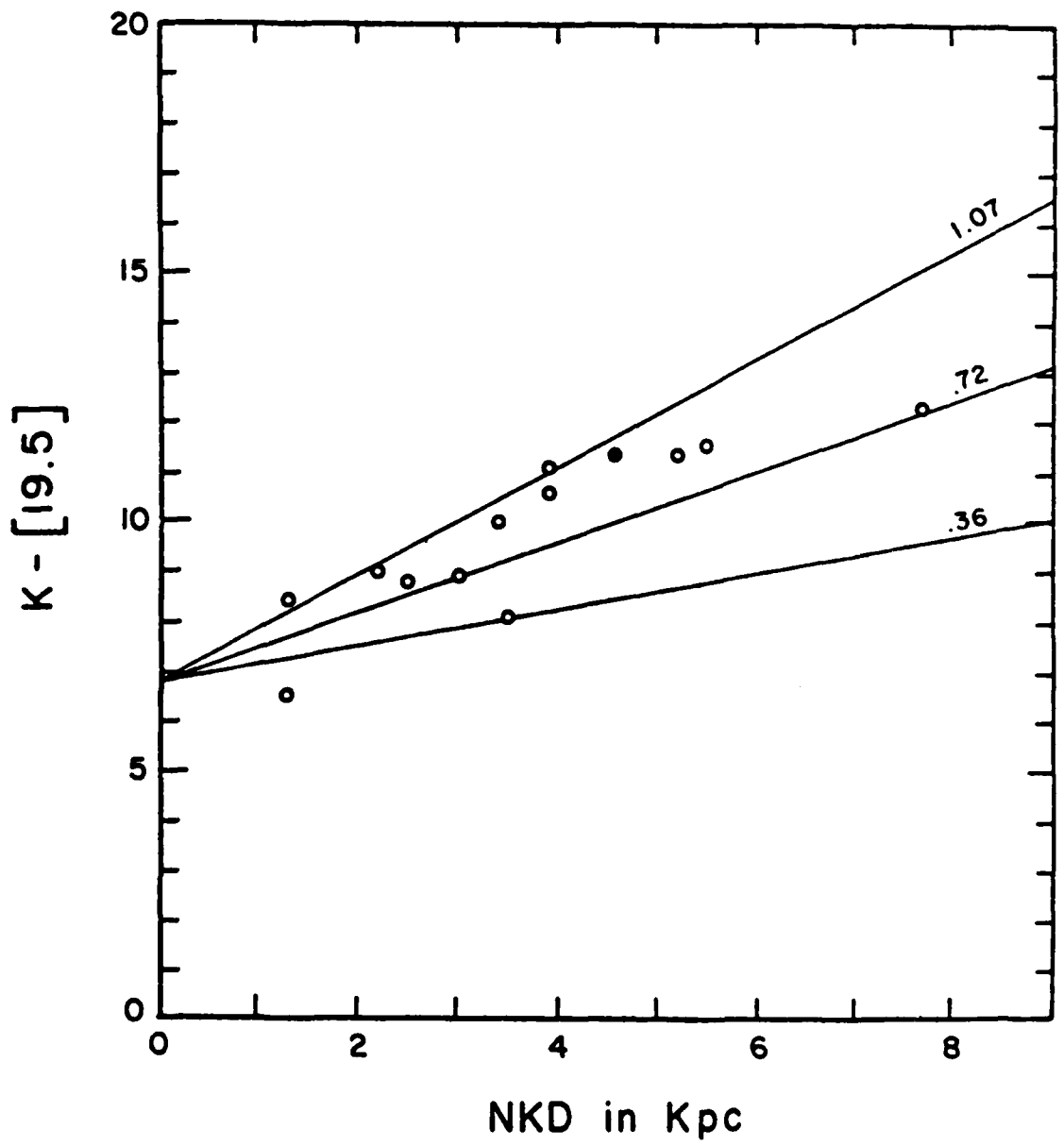


Figure 4b

