Accurate positions and finding charts of known planetary nebulae in the Large Magellanic Cloud^{*,**,***}

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Received July 28, 1995; accepted June 10, 1996

Abstract. We present identifications and accurate positions for about 280 planetary nebulae (PNe) in the Large Magellanic Cloud (LMC). These positions are needed for follow-up ground or space observations. Entire Schmidt plates have been scanned with the MAMA microdensitometer, and PPM stars used for the astrometric reduction. The precision achieved is always better than $0''.5$, and better than $0''.3$ for most of the objects not located close to the border of the plates. Photometry in the B band is provided with an accuracy of about 0.2 magnitude, except in too crowded zones where the background cannot be determined. Cross-identifications with IRAS sources have also been tabulated and discussed.

Key words: planetary nebulae: general — galaxies: Magellanic Clouds — galaxies: ISM; stellar content — astrometry

1. Introduction

The study of physical properties of planetary nebulae (PNe), and, in particular, the determination of their luminosity function is hampered in our Galaxy by the poor knowledge of their distances. This problem can be overcome by going to external galaxies, like the Magellanic Clouds, where the distance is known with a reasonable accuracy and where, in first approximation, all PNe can be taken to be located at the same distance. Several photographic surveys, either by direct imaging or through objective-prism, have been devoted in the past to the

search of emission-line objects in the Clouds, but their limited sensitivity did not allow the detection of the faintest objects even at these nearby distances. Progress in detector technologies however open the prospect to get complete samples of such objects in Local Group Galaxies in the near future.

The possibilities of photographic plates can however still be further exploited in the meantime. Sky Survey Schmidt plates are ideal tools to measure a large number of objects spread over a large area like the Magellanic Clouds. They allow easily a determination of positions with an accuracy better than $0.5''$, a significant improvement over available coordinates. Such accurate coordinates are nowadays indispensable for follow-up work, with ground-based facilities like multi-object spectrographs or for centering with space instruments. They are further necessary for cross-identification with other surveys, devoted specifically to PNe or more general ones, like the Deep European Near IR Sky Survey (DENIS). At the same time, these Schmidt plates provide finding charts still necessary for detailed study in crowded regions like the Bar, charts often missing in earlier surveys. Finally, reasonable magnitudes (to 0.1 – 0.2 m accuracy) can be provided in an homogeneous set for a large sample, allowing a first sight at the luminosity function.

We have therefore embarked on a program of systematic measure of positions and magnitudes of the known PNe in both Clouds by digitizing Survey Plates (blue and red) over the whole Cloud area, with pixels of 10 microns (or $0''.67$). This work had to be supplemented by CCD observations, to recover some of the cataloged, but unidentified PNe and provide photometric zero points.

This first paper describes the methods and first results in the Large Magellanic Cloud. Section 2 describes the main PNe catalogues used as input. We explain the observations and reduction techniques in Sect. 3, while

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* Plate scanning done with MAMA, Paris Observatory.

** Based on observations made at the European Southern Observatory, La Silla, Chile.

*** Tables also available in electronic form at CDS.

Sect. 4 gives the results. We finally work out, as an example of possibilities opened by these results, the cross-identifications with IRAS data in the last section.

2. Existing surveys, confirmed and rejected candidates

2.1. First surveys

Early work on H α emission-line stars and nebulae was published by Henize in 1956. This survey, based on objective-prism photographs taken with a 10-inch camera, yielded 415 objects in the LMC, and among them 97 point-like emission sources, with no visible continuum, which could thus be considered as candidates PNe. Finding charts were provided. Lindsay & Mullan (1963) and Lindsay (1963), using the same instrument, selected, out of a sample of about 1000 emission objects, 109 point-like H α emission sources with no continuum. 65 of these were classified as candidate PN because emission lines other than H α were also seen, while the remaining 44 objects showed only H α . This later group however potentially also contained PNe, because it consisted of fainter objects where other emission lines needed more sensitive material to be revealed. Unfortunately, no finding charts were ever published for this sample, so that recovery of all the PNe is necessary.

In 1964, Westerlund and Smith used a blue objective-prism with a 20/26 inch Schmidt telescope to survey 100 square degrees of the LMC and produced a catalogue of 42 LMC PNe with approximate coordinates and manually drawn finding charts. Only point sources were retained.

2.2. Sanduleak et al. (1978), (1984)

Sanduleak et al. (1978) obtained objective prism plates with the Curtis Schmidt telescope at Cerro Tololo over a large fraction of the LMC. They presented a list (SMP) of 102 PNe, with cross-references to previous work. Objects were selected with no evidence of a continuum, and simultaneously with unresolved structure on direct plates (with the possible exception of SMP007). Unfortunately the coordinates are only approximate and no finding charts are provided, which makes the identification difficult. For further studies, these PNe have therefore to be “re-discovered”. This was the most complete list of confirmed PNe at that time and therefore their designation is preferred to older ones. Some objects, believed to be of too low excitation to represent classical PNe (and denominated Very Low Excitation (VLE) objects) were presented in an independent list (Sanduleak & Philipp 1977). A few of the objects initially rejected by SMP, have been detected again in later surveys.

Sanduleak (1984) added 26 PNe (denoted Sa in our table, from Sa104 to Sa126) candidates to this list thanks to deeper plates obtained in the central region of the LMC.

Nine of those had already been found by Jacoby (1980), but have been labeled with the Sanduleak denomination in our table.

Five objects were later rejected. The candidate Sa103 is a galaxy, with $z = 0.035$, see Dennefeld (1986). Four objects (108-119-125-127) could not be found again: we took ON and OFF line CCD images in H α and couldn’t detect any emission object inside the 4 fields (from $3.2' \times 2.5'$ for Sa108 and Sa119, to $4.3' \times 3'$ for Sa125, and up to $7' \times 7'$ for Sa127).

We note that almost all the objects observed with the smaller field (0.90 m Dutch telescope + CCD camera, with a field of $2.5' \times 3.2'$) fall on the edges of the field. As an example, Sa104 was hard to recovered because the position was erroneous by about $2'$. However for Sa125 and Sa127 the field is large enough to conclude that no PNe are present in these 2 regions. This has been independently confirmed by Morgan & Good (1992) who suggest in addition that Sa108 and Sa119 are carbon stars.

Sa104a was first discovered by Savage et al. (1982) and is a true PNe (with particularly low abundances, Leisy & Dennefeld 1995).

Later on, while this work was in progress, Meatheringham et al. (1991a,b) published, with their spectroscopic observations, better positions for 60 out of the 102 SMP PNe, while 10 others were measured by Vassiliadis et al. (1992). However the R.A. of these 70 PNe are rounded-up to the nearest second of time!

2.3. Jacoby (1980)

Jacoby (1980) used the Cerro Tololo 4 m telescope at the prime focus with a direct imaging technique (*on-line/off-line* narrow filters photography at [OIII] and H α) in 4 central regions of LMC (small area of the Bar). This is a much deeper survey which produced 41 faint PNe, 5-6 mag fainter than the brightest ones. Later on, Boroson & Liebert (1989) rejected 14 objects: 9 were early type stars, 3 M giant stars, 2 objects were not found at all. Furthermore, 8 PNe candidates were already known and confirmed by previous surveys. The coordinates are good to $2''$ but the finding charts are difficult to use at the telescope because they are taken in narrow-band emission line filters: the object is then difficult to recognize in a typical telescope acquisition camera or a broad band CCD image.

In 1990, Jacoby et al. published the [OIII] photometry and interference filter images of the fields of the 102 PNe from the first Sanduleak list (1978). These images suffer from the same shortcomings at the telescope as only the brightest stars are visible.

2.4. Morgan and Good (1992), (1994)

Recently Morgan & Good (1992) and Morgan (1994) published respectively 86 and 54, new PNe candidates from plates taken with the 1.2 m UKST and objective prism, covering the entire LMC system. The errors on coordinates are “typically $\pm 2 - 3$ arcsec”. Finding charts are provided, but the first series is hardly usable, specially in crowded areas, because of the small dynamics. These objects have also been included here for completeness and homogeneity.

