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ASTRONOMY AND ASTROPHYSICS

A preliminary database of DENIS point sources*

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Abstract. This paper announces the release at CDS of a substantial set of point sources detected by the DENIS project. DENIS is the first astronomical survey of the Southern sky in two near-infrared bands (J at 1.25 μm, and K_s at 2.15 μm) and one optical band (Gunn-i at 0.82 μm), conducted by a European consortium, using the 1m telescope at ESO, La Silla (Chile).

The first data release, described here, consists of a preliminary set of about 17 million extracted point sources, corresponding to 102 strips (2% of the Southern sky), and resulting from observations performed in 1996.

Data are available through a World-Wide Web server at the CDS (Strasbourg astronomical Data Center): http://cdsweb.u-strasbg.fr/denis.html.

Key words: infrared: stars – Galaxy: stellar content – stars: low-mass, brown dwarfs – astronomical data bases: miscellaneous – surveys

1. Introduction

The main purposes of this paper are to announce the first public release of DENIS data, through the World-Wide Web server of the CDS, and to present the first steps in the validation process of these data, concerning their astrometric and photometric reliability.

The Deep Near-Infrared Survey of the Southern sky (DENIS) is a project to survey the southern sky in three wavelength bands (Gunn-i, 0.82 μm; J, 1.25 μm; and K_s, 2.15 μm) simultaneously, with limiting magnitudes 18.5, 16.5 and 14.0, respectively (for a detailed description, see Epchtein 1998).

The project is managed by a European consortium, led by N. Epchtein (Observatoire de la Côte d'Azur), involving fifteen institutes in eight different countries. The observations are performed with the ESO 1m telescope at La Silla (Chile). The survey is carried out by observing strips of $30°$ in declination and $12'$ in right ascension with an overlap of $2'$ between consecutive strips. The observations started at the end of 1995 and will be completed by the end of 2000.

The data are reduced in two consecutive steps: the first is performed as a joint effort of the Institut d'Astrophysique de Paris (IAP) and Observatoire de Paris; the second is performed at the Leiden Observatory. The position of a general extracted

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point source is provided with an accuracy better than $1''$ and its magnitude to better than 0.1 mag.

The *Centre de Données Astronomiques de Strasbourg* (CDS) is implementing the final databases and provides access to a preliminary set of processed and calibrated data, through a WWW server.

The scientific exploitation of the already existing data is carried out by several working groups, allowing a continuous monitoring of the quality of the survey data.

2. The data

2.1. The survey observations

The survey observations with all 3 cameras started in routine mode in December 1995 and were slowed down by technical and meteorological problems in 1997 and 1998. The survey is currently (June 1999) progressing at nominal speed.

Special efforts have been devoted to cover priority regions of high scientific interest, such as the Magellanic Clouds, the Galactic bulge, and giant molecular clouds.

The observing technique is the following: the sky, south of declination $+2°$, has been divided into 5112 regions named *slots*. A slot is $12'$ wide in right ascension, and spans $30°$ in declination. Two adjacent slots have $2'$ overlaps in right ascension or declination. A DENIS *strip* corresponds to the observation of a slot. A given slot may be observed several times (for example if the photometric quality has been detected as insufficient by the data reduction software). Thus several strip numbers can refer to the same slot. A strip is made of 180 individual images ($12'\times12'$), with $2'$ overlaps between consecutive images.

2.2. Point source data reduction

All the images received from La Silla are first processed at the Paris Data Analysis Center (PDAC), where the images are checked and calibrated (Borsenberger 1997); afterwards, the point source extraction (Bertin & Arnouts 1996) and the astrometric and photometric calibrations (Deul et al. 1995) are carried out at the Leiden Data Analysis Center (LDAC). Each strip is processed independently. Analysis of extended sources, carried out at PDAC, is not considered in the present article, which deals only with point sources.

2.3. Data selection

The preliminary database of DENIS point sources released at CDS provides, for 102 *strips* (as of June 1999), the three-colour information resulting from the reduction pipeline.

The available strips were selected according to their astrometric and photometric quality, in order to form a useful sample of the current DENIS point source catalogue. It is to be noted, however, that this is not a subset of the final catalogue of point sources, because some improvements in the reduction pipeline are still currently being implemented, and this will imply a new reduction of already observed data. These improvements are not, however, of such a nature that they could change the statistical interpretation of the currently released data sets.