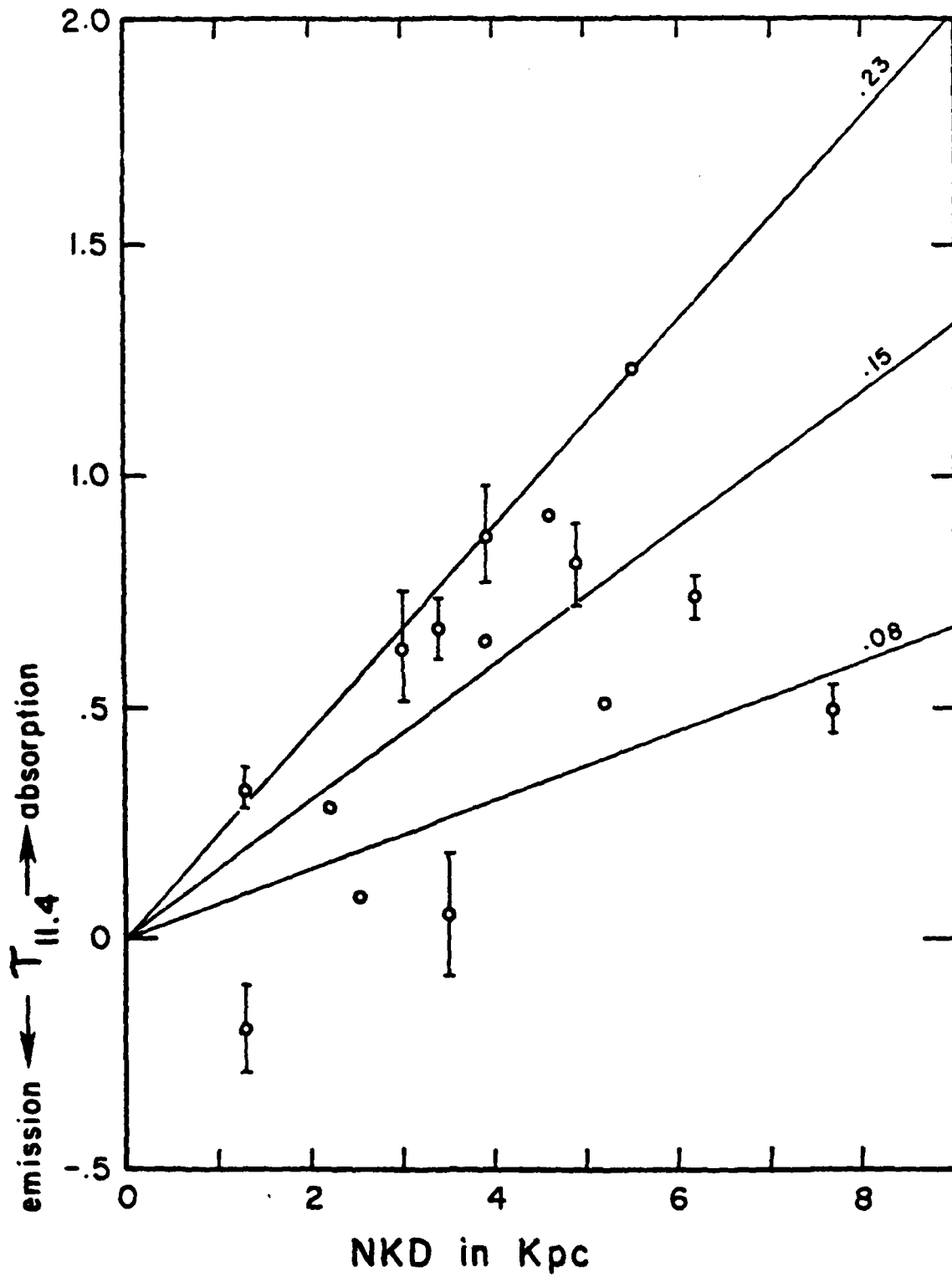


Figure 4c

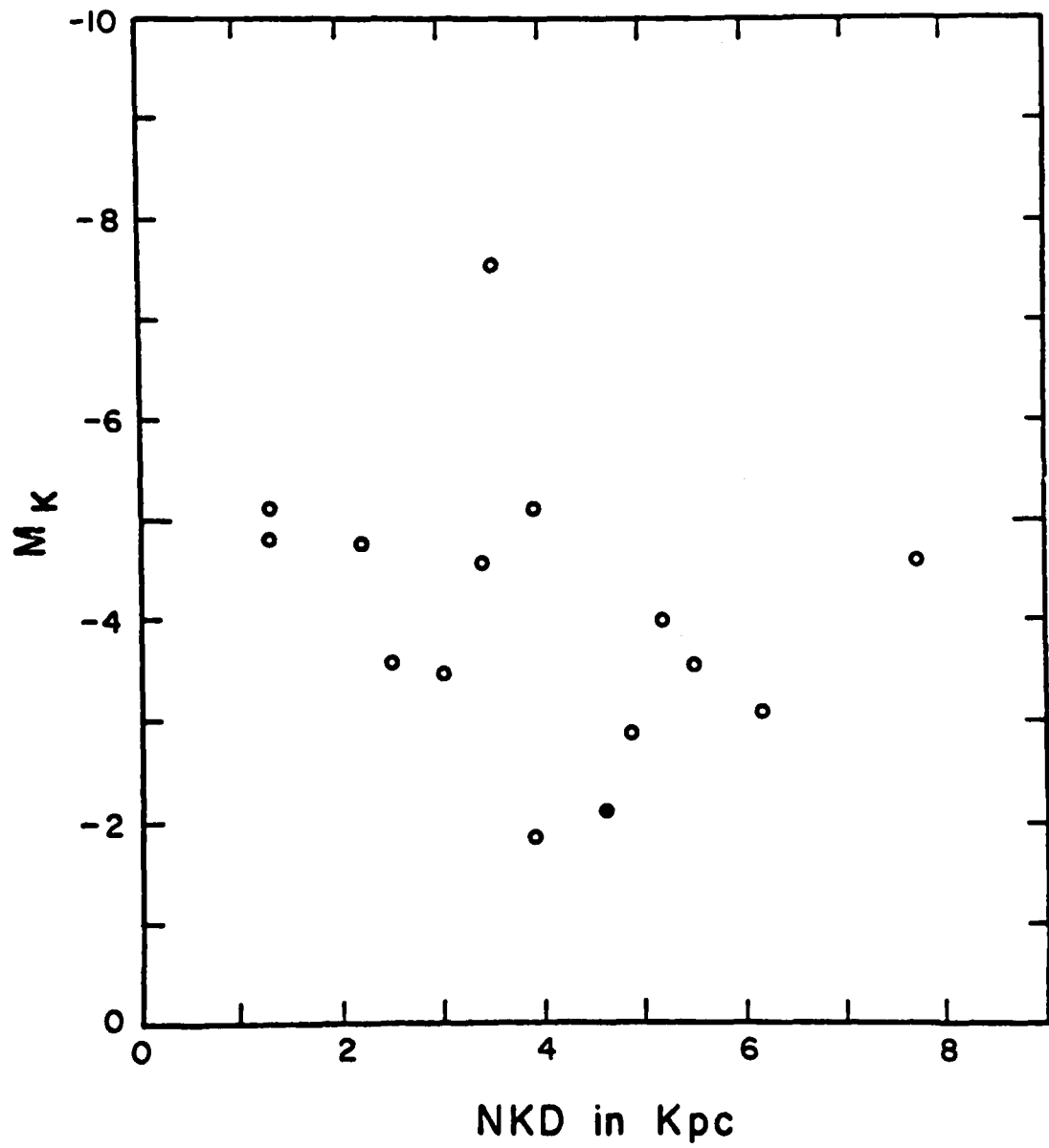