The various lists discussed above provide the basic set of candidate PNe used here. No attempt has been made to be exhaustive. It should be further noted that these are only candidates, and only follow-up slit spectroscopy can confirm the nature of the object. When this was available (from our or published work), it is noted in Table 4. To date, 139 only out of the 277 candidates have been observed with slit spectroscopy.

3. Observations and reductions

To obtain identifications and accurate coordinates, two types of follow-up observations were obtained. For those objects where no finding chart was available at the time, CCD images were obtained with interference filters centered ON and OFF the $H\alpha$ emission line, the images being centered on the published coordinates (see Sect. 3.1). This allowed to recover one (or more) emission-line objects in the field. For other PNe, the identification was taken from the literature. For all the identified PNe candidates, entire Schmidt plates were scanned, covering the whole LMC, to determine accurate coordinates and a rough broad-band magnitude.

3.1. CCD imaging

Images of about 50 PN candidates have been taken, from 1990 to 1991, with several telescopes in ESO La Silla (NTT, 2.2 m and the Dutch 90 cm) with respective fields of view of $7' \times 7'$, $4.3' \times 3'$ and $3.2' \times 2.5'$. A few objects turned out to be resolved in the $H\alpha$ images (SMP011, SMP017, SMP024, SMP030, SMP060, SMP086, J26). All candidates in these fields could be recovered, with the exception of Sa108, Sa119, Sa125 and Sa127 which are therefore rejected as PNe candidates (see Sect. 2.2). Many broad band images were also recorded, just before spectroscopy, to allow a proper positioning of the objects on the slit. These images also provide high quality finding charts.

3.2. Scanning of Schmidt plates

We have scanned 5 SERC J (Blue) and 3 ESO (Red) Schmidt plates (to cover a maximum area of the LMC) with the MAMA (Machine à Mesurer Automatique) at

Paris Observatory. MAMA is a linear scanner of 1024 diodes mounted on a stable marble table in a cooled room and provides excellent stability and accuracy (see Berger et al. 1991). The dynamics is 12 bits, therefore with very deep exposures all the stars of $M_B = 16 - 17$ or brighter are already saturated. For stars brighter than $M_B = 12$ the saturation is too strong, and then no precise centering can be done. This dynamics is however perfectly adequate for copy Survey Plates such as the ones we used, where the intrinsic dynamics is anyway limited. The J plates, with a field about 6° by 6° , are mapped in a mosaic of 33 by 33, 1024×1024 pixel images, while the mosaic is 28 by 28 in the case of the red plates. The total J image is 33792×33792 pixels and occupies about 2.2 Gbytes of disk space. The pixel size is $10 \mu\text{m}$ or $0''.67$. The main characteristics of these plates are shown in Table 1. The coordinates are the (α, δ) of the plate center in J2000 equinox derived from our astrometry. The date of observation is also given. The last column presents respectively the initial and the final number of PPM (Röser & Bastian 1988) stars taken into account for the astrometric reduction (see below).

Table 1. Parameters of the used Schmidt plates

Plate field	Plate center J2000		Epoch	PPM
	R.A.	DEC.		
SERC 033J	5 28 26.94	-74 57 45.8	1976.010	278-263
ESO 034R	6 33 56.87	-75 02 31.2	1985.079	203-195
ESO 055R	4 19 48.66	-69 47 56.1	1984.991	164-159
SERC 056J	5 11 34.48	-69 56 30.7	1975.947	235-226
SERC 057J	6 03 30.15	-70 00 16.4	1975.936	248-232
SERC 085J	5 08 14.28	-64 56 15.1	1976.925	276-265
SERC 086J	5 52 10.55	-64 59 25.4	1975.027	255-246
ESO 087R	6 36 17.86	-65 04 37.6	1982.068	191-171

3.3. positions

The published coordinates for the various PNe candidates are given in several equinoxes (1950, 1975 and 2000). Most of the astronomical reductions have probably been done (although not explicitly said, except by Jacoby 1980) with earlier catalogues in the FK4 system, whose accuracy of positions and proper motions are no longer satisfactory. Therefore, in order to make the comparison with our new positions, we converted all the coordinates to the J2000 equinox with the matrix suggested by Lieske (1979).

On each SERC or ESO plate, all the PPM references (in equinox J2000 and in the FK5 system) stars have been searched (the mean number is about 200), and their positions on the plates determined in (X, Y) . For all the (bright) PPM stars we used a spike centering method.

The Schmidt plate is then mapped with a bidimensional 3-degree polynomial in order to transform the (X, Y) to (α, δ) or to make the reverse transformation. The program is iterative, in the sense that it rejects the reference stars which deviate by more than 3σ from the calculated position and recalculates the new coefficients of the fit. On the average, the program iterates only 3 – 4 times and rejects only about 10 stars randomly positioned on the plate (and not at the outer part as would be the case for a bad fitting on the borders).

Fig. 1. Differences between our new positions and previously published ones (new-old)

Figure 1 shows the differences between our new positions and the ones given in previous papers. In the case of Sanduleak et al. (1978) objects the original coordinates have been taken only if better ones were not available. The difference can be as large as $2'$ and therefore the identification is made impossible in such dense fields from coordinates alone.

We used the same symbols for Figs. 1, 2 and 3: squares (Sanduleak et al. 1978, 1984; and Meatheringham et al. 1991a,b); crosses (Jacoby 1980); circles (Morgan & Good 1992; Morgan 1994). Figure 2 is an enlargement of the central part of Fig. 1 and shows only the points with better original coordinates (Jacoby 1980; Morgan & Good 1992; Morgan 1994; and Meatheringham et al. 1991a,b). The accuracy is still not satisfactory. Moreover we see a systematic difference in coordinates, both in α and δ , of respectively $1''$ and $2''$. The bulk of data is not centered at the origin indicated by the cross.

Fig. 2. Enlargement of the previous figure. Systematic difference in positions (new-old) of about $1''$ is clearly visible. The cross indicates the center at position 0,0

The origin of this discrepancy is probably multiple. It could be due to the use of film copies for some earlier measurements, to systematic differences between astrometric catalogues (PPM versus SAO, Perth70, ...), to differences between reference systems (FK5 versus FK4, amounting to about $-0''.5$ in α and $+0''.2$ in δ (Schwan 1988)), to unaccounted proper motions of standard stars, etc ... The measurements presented here are however based on the best available material (glass copies, digitized images, PPM stars).

The (X, Y) positions of all objects have been measured with the 2 completely different methods. The first method is a Gaussian centering fit inside the MIDAS Image Processing Package of ESO. In very crowded fields, like the Bar, and/or with tightly blended stars, the fit does not converge properly and this measurement has not been retained.

The second is a home-made program (Alard 1995) which separates the blended stars, measures the central position and does the photometry of all the stars found in the field. This method failed only in a few peculiar cases where no position and photometry could be derived (7 objects in total from the BAR: SMP047, SMP048, J12, J22, J26, Mo15 and Mo23). These cases are indicated by a colon in Table 4 (Col. 3 after the flag number).

Figure 3 shows that for all the objects, which could be measured by the two methods, the two determinations agree quite well. They gave similar results with a difference always less than $0''.30$ and a σ of about $0''.09$. Both methods

To look at the internal consistency, we use PNe in common on all plate pairs. The mean position error of the PPM stars at the LMC declination is $0''.11$ and the estimated residual systematic deviation between PPM south and the FK5 system has a typical size of $0''.05$.

The external consistency has been checked over all overlapping PPM stars on each pair of plates, and no systematic error could be found nor border fitting problems. The residual errors are of the order of $0''.2$. Figure 4 shows the results of this test for the plate pair SERC 056J/SERC 085J.

