THE UNAM-KIAS CATALOG OF ISOLATED GALAXIES

H. M. Hernández-Toledo\textsuperscript{1}, J. A. Vázquez-Mata\textsuperscript{1}, L. A. Martínez-Vázquez\textsuperscript{1}, Yun-Young Choi\textsuperscript{2}, and Changbom Park\textsuperscript{3}

\textsuperscript{1} Instituto de Astronomía, Universidad Nacional Autónoma de México, A.P. 70-264, 04510 México D. F., Mexico; hector@astroscu.unam.mx, jvazquez@astroscu.unam.mx

\textsuperscript{2} Astrophysical Research Center for the Structure and Evolution of the Cosmos, Sejong University, Seoul 144-747, Republic of Korea; yychoi@kias.re.kr

\textsuperscript{3} Korea Institute for Advanced Study, Seoul 130-012, Republic of Korea; cbp@kias.re.kr

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ABSTRACT

A new catalog of isolated galaxies from the Sloan Digital Sky Survey Data Release 5 (SDSS DR5) is presented. A total of 1520 isolated galaxies were found in 1.4 sr of sky. The selection criteria in this UNAM-KIAS catalog are a variation on the criteria developed by Karachentseva, including full redshift information. Through an image processing pipeline that takes advantage of the high-resolution (~0.4 pixel\textsuperscript{-1}) and high dynamic range of the SDSS images, a uniform g-band morphological classification for all these galaxies is presented. We identify 80\% (Sa-Sm) spirals (50\% later than Sbc types) on one hand, and a scarce population of early-type E (6.5\%) and S0 (8\%) galaxies amounting to 14.5\% on the other hand. This magnitude-limited catalog is ~80\% complete at 16.5, 15.6, 15.2, 14.6, and 14.4 mag in the ugriz bands, respectively. Some representative physical properties including SDSS magnitudes and color distributions, color–color diagrams, absolute magnitude–color, and concentration–color diagrams as a function of morphological type are presented. The UNAM-KIAS Morphological Atlas is also released along with this paper. For each galaxy of a type later than Sa, a mosaic is presented that includes (1) a g-band logarithmic image, (2) a g-band filtered-enhanced image where a Gaussian kernel of various sizes was applied, and (3) a red giant branch color image from the SDSS database. For E/S0/Sa galaxies, in addition to the images in (1), (2), and (3), plots of r-band surface brightness and geometric profiles (ellipticity $\epsilon$, position angle $PA$, and $A_4/B_4$ coefficients of the Fourier series expansions of deviations of a pure ellipse) are provided. The size of the sample, the redshift completeness, the availability of high-quality multicolor photometric data and detailed morphological and spectroscopic information make the UNAM-KIAS catalog of isolated galaxies a suitable sample to address important issues such as (1) comparative studies of environmental effects, (2) constraining the currently competing scenarios of galaxy formation and evolution, (3) the nature and evolution of elliptical and spiral galaxies in the field, (4) the spectral properties of a statistically significant number of isolated galaxies and their evolution as a function of redshift, and (5) the fraction of active galactic nuclei in isolated environments, among other important topics. The optimization and estimation of new structural parameters as well as important information to complement existing ones in other wavelengths is being carried out.

Key words: galaxies: elliptical and lenticular, cD – galaxies: fundamental parameters – galaxies: photometry – galaxies: spiral – galaxies: structure

Online-only material: color figures, machine-readable and VO tables

1. INTRODUCTION

The large and homogeneous redshift and image surveys, such as the 2dFGRS (Colless et al. 2001), Sloan Digital Sky Survey (SDSS; York et al. 2000), and more recently the 6dFGRS (Jones et al. 2004, 2009), have helped us to extend our view of the local universe. Not only is the small-scale distribution of galaxies being revealed but, equally important, it is now possible to make accurate measurements of the relationship between the various physical properties of galaxies and the local environment. Recently, Park et al. (2007, 2008) and Park & Choi (2009) used the SDSS data and studied the environmental dependence of the observed morphology at large and small smoothing scales to address the question of whether galaxy morphology depends primarily on the large-scale environment in which the galaxy initially formed or on a smaller scale environment that may reflect the influence of later evolutionary effects such as galaxy–galaxy interactions. Park et al. (2008) pointed out that galaxies statistically become more isolated if they recently merged and that at a fixed large-scale density, more isolated galaxies are more likely to be recent merger products.

One of the most debated topics in modern cosmology is how galaxies assemble their mass and define their Hubble sequence. Galaxy formation models within the $\Lambda$CDM cosmology have been used to explore the mechanisms primarily responsible for the observed morphological mix in the local universe (De Lucia et al. 2006; Benson & Devereux 2010). Model predictions start concurring with recent observational results or trends in galaxy morphological content seen across a wide range of luminosities in various samples of field galaxies. In the simulations of De Lucia et al. (2006), the final fractions of ellipticals, spirals, and lenticulars brighter than $-18$ in the $V$ band are 17\%, 65\%, and 18\%, very close to the fractions of 13\%, 67\%, and 20\% reported by Loveday (1996). If bulge growth is switched off, the above fractions become 7\%, 84\%, and 8\%, respectively, very close to the reported fractions in the UNAM-KIAS catalog and those for isolated galaxies from the Catalog of Isolated Galaxies (CIG; Karachentseva 1973) that are in common with the SDSS Data Release 6 (DR6) by Hernández-Toledo et al. (2008; see also Delgado-Serrano et al. 2010). This could be evidence of the impact of secular processes in the properties of isolated galaxies (see Benson & Devereux 2010).

Uniformly selected and observed samples of galaxies that have not suffered any interaction with another normal galaxy or with a group environment over a Hubble time are thus crucial for studying intrinsic and secular processes able to affect the
structure, morphology, and dynamics of galaxies, for instance, the formation and evolution of bars, rings, lopsidedness, and bulges. Homogeneous observational data for such isolated galaxies are crucial for obtaining transparent scaling relationships and correlations that can be appropriately confronted to model predictions (see, e.g., Zavala et al. 2003; Avila-Reese et al. 2008). It is worthwhile to mention that an important requirement for all these samples is well defined and strong isolation criteria, along with a uniform quality data acquisition in several wavelengths, and statistical completeness.