Within a strip, association has been done between bands (I, J, K_s), and overlapping images (with the notable exception of bad quality flagged sources which are not matched and appear duplicated). The positional coincidence is determined by examining the elliptical shape parametrization of each entry. When a source is present several times in a given band, the resulting merged entry in the catalogue carries the simple flux average for the magnitudes, and the weighted average for the coordinates. Eventual overlaps between adjacent ($12'\times30°$) strips have not been matched in this preliminary release. These elements should be carefully taken into account when working on star counts derived from the released data.

It should also be noted that in the final DENIS catalogue, overlaps between adjacent strips will lead to a better accuracy in the photometry (see Sect. 3.2).

3. Data validation

One of us (S. Derriere) has performed a series of tests in order to assess the astrometric and photometric quality of the released point source data.

3.1. Astrometric validation

The catalogues of the strips in the first DENIS release contain a single entry for objects cross-identified in the same colour (frame overlap) or among different colours. About 10% of the objects are identified simultaneously in the three colour channels.

DENIS astrometry is performed in two steps: first, pairing of extracted objects is done between channels (I, J, K_s), in overlaps between consecutive frames, and with sources from an astrometric reference catalogue (ARC hereafter); then, the actual astrometric calibration based on this pairing information is performed, and a sky position is derived for each source.

Comparison of objects lying in overlapping strips indicates an internal accuracy of $0.5''$.

In the released DENIS data, the Guide Star Catalog (GSC, Lasker et al. 1990), which contains about 15 million stars, is used as the ARC. The astrometry of the final DENIS point source catalogue will be based on the Tycho catalogue (ESA 1997), through the use of the USNO A2.0 catalogue (Monet et al. 1997), itself calibrated on Tycho. Since an independent offset is indeed determined for each DENIS frame, the ARC must have a large average density (at least of the order of 1 star per DENIS frame).

In order to check for the accuracy of the DENIS astrometry, comparisons between positions in the DENIS and USNO A1.0 (also calibrated on the GSC) catalogues have been performed. The USNO A1.0 was preferred in order to have, for each DENIS frame, a sufficient number of objects likely to be detected in both catalogues. We selected for each DENIS frame all the DENIS and USNO A1.0 sources detected on that sky region, and for *each* single USNO A1.0 source we searched for all the DENIS sources located in its vicinity. We over-plotted on a single chart

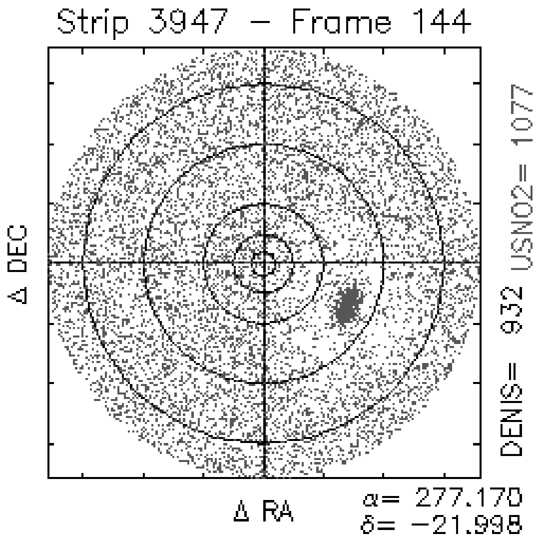

Fig. 1. Chart showing the systematic shifts between USNO A1.0 and DENIS positions for a given frame (example of bad quality astrometry leading to the rejection of the strip). Circles show the 1, 2.5, 5, 10 and $15''$ ranges. The shift illustrated here was in the range 5 to 10 arcsec.