Table 2 lists the number of PNe in common, as well as the corresponding sigma in coordinate differences. This test was done on the SERC plates only (overlap on ESO

Fig. 3. Half difference between the two centering methods. No systematic effect can be found

have advantages and disadvantages. The first one, with manual identification, is indispensable when an object has poor coordinates but can be identified on a finding-chart. Its limits are reached in crowded fields not because of identification problems, but because the centering algorithm in MIDAS is not able to properly distinguish between sky background and adjacent objects. The second, automatic method is optimized for these difficult cases but, because no a-priori identification is made, the PN candidate cannot be selected out from the outputs when its initial coordinates are too poorly determined. Both methods are thus complementary and have been used in sequence.

We first identified the candidate, to center it in an extracted sub-frame of 128×128 pixel (in order to produce the finding-charts). We then use first and second methods in this sub-frame only to determine the position and the magnitude of the PNe. In all the cases where the first method works properly, the two (X , Y) position determinations agree perfectly. Therefore, in order to improve the accuracy and to reduce dispersion, the two determinations have been simply averaged. The final PNe coordinates are directly determined from the proper (X , Y) to (α , δ) transformation, and averaged if several positions were measured on different Schmidt plates. In the case of multiple determinations, if one is coming from a plate corner, check of the reliability is done automatically and the point is rejected if its distance to the mean value is greater than $0''.30$ (see the final position Table 4 in Appendix). The definition of a corner is the area within 4 cm, in both directions, of the scanned border zone. Elsewhere, no distortion problem has been noted.

Fig. 4. PPM position differences on Plates SERC 056J and SERC 085J

Table 2. PNe in common

Plates	PNe	σ
56-57	64	$0''.16$
56-85	35	$0''.11$
56-86	17	$0''.25$
56-33	8	$0''.16$
57-85	6	$0''.16$
57-86	15	$0''.11$
57-33	8	$0''.14$
85-86	27	$0''.20$

plates is too small) but ensures the accuracy and consistency of the whole astrometry. Figure 5 represents the histogram of coordinates differences for all the overlapping PNe on the 8 plates. Very few objects fall outside $0''.5$, and all the bad determinations came from a PNe pair with at least one lying in a plate corner. The average error is about $0''.3$ and the corresponding mean standard deviation is about $0''.17$. But these objects are taken from the borders of the plates, and therefore the expected errors in the inner part of the plates should be much smaller.

Fig. 5. Histogram of the position differences for all the PNe present on at least 2 Schmidt plates

3.4. Photometry

The automatic centering program (Alard 1995) also furnishes magnitudes, by profile reconstruction of point-like sources and integration inside the profile. This method has the advantage to give good results even when the central part of the star is saturated. We have therefore directly the magnitude (in B band) for all the PNe where crowding was not too important.

Calibration was obtained from B and V photometry of faint stars in the LMC (Linde et al. 1988) for very faint sources and from the Atlas of star clusters with color magnitude diagrams in the Magellanic Clouds (Alcaino 1975) from which we extracted 12 photometric sequences in LMC.

In total we used about 250 stars, covering a large magnitude domain from $M_B = 9.1$ to $M_B = 22.7$. B and V photometry has been used to produce B_J magnitudes for the standard stars, following the recipe given Blair & Gilmore (1982): $B_J = B - 0.28 (B - V)$.

Figure 6 shows the calibration curve with all the standard stars (except a few rejected outlying points due to confusion, saturation, etc...) and a fitted 6-degree polynomial, taken from two different plates (SERC 056J and SERC

085J). No systematic effect can be seen between these two plates. The linear domain extends from $M_B = 18$ to 22 with a precision of about 0.20 magnitudes which is the expected internal error from the published measurements. The stars brighter than $M_B = 16-17$ are saturated, due to the limited dynamical range of MAMA. This phenomenon is clearly seen in Fig. 6, where the slope at brighter magnitudes is smaller, and therefore the precision is diminished. But a magnitude determination is still possible down to 10-11th magnitude. From 114 stars which have been measured more than once, we derive an internal error smaller than 0.25 magnitude. Only for a few objects is the uncertainty larger, possibly due to peculiar local problems.

Fig. 6. Schmidt plates calibration

4. The catalogue

4.1. LMC catalogue

We summarize in Table 4 all our results for the 277 LMC PNe. The 4 candidates (Sa108, Sa119, Sa125 and Sa127) have been excluded (see Sect. 3.1). Excluded also are WS03 (not confirmed as a PN candidate, see SMP and Fehrenbach et al. 1978), and N016, N047 (extended), N099 (point like) VLE objects (Monk et al. 1988), but coordinates are available. The PNe are listed, first ordered by catalog names and then, within each catalogue, by increasing Right Ascension.

Column 1 indicates the selected name, with one cross-identification (first SMP, if available, then, in decreasing order of priority, Sanduleak, Jacoby, Henize, Westerlund, Lindsay, etc...). The complementary cross-identifications can then be found, if necessary, in the original papers. In Col. 2 Right Ascension and declination coordinates are given in equinox J2000 and B1950.

Column 3 is a number which gives a rough idea of the

position error (1 for precision better than $0''.2$, 2 between $0''.2$ and $0''.3$, 3 between $0''.3$ and $0''.5$, and finally 4 for coordinates less precise than $0''.5$). In parentheses, respectively, the number of position determinations (a maximum of 4), and the number of positions kept for the final averaged coordinate. The derived B magnitude are listed in Col. 4 (the number of plates used is given in parentheses). Because of intense crowding, some measurements were impossible.

4.2. LMC finding charts

The second product of this work is the complete set of finding charts for the LMC PNe. As already mentioned, only a fraction of the known PNe had published finding charts, and these were not always of usable quality. We therefore produced a homogeneous set of charts for all the objects. Plates 1-25 give the 280 finding charts taken from the IIIa-J plates of the ESO/SERC Southern Sky Atlas. Only a few exceptions (SMP098, Sa104, Mo01, Mo02, Mo49 and Mo54) are taken from Red plates. Field sizes are all $2' \times 2'$ and North is up and East to the left.

Note that, as a by-product, accurate positions are now also available for the standard stars.

4.3. Cross-identification with IR sources

As an example of possibilities opened by the knowledge of precise coordinates for PNe, we have looked for associations with IRAS sources, as given in the catalogue of Schwering & Israel (1990). While this is of obvious interest for the study of the PNe, it is however not illustrating the best possibilities of our catalogue, as the IRAS positions themselves are not known with an extreme accuracy. The uncertainty of the IRAS positions is given in Table 3 as the size of the error-ellipse from the Point Source Catalogue (PSC), when an association exists, as explained in the Catalogue of Schwering & Israel. The main criterion for an association of a PN with an IRAS source is the coincidence in position. We have, somewhat arbitrarily (but nevertheless based on the size of the average error-ellipse) separated sources in 3 categories: association closer than $30''$ in distance, between $30''$ and $60''$, and between $1'$ and $2'$. With the density of sources in the LMC, at these larger distances however, many unrelated sources would enter the catalogue. A second criterion has thus been applied, based on the expected IR flux distribution for PNe. Following experience from galactic PNe (Pottasch et al. 1988), a very broad selection on flux densities can be used to select PNe: $F_{\nu 25\mu} / F_{\nu 12\mu} > 2$ (to eliminate stars) and $F_{\nu 25\mu} / F_{\nu 60\mu} > 0.2$ to eliminate galaxies. We have applied this criterion for those objects where the distance of the IRAS source to the optical PN was larger than $1'$, to eliminate many spurious associa-

tions. For the closer associations, we have left all of them in Table 3, but will apply the criterion subsequently to assess the reality of the identification. When the 60μ flux was not well estimated due to confusion, the source was kept, pending further identification (a C is then printed instead of a flux value).

The results are given in Table 3, where we list the serial number from Schwering's list, in Col. 1, the PN name (Col. 2), the IRAS PSC cross-identification when appropriate (Col. 3) and the associated error ellipse (Cols. 4-6). If no PSC identification could be done the typical errors are $1'$ in both RA. and Dec. (Schwering & Israel 1990). Columns 7 to 9 give respectively the optical and IR positions (in J2000 equinox) and the distance between the two determinations (in arcsec). Columns 10 to 13 show the IR fluxes at 12, 25, 60 and $100 \mu\text{m}$, while in column 14, a "p" indicates a point-source. More details about the IRAS data can be found in the original reference (Schwering & Israel 1990).