In order to overcome some limitations of one of the most representative censuses of isolated galaxies in the local universe started a few decades back by Karachentseva (1973) (e.g., lack of uniform, deep, and high-resolution CCD imaging, scarcity of uniform and reliable photometric data, as well as incompleteness in high-resolution spectroscopic data), we compiled a new catalog of isolated galaxies from the SDSS (DR5) as part of the IAUNAM-KIAS collaboration, hereafter called the UNAM-KIAS catalog. This catalog has been compiled by implementing a variation on the criteria developed by Karachentseva, including full redshift information as well as more accurate photometric information now available in the SDSS database. Using the three-dimensional information, we are able to avoid missing galaxies that happen to lie close to background or foreground galaxies. One principal aim of this new catalog is providing new isolated galaxy candidates with the highest possible statistical and redshift completeness to complement the existing lists of similarly selected galaxies in the local universe. Another relevant aim is to provide a body of observational parameters that will be used for a comparison analysis of the predicted properties of different models of galaxy formation and evolution.

In a companion paper by Hernández-Toledo et al. (2008, hereafter Paper 1), the results of a detailed morphological reevaluation of all the available isolated CIG galaxies (549) from the Karachentseva (1973) catalog in common with the SDSS (DR6) were presented. The methodology was based on an image processing scheme that takes advantage of the uniformity, photometric conditions, and high resolution (0.′4 pixel\(^{-1}\)) of the SDSS CCD images. Here we have applied the same image procedures to proceed with a morphological classification for the isolated galaxies of the UNAM-KIAS catalog. A good understanding of these isolated, non-perturbed, galaxies and in particular of their morphological content is the basis of any further correlations with other physical parameters and will be one of the main legacies of the presentation of the UNAM-KIAS catalog.

The outline of the paper is as follows. Section 2 summarizes the relevant SDSS information and selection criteria used to compile the UNAM-KIAS catalog of isolated galaxies. In Section 3, the results of a detailed morphological classification are presented along with the public release of the UNAM-KIAS Morphological Atlas. In Section 4, some general properties, namely, completeness, apparent magnitude, color distributions, color–color diagrams, absolute magnitude–color, and concentration–color diagrams as a function of morphological type are presented. Finally, in Section 5, a brief summary of the principal results and the main conclusions achieved are presented. The corresponding photometric and spectroscopic catalogs will be presented elsewhere. The widely accepted cosmology with \(H_0 = 70\) km s\(^{-1}\) Mpc\(^{-1}\), \(\Omega_m = 0.27\), and \(\Omega_{\Lambda} = 0.73\), suggested by the WMAP data (Spergel et al. 2003), is adopted throughout this paper.

2. THE SAMPLE AND SELECTION CRITERIA

2.1. The SDSS DR5 Data

The SDSS (York et al. 2000; Stoughton et al. 2002) is a survey to explore the large-scale distribution of galaxies and quasars by using a dedicated 2.5 m telescope at Apache Point Observatory (Gunn et al. 2006). The photometric survey has imaged roughly \(\pi\) steradians of the northern Galactic cap in five photometric bandpasses denoted \(u, g, r, i, z\) centered at 3551, 4686, 6165, 7481, and 8931, respectively, by an imaging camera with 54 CCDs (Fukugita et al. 1996; Gunn et al. 1998). The limiting magnitudes of photometry at a signal-to-noise ratio of 5:1 are 22.0, 22.2, 22.2, 21.3, and 20.5 in the five bandpasses, respectively. The median width of the point-spread function (PSF) is typically 1′.4, and the photometric uncertainties are 2% rms. After image processing (Lupton et al. 2001; Stoughton et al. 2002; Pier et al. 2003) and calibration (Hogg et al. 2001; Smith et al. 2002; Ivezić et al. 2004; Tucker et al. 2006), targets are selected for spectroscopic follow-up observation.

We used a large-scale structure sample, DR4plus, from the New York University Value-Added Galaxy Catalog (NYU-VAGC; Blanton et al. 2005). The NYU-VAGC is a local galaxy catalog containing the SDSS galaxies with redshifts below about 0.3, and selects galaxies in a way similar to that by which the SDSS Main Galaxy sample is made (see Strauss et al. (2002) for the detailed selection criteria for the SDSS Main galaxies). The SDSS produced two galaxy samples: a flux-limited sample to extinction-corrected apparent Petrovian r-band magnitudes of 17.77 (the Main Galaxy sample), and a color-selected and flux-limited sample extending to \(r = 19.5\) (the Luminous Red Galaxy sample). The sample DR4plus is close to the SDSS DR5 (Adelman-McCarthy et al. 2007). From this catalog, we selected the galaxies with r-band magnitudes in the range \(14.5 \leq r_{\text{pet}} < 17.6\). We did not use galaxies in the southern Galactic cap because of the narrow angular extent of the survey regions. Our survey region covers 4464 deg\(^2\), containing 312,338 galaxies. Of the sample, approximately 6% lack measured redshifts because of fiber collisions, are assigned the spectroscopic redshift of the nearest neighbor, and are kept in our parent galaxy catalog. The isolated galaxies in our catalog are restricted to those with measured redshifts. However, we included galaxies with borrowed redshifts when the neighbors are searched to determine isolation of the target galaxies. This primary sample effectively has a magnitude range of only about 3.1 mag, which significantly limits the number of candidate isolated galaxies. To extend the range of magnitude, we attempt to include bright galaxies with \(r < 14.5\). However, the spectroscopic sample of the SDSS galaxies is not complete for \(r_{\text{pet}} < 14.5\). We thus searched the literature to borrow redshifts of the bright galaxies without SDSS spectra to increase the spectroscopic completeness. We added 5195 bright galaxies within our survey boundary to the primary sample (see Choi et al. 2007 for further details). In total, the final data set consists of 317,533 galaxies with known redshift and SDSS photometry.

2.2. Selection Criteria

Our isolation criteria are specified by three parameters. The first is the extinction-corrected Petrovian r-band apparent magnitude difference between a candidate galaxy and any neighboring galaxy, \(\Delta m_r\). The second is the projected separation from the neighbor across the line of sight, \(\Delta l\). The third is the radial velocity difference, \(\Delta V\). Suppose a galaxy \(i\) has a magnitude \(m_{r,i}\),
and $i$-band Petrosian radius $R_i$. It is regarded as isolated with respect to potential perturbers if the separation $\Delta d$ between this galaxy and a neighboring galaxy $j$ with magnitude $m_{r,j}$ and radius $R_j$ satisfies the conditions

$$\Delta d \geq 100 \times R_j$$

(1)

or $\Delta V \geq 1000 \text{ km s}^{-1}$,

(2)

or the conditions

$$\Delta d < 100 \times R_j$$

(3)

$$\Delta V < 1000 \text{ km s}^{-1}$$

(4)

$$m_{r,j} \geq m_r + \Delta m_r$$

(5)

for all neighboring galaxies. Here, $R_j$ is the seeing-corrected Petrosian radius of galaxy $j$, measured in the $i$ band using elliptical annuli to consider flattening or inclination of galaxies (Choi et al. 2007). We choose $\Delta m_r = 2.5$. Using these criteria, we found a total of 1548 isolated galaxy candidates. We removed spurious objects due to poor image deblending, bright stars within the area of a galaxy, images with strong diffraction spikes, and the presence of strong diffuse light from other sources. We also removed galaxies fainter than $m_r = 15.2$ for reliability of our isolated galaxy sample because we require $\Delta m_r = 2.5$ for galaxies in the primary sample defined by the magnitude limit of $m_r = 17.6$. Thus, the final number of isolated galaxies that will comprise the UNAM-KIAS catalog amounts to 1520.