Figure 5a

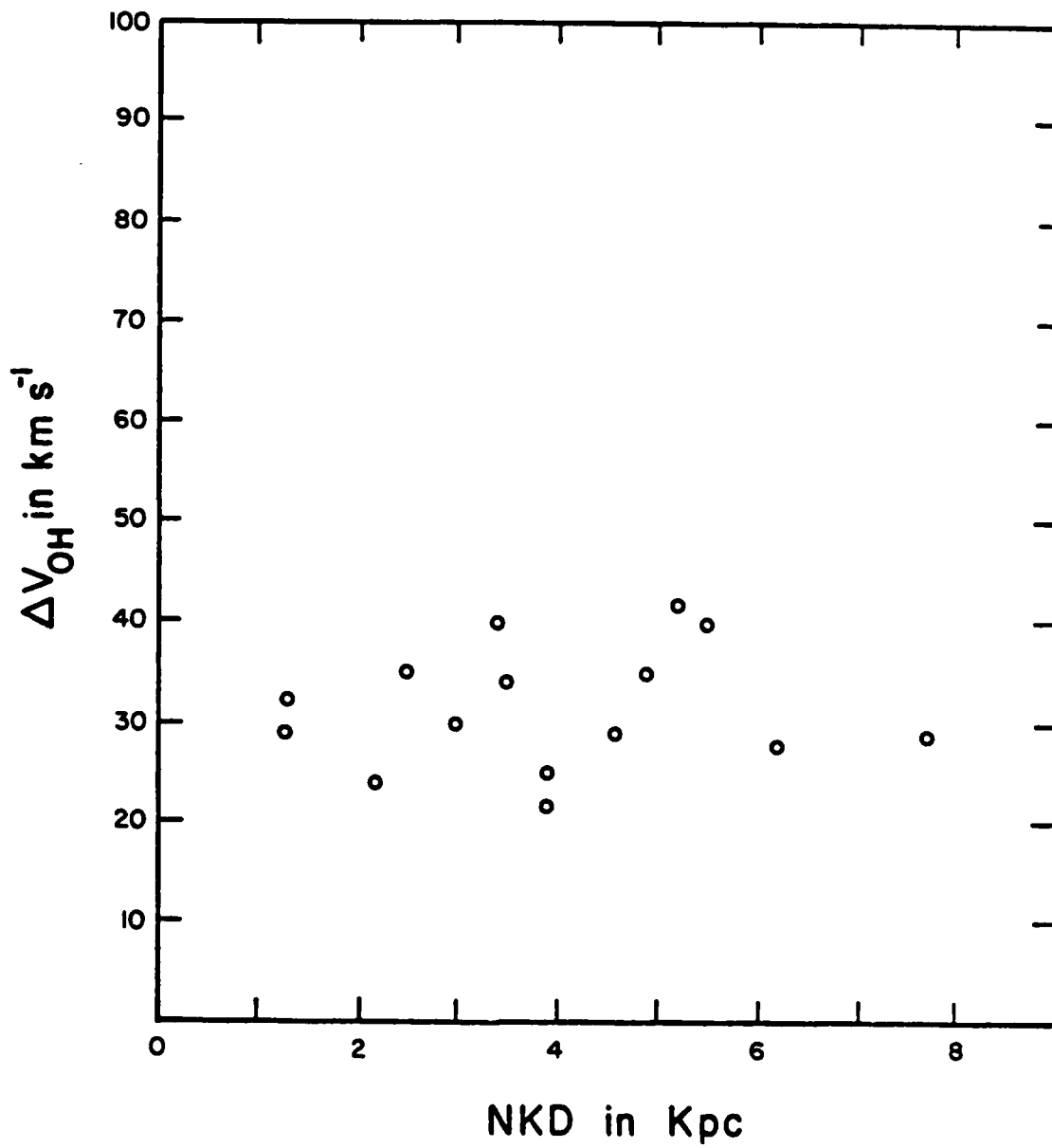