Zilstra et al. (1994) published a list of 12 IRAS sources associated with LMC PNe. Five of them do not show up here: SMP006, SMP061, SMP098, MG45 and Mo18, which indicates a distance between IRAS and optical position larger than $2'$. As we used only the catalogue of Schwering & Israel (1990), based on a special observation in the Deep Sky Mapping mode, (while Zilstra et al. used indifferently this list or the Faint Source Catalogue (FSC)), this difference has probably to be ascribed to a discrepancy between the two catalogues, which needs further investigation.

Applying now the flux ratio criteria in addition to the association with separations smaller than $1'$, we end with a "quality criterion" (Q) for the association, given in the last column of Table 3. Quality 1 is a secure association, both because of small distances and adequate flux ratios, while quality 2 is less secure (flux ratios at the limit, or unclear due to confusion, and larger separation between optical and IR sources). Quality 3 is a doubtful association, while 0 means rejection. In the latter category enter SMP013, SMP043, SMP064, SMP069 and MG58 because the IR flux distribution indicates a stellar source (for SMP064, the IRAS source is clearly associated to the cluster NGC 1984), while for SMP092 and Mo19 the flux distribution would indicate a cold galaxy. If the two latter objects are indeed PNe, which is confirmed for SMP092 (Meatheringham & Dopita 1991b), then they have in fact an optically thick dust shell, with a cooler exciting source, which is known to mimic the flux distribution of a galaxy. Further spectroscopy will be necessary. The same remark applies to some of the quality 3 associations in the first part of Table 3, which could be the same type objects, or lower excitation HII regions (SMP024, SMP029, SMP036, SMP075). The known (high) excitation class for the first three PNe suggests an IR excess due to a dust shell. Note that some objects are already classified as Very Low

Table 3. Possible IRAS associations

Num	Name	IRAS PSC	$\Delta\alpha$	a	b	Θ	OPT (J2000)			IRAS (J2000)			d (")	F12 μ	F25 μ	F60 μ	F100 μ	ext	Q							
							h	m	s	h	m	s														
72	SMP008	04505-6938	10	3	165	4	50	13.20	-69	33	56.6	4	50	12.2	-69	33	45	12.8	0.15:	0.56	2.1:	C	-	2		
89	SMP011	04515-6710	11	8	3	4	51	37.89	-67	05	16.3	4	51	37.7	-67	05	19	3.1	0.33	0.56	C	C	p	2		
303	SMP013						5	00	00.15	-70	27	40.5	5	00	01.4	-70	27	41	6.4	0.22	-	-	-	-	0	
438	SMP024	05066-6903	21	7	157	5	06	18.27	-68	59	30.9	5	06	23.2	-68	59	20	28.5	0.07:	0.11:	1.7	4.2	-	-	3	
481	SMP028	05081-6855	14	8	21	5	07	57.71	-68	51	46.2	5	07	56.9	-68	51	48	4.6	-	0.44	2.1:	C	-	-	2	
483	SMP029	05082-6844	33	14	4	5	08	03.53	-68	40	16.3	5	08	02.1	-68	40	36	21.1	0.07:	0.11	2.1:	C	-	-	3	
513	SMP031	05094-6751	9	8	174	5	09	20.16	-67	47	24.3	5	09	19.5	-67	47	23	3.9	0.15:	0.44	-	-	p	-	1	
557	SMP036	05108-6839	16	8	167	5	10	39.68	-68	36	04.0	5	10	39.8	-68	36	00	3.8	0.33	0.22	3.3:	C	-	p	3	
850	SMP051	05213-7012	11	8	78	5	20	52.55	-70	09	35.0	5	20	52.3	-70	09	42	6.7	0.15	0.44	1.2:	4.2:	-	-	2	
982	SMP058	05248-7007	35	8	143	5	24	20.86	-70	05	00.5	5	24	21.8	-70	05	07	8.0	0.15	0.22	-	-	-	-	1	
1014	SMP062	05257-7135	36	8	139	5	24	55.04	-71	32	55.4	5	24	57.5	-71	33	14	21.8	0.19:	0.44	C	C	p:	-	2	
1327	SMP075						5	33	47.00	-68	36	44.2	5	33	44.0	-68	37	06	27.2	0.19	0.33	1.7:	C	p:	-	3
1513	SMP085	05404-6619	12	8	128	5	40	30.91	-66	17	37.0	5	40	30.1	-66	17	38	4.9	-	0.44	-	-	p	-	1	
1113	Mo26						5	28	01.52	-70	13	30.1	5	27	59.4	-70	13	41	15.7	0.11	0.11	2.5	0.4	-	-	2
1785	Mo41	05551-6528	8	5	18	5	55	13.70	-65	28	22.8	5	55	13.5	-65	28	18	5.2	-	0.22	-	-	p	-	1	
254	N016 VLE	04581-6745	16	3	159	4	58	07.24	-67	41	10.3	4	58	05.3	-67	41	04	12.3	0.07:	0.22	2.1	4.2:	-	-	2	
964	N047 VLE	05245-6712	12	5	3	5	24	28.01	-67	09	09.9	5	24	28.2	-67	09	28	18.3	0.26	0.33	5.4	0.4	-	-	2	
2	SMP001	04388-7042	20	10	72	4	38	34.78	-70	36	43.2	4	38	24.6	-70	36	58	53.1	0.11:	0.33	0.2:	1.0:	p	-	2	
736	SMP043						5	17	02.87	-69	07	16.4	5	17	01.2	-69	07	54	38.3	0.15	0.11	-	-	-	-	0
822	SMP047	05202-6933	7	3	45	5	19	54.71	-69	31	04.5	5	19	49.6	-69	30	39	37.2	0.44	0.56	0.3	0.8:	-	-	2	
1100	SMP064	05280-6910	10	3	12	5	27	35.80	-69	08	56.3	5	27	40.2	-69	08	05	56.8	3.88	3.31	0.3	4.2	p	-	0	
1149	SMP069	05293-6715	8	7	37	5	29	23.24	-67	13	21.9	5	29	16.5	-67	13	30	39.8	0.41	0.33	-	-	p	-	0	
1336	SMP078						5	34	21.27	-68	58	24.9	5	34	15.7	-68	59	08	52.7	0.22	0.44	C	C	p:	-	2
1707	SMP092						5	47	04.68	-69	27	33.3	5	47	00.6	-69	27	04	36.2	0.30	0.33	8.3	9.1	-	-	3
1280	MG58						5	32	37.68	-67	08	31.1	5	32	36.3	-67	08	00	31.7	0.52	0.44	-	-	-	-	0
574	Mo19						5	11	00.46	-70	05	04.8	5	10	53.3	-70	04	28	52.2	-	0.11:	1.2	4.2	-	-	3
436	SMP025	05063-6908	13	8	42	5	06	23.90	-69	03	19.3	5	06	04.1	-69	04	15	119.8	0.11:	0.33	-	-	-	-	3	
836	SMP048	05207-6956	25	8	141	5	20	09.66	-69	53	38.9	5	20	18.4	-69	55	08	99.9	0.07:	0.33	-	-	-	-	3	
947	SMP056						5	23	31.16	-69	04	04.4	5	23	41.2	-69	02	22	115.4	0.15	0.33	3.7	2.5	-	-	3
1604	SMP088						5	42	33.31	-70	29	24.0	5	42	45.3	-70	30	46	101.4	0.11	0.11:	-	-	S	-	3
1335	Sa122						5	34	24.32	-69	34	28.0	5	34	05.3	-69	34	08	101.6	0.15:	0.44	2.1:	0.4:	-	-	3
740	J18						5	17	23.93	-69	39	13.2	5	17	06.4	-69	38	54	93.2	0.15	0.22	C	C	-	-	3
794	J21	05191-6936	25	3	158	5	18	55.70	-69	33	02.1	5	18	47.0	-69	34	01	74.8	-	0.44	C	C	-	-	3	
899	MG39	05228-6945	13	3	144	5	22	12.93	-69	43	29.1	5	22	24.3	-69	42	29	84.1	0.74	3.33	6.6:	C	-	-	3	
1467	MG68						5	38	19.45	-68	58	37.2	5	38	35.3	-68	59	27	99.0	0.93:	2.77:	C	C	-	-	3
466	SMP026 VLE						5	07	30.77	-69	08	07.0	5	07	12.7	-69	08	12	96.6	0.11	0.22	0.8	2.1:	-	-	3

Excitation objects. It should be noted also that, because of the metallicity which is different in the Clouds compared to our Galaxy, the color criteria for the PNe might also be slightly modified. We end with 15 associations of quality 2 or better, closer than 1' (among them 7 in the list of Zijlstra et al. 1994). These objects are worth further study. In the case of associations with larger separation, a close inspection of the finding charts reveals in almost all cases a better identification for the IRAS source than the PN.

