Companions of Bright Barred Shapley Ames Galaxies

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ABSTRACT

Companion galaxy environment for a subset of 78 bright and nearby barred galaxies from the Shapley Ames Catalog is presented. Among the spiral barred galaxies there are Seyfert galaxies, galaxies with circumnuclear structures, galaxies not associated with any large scale galaxy cloud structure, galaxies with peculiar disk morphology (crooked arms) and galaxies with normal disk morphology; the list includes all Hubbles types. The companion galaxy list includes the number of companion galaxies within 20 diameters, their Hubble type and projected separation distance. Additionally, companion environment was searched for four known active spiral galaxies, three of them are Seyfert galaxies, namely, NGC 1068, NGC 1097, NGC 5548 and one is a starburst galaxy, M82. Among the results obtained it is noted that the only spiral barred galaxy classified as Sy 1 in our list has no companions within a projected distance of 20 diameters; 6 out of 10 Sy 2 bar galaxies have no companions within 10 diameters, 6 out of 10 Sy 2 galaxies have one or more companions at projected separation distances between 10 and 20 diameters; 6 out of 12 galaxies with circumnuclear structures have 2 or more companions within 20 diameters.

Subject headings: galaxies: spiral — galaxies: clusters: general — galaxies: Seyfert — galaxies:active
1. INTRODUCTION

Nearby barred spiral galaxies are important to study because they have a large scale stellar bar and are better resolved compared with barred galaxies which are small and distant. A non-axisymmetric gravitational potential can drive gas to flow from large to small radii (Combes 1988), yet not all barred galaxies present a similar level of central activity. Bipolar nuclear outflows (as detected by their radio continuum emission) and circumnuclear structures are perhaps a result of gas inflow; in particular, circumnuclear structures are thought to be a result of a dynamical resonance between the pattern speed of the stellar bar and the orbital motion of gas and stars in the disk, generally known as Inner Lindblad Resonance (Binney & Tremaine 1987, Buta & Combes 1996).

The connection between nuclear activity and the properties of the parent galaxy is still under investigation. The level of central (or nuclear) activity in galaxies is thought, in general, to be mainly due to: a) merger events, (ie. ellipticals - radio galaxies [Toomre & Toomre 1972, Toomre 1977], ultra luminous infrared galaxies [Sanders & Mirabel 1996]); b) tidal effects, (e.g., similar size nearby companions, [Salo 1991, Noguchi 1988]); c) non-axisymmetric gravitational potential (e.g., stellar bars); d) minor mergers (with small galaxy satellites, [Walker, Mihos & Hernquist 1996]). The central activity in spiral galaxies is thought to be mainly due to the last three mechanisms.

The issue of the role of bars may play on this process has been the subject of several investigations (Combes 1988, Shlosman et al. 1989, Athanassoula 1992, Phinney 1994, Athanassoula 1994, Wada & Habe 1995, Ho, Filippenko & Sargent 1996, Mulchaey, Regan & Kundu 1997, Sakamoto et al. 1999, Sakamoto, Baker & Scoville 2000, Combes 2000, Combes 2003). However, a conclusive link between bars and nuclear activity has not yet been established (Combes 2000, Combes 2003). One way to further investigate this possible link is to focus not on how frequently active spiral galaxies are barred, but on studying the properties of barred galaxies: for example, the strength of the stellar bar, the frequency of companions, the atomic and molecular gas content, the group membership and the possible existence of intergalactic gas capable of gas stripping as the barred galaxy travels, the radio continuum bipolar outflows, etc. In this paper we concentrate on the frequency of companions to barred galaxies. This would tell us if tidal interactions are important with respect to the issue of activity in barred galaxies or if there are other factors involved.