Table 1. Summary of catalogue record contents for DENIS point sources

Column	Contents
DENIS Id.	Identifier JHHMMSS.s±DDMMSS
Strip	DENIS strip number
RA, DEC	J2000 Right Ascension and Declination, and associated error
	For each I, J, K_s channel
Mag_Aper $7''$	Magnitude derived from the flux collected in a fixed $7''$ aperture centered on the source, and associated error
Mag_Aper $15''$	Same as above with $15''$ aperture, and associated error
Mag_Auto	Automatic (Kron type) scaling elliptical aperture magnitude
a, b, e, θ	Parameters of the object ellipse
Stellarity	1 for a star; 0 for an extended source; see Bertin & Arnouts (1996)
Flags	Extraction and Image Flags; Image Artifact marker; Merged object indicator
Field	Field Position reference

(as shown on Fig. 1) for each USNO A1.0 source, the relative position of all its DENIS neighbours closer than a given radius. Provided that some objects are detected in both catalogues, and that there is no significant shift between the two catalogues, there will be a cluster of points around relative position (0,0). In case there is a systematic shift, this cluster will be located around the relative position corresponding to the shift.

This operation was systematically applied to each DENIS frame, in order to reject strips with anomalous astrometric solution.

3.2. Photometric validation

The photometric calibration of each night is derived from observations of standard star fields; a fixed extinction coefficient is used to determine the zero point (hereafter ZP) for each strip (see details in Fouqué et al. 1999).

Although each standard star is observed 8 times on different parts of the chip, some of these measurements might later be rejected in the phase of source extraction and object characterization. On average this reduces the number of measurements from 8 to 6. In addition, only standard stars fainter than I=10.5 mag, J=8.0 mag, and K=6.5 mag are used for the photometric calibration.

A series of graphics (including colour-colour diagrams and differential star counts histograms) are routinely provided for each DENIS strip, together with the data. These graphs allow the user to check the contents and quality of individual strips. For example, colour-colour diagrams clearly show the effect of interstellar reddening, while star counts provide an estimate of the completeness limit for the corresponding strip.

Only strips observed during good photometric nights and with good zero points were released. Care was also exercised to remove strips with heavily parasited frames. A small number of artifacts may, however, remain among the point sources: some of them, appearing as vertical triplets in J or K_s, are microscanning features due to poor pixels on the NICMOS cameras. They will, as much as possible, be removed from the final DENIS catalogue.

Fig. 2 shows the histogram of I, J, and K_s magnitudes for the 17 million point sources belonging to the first data release.

In the final DENIS catalogue, overlaps between adjacent strips will lead to a better accuracy in the photometry. Global photometry will be performed when a sufficient number of adjacent overlapping strips are reduced, by deriving variations in the originally derived nightly based ZPs. Comparison of objects lying in overlapping strips indicates an accuracy of 0.05 to 0.1 mag for the photometric zero-points.

4. Data organization

4.1. Catalogue contents

Table 1 gives an overview of the contents of an individual record in the preliminary database of DENIS point sources.

4.2. Data access

The released data are being made available through the CDS Web server at the following address:
http://cdsweb.u-strasbg.fr/denis.html

This server provides access to DENIS documentation, including scientific reports, list of publications, etc., and to the publicly released data sets. The database implementation benefits from the CDS environment (Genova et al. 1998): SIMBAD name resolver, VIZIER query engine (Ochsenbein 1998), ALADIN cross-identification atlas, etc.