Since the SDSS project scanned a quarter of the sky, one can figure out the number of CIG galaxies intersected by the Sloan survey, namely, $(1050/2) \sim 525$ galaxies, similar to the number of CIG galaxies $(\sim 550)$ found in common to the SDSS (DR6) by Hernández-Toledo et al. (2008). The CIG and the UNAM-KIAS catalogs have an overlap at velocities up to $<10,000$ km s$^{-1}$ sharing 107 galaxies in common (see Table 1). This means that more than 400 CIGs were rejected after applying our selection criteria. Part of this can be explained by invoking Equations (1) and (2) and imposing, for the sake of clarity, the condition $R_i = R_j$ (or $a_i = a_j$ in Karachentseva criteria). The isolation from similar-sized neighbors as projected in the sky is stronger in the UNAM-KIAS, rejecting cases where strict isolation is not satisfied by CIG galaxies and cases where isolation is satisfied but not Equation (2) above. Equations (3), (4), and (5) also impose a stronger restriction on the presence of small-sized galaxies in the neighborhood of an isolated galaxy, rejecting a fraction of CIGs in such circumstances. Evidence for this comes from the refinement of the CIG isolation criteria in terms of collective tidal effects of small-sized neighbors (Verley et al. 2007) showing that an additional $\sim 20\%$ of the CIGs should be eliminated from the original sample. From the 107 CIG galaxies in common with the UNAM-KIAS, 77 belong to the refined sample in Verley et al. (2007) indicating that our selection criteria include much of such a refinement.

The UNAM-KIAS not only adds a significant number of new isolated galaxies at $v < 10,000$ km s$^{-1}$ vindicating some previously presumed non-isolated cases lacking radial velocity information (e.g., Hernández-Toledo et al. 2010), but becomes a natural extension of the CIG for $v > 10,000$ km s$^{-1}$ up to a bit more than 20,000 km s$^{-1}$. It is therefore hoped that any joint study of the properties of these isolated galaxies will necessarily add more statistical significance and deeper insight to the origin of such galaxies.

### 2.3. The UNAM-KIAS Catalog

In Table 1, we list the general properties of the 1520 isolated galaxies sorted in right ascension: Column 1 gives a running identification number; Column 2, the galaxy name (following the IAU-designated SDSS naming convention); Column 3, an alternative name when available in the HyperLeda database, or CIG number when a match is produced; Column 4, the $r$-band Petrosian magnitude corrected for Galactic extinction according to Schlegel et al. (1998) reddening maps; Column 5, the $r$-band Absolute Magnitude (as described in the following section); Column 6, the galaxy redshift; Column 7, the $i$-band

### Table 1: The UNAM-KIAS Sample of Isolated Galaxies

| ID | SDSS ID   | Alt. Name  | $r$   | $M_r$ | $z$   | $(b/a)_i$ | Hleda Type |
|----|-----------|------------|-------|-------|-------|-----------|------------|
| 1  | SDSS J072246.73+413929.6 | UGC03818 | 13.82 | −20.236 | 0.0235 | 0.39 | Sb, SBbc(r) |
| 2  | SDSS J072333.23+412605.5 | 0187 | 13.41 | −20.804 | 0.0279 | 0.87 | SABb, SB(b(r) |
| 3  | SDSS J072653.39+431746.8 | CIG 0189 | 12.77 | −19.436 | 0.0105 | 1 | E, E |
| 4  | SDSS J072642.64+391724.5 | PGC214073 | 14.64 | −20.618 | 0.0457 | 0.54 | S?, SABbc |
| 5  | SDSS J072719.74+442538.3 | PGC2244121 | 14.85 | −19.737 | 0.0325 | 0.39 | S?, Sa |
| 6  | SDSS J072954.29+372706.3 | IC2190 | 13.45 | −21.376 | 0.0358 | 0.64 | Sbc, SB(b(r) |
| 7  | SDSS J073054.71+390110.1 | UGC03888 | 14.16 | −19.199 | 0.0199 | 0.3 | Sb, SB(b(r) |
| 8  | SDSS J073548.83+401938.2 | PGC3087991 | 14.67 | −20.545 | 0.0421 | 0.68 | S?, ... |
| 9  | SDSS J073904.44+315452.9 | PGC021632 | 13.81 | −20.853 | 0.0403 | 0.77 | SB0 |
| 10 | SDSS J074041.42+321140.5 | PGC021523 | 14.65 | −19.688 | 0.0277 | 0.51 | S?, Sab |
| 11 | SDSS J074018.11+282751.4 | 14.31 | −19.659 | 0.0221 | 0.9 | Sab |
| 12 | SDSS J074022.74+231629.9 | UGC03960 | 13.29 | −18.178 | 0.0075 | 0.66 | E, E |
| 13 | SDSS J074109.47+492347.0 | PGC021575 | 14.66 | −19.986 | 0.0506 | 0.96 | S?, SABbc |
| 14 | SDSS J074112.48+424457.7 | PGC021577 | 13.47 | −21.446 | 0.0360 | 0.64 | E?, Sa |
| 15 | SDSS J074127.73+294009.0 | 14.55 | −19.565 | 0.0236 | 0.47 | SABb(r) |
| 16 | SDSS J074158.62+231035.0 | PGC021598 | 14.18 | −21.133 | 0.0436 | 0.71 | S?, E/S0 |
| 17 | SDSS J074232.36+491127.9 | PGC021619 | 14.35 | −17.797 | 0.0099 | 0.45 | Sa, Sa |
| 18 | SDSS J074252.09+220645.7 | PGC021632 | 13.81 | −20.233 | 0.0287 | 1 | SB(c(r) |
| 19 | SDSS J074330.38+225549.9 | UGC03987 | 14.52 | −19.716 | 0.0242 | 0.28 | Sbc, Sc |
| 20 | SDSS J074403.33+330438.6 | PGC021672 | 14.64 | −21.163 | 0.0554 | 0.73 | S?, SABbc |

(This table is available in its entirety in machine-readable and Virtual Observatory (VO) forms in the online journal. A portion is shown here for guidance regarding its form and content.)
minor-to-major isophotal axis ratio, as an indicator of the apparent inclination; Column 8, the morphological type according to HyperLeda; and finally Column 9, the morphological type according to this work.