5. Conclusions

With the last published catalogues (Morgan & Good 1992; and Morgan 1994) the sample of known PNe in the LMC has been doubled, allowing a better study of the population of these objects in the LMC. We have provided accurate coordinates and finding charts in a homogeneous way for the whole sample. From multiple position measurements of objects lying in the overlapping parts of the Schmidt plates, we derive an accuracy better than 0".5 (with a few exceptions) and probably better than 0".3 for most of the objects lying further away from the plate borders. This is adequate for most of the follow-up work from ground or space. It should be added that the material

available will easily allow a similar, accurate measurement for any new object which should be discovered later on. An application to the identification of IRAS sources in the LMC (which have themselves poor coordinates) leads to 15 identifications with reasonable confidence, which will be further observed.

Acknowledgements. We thank Dr. D.H. Morgan for a careful reading of the manuscript. We are grateful to Rene Chesnel for scanning the Schmidt plates and support during the astrometric reductions and tests made for this program.

A. Positions

See Table 4 with LMC positions on the six next pages.

continued from previous page						
Name	coord OPT		F	(n1,n2)	m_B	(n)
	J2000	B1950				
SMP053=N042	5 21 32.89 -67 00 04.0	5 21 34.53 -67 02 51.4	2	(3,1)	16.3	(3)
SMP054=J35	5 21 42.93 -68 39 24.8	5 21 58.02 -68 42 11.0	1	(1,1)	17.0	(1)
SMP055=N199	5 22 40.96 -71 19 06.7	5 23 22.52 -71 21 47.7	1	(1,1)	17.1	(1)
SMP056=N136	5 23 31.16 -69 04 04.4	5 23 50.10 -69 06 42.7	1	(1,1)	18.1	(1)
SMP057	5 23 48.62 -69 12 21.6	5 24 08.86 -69 14 58.5	1	(1,1)	18.0	(1)
SMP058=N013	5 24 20.86 -70 05 00.5	5 24 49.55 -70 07 34.8	1	(1,1)	19.4	(1)
SMP059=LM2-25	5 24 27.35 -70 22 23.7	5 24 58.98 -70 24 57.4	1	(1,1)	17.3	(1)
SMP060	5 24 15.69 -70 53 56.3	5 24 52.83 -70 56 30.8	1	(1,1)	16.5	(1)
SMP061=N203	5 24 36.02 -73 40 39.4	5 25 48.13 -73 43 11.1	1	(1,1)	16.2	(1)
SMP062=N201	5 24 55.04 -71 32 55.4	5 25 39.51 -71 35 26.7	2	(2,1)	15.0	(2)
SMP063=N141	5 25 26.18 -68 55 53.8	5 25 44.12 -68 58 23.8	1	(1,1)	16.6	(1)
SMP064=N145	5 27 35.80 -69 08 56.3	5 27 55.93 -69 11 16.9	1	(1,1)	18.7	(1)
SMP065	5 27 43.83 -71 25 56.0	5 28 27.29 -71 28 15.2	2	(2,1)	17.7	(2)
SMP066=N052	5 28 41.15 -67 33 39.1	5 28 47.85 -67 35 55.4	2	(3,2)	16.2	(3)
SMP067=N053	5 29 15.67 -67 32 46.7	5 29 22.31 -67 35 00.6	2	(3,2)	16.9	(3)
SMP068	5 29 02.85 -70 19 24.8	5 29 34.48 -70 21 38.7	1	(2,2)	19.3	(2)
SMP069=N054	5 29 23.24 -67 13 21.9	5 29 27.35 -67 15 35.3	2	(3,1)	15.4	(3)
SMP070=LM2-28	5 29 26.64 -72 38 42.6	5 30 25.11 -72 40 53.8	1	(3,3)	18.4	(3)
SMP071=N207	5 30 33.30 -70 44 37.6	5 31 09.47 -70 46 44.8	2	(2,1)	16.0	(2)
SMP072	5 30 45.83 -70 50 15.8	5 31 23.03 -70 52 22.1	1	(2,2)	16.4	(2)
SMP073=N208	5 31 21.97 -70 40 44.9	5 31 57.53 -70 42 48.6	2	(2,1)	14.4	(2)
SMP074=N209	5 33 29.84 -71 52 28.4	5 34 19.09 -71 54 22.3	1	(2,2)	14.9	(2)
SMP075=N151	5 33 47.00 -68 36 44.2	5 34 02.90 -68 38 38.1	2	(2,1)	15.8	(2)
SMP076=N060	5 33 56.17 -67 53 08.3	5 34 05.93 -67 55 01.8	2	(4,2)	16.6	(4)
SMP077=N152	5 34 06.28 -69 26 17.7	5 34 29.69 -69 28 09.9	1	(2,2)	17.7	(2)
SMP078=N153	5 34 21.27 -68 58 24.9	5 34 40.41 -69 00 16.2	2	(2,1)	16.8	(2)
SMP079=N210	5 34 08.73 -74 20 06.5	5 35 32.07 -74 21 56.4	1	(1,1)	16.3	(1)
SMP080	5 34 38.95 -70 19 55.5	5 35 11.18 -70 21 45.0	1	(2,2)	18.5	(2)
SMP081=N211	5 35 20.95 -73 55 29.6	5 36 38.04 -73 57 14.5	1	(1,1)	16.3	(1)
SMP082=LM2-38	5 35 57.62 -69 58 16.6	5 36 26.32 -70 00 00.6	1	(2,2)	19.3	(2)
SMP083=N066	5 36 20.81 -67 18 07.5	5 36 26.08 -67 19 50.6	1	(4,4)	15.5	(4)
SMP084=N212	5 36 53.02 -71 53 38.0	5 37 42.80 -71 55 17.2	2	(3,2)	16.3	(3)
SMP085=N069	5 40 30.91 -66 17 37.0	5 40 28.87 -66 19 02.2	1	(1,1)	17.4	(1)
SMP086=LM2-41	5 41 22.05 -68 07 44.2	5 41 34.31 -68 09 05.3	2	(3,2)	18.7	(3)
SMP087=N215	5 41 08.04 -72 42 07.8	5 42 08.32 -72 43 28.1	1	(3,3)	17.1	(3)
SMP088=LM2-42	5 42 33.31 -70 29 24.0	5 43 07.73 -70 30 39.0	1	(2,2)	16.2	(2)
SMP089=N178	5 42 37.00 -70 09 31.1	5 43 08.02 -70 10 46.0	1	(2,2)	14.8	(2)
SMP090=LM2-43	5 44 34.76 -70 21 40.0	5 45 07.95 -70 22 46.3	2	(2,1)	18.1	(2)
SMP091=LM1-57	5 45 05.97 -68 06 50.9	5 45 18.28 -68 07 55.7	2	(3,2)	17.2	(3)
SMP092=N170	5 47 04.68 -69 27 33.3	5 47 29.06 -69 28 29.0	2	(2,1)	15.6	(2)