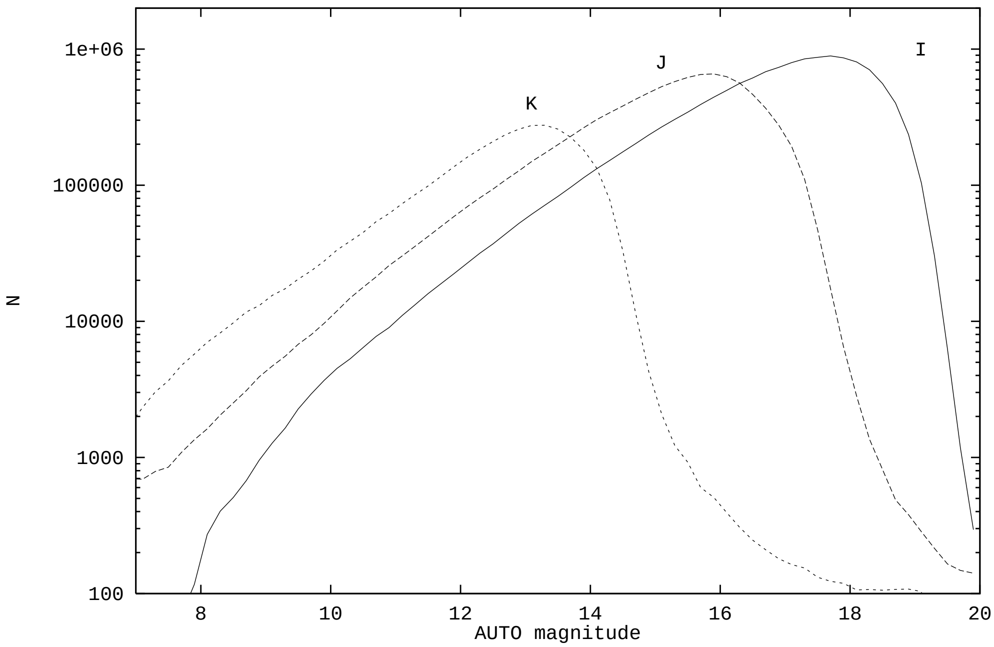

Fig. 2. Raw differential star counts for I, J and K_s (0.2 mag bins) cumulated for the 102 released strips (17.5 million sources).

4.3. Query modes

An interactive sky map provides a graphical access to individual strips, while an auxiliary database provides information about night and strip qualities. Strips can be searched directly by position or *strip* or *slot* number.

In addition an optimized query mechanism provides access to individual data records (including source number, position, I, J, K_s magnitudes, and estimated errors, and additional flags related to the source extraction) for the extracted point sources. The first release of the preliminary database includes about 17 million entries in 102 strips.

Queries can be made for all DENIS sources around a given position (center and radius, where the center is to be specified either as J2000 coordinates, or by the name of a central object to be resolved by SIMBAD). Selection of objects in the colour-colour diagrams of specified strips is also possible.

Finally, the DENIS point source database is also available through the VIZIER catalogue service, and through the ALADIN interactive sky atlas, where additional query modes and functionalities are available.

4.4. Future evolutions

The DENIS point source data server at CDS will continue to evolve in the future, with newly reduced data being gradually incorporated.

Changes in the data reduction pipeline will be posted in the corresponding information pages.

New features for an improved support of the query mechanism and source selection will also be made available as they are being developed. A mirror copy of the publicly released 2MASS J, H, K_s data (see e.g. Skrutskie 1998) is planned to become available, in parallel, at CDS, for easier cross-comparison.

In complement to the CDS services, observational DENIS data for galaxies are also being made available through the Lyon-Meudon Extragalactic Database (LEDA; see Sect. 5.6, below). DENIS data of Asymptotic Giant Branch (AGB) stars recognized as associated to sources included in the ASTRID database are also gradually integrated into this base.

5. Highlights of DENIS scientific results

5.1. Faint stars in the solar neighbourhood: red and brown dwarfs

The large range of DENIS wavelengths (from the I-band to the K-band is a factor 2.5 in wavelength) makes the survey data well suited for the detection of red dwarfs of the latest spectral types (M7 or later) about which little is known. The analysis of 220 square degrees of high galactic data led to the identification of 25 dwarfs later than M7V, doubling the known inventory of these very cool objects (Delfosse et al. 1999), and 3 brown dwarf candidates. One of these three is DENIS-P J1228-1547 (Delfosse et al. 1997); Keck spectroscopy showed the presence of a strong lithium absorption line at 680.7 nm (Martín et al. 1997; Tinney et al. 1997); in such fully convective objects lithium nuclear burning never took place and thus there has been no hydrogen burning either. In addition, this object is the first identified binary brown dwarf (Martin et al. 1999). Interestingly, one of the other two candidates DENIS-P J0205-1159 has no lithium (Martín, private communication) in spite of a significantly lower effective temperature.

Very few of these enigmatic objects are known. The extreme M dwarfs and brown dwarfs contained in the DENIS database constitute potentially the first statistically significant sample of these objects, sufficiently large to determine their local density (i.e. the disc luminosity function) and to form the basis for the calibration of the observable properties of brown dwarfs (flux calibrated spectra and distances) into more fundamental physical quantities (effective temperature, luminosity, mass).