Seyfert galaxies are found to be barred spirals of 79% in the CfA sample (Knapen, Shlosman & Peletier 2000) which suggests that a non-axisymmetrical gravitational potential might be relevant to the activity. From statistical analysis the issue of large-scale companions near Seyfert galaxies is still controversial but different studies indicate that Seyfert 1 galaxies do not have an excess of companion galaxies, while Seyfert 2 galaxies have a significant excess of large companions within a radius of 100 kpc (Laurikainen & Salo 1995, Dultzin-Hacyan et al. 1999). This result suggests that tidal interaction with a galaxy of similar size may induce central activity; tails, as in the best example of tidal interaction between galaxies of similar size, are observed in the Antennae and M51 systems (Toomre & Toomre 1972). Observationally, it is very difficult to detect companions of small dimensions and mass compared to the parent galaxy (Ibata, Gilmore & Irwin 1994, Ibata et al. 1997); there are, however, observations of several galaxies suggesting that the observed morphology is the result of a merging event of a large (parent) galaxy and a minor galaxy in dimensions and mass (e.g., M 101 [Waller et al. 1997]; NGC 7479 [Laine & Heller 1999]; NGC 2110 [Gonzalez Delgado et al. 2002]).
In this paper, we ask the following question: How many galaxy companions are there within a distance of 10 and between 10 and 20 diameters ($D_{25}$) of a given barred galaxy? What Hubble type is each companion galaxy? At what projected distance is the companion galaxy from the barred galaxy under study? For this purpose we have searched for companions, extracted from NED with the following criteria: a) the first and strongest criterium is that their distance was chosen equal or less than 20 diameters from each galaxy in our study; b) for large-scale clouds of galaxies, the systemic velocity of a companion should not differ from that of the barred galaxy in question by more than twice the measured velocity dispersion of the cloud. If the cloud has no measured velocity dispersion, then the velocity difference needs to be less than 300 km s$^{-1}$ as discussed by Tully (1987); c) third, no attention was given to the visible magnitude of the companion. The sample of 78 barred spirals, from the Shapley Ames Catalog, includes 2 SB0, 9 SBa, 1 SBab, 17 SBb, 17 SBbc, 22 SBc, 2 SBd, 3 SBm, 1 SB(r), and 1 SB(late). Of them 1 is Seyfert 1, 10 are Seyfert 2, 1 is Seyfert 2-like, 7 have circumnuclear structures, 11 have peculiar disk morphology (e.g., crooked arms [García-Burillo, Combes & Gerin 1991]), 10 galaxies are not associated with any large scale galaxy sub structure (according to Tully[1987,1988=T88]) and 38 have normal disk morphology; they all are in the distance interval $2.2 \, \text{Mpc} \leq D \leq 53.2 \, \text{Mpc}$. This subset of barred galaxies is not complete to any limiting distance or apparent magnitude, but it is a representative subset of nearby barred spiral galaxies with different Hubble types and members of different cloud or group associations. This sample was originally chosen based on far infrared (IRAS) colors ($\log[f_{12}/f_{25}] \leq -0.15$ and $\log[f_{60}/f_{100}] \leq -0.1$) indicative of central star formation (after Helou 1986) or relatively warm dust (IRAS) temperature, $T_d \geq 29 \, \text{K}$, (García-Barreto et al. 1993, García-Barreto et al. 1996) at $\delta \geq -41$. The study of “bar galaxies and their environment” by van den Bergh (2002) focused in assigning each of all northern Shapley Ames galaxies to either field, group or cluster environment. We believe that our approach has the advantage over van den Bergh’s study by giving a list of names of companions, their Hubble type, systemic velocity and projected distance from 78 Shapley Ames barred galaxies.

Table 1 lists group membership and (cosmological) distances (using $H_0 = 75 \, \text{km s}^{-1} \, \text{Mpc}^{-1}$, T88) and Tables 2 and 3 list the projected linear separations (based on angular distances estimated from NED) to each nearest large scale neighbor galaxy (using systemic velocity information from T88 and NED).