continued from previous page							
Name	coord OPT				F	(n1,n2)	m_B (n)
	J2000		B1950				
Sa106	5 03 05.75	-68 33 37.0	5 03 17.24	-68 37 43.0	1	(1,1)	19.3 (1)
Sa107=LM2-06	5 06 43.71	-69 15 37.8	5 07 02.00	-69 19 28.2	1	(1,1)	18.2 (1)
Sa109=J05	5 11 48.12	-69 23 43.1	5 12 08.48	-69 27 11.7	1	(1,1)	18.4 (1)
Sa110	5 12 16.72	-68 29 10.1	5 12 29.08	-68 32 36.9	1	(1,1)	18.7 (1)
Sa117	5 24 56.74	-69 15 31.2	5 25 17.59	-69 18 03.3	1	(1,1)	19.9 (1)
Sa120	5 29 32.70	-70 17 39.0	5 30 04.08	-70 19 50.7	1	(2,2)	20.5 (2)
Sa121	5 30 26.27	-71 13 48.0	5 31 07.75	-71 15 55.5	1	(2,2)	19.1 (2)
Sa122	5 34 24.32	-69 34 28.0	5 34 49.05	-69 36 18.9	2	(2,1)	19.1 (2)
Sa123	5 34 30.17	-70 28 34.5	5 35 03.89	-70 30 24.6	1	(2,2)	18.7 (2)
Sa124	5 40 44.59	-67 18 07.7	5 40 50.12	-67 19 31.7	2	(4,3)	19.4 (4)
Sa126	5 53 14.61	-70 25 02.0	5 53 48.66	-70 25 30.4	1	(1,1)	19.1 (1)
Sa104a	4 25 31.9	-66 47 18	4 25 21.3	-66 54 00	4	(0,0)	00.0 (0)
J04	5 11 44.63	-68 59 57.2	5 12 01.38	-69 03 26.1	1	(1,1)	21.1 (1)
J07	5 11 55.89	-69 07 30.8	5 12 13.80	-69 10 58.9	1	(1,1)	21.7 (1)
J10	5 12 59.89	-68 57 07.7	5 13 16.41	-69 00 31.3	1	(1,1)	21.2 (1)
J12	5 13 04.56	-69 13 25.3	5 13 23.53	-69 16 48.5	1:	(1,1)	00.0 (0)
J14	5 15 08.70	-69 21 00.9	5 15 29.14	-69 24 15.2	1	(1,1)	20.4 (1)
J15=Sa111	5 15 24.85	-69 28 43.1	5 15 46.53	-69 31 56.2	1	(1,1)	20.1 (1)
J16	5 15 54.68	-69 30 35.7	5 16 16.72	-69 33 46.6	1	(1,1)	00.0 (0)
J17	5 17 00.72	-69 19 29.1	5 17 21.19	-69 22 35.3	1	(1,1)	20.6 (1)
J18	5 17 23.93	-69 39 13.2	5 17 47.54	-69 42 17.7	1	(1,1)	00.0 (0)
J19	5 17 58.87	-69 39 23.0	5 18 22.59	-69 42 25.0	1	(1,1)	21.1 (1)
J20=Sa112	5 18 45.78	-69 10 11.5	5 19 05.07	-69 13 10.3	1	(1,1)	20.6 (1)
J21	5 18 55.70	-69 33 02.1	5 19 18.53	-69 36 00.0	1	(1,1)	00.0 (0)
J22	5 19 07.02	-69 41 54.0	5 19 31.28	-69 44 51.1	1:	(1,1)	00.0 (0)
J23	5 19 15.08	-69 34 52.6	5 19 38.25	-69 37 49.1	1	(1,1)	00.0 (0)
J24	5 19 34.18	-69 44 58.9	5 19 59.00	-69 47 54.0	1	(1,1)	00.0 (0)
J26=Sa113	5 20 01.02	-69 25 57.0	5 20 22.90	-69 28 50.3	1:	(1,1)	00.0 (0)
J31=Sa114	5 20 56.92	-70 05 10.5	5 21 25.21	-70 07 59.6	1	(1,1)	19.4 (1)
J32	5 21 07.64	-69 44 28.1	5 21 32.58	-69 47 16.5	1	(1,1)	00.0 (0)
J33=Sa115	5 21 17.55	-69 43 01.0	5 21 42.28	-69 45 48.7	1	(1,1)	00.0 (0)
J38=Sa116	5 24 36.58	-69 05 51.1	5 24 55.92	-69 08 24.6	1	(1,1)	19.0 (1)
J41=Sa118	5 26 09.52	-69 00 58.5	5 26 28.29	-69 03 25.4	1	(1,1)	18.0 (1)
MG01	4 47 22.84	-67 41 18.8	4 47 24.15	-67 46 31.1	2	(3,1)	19.3 (2)
MG02	4 48 09.25	-68 33 39.0	4 48 17.73	-68 38 47.9	1	(2,1)	19.6 (1)
MG03	4 50 56.72	-66 19 52.5	4 50 48.82	-66 24 50.3	1	(1,1)	19.1 (1)
MG04	4 52 45.24	-70 17 49.1	4 53 10.54	-70 22 38.2	1	(1,1)	19.9 (1)
MG05	4 53 29.66	-68 22 52.3	4 53 37.80	-68 27 38.9	1	(1,1)	19.0 (1)
MG06	4 54 12.87	-72 46 23.9	4 55 06.42	-72 51 05.9	1	(2,2)	18.5 (2)
MG07	4 54 09.75	-74 59 50.7	4 55 35.98	-75 04 31.7	1	(1,1)	19.1 (1)