5.2. *The interstellar medium*

Detailed maps of the extinction in nearby molecular clouds (in Chameleon, Ophiuchus, Orion and Serpens) can be obtained via star counts in the DENIS data. An example is the study by Cambrésy et al. (1997) of the nearby Cham I cloud, that has produced an extinction map of much higher angular resolution than before.

The DENIS survey observations make possible to obtain similar maps of other well-known and nearby clouds, e.g. those in Ophiuchus and Serpens, but also in small globules. When these extinction maps are combined with maps in the CO millimeter line emission, with 60 and 100 μm maps obtained by IRAS, the distribution of gas, dust and of the temperature will be known much better than so far.

Counting stars in the whole DENIS data base will eventually provide the first deep maps of interstellar extinction throughout the Galaxy.

5.3. *Young stars in dark clouds*

The exploration of DENIS data of dense molecular clouds will lead to the detection of a large number of stars in the process of formation: young stellar objects (YSOs), protostars, etc. Copet (1996) has studied DENIS data of the Orion molecular cloud and discovered many new faint YSOs which are likely to be T Tau stars.

From an analysis of similar data, Cambrésy et al. (1998) detected YSOs that probably form a new population of low-luminosity T Tau stars: a full survey of the clouds in Chameleon (an area of several tens of square degrees) and in other similar regions will improve our knowledge of the low-end of the luminosity function.

5.4. *The distribution of stars in the disc and in the bulge of our Galaxy*

At visual wavelength the search for stars in the inner galactic disc is limited to distances smaller than one or two kiloparsecs, while at 2 μm red giants and supergiants are detected up to galactic center distances: the extinction in the infrared is much smaller ($A_K \approx A_V/10$). The DENIS large-scale digital survey in the infrared, with its homogeneous magnitude limits in its photometric bands – with the exception of a modest variation (0.6 mag) in the early data in the K_s-band – provides an ideal support for new studies of the distribution of dust, red giants and red supergiants in our Galaxy. The newly detected supergiants will give the distribution of the star formation rate and the red giants the distribution and evolution of older stellar populations in the galactic plane.

Detailed new information are expected to be obtained about the inner spiral arms, the ring, the bar and the bulge of the Galaxy. The COBE/DIRBE data have been important in finding such large scale structures; the much higher angular resolution of DENIS (a few arcseconds instead of a few degrees with COBE) will give more detailed information.

The DENIS data will be used to interpret the data on the inner Galaxy at 7 and 15 μm obtained through the ISOGAL program (see Pérault et al. 1996). Several other surveys of the inner Galaxy exist already, and we expect that the additional information from the DENIS and ISOGAL survey on the stellar content will be important, perhaps essential, to obtain a comprehensive model for the inner Galaxy.

The existing survey data have already significantly constrained models for the large scale structure of the Galaxy (Ruphy et al. 1996, 1997). The scale length in the galactic plane has been determined as well as the outer edge of the stellar disc, the position of the Sun relative to the galactic plane and the shape and density of some spiral arms and of the 3 kpc ring.

There is a strong interest in DENIS survey data on the bulge and the bar of our Galaxy: Schultheis (1998) analysed the DENIS measurements of $\sim$ 30,000 sources in the Palomar-Groningen field #3 (PG3). Among these there are 36 previously known AGB variables; carbon stars are missing, confirming earlier studies.

Planetary nebulae (PNe) are an interesting category of objects as well. Already 250 of the 750 known PNe in the southern sky have been detected by the DENIS survey (Kimeswenger et al. 1998). The survey will provide better surface photometry at its three wavelengths than previously known. It will also discover faint, red, background stars that often contaminate photometry at visual wavelengths but that also may be used as distance indicators. A further goal concerns the few thousand PNe in the inner Galaxy that must exist, but that have escaped detection so far because of interstellar extinction. Kimeswenger et al. expect that DENIS will find many new of those.

Even in medium or high latitude fields, where interstellar extinction at visual wavelengths is not a problem, the DENIS survey data will identify red giants that can be used to trace their distribution in the halo, before optical surveys (such as the Sloan) produce more complete results.