Figure 5b

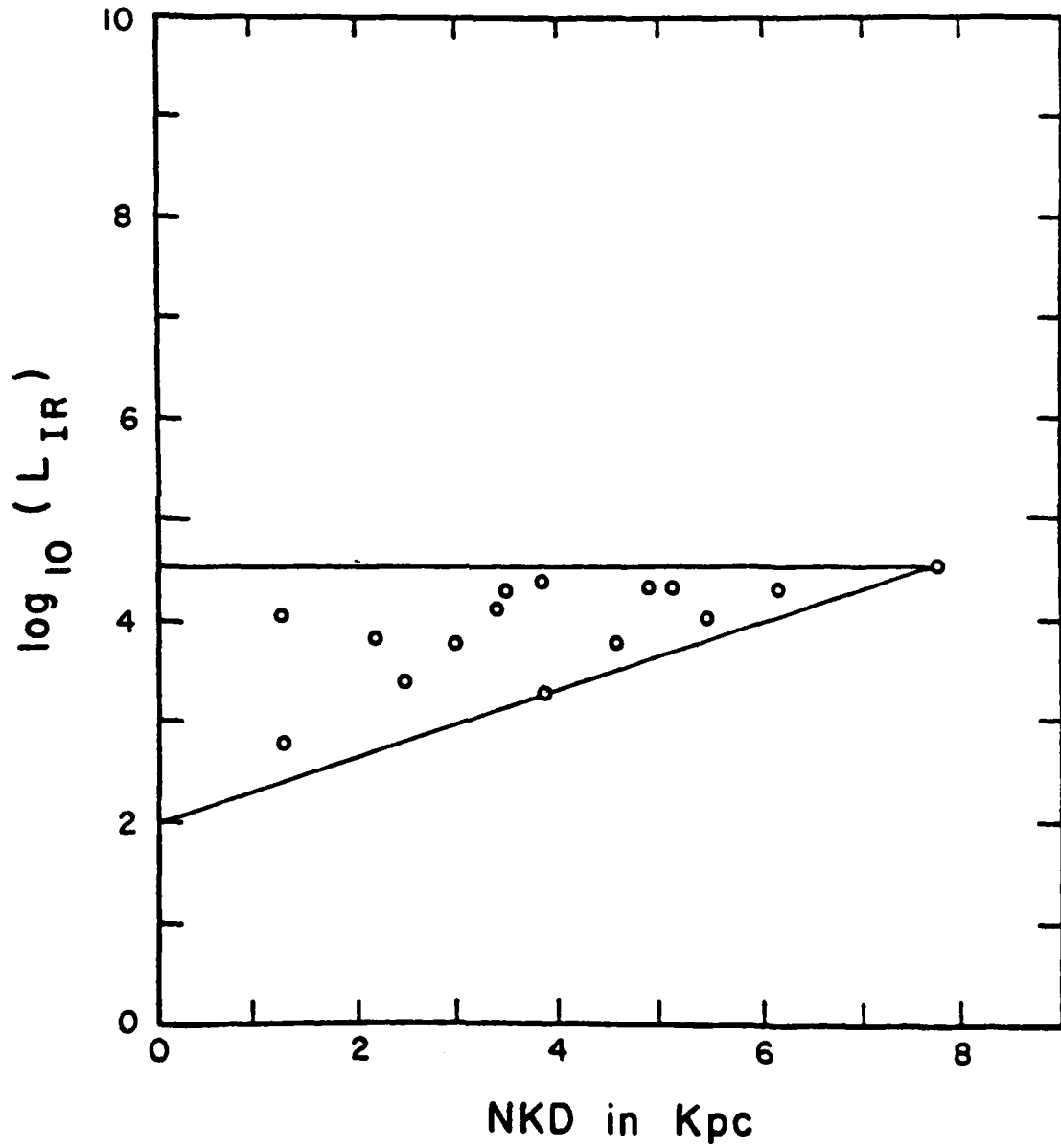


Figure 5c

END

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