continued from previous page								
Name	coord OPT				F	(n1,n2)	m_B	(n)
	J2000		B1950					
MG20	5 10 40.24	-68 10 23.5	5 10 49.73	-68 13 57.3	1	(1,1)	19.7	(1)
MG21	5 11 37.95	-65 42 42.1	5 11 29.17	-65 46 12.4	1	(1,1)	18.5	(1)
MG22	5 11 53.52	-65 32 27.0	5 11 43.63	-65 35 56.3	1	(1,1)	19.4	(1)
MG23	5 11 47.39	-68 16 09.5	5 11 57.85	-68 19 38.5	1	(1,1)	18.3	(1)
MG24	5 13 01.01	-65 15 34.1	5 12 49.40	-65 18 58.7	1	(1,1)	18.8	(1)
MG25	5 12 17.83	-71 54 49.5	5 13 04.68	-71 58 15.0	2	(2,1)	19.3	(2)
MG26	5 13 28.00	-66 17 28.4	5 13 23.47	-66 20 50.8	1	(1,1)	17.9	(1)
MG27	5 13 34.23	-65 35 13.2	5 13 24.85	-65 38 35.3	1	(1,1)	19.7	(1)
MG28	5 13 09.74	-69 31 18.0	5 13 31.48	-69 34 40.7	1	(1,1)	19.2	(1)
MG29	5 13 42.35	-68 15 16.4	5 13 52.96	-68 18 37.2	1	(1,1)	17.0	(1)
MG30	5 14 14.69	-70 50 31.5	5 14 49.79	-70 53 49.1	1	(1,1)	18.5	(1)
MG31	5 16 29.29	-68 18 11.3	5 16 40.69	-68 21 20.2	1	(1,1)	19.8	(1)
MG32	5 19 04.04	-64 59 18.6	5 18 51.38	-65 02 17.2	1	(1,1)	19.0	(1)
MG33	5 19 13.74	-66 09 31.3	5 19 08.97	-66 12 28.9	1	(1,1)	20.6	(1)
MG34	5 19 28.87	-67 14 26.5	5 19 32.10	-67 17 22.8	2	(3,1)	20.0	(3)
MG35	5 19 33.35	-66 55 37.2	5 19 34.21	-66 58 33.2	2	(2,1)	20.0	(2)
MG36	5 20 29.71	-64 53 14.0	5 20 16.55	-64 56 06.4	1	(1,1)	18.0	(1)
MG37	5 21 46.81	-65 22 26.7	5 21 36.95	-65 25 13.5	2	(2,1)	18.0	(2)
MG38	5 22 02.97	-64 25 16.0	5 21 47.04	-64 28 01.9	1	(1,1)	18.8	(1)
MG39=LM2-19	5 22 12.93	-69 43 29.1	5 22 37.85	-69 46 12.8	1	(1,1)	00.0	(0)
MG40	5 22 35.26	-68 24 25.3	5 22 48.30	-68 27 07.9	1	(1,1)	18.4	(1)
MG41	5 23 37.73	-65 09 54.3	5 23 26.68	-65 12 33.2	2	(2,1)	19.2	(2)
MG42	5 25 01.81	-67 23 56.9	5 25 06.88	-67 26 29.2	2	(3,2)	20.8	(3)
MG43	5 24 34.19	-71 13 39.5	5 25 14.97	-71 16 12.5	2	(2,1)	19.5	(2)
MG44	5 25 55.67	-63 44 12.4	5 25 35.95	-63 46 41.7	1	(2,2)	18.9	(2)
MG45	5 26 06.49	-63 37 02.1	5 25 46.08	-63 39 30.6	1	(2,2)	17.5	(2)
MG46	5 26 20.48	-65 21 45.9	5 26 10.99	-65 24 13.0	2	(2,1)	17.8	(2)
MG47	5 26 45.26	-64 38 00.8	5 26 31.08	-64 40 26.3	1	(2,2)	17.5	(2)
MG48	5 26 59.77	-66 07 05.8	5 26 55.51	-66 09 29.9	1	(2,2)	20.0	(2)
MG49	5 27 32.13	-69 32 18.8	5 27 55.87	-69 34 39.5	1	(1,1)	20.5	(1)
MG50	5 29 08.63	-66 42 56.3	5 29 08.88	-66 45 10.9	1	(2,2)	19.2	(2)
MG51	5 28 34.41	-70 33 01.6	5 29 08.34	-70 35 17.4	1	(2,2)	17.5	(2)
MG52	5 29 08.78	-69 45 28.0	5 29 34.79	-69 47 41.7	1	(2,2)	00.0	(0)
MG53	5 29 35.67	-69 46 05.2	5 30 01.83	-69 48 16.9	2	(2,1)	20.7	(1)
MG54	5 29 51.41	-68 50 05.6	5 30 08.93	-68 52 16.5	1	(2,2)	19.2	(2)
MG55	5 31 09.07	-71 36 40.2	5 31 54.97	-71 38 44.5	2	(2,1)	17.7	(2)
MG56	5 31 45.00	-69 43 07.2	5 32 10.88	-69 45 09.6	2	(2,1)	19.5	(2)
MG57	5 31 11.17	-74 22 53.3	5 32 34.92	-74 24 56.0	1	(1,1)	21.0	(1)
MG58	5 32 37.68	-67 08 31.1	5 32 41.44	-67 10 30.5	2	(4,3)	19.2	(4)
MG59	5 32 56.00	-65 16 42.0	5 32 46.47	-65 18 40.5	1	(2,2)	18.8	(2)
MG60	5 33 30.90	-69 08 13.3	5 33 51.47	-69 10 08.2	2	(2,1)	20.0	(2)
MG61	5 33 13.11	-72 36 46.3	5 34 11.55	-72 38 41.1	1	(3,3)	19.2	(3)
MG62	5 34 36.53	-68 18 27.9	5 34 49.87	-68 20 18.3	1	(2,2)	16.6	(2)
MG63	5 34 10.21	-71 43 14.1	5 34 57.69	-71 45 05.1	1	(2,2)	18.5	(2)
MG64	5 35 12.77	-67 37 58.0	5 35 20.57	-67 39 46.0	1	(4,4)	20.1	(4)
MG65	5 35 10.30	-69 39 38.9	5 35 35.91	-69 41 26.4	1	(2,2)	19.9	(2)
MG66	5 37 59.54	-65 58 50.0	5 37 55.13	-66 00 26.3	1	(1,1)	19.7	(1)
MG67	5 37 38.02	-71 41 37.9	5 38 25.47	-71 43 14.0	1	(2,2)	18.0	(2)
MG68	5 38 19.45	-68 58 37.2	5 38 38.92	-69 00 11.2	1	(2,2)	20.2	(2)
MG69	5 39 15.48	-66 49 43.5	5 39 17.30	-66 51 14.1	2	(3,1)	19.8	(3)
MG70	5 38 12.26	-75 00 21.9	5 39 47.17	-75 01 53.7	1	(1,1)	18.8	(1)
MG71	5 39 54.87	-66 34 13.1	5 39 54.81	-66 35 40.9	2	(2,1)	19.7	(2)
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Name	coord OPT		F	(n1,n2)	m_B	(n)
	J2000	B1950				
MG72	5 40 20.25 -67 02 02.1	5 40 23.69 -67 03 27.9	2	(4,1)	18.7	(4)
MG73	5 41 36.61 -69 27 09.8	5 42 00.67 -69 28 29.4	2	(2,1)	19.7	(2)
MG74	5 40 54.87 -74 41 19.2	5 42 24.60 -74 42 39.4	1	(1,1)	17.2	(1)
MG75	5 42 15.41 -68 48 55.7	5 42 33.65 -68 50 12.7	1	(2,2)	19.1	(2)
MG76	5 42 24.24 -69 53 05.1	5 42 52.51 -69 54 21.0	1	(2,2)	15.6	(2)
MG77	5 43 47.59 -68 38 35.1	5 44 04.38 -68 39 45.4	2	(2,1)	19.8	(2)
MG78	5 46 25.41 -67 50 02.8	5 46 35.46 -67 51 01.9	1	(2,2)	20.9	(2)
MG79	5 45 59.68 -71 19 04.9	5 46 43.30 -71 20 04.7	2	(2,1)	17.1	(2)
MG80	5 49 29.11 -67 54 54.1	5 49 39.92 -67 55 39.8	1	(2,2)	19.6	(2)
MG81	5 51 00.09 -67 58 45.6	5 51 11.48 -67 59 24.6	1	(2,2)	20.1	(2)
MG82	5 53 11.87 -71 28 57.0	5 53 57.59 -71 29 25.2	1	(1,1)	18.9	(1)
MG83	5 54 39.41 -69 20 34.6	5 55 02.88 -69 20 57.2	1	(1,1)	16.9	(1)
MG84	5 54 41.47 -72 23 31.8	5 55 38.26 -72 23 53.0	1	(2,2)	19.2	(2)
MG85	6 04 10.14 -70 04 22.9	6 04 40.65 -70 04 03.6	1	(1,1)	19.2	(1)
MG86	6 04 58.70 -72 03 53.0	6 05 51.30 -72 03 29.4	1	(2,2)	20.1	(2)
Mo01	4 34 51.80 -68 16 02.8	4 34 54.65 -68 22 06.6	1	(1,1)	00.0	(0)
Mo02	4 34 46.67 -69 23 19.6	4 34 58.91 -69 29 23.5	1	(1,1)	00.0	(0)
Mo03	4 36 14.41 -70 31 03.0	4 36 37.60 -70 37 00.5	3	(2,1)	20.1	(1)