5.5. *Stars in the Magellanic Clouds*

With a distance modulus of $(m - M) = 18.6$ for the Large Magellanic Cloud and $(m - M) = 19.1$ for the SMC, DENIS records data of all stars with $(V - I) > 3$ that have a luminosity higher than about 2500 $L_\odot$ or $M_{\rm bol} < -4.0$ and thus all AGB stars except the few that are very red. There are large differences in luminosities and element abundances between populations of AGB stars in different surroundings, e.g. the SMC, the LMC, the outer disc of our Galaxy and our bulge. Most AGB stars in the SMC are carbon-rich whereas in the galactic bulge the AGB stars are all of M–type (“oxygen-rich”). The reasons for these variations are not well understood at present and the DENIS samples may provide the data for a breakthrough.

Knowledge so obtained will be of great importance in the study of AGB stars in other Local Group dwarf galaxies, within the grasp of large ground-based telescopes such as the ESO VLT.

A specific catalogue of DENIS point sources in both Magellanic Clouds is planned to become publicly available around mid 1999 (see Cioni, Loup & Habing 1999).

5.6. Galaxies and cosmology

Near infrared surveys such as DENIS offer substantial advantages for constructing samples of galaxies: the low extinction allows for a fair view of external galaxies, virtually unaffected by their interstellar media, and for samples extending to low galactic latitudes. Moreover, the near infrared domain provides galaxy samples that are more mass-weighted and less affected by recent star formation than galaxy samples in other wavebands.

Vauglin et al. (1999) have produced the first DENIS I-band extragalactic catalog, by extracting galaxies from highly compressed DENIS images, in a homogeneous manner. The I-band data are the best suited to separate stars from galaxies and to determine the parameters of extended objects. The first catalog, corresponding to DENIS observations prior to June 1997, contains 20,260 galaxies, of which roughly $2/3$ are new, and is complete to $I \simeq 14.5$. The catalogue is available from CDS. The comparison of this catalogue with the sample of Mathewson et al. (1992) and Mathewson & Ford (1996) shows that the uncertainty in DENIS I-magnitude is about 0.18 mag at $I \simeq 14$.

An updated version of the catalogue, containing 41,000 galaxies, and covering the observations before February 1999, is in preparation.

A special project is the search for galaxies in the Zone of Avoidance in the direction of the “Great Attractor” (Kraan-Korteweg et al. 1998). A systematic search is being made at Lyon for galaxies at latitudes smaller than $15°$. Routine analysis of the DENIS data base started in March 1997. More than 1500 extended objects have already been listed; some of these are not galaxies but newly discovered globular clusters or planetary nebulae.

It is possible to go as faint as $I = 16.5$ and extract galaxies with very high ($> 95\%$) completeness and reliability, as shown by Mamon et al. (1998). The galaxy counts in I and J follow the Euclidean 0.6 slope up to the completeness limit, with no lack of bright objects, in contrast to counts performed in the optical (Heydon-Dumbleton et al. 1989; Maddox et al. 1990), and in agreement with recent optical counts by Bertin & Dennefeld (1997). A complete and reliable catalogue with 900,000 galaxies in the $I-$band, 500,000 at J and 50,000 at K_s is expected. The homogeneity of the extraction is essential for statistical cosmological studies of galaxies such as the measurement of the angular two-point correlation function of galaxies, the derivation of the primordial density fluctuation spectrum, the building of catalogs of groups and clusters, and the study of the variation of galaxy colours with environment. So far, such studies have been based on photographic photometry, which suffers from non-linearities and large systematics in photometric calibration.

The galaxies discovered in the DENIS survey are expected to be the input for future spectroscopic surveys of the southern sky (see e.g. Theureau et al. 1997; Mamon 1998).

6. Conclusion

The preliminary database of DENIS point sources (about 17 million sources for 2% of the Southern sky) can be used for assessing the interest of DENIS data for large scale scientific studies in a variety of fields.