3. MORPHOLOGICAL CONTENT

3.1. Morphological Considerations

The general criteria to carry out a morphological classification of the SDSS galaxies have been established and presented in a companion paper by Hernández-Toledo et al. (2008) where ~550 isolated galaxies from the CIG in common with the SDSS (DR6) database were classified in detail following an image processing scheme that take advantage of the improved scale and dynamic range of the SDSS images and that enhances SDSS (DR6) database were classified in detail following an ∼ of the SDSS galaxies have been established and presented in this work.

In order to discuss the optical morphology and its relationship to the global photometric properties, the isolated galaxies in the UNAM-KIAS catalog were visually inspected through mosaics of images including, from upper left to lower right panel: (1) a grayscale g-band image where a logarithmic transformation was applied to look for bright/faint internal/external details; (2) A g-band filter-enhanced image where a Gaussian kernel of various sizes is applied to look for internal structure in the form of star-forming regions, bars, rings, and/or structure embedded into dusty regions. The filter-enhancing techniques (Sofue 1993) allow the subtraction of the diffuse background in a convenient way to discuss different morphological details, including low surface brightness features; and (3) an RGB color image from the SDSS database to complement our morphological analysis.

These images are useful to visualize the spatial distribution of various morphological components in the images (blue colors are for recent SF and red colors for older populations/dusty components).

For E/S0 candidates, we further include in each mosaic plots of surface brightness profiles and the corresponding geometric profiles (ellipticity ε, position angle PA, and A4/B4 coefficients of the Fourier series expansions of deviations of a pure ellipse) from the r-band images to provide further evidence of boxyness/diskyness and other structural details.

The classification of the sample followed the basic Hubble sequence. For spiral types, the bulge-to-disk ratio as judged from the observed prominence of the bulge, tightness of the arms, and the degree of resolution of structure along the arms/outter disk were considered. In the majority of the UNAM-KIAS spirals these features are well recognized, however in some cases the presence of structures such as dust lanes, prominent knots, and the apparent tightening of the arms in the central regions may confuse the identification of structures such as inner rings or bars. Outer rings/pseudo-rings (Buta 1995) were also identified when possible. While the presence/absence of a bar was confirmed in some cases (SB), in the suspected cases we adopted the (SAB) nomenclature convention. The data presented in Table 1 report the r-band minor-to-major isophotal axis ratio as an indicator of the inclination. This is important to evaluate the reliability of the classification presented here.

Figure 1 illustrates our image procedures, and shows four examples of UNAM-KIAS spirals classified according to the adopted criteria. The left panel shows a logarithmically scaled g-band image. The middle panel shows the corresponding filter-enhanced version, and the right panel shows the corresponding RGB image from the SDSS database. The relative importance of the bulge, arms, and their degree of resolution into fragmented clumps in Sb, Sbc, Sc, and Scd types is considered. Some main structural features such as bars and rings were identified and sometimes suspected. Each galaxy is identified by its ISO number and the corresponding morphological type. The average radial velocity of the UNAM-KIAS spirals is ~10,000 km s⁻¹, and in some cases the structural details are difficult to recognize at v > 10,000 km s⁻¹.

For early-type (E/S0) candidates, in addition to a careful inspection of the corresponding mosaic images, an evaluation of the geometric profiles after an isophotal analysis was carried out. Although the absolute value of the A4 parameter depends on the inclination of the galaxy to the line of sight, its sign is useful to detect subtle diskyness features in the early-type candidates. A galaxy was judged to be elliptical if the A4 parameter showed (1) no significant boxy (A4 < 0) or disky (A4 > 0) trend in the outer parts, or (2) a generally boxy (A4 < 0) character in the outer parts. We further inspected the surface brightness profile for the presence/absence of (3) a linear component in the surface brightness–radius diagram. Central diskyness is not considered enough for an S0 classification. Figure 2 shows ISO 1404 to illustrate an elliptical galaxy, and Figure 3 shows ISO 459 to illustrate a lenticular galaxy both at v < 10,000 km s⁻¹.

The g-band filter-enhanced image of ISO 1404 shows some sort of faint external envelope. We caution the reader about the reality of these features in some of our E/S0 candidates and that care must be taken about its interpretation, especially at velocities v > 10,000 km s⁻¹ where our image methodology might not be good enough to resolve some structural details.

Another relevant goal of our image procedure is to isolate as much as possible the differences among lenticulars and very early-type spirals. Only from a more uniform and deeper survey like the CCD SDSS, it is possible to systematically search for fainter features that could point to a more definite morphological classification. Here we use, in addition, plots of both ε and PA radial profiles as an auxiliary tool to disentangle S0 and Sa cases. Significant and not necessarily coupled changes in ε and PA radial profiles should be evidencing the presence of additional structure (in the form of a disk) for an S0 galaxy or in the form of arms, outer rings, or envelopes for Sa galaxies. If further additional image processing did not show definite evidence of those features, we kept the galaxy type as lenticular. Figure 4 shows ISO 283 to illustrate a very early-type Sa galaxy. The advantages of the higher resolution and depth of the CCD SDSS images, in combination with our image procedures, is illustrated here for a galaxy with v < 10,000 km s⁻¹. Nevertheless, the reader should be cautious about the classification for distant E/S0/Sa galaxies where it may be difficult to discriminate among representative structural details.

3.2. Morphological Content: Results

Table 2 reports our morphological evaluation for 1318 UNAM-KIAS galaxies, after removing 202 unclassifiable galaxies (advanced mergers; compact, poorly defined objects; edge-on, and highly inclined galaxies, as devised from their aspect ratio). The results are presented according to three velocity regimes: v < 10,000 km s⁻¹, v < 15,000 km s⁻¹, and v < 20,000 km s⁻¹. Column 1 gives the morphological type, Column 2 the morphological code number following HyperLeda convention (code numbers 9 and 10 have been reassigned to...
include Sdm and Sm galaxies), Columns 3 and 4 give the number \( n \) of galaxies of each morphological type in each velocity regime and the corresponding fraction, respectively.