Mo04	4 40 12.30 -64 55 32.6	4 39 53.04 -65 01 15.3	1	(1,1)	19.7	(1)
Mo05	4 45 19.91 -67 34 33.4	4 45 19.90 -67 39 54.3	1	(3,2)	20.3	(2)
Mo06	4 46 33.07 -70 12 46.4	4 46 56.06 -70 18 01.4	1	(2,2)	20.1	(1)
Mo07	4 49 19.86 -64 22 35.7	4 48 59.07 -64 27 40.7	1	(1,1)	19.5	(1)
Mo08	4 50 24.35 -64 21 51.1	4 50 03.68 -64 26 51.6	1	(1,1)	19.4	(1)
Mo09	4 52 11.39 -70 12 46.4	4 52 35.73 -70 17 37.9	1	(1,1)	18.2	(1)
Mo10	4 55 45.43 -65 48 34.7	4 55 34.86 -65 53 12.4	1	(1,1)	19.7	(1)
Mo11	4 58 03.23 -70 25 08.8	4 58 30.93 -70 29 35.6	1	(1,1)	19.9	(1)
Mo12	4 58 37.00 -69 35 46.5	4 58 56.86 -69 40 11.2	1	(1,1)	19.7	(1)
Mo13	4 59 09.07 -69 50 30.8	4 59 31.35 -69 54 53.1	1	(1,1)	20.2	(1)
Mo14	5 01 36.50 -70 26 31.9	5 02 05.17 -70 30 43.6	1	(1,1)	19.5	(1)
Mo15	5 02 33.85 -73 47 51.0	5 03 43.52 -73 51 57.2	1:	(1,1)	00.0	(0)
Mo16	5 06 14.93 -69 48 24.7	5 06 38.22 -69 52 16.9	1	(1,1)	20.2	(1)
Mo17	5 07 25.52 -67 28 49.5	5 07 28.96 -67 32 37.4	2	(2,1)	20.2	(2)
Mo18	5 09 11.19 -67 34 01.7	5 09 15.57 -67 37 42.1	1	(2,2)	17.7	(2)
Mo19	5 11 00.46 -70 05 04.8	5 11 27.27 -70 08 36.5	1	(1,1)	18.0	(1)
Mo20	5 11 10.83 -71 10 26.4	5 11 49.02 -71 13 57.0	1	(1,1)	20.1	(1)
Mo21	5 19 04.10 -64 44 38.1	5 18 49.87 -64 47 36.8	1	(1,1)	20.9	(1)
Mo22	5 21 26.64 -62 34 12.5	5 20 59.92 -62 37 01.3	1	(1,1)	17.9	(1)
Mo23	5 21 52.32 -69 43 18.0	5 22 17.17 -69 46 03.1	1:	(1,1)	00.0	(0)
Mo24	5 22 53.20 -71 05 40.7	5 23 32.29 -71 08 21.0	1	(1,1)	19.2	(1)
Mo25	5 26 02.56 -72 31 02.5	5 26 58.96 -72 33 28.5	2	(3,2)	20.2	(3)
Mo26	5 28 01.52 -70 13 30.1	5 28 32.04 -70 15 48.4	2	(2,1)	19.8	(2)
Mo27	5 29 16.65 -69 37 18.1	5 29 41.36 -69 39 31.3	1	(2,2)	19.9	(1)
Mo28	5 29 18.43 -70 23 49.7	5 29 50.84 -70 26 02.4	1	(2,2)	18.6	(2)
Mo29	5 31 42.90 -62 10 07.7	5 31 14.82 -62 12 12.2	1	(2,2)	20.8	(2)
Mo30	5 31 35.30 -69 23 46.4	5 31 58.10 -69 25 49.6	2	(2,1)	18.8	(2)
Mo31	5 32 43.37 -62 32 39.7	5 32 17.38 -62 34 39.7	2	(2,1)	18.4	(2)
Mo32=?LM2-33	5 32 05.22 -69 57 27.4	5 32 33.47 -69 59 28.3	2	(2,1)	20.6	(1)
Mo33	5 32 09.28 -70 24 41.5	5 32 42.12 -70 26 41.8	2	(2,1)	17.9	(2)
Mo34	5 35 13.81 -70 01 19.2	5 35 42.96 -70 03 06.3	1	(2,2)	18.9	(2)
Mo35	5 38 04.85 -70 29 25.8	5 38 39.00 -70 31 00.4	1	(2,2)	18.7	(2)
Mo36	5 38 53.56 -69 57 55.7	5 39 22.42 -69 59 26.9	1	(2,2)	19.3	(2)
Mo37	5 39 14.47 -70 00 18.6	5 39 43.75 -70 01 48.3	2	(2,2)	20.8	(2)
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Name	coord OPT		F	(n1,n2)	m_B	(n)
	J2000	B1950				
Mo38	5 40 32.26 -68 44 47.6	5 40 49.80 -68 46 12.1	2	(2,1)	20.6	(2)
Mo39	5 42 41.09 -70 05 49.1	5 43 11.49 -70 07 03.7	2	(2,1)	20.4	(2)
Mo40	5 46 25.29 -71 23 22.3	5 47 09.74 -71 24 20.1	2	(2,1)	19.7	(2)
Mo41	5 55 13.70 -65 28 22.8	5 55 06.37 -65 28 44.0	1	(1,1)	19.2	(1)
Mo42	5 55 14.61 -66 50 24.6	5 55 17.05 -66 50 45.4	1	(1,1)	18.8	(1)
Mo43	5 58 46.10 -64 30 45.0	5 58 32.52 -64 30 50.9	1	(1,1)	17.9	(1)
Mo44	6 01 43.34 -68 00 35.0	6 01 55.04 -68 00 27.1	1	(2,2)	19.1	(2)
Mo45	6 09 17.13 -68 43 52.2	6 09 34.84 -68 43 11.0	1	(1,1)	18.3	(1)
Mo46	6 10 09.61 -67 10 19.2	6 10 14.40 -67 09 34.7	1	(3,2)	19.8	(2)
Mo47	6 13 03.38 -65 55 09.3	6 12 58.84 -65 54 12.5	1	(2,2)	20.3	(1)
Mo48	6 13 41.12 -64 00 45.3	6 13 24.15 -63 59 46.2	1	(2,2)	18.0	(1)
Mo49=?LM1-64	6 21 04.79 -66 08 00.4	6 21 01.34 -66 06 28.5	1	(2,1)	20.3	(1)
Mo50	6 21 14.99 -68 57 45.6	6 21 34.10 -68 56 12.2	1	(1,1)	19.5	(1)
Mo51	6 25 04.38 -69 07 36.9	6 25 24.66 -69 05 46.8	1	(1,1)	19.4	(1)
Mo52	6 26 35.98 -69 49 38.2	6 27 02.71 -69 47 41.2	1	(1,1)	19.8	(1)
Mo53	6 38 18.64 -69 24 17.3	6 38 39.99 -69 21 29.8	1	(1,1)	18.8	(1)
Mo54	6 41 24.62 -67 01 29.2	6 41 25.72 -66 58 29.1	1	(1,1)	00.0	(0)
SMP026=N101	5 07 30.77 -69 08 07.0	5 07 48.06 -69 11 54.0	1	(1,1)	19.4	(1)
Denomination						
BE : Bohannan & Epps (1974)						
J : Jacoby (1980)						
L : Lindsay (1963)						
LM1 : Lindsay & Mullan (1963)						
LM2 : Lindsay & Mullan (1963)						
MG : Morgan & Good (1992)						
Mo : Morgan (1994)						
N : nebulae Henize (1956)						
S : stars Henize (1956)						
SMC1 : Savage, Murdin, Clark (1982)						
SMP: Sanduleak et al. (1978)						
Sa: Sanduleak (1984)						
WS : Westerlund & Smith (1964)						

Table 4. LMC positions

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Fig. 7. Finding charts Sanduleak et al.

Fig. 8. Finding charts Sanduleak et al.

N

Fig. 9. Finding charts Sanduleak et al.

Fig. 10. Finding charts Sanduleak et al.

Fig. 11. Finding charts Sanduleak et al.

Fig. 12. Finding charts Sanduleak et al.

Fig. 13. Finding charts Sanduleak et al.

Fig. 14. Finding charts Sanduleak et al.

N

Fig. 15. Finding charts Morgan & Good

Fig. 16. Finding charts Morgan & Good

N

Fig. 17. Finding charts Morgan & Good

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Fig. 18. Finding charts Morgan & Good

Fig. 19. Finding charts Morgan & Good

Fig. 21. Finding charts Morgan

Fig. 22. Finding charts Morgan

Fig. 23. Finding charts Morgan

Fig. 20. Finding charts Morgan & Good

Fig. 24. Finding charts Morgan