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References

Bertin E., Arnouts S., 1996, A&AS 117, 393
Bertin E., Dennefeld M., 1997, A&A 317, 43
Borsenberger J., 1997, In: The Impact of Near-Infrared Sky Surveys. Proc. 2nd Euroconf. on Near-Infrared Surveys, Kluwer ASSL 210, 181
Cambrésy L., Epchtein N., Copet E., et al., 1997, A&A 324, L5
Cambrésy L., Copet E., Epchtein N., et al., 1998, A&A 338, 977
Cioni M.-R., Loup C., Habing H., 1999, In: Whitelock P., Cannon R. (eds.) IAU Symposium 192, The Stellar Content of Local Group Galaxies. Cape Town, South Africa, 7-11 September 1998, to be published by ASP, E2
Copet E., 1996, Thèse de doctorat de l’Université Paris 6
Delfosse X., Tinney C.G., Forveille T., et al., 1997, A&A 327, L25
Delfosse X., Tinney C.G., Forveille T., et al., 1999, A&A 135, 41
Deul E., Holl A., Guglielmo F., et al., 1995, In: Proc. of 1st Euroconference on near-infrared sky surveys. San Miniato, Mem. Soc. Astron. Ital. 66, 549
Epchtein N., 1998, The impact of near-infrared surveys on galactic and extragalactic astronomy. Proc. 3rd. Euroconf., Kluwer ASSL, 230
ESA, 1997, The Hipparcos and Tycho Catalogues. ESA SP–1200
Fouqué P., Chevallier L., Cohen M., et al., 1999, A&AS, in press
Genova F., Bartlett J.G., Bonnarel F., et al., 1998, In: Astronomical Data Analysis Software and Systems VII, ASP Conf. Ser. 145, p. 470
Heydon-Dumbleton N.H., Collins C.A., MacGillivray H.T., 1989, MNRAS 238, 379
Kimeswenger S., Kerber F., Roth M., et al., 1998, A&A 332, 300
Kraan-Korteweg R.C., Schröder A., Mamon G.A., Ruphy S., 1998, In: The Impact of Near-Infrared Sky Surveys on Galactic and Extragalactic Astronomy. Proc. 3rd Euroconf. on Near-Infrared Surveys, Kluwer ASSL 230, 209
Lasker B., Sturch C.H., McLean B.J., et al., 1990, AJ 99, 2019
Maddox S.J., Sutherland W.J., Efstathiou G., Loveday J., Peterson B.A., 1990, MNRAS 247, 1P

Mamon G.A., 1998, In: Colombi S., Mellier Y., Raban B. (eds.) 14th IAP meeting, Wide Field Surveys in Cosmology. Editions Frontières, Paris, p. 323 (astro-ph/9809376)
Mamon G.A., Borsenberger J., Tricottet M., Banchet V., 1998, In: The impact of near-infrared surveys on galactic and extragalactic astronomy. Proc. 3rd. Euroconf., Kluwer ASSL 230, 177 (astro-ph/9712169)
Martin E., Basri G., Delfosse X., Forveille T., 1997, A&A 327, L29
Martin E.L., Brandner W., Basri G., 1999, Sci 283, 1718
Mathewson D.S., Ford V.L., Buchhorn M., 1992, ApJS 81, 413
Mathewson D.S., Ford V.L., 1996, ApJS 107, 97
Monet D., Canzian B., Harris H., et al., 1997, The PMM USNO A1.0 Catalogue. US Naval Observatory Flagstaff Station
Ochsenbein F., 1998, In: Astronomical Data Analysis Software and Systems VII, ASP Conf. Ser. 145, p. 387
Pérault M., Omont A., Simon G., et al., 1996, A&A 315, L165
Ruphy S., Robin A.C., Epchtein N., et al., 1996, A&A 313, L21
Ruphy S., Epchtein N., Cohen M., et al., 1997, A&A 326, 597
Schultheis M., 1998, Ph.D. Thesis, Vienna astronomical Observatory
Skrutskie M., 1998, In: The impact of near-infrared surveys on galactic and extragalactic astronomy. Proc. 3rd. Euroconf., Kluwer ASSL 230, 11
Theureau G., Paturel G., Vauglin I., 1997, In: Mamon G.A., Thuan T.X., Tran Van Thanh J. (eds.) XVIIth Moriond Astrophysics Mtg, Extragalactic Astronomy in the Infrared. Editions Frontières, Paris, p. 393
Tinney C.G., Delfosse X., Forveille T., 1997, ApJ 490, L95
Vauglin I., Paturel G., Borsenberger J., et al., 1999, A&AS 135, 133