Table 3 shows the results of our morphological classification this time reporting a morphological code number following the HyperLeda convention. Similarly to Table 2, code numbers 9 and 10 have been reassigned to include Sdm and Sm galaxies. Column 1 gives a running identification number, Column 2 gives the galaxy name (following the IAU-designated SDSS naming convention), Column 3 gives the morphological code number, Column 4 indicates the presence of a bar structure (absence = 0, suspected = 1, definite = 2), and Column 5 indicates the presence of rings (absence = 0, inner = 1, outer = 2, both = 3).

Figures 5, 6, and 7 illustrate the corresponding results in Table 2 according to three velocity regimes and in the form of histograms (upper panel) and cumulative distributions (lower panel). A classification avoiding transition E/S0 and S0/Sa cases was attempted as much as possible. For comparison, the results of our classification of 549 galaxies from the local \( v < 10,000 \) km s\(^{-1}\) CIG catalog in common to the SDSS (DR6) (Hernández-Toledo et al. 2008) are also presented.
Figures 5–7 show that at \( v < 10,000 \text{ km s}^{-1} \) our classification is consistent with that reported for the CIG galaxies in common with the SDSS database by Hernández-Toledo et al. (2008) in the whole range of morphological types. The fraction of transition E/S0 and S0/Sa morphologies increases, however at velocities \( v > 10,000 \text{ km s}^{-1} \) denoting our increasing inability to distinguish structural details in early-type galaxies at such velocities. While the fraction of pure (E,S0) galaxies is \( \sim 11\% \) at \( v < 10,000 \text{ km s}^{-1} \), that fraction slightly increases up to \( \sim 15\% \) at \( v > 10,000 \text{ km s}^{-1} \), similar to the \( \sim 14\% \) of (E,S0) galaxies reported by Sulentic et al. (2006) for the whole CIG catalog and consistent with the 18% obtained by Delgado-Serrano et al. (2010) in a local sample of galaxies from the SDSS. For early-type Sa, Sab spirals, a fraction \( \sim 14\%–15\% \) is obtained along the whole velocity range also consistent with the results in Hernández-Toledo et al. (2008) but definitely at odds with the \( \sim 6\% \) reported by Sulentic et al. (2006). Part of this discrepancy could be explained by the higher resolution and depth of the CCD SDSS images that in combination with our image procedures allow us to detect more easily high spatial frequency structures delineating arms, bars, and rings.

According to our results, \( \sim 80\% \) of the UNAM-KIAS galaxies are in the range of (Sa-Sm) types, also consistent with the 72% reported in Delgado-Serrano et al. (2010). While \( \sim 30\% \) of the spirals in this galaxy sample are earlier than Sbc, \( \sim 50\% \) are of Sbc type or latter (up to Sm types). Higher
resolution is important to distinguish between inner rings and ring-like features produced by the tightening of the arms, the fragmentation degree of the arms in spirals or structures such as bars, clumps, and dust lanes, among others. Our filtering process enhances high spatial frequency structures in spirals (and sometimes, depending on the kernel size, in ellipticals too) making easier the distinction among various spiral types. However, it is also natural to expect that the filtering process loses power as the galaxy distance increases. This could explain the slight variations reported for the late-type fractions in Table 2 at the three velocity regimes. Care had to be taken to not over-interpret high spatial frequency features during the classification, and all these results should be considered as a first homogeneous insight into the morphological content of the isolated galaxies in the UNAM-KIAS sample.

The information concerning bars (confirmed and presumed) indicate that about 62.9% of the isolated galaxies in the UNAM-KIAS catalog show evidence of barred structure: for 26.3% the evidence is clear (SB galaxies) and for 36.6% the bars are weak or suspected (SAB galaxies). The bar fraction (SAB + SB) is 27.8% for early types and 35% in late types. However, we caution the reader about these numbers. The bar fraction reported here is mainly the result of our visual reevaluation of the mosaic images and only a fraction of the UNAM-KIAS spirals (mainly Sa types) were judged for the presence of bars through a photometric analysis of the $r$-band isophotal
ellipticity and PA profiles (compared to Wozniak et al. 1995). Furthermore, the fraction of bars could increase to an additional 10%–20% if the corresponding analyses were extended into the NIR bands (compared to Hernández-Toledo et al. 2007, 2008). For a comparison, in a study of large-scale bars ($d > 2$ kpc) in the local universe from a sample of SDSS galaxies, Barazza et al. (2008) found an optical $r$-band fraction of $\sim 52\%$ of bars. This number is consistent with our results if we take into account that oval distortions and other candidate small-scale structures were considered in our revision. Similarly, the information for rings (inner, outer rings, and pseudo-rings) in our sample is tentatively reported at the 36% level.

3.3. The Atlas

A total of 1420 isolated galaxies are presented in the form of mosaic images. Compact objects or other objects of non-definite nature were eliminated from the Atlas. For spiral galaxies of types later than Sa, we include, from upper left to lower right panels (1) a gray scale $g$-band logarithmically transformed image, (2) a $g$-band filtered-enhanced version of the image in (1) where a Gaussian kernel of variable size was applied, and (3) an RGB color image from the SDSS database.

For E/S0/Sa galaxies, in addition to the images in (1), (2), and (3), plots of the surface brightness and geometric profiles
Table 2

Results of the Morphological Classification for the UNAM-KIAS Sample at Three Velocity Regimes

| Type   | T | n    | $v < 10,000$ km s$^{-1}$ | $v < 15,000$ km s$^{-1}$ | $v < 20,000$ km s$^{-1}$ |
|--------|---|------|--------------------------|--------------------------|--------------------------|
|        |   | $n/835$ | $n/1203$ | $n/1318$ | $n/835$ | $n/1203$ | $n/1318$ |
| E      | -5| 42    | 0.050       | 69     | 0.057     | 86     | 0.065     |
| E/S0   | -3| 9     | 0.011       | 37     | 0.031     | 45     | 0.034     |
| S0     | -2| 56    | 0.067       | 89     | 0.074     | 105    | 0.080     |
| S0/Sa  | 0 | 12    | 0.014       | 32     | 0.027     | 39     | 0.030     |
| Sa     | 1 | 51    | 0.061       | 67     | 0.056     | 76     | 0.058     |
| Sab    | 2 | 73    | 0.087       | 115    | 0.096     | 126    | 0.096     |
| Sb     | 3 | 110   | 0.132       | 171    | 0.142     | 185    | 0.140     |
| Sbc    | 4 | 114   | 0.137       | 179    | 0.149     | 197    | 0.149     |
| Sc     | 6 | 215   | 0.257       | 283    | 0.235     | 297    | 0.225     |
| Scd    | 7 | 93    | 0.111       | 101    | 0.084     | 102    | 0.077     |
| Sd     | 8 | 52    | 0.062       | 52     | 0.043     | 52     | 0.039     |
| Sdm    | 9 | 4     | 0.005       | 4      | 0.003     | 4      | 0.003     |
| Sm     | 10| 4     | 0.005       | 4      | 0.003     | 4      | 0.003     |
| E-S0   | 98| 0.117 | 158         | 0.131  | 191       | 0.145  |
| Sa-Sd  | 708| 0.848| 968         | 0.805  | 1035      | 0.785  |
| Sb-Sc  | 439| 0.526| 633         | 0.526  | 679       | 0.515  |

Table 3

Morphological Code Numbers for the UNAM-KIAS Sample of Isolated Galaxies

| ID | SDSS ID                  | T  | Bar | Ring |
|----|--------------------------|----|-----|------|
| 1  | SDSS J072246.73+413929.6 | 4  | 2   | 1    |
| 2  | SDSS J072333.23+412605.5 | 5  | 0   | 1    |
| 3  | SDSS J072635.39+431746.8 | -5 | 0   | 0    |
| 4  | SDSS J072642.64+391724.5 | 4  | 1   | 0    |
| 5  | SDSS J072719.37+442538.3 | 5  | 0   | 0    |
| 6  | SDSS J072954.29+372706.3 | 5  | 0   | 1    |
| 7  | SDSS J073054.71+390110.1 | 5  | 0   | 1    |
| 8  | SDSS J073548.83+401938.2 | ...| 0   | 0    |
| 9  | SDSS J073901.44+315452.9 | -2 | 2   | 0    |
| 10 | SDSS J074001.42+321140.5 | 2  | 0   | 0    |
| 11 | SDSS J074018.11+282751.4 | 2  | 0   | 0    |
| 12 | SDSS J074022.74+316299.9 | -5 | 0   | 0    |
| 13 | SDSS J074109.47+492347.0 | 5  | 1   | 0    |
| 14 | SDSS J074112.48+424457.7 | 1  | 0   | 0    |
| 15 | SDSS J074127.73+294009.0 | 3  | 1   | 1    |
| 16 | SDSS J074158.62+330438.6 | 4  | 1   | 0    |
| 17 | SDSS J074232.38+491127.9 | 7  | 0   | 0    |
| 18 | SDSS J074252.09+220645.7 | 5  | 0   | 1    |
| 19 | SDSS J074330.38+225494.9 | 5  | 0   | 0    |
| 20 | SDSS J074403.33+30438.6  | 4  | 1   | 0    |

This table is available in its entirety in machine-readable and Virtual Observatory (VO) forms in the online journal. A portion is shown here for guidance regarding its form and content.

The morphological diversity of the UNAM-KIAS sample is demonstrated in this Atlas. Interested people are invited to visit our Web site (http://www.astroscu.unam.mx/~hector/KIAS/kias.html).

4. GENERAL PROPERTIES OF THE UNAM-KIAS SAMPLE

A first preliminary view of the relationship among some physical parameters of the galaxies in the UNAM-KIAS sample is presented. We start by showing in Figure 8 an histogram of the redshift distribution for the original number of galaxies (1520) in the UNAM-KIAS catalog. Plots are shown distinguishing by morphological type: early (ellipticals and lenticulars) and late (spirals and irregulars) types, based on our own classification.

The mean redshift for the UNAM-KIAS sample is $\langle z \rangle = 0.032$, which corresponds to a comoving distance of $143\ h^{-1} \text{Mpc}$ for an $\Omega_m = 0.27$, $\Omega_\Lambda = 0.73$ cosmology. The redshift distribution of the spirals in the UNAM-KIAS catalog is consistent with a Gaussian distribution and does not show evidence of obvious concentrations associated with major components of large-scale structure. However, the bins centered at $z = 0.027$ and 0.042 in the E/S0 distribution show two peaks slightly deviating from a Gaussian. This may be interpreted as a departure from a homogeneous distribution but a more careful analysis needs to be done. The apparent homogeneity in redshift distribution of the galaxies in the UNAM-KIAS catalog points...
to a sample that is close to a local homogeneous component of the isolated galaxy distribution.

Aitoff projections in right ascension and declination in Figures 9 and 10 show the distribution of the UNAM-KIAS sample on the sky at 3,000 km s\(^{-1}\) velocity intervals covering the velocity interval from 0 to 21,000 km s\(^{-1}\). Due to their small number, galaxies at \(v > 21,000\) km s\(^{-1}\) were not considered. After a new search for redshifts of Abell cluster cores in the literature, we show their position at every redshift range according to increasing richness classes from 0 (crosses), 1 (asterisks), 2 (rhombus), and 3 (triangles).

There is no apparent association between the positions of the Abell cluster cores and the UNAM-KIAS galaxies in the 0–9000 km s\(^{-1}\) velocity intervals. However, as velocity increases, the presence of Abell clusters is more significant and a possible association of some of our galaxies with those structures may not be negligible. Any correspondence of our galaxies to complex local large-scale structures is something that needs to be explored in more detail.

Figure 11 shows the distribution of isolated galaxies in the redshift \(z\)--Absolute Magnitude diagram. Red dots represent E/S0 isolated galaxies, while black dots correspond to spiral isolated galaxies. We use the seeing-corrected isophotal axis ratio in the \(i\) band to take into account the inclination of the galaxies. Cross symbols indicate galaxies with inclinations greater than 70°. The \(r\)-band absolute magnitude \(M_r\) is estimated from the SDSS apparent magnitudes by using the expression

\[
m_r - M_r = 5 \log (r(1 + z)) + 25 + K(z) + E(z),
\]

where \(K(z)\) is the \(K\) correction, \(E(z) = 1.6(z - 0.1)\) is the mean luminosity evolution correction (Tegmark et al. 2004), and \(r\) is the comoving distance corresponding to redshift \(z\). We also omit the \(+5\log h\) term in the absolute magnitude. We adopt a flat ΛCDM cosmology with density parameters \(\Omega_\Lambda = 0.73\) and \(\Omega_m = 0.27\) to convert redshift to the comoving distance. The \(r\)-band rest-frame magnitude is Galactic extinction corrected (Schlegel et al. 1998) and \(K\) corrected to redshift of 0.1 (Blanton et al. 2003). This makes galaxies at \(z = 0.1\) have a \(K\) correction of \(-2.5\log (1 + 0.1)\), independent of their spectral energy distributions.

A wide range in absolute magnitudes is observed for the UNAM-KIAS sample. Notice a scarcity of nearby dwarf isolated E/S0 galaxies, and that bright E/S0 galaxies are preferentially found more at intermediate to high redshifts than spirals. The covered redshift range of UNAM-KIAS samples has increased with respect to that in the CIG catalog by about a factor of 2. Although deeper, note that this is also a magnitude-limited sample.
Figure 9. Aitoff projections in right ascension and declination showing the distribution of the UNAM-KIAS sample on the sky at 3000 km s$^{-1}$ velocity intervals from 0 to 12,000 km s$^{-1}$. Abell cluster cores of increasing richness classes from 0 (crosses), 1 (asterisks), 2 (rhombus), and 3 (triangles) are also indicated.

Figure 10. Similar to Figure 9 but from 12,000 to 21,000 km s$^{-1}$. 
Figure 11. r-band absolute magnitude vs. redshift diagram for the UNAM-KIAS isolated galaxy sample. E/S0 galaxies are in red; Sa-Sm are in black symbols. Cross symbols indicate galaxies with inclinations greater than 70°.

(A color version of this figure is available in the online journal.)

Figure 12 presents the distribution of apparent magnitudes in the ugriz SDSS photometric bands. Galaxies are sorted into E/S0 (red) and Sa-Sm (black). Apparent magnitudes were corrected for Galactic extinction according to Schlegel et al. (1998).

The cutoff at about ~15.2 mag in the r band is a consequence of the selection criteria applied to these galaxies. The g-band magnitude distribution shows a similar range of variation to that shown in the B band for the CIG galaxies in the Karachentseva catalog, considering a proper photometric transformation.

Figure 13 shows the (u − r), (r − i), (g − r), and (i − z) color distributions for the galaxies in the UNAM-KIAS catalog. Red histograms are denoted for E/S0 galaxies, while black histograms are for Sa-Sm galaxies. The computed colors use extinction-corrected (Schlegel et al. 1998) and K-corrected magnitudes (Blanton et al. 2003).

This figure shows how the (u − r) color index is more effective at distinguishing among different galaxy types, although a significant overlap is still seen at redder colors (see, e.g., Park & Choi 2005). The (u − r) color could be used as a measure of star formation activity of galaxies in the recent past, as suggested by Choi et al. (2007).

Figure 14 presents the apparent (u − g) versus (g − r), (g − r) versus (r − i), (r − i) versus (i − z), and (g − r) versus (u − r) color–color diagrams for all the galaxies in the UNAM-KIAS catalog. Cross symbols (red) denote E/S0 galaxies and inverted triangles (black) represent Sa-Sm galaxies.

Tighter color–color distributions are seen in the UNAM-KIAS Catalog compared to similar color–color diagrams for isolated galaxies from the SDSS (DR1) in Allam et al. (2005).

Figure 15 presents the behavior of the UNAM-KIAS isolated galaxies in the $C_{in}$ versus (u − r) and $C_{in}$ versus morphological type diagrams. The inverse concentration index, $C_{in}$, is defined as $R_{50}/R_{90}$, where $R_{50}$ and $R_{90}$ are the radii from the center of a galaxy containing 50% and 90% of the flux in the i band. Red dots are for E galaxies, blue dots are for S0 galaxies, and green dots are for Sa galaxies.

Late types are loosely distributed in the $C_{in}$ versus (u − r) diagram showing a broad overlap with early-type galaxies. Notice how highly inclined galaxies are shifted toward redder colors. The lower panel of Figure 15 shows that the inverse concentration index follows a loose tendency with morphological type. Early types are the most concentrated. The tendency is fuzzy due to the big scatter of $C_{in}$ values at later types.

(A color version of this figure is available in the online journal.)
Figure 13. \((u-r)\), \((g-r)\), \((r-i)\), and \((i-z)\) color distributions of the UNAM-KIAS isolated galaxy sample. Colors are corrected for galactic extinction. Red histograms are for E/S0 galaxies. Black histograms are for Sa-Sm galaxies.

(A color version of this figure is available in the online journal.)

A high degree of overlap in morphological types at a given \(C_{in}\) value in this diagram illustrates the difficulty in distinguishing not only between E/S0, S0/Sa classes but also between early and late types by simply establishing cuts in the \(C_{in}\) domain. Figure 15 compares with the similar plot for randomly chosen SDSS galaxies brighter than \(r = 15.9\) shown in Figure 1 of Park & Choi (2005).

Finally, Figure 16 shows the \(C_{in}\) versus \(M_r\) and color magnitude \((u-r)\) versus \(M_r\) diagrams.

The inverse concentration index \(C_{in}\) of early-type galaxies is nearly independent of absolute magnitude but a very slight dependence toward lower concentration is noticed at fainter magnitudes. For late-type galaxies, it is more difficult to see a tendency due to the large scatter at all absolute magnitude intervals. This trend has also been observed for the general SDSS early-type galaxies (see Figure 3 of Choi et al. 2007). We inspect a color–magnitude diagram in the lower panel of Figure 16 to explore how a segregation into early-type (red symbols) and late-type (black symbols) sequences is possible in isolated environments. We notice a tendency of isolated early-type galaxies to have redder colors at brighter absolute magnitudes. In the case of the general SDSS galaxies, the red sequence of early-type galaxies has a break in the slope at about \(M_r = -19.6\) (Figure 3 of Choi et al. 2007). Isolated late-type galaxies show a larger scatter in \((u-r)\) color compared to early-type galaxies. Note that the color distribution of late-type galaxies overlaps with early types at practically all absolute magnitude intervals and thus a line dividing the sequences of red and blue galaxies is difficult to find. Although the fraction of early types located outside the red sequence is low, this diagram illustrates the danger of generating samples of early-type galaxies by a simple cut in the absolute magnitude–color diagram. We also detect a relatively small fraction of blue early-type galaxies that may be associated with recent merger events. Note that a significant fraction of the most inclined galaxies is located toward fainter magnitudes and redder colors due to internal extinction (see also Figure 12 of Choi et al. 2007 for a comparison).

4.1. Completeness

An estimate of the statistical completeness of the sample by means of the \((V/V_m)\) test (Schmidt 1968) is presented. For each object, we estimated the volume \(V\) at a radius corresponding to its distance and the maximum volume \(V_m\) at a radius corresponding to the maximum distance given the magnitude limit of the UNAM-KIAS sample. We then calculate the average \(V/V_m\) for objects brighter than a given magnitude limit. Figure 17 shows the results of the \(V/V_m\) test as a function of limiting ugriz apparent magnitudes. Approximately 1450 isolated galaxies were included in the test. Due to their small number, galaxies with radial velocities in excess of 20,000 km s\(^{-1}\) were eliminated from this analysis.
Figure 14. \((g-r)\) vs. \((r-i)\), \((r-i)\) vs. \((i-z)\), \((u-g)\) vs. \((g-r)\), and \((g-r)\) vs. \((u-r)\) color–color diagrams of the UNAM-KIAS isolated galaxy sample. E/S0 galaxies are in red; Sa-Sm are in black symbols.

(A color version of this figure is available in the online journal.)

Figure 15. Upper panel: inverse concentration vs. \((u-r)\) color diagram. Lower panel: inverse concentration vs. morphological type diagram for galaxies in the UNAM-KIAS isolated galaxy sample. E/S0 galaxies are in red; Sa-Sm are in black symbols. Cross symbols indicate galaxies with inclinations greater than 70°. Red dots are for E galaxies, blue dots are for S0 galaxies, and green dots are for Sa galaxies.

(A color version of this figure is available in the online journal.)

Figure 16. Upper panel: inverted concentration vs. \(r\)-band absolute magnitude diagram. Lower panel: \((u-r)\) color vs. \(r\)-band absolute magnitude diagram for galaxies in the UNAM-KIAS isolated galaxy sample. E/S0 galaxies are in red; Sa-Sm are in black symbols. Cross symbols indicate galaxies with inclinations greater than 70°.

(A color version of this figure is available in the online journal.)
The decreasing trend observed in the (12–13.6) $r$-band interval is interpreted as a statistical fluctuation or incompleteness due to the small number of galaxies in those magnitude bins. Since the parent galaxy sample from which the UNAM-KIAS was selected is intrinsically incomplete at bright magnitudes and in spite of the fact that bright galaxies from other catalogs were added, the effect this supplement had on completeness appeared to be insignificant and reflects the difficulty of having nearby isolated bright galaxies. At intermediate (13.7–15.2) $r$-band magnitudes where most of our galaxies yield statistical significance to the test, the UNAM-KIAS is about 80% complete for galaxies satisfying our selection criteria. Incompleteness of this sample, beyond 15.2 $r$-band Petrosian magnitudes, is a natural consequence of our selection criteria that excludes galaxies beyond that magnitude range to ensure that we are within the completeness limit of the parent sample (Section 2.2). Notice how the faint-end completeness limit in the $r$-band magnitude is correctly recovered from this test.

5. SUMMARY AND CONCLUSIONS

In order to overcome some limitations of the previous major sample of isolated galaxies in the local universe by Karachentseva (1973), including a lack of uniform, deep, and high-resolution CCD imaging, the scarcity of uniform and reliable photometry, and high-resolution spectroscopic incompleteness, we compiled a new catalog of isolated galaxies from the SDSS (DR5) that adds a significant number of new isolated galaxies in the local universe also complementing the previous census. This catalog, coined UNAM-KIAS, has been compiled by implementing a variation on the criteria developed by Karachentseva, including full redshift information as well as more accurate photometric information now available in the SDSS database.

We have taken advantage of the high resolution ($\sim$0.4 pixel$^{-1}$) and high dynamic range of the SDSS images by implementing a simple digital image processing scheme that enhances structural details in galaxies of various types supporting a detailed morphological characterization for the isolated galaxies in the UNAM-KIAS catalog. A Morphological Atlas containing detailed mosaic images for the galaxies is also presented and released along with this paper. The classification presented here preserves the optically observed morphology but takes into account structural information provided from the digital image processing, the isophotal analysis (E/S0/Sa cases), and the color information provided by the SDSS RGB images.

The isolated galaxy candidates in the UNAM-KIAS catalog show a wide morphological diversity, from E to Sm types. 80% of these galaxies are in the range of (Sa-Sm) types, 14.5% are of (E,S0) type, and 50% are of Sbc type or later (up to Sm types). Although this is an attempt to provide a uniform morphological classification, the reader should note that this classification is not free of uncertainties, especially for some E/S0/Sa galaxies at larger distances where our image procedures may not be capable of disentangling their characteristic structural properties. A tentative fraction of about 62.9% of the isolated galaxies in the UNAM-KIAS catalog shows evidence of barred structure: for 26.3% the evidence is clear (SB galaxies) and for 36.6% the bars are weak or suspected (SAB galaxies). The bar fraction
environments (e.g., Barrazza et al. 2008). This could suggest that interactions and the global effects of the group/cluster environment are not so different from that reported for galaxies in other environments. In the present study, we note that the tentative fraction of bars (62.9%) is not so different from that reported for galaxies in other environments.

1. The spatial distribution of the UNAM-KIAS galaxies, as seen from their redshift distribution, does not show evidence of obvious concentrations associated with major components of large-scale structure in the local universe, but a more careful study in this direction needs to be done. This apparent homogeneity points to a sample that is close to a local homogeneous component of the isolated galaxy distribution.

2. Although the UNAM-KIAS galaxies comprise a nearby sample, its redshift interval has increased with respect to that in the CIG catalog by about a factor of 2, making it deeper and more representative of the galaxies in this environment in the local universe.

3. The UNAM-KIAS sample is also diverse in terms of physical properties explored here. A scarcity of nearby dwarf isolated E/S0 galaxies and a tendency of bright E/S0 galaxies being farther away than spiral galaxies is observed.

4. The UNAM-KIAS catalog of isolated galaxies is a magnitude-limited sample that is reasonably complete (∼80%) up to 15.2 $r$-band apparent magnitudes, providing statistical significance to studies of these galaxies in isolated environments.

The finding of reasonably nearby isolated galaxies uniformly selected and with detailed morphological information is of high relevance. The UNAM-KIAS catalog, along with the most isolated galaxies of the CIG catalog that are in common with the SDSS, will provide a unique database that can be used for several purposes, including (1) studies of environmental effects on galaxies belonging to groups and clusters, and (2) testing theoretical and model predictions of galaxy evolution.

Another major aim of the present study, is to provide as much as possible a new body of observational parameters for these isolated galaxies in different wavelengths that will greatly increase our understanding of the nature of such galaxies.

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