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3A projected distance of 20 $D_{25}$ diameters from a given barred galaxy is somewhat arbitrary; it is a large enough distance in order to have an estimate of companions: for a galaxy with $D_{25} = 3^\prime$ at 40 Mpc, 20 $D_{25}$ would be $\sim 700 \, \text{kpc}$. Bergvall, Laurikainen & Aalto [2003] consider an isolated galaxy as a galaxy having no neighbors (with magnitude difference $\leq 2$ magnitudes) closer than 6 diameters and having no more than 2 neighbors within 16 diameters. Tully[1987] considers an isolated galaxy if there are no companions within 6 Mpc.

4This research has made use of the NASA/IPAC Extragalactic Database (NED) which is operated by the Jet Propulsion Laboratory, California Institute of Technology, under contract with the National Aeronautic and Space Administration.
1.1. Tully’s Group Terminology

Since we refer to the group assignment of each galaxy according to T88, a brief description of his terminology\(^5\) is in order: a) a galaxy is part of a group under the density criterion based on luminosity and distance separation as \(\rho = LR_{ij}^{-3}\), specifically \(\rho_g = 2.5 \times 10^9 L_\odot Mpc^{-3}\); b) galaxies can be associated on two levels, i) at first level there are entities that failed the criterion for a group but passed the criterion for association, \(\rho_g = 2.5 \times 10^8 L_\odot Mpc^{-3}\); ii) at a second level, several groups or first level associations of individual galaxies may link together at densities that satisfy the definition of an association; c) a galaxy is assigned to a structure identified by \(xx\pm yy\pm zz\), where \(xx\) refers to a Cloud or Spur, \(-yy\) refers to a group, \(+yy\) refers to a first level association and \(+zz\) refers to a second level association; d) a galaxy identified with a cloud that is not associated with any substructure would have group assignment \(xx-0\) (i.e. NGC 2525 has group assignment 31-0 in the Antlia-Hydra Cloud); groups and associations within a cloud are numbered in order according to their proximity to the prominent structure within a cloud (e.g., NGC 4477 has a group assignment 11-1 which means it is within the Virgo Cluster, while NGC 1415 has a group assignment 51-4+4 which means that it is a little away from the Fornax Cluster \(\sim 4 \text{ Mpc away}\); e) if a galaxy in the general region \(X\) cannot be associated with any cloud, then it has the group assignment \(xx\pm yy\) where \(yy=-0\) is given if the galaxy is not in a group or association (e.g., NGC 6951 has group assignment 40-0 in the Leo Clouds); f) a galaxy is called isolated if it is farther than 6 Mpc from any high probability member.

Table 1 lists the barred galaxies in our study; the table is divided in five groups, namely, galaxies with Seyfert activity, galaxies having circumnuclear structures, galaxies with peculiar disk morphology, galaxies not associated with any large scale (cloud) substructure as defined by T88 and galaxies with normal disk morphology. Table 2 lists the number of companions extracted from NED according to angular separation and systemic velocity (see below). Table 3 lists a summary of Table 2 with number of companions from every barred galaxy in our study within 10 and between 10 and 20 parent galaxy diameters.

2. RESULTS

Gas flow is a necessary condition for nuclear or central activity, a condition which could be satisfied by a large-scale stellar bar. However evidence linking actual bars to nuclear activity has been weak (Sakamoto et al. 1999, Combes 2000, Sakamoto, Baker & Scoville 2000, Combes 2003, Martini et al. 2003). Observational evidence of (stellar and gas) long tails or optical morphology deformation as of the type of the antennae was shown to be the result of tidal interaction or a recent major merger event (Toomre & Toomre 1972, Rots et al. 1990, Tyson et al. 1998, Salo & Laurikainen 1999a, Salo & Laurikainen 1999b, Hibbard 2000). Numerical simulations indicate that merging of two spiral disks of equal mass might result in a completely different stellar population, for example a galaxy with shells (Hernquist & Spergel 1992). Long exposure optical images of the spiral galaxy NGC 5548 (SA0/a) classified as Seyfert 1.5 shows a long, low surface brightness structure suggesting that its origin could have been the result of a major merger (Tyson et al. 1998).

\(^5\)For a complete description of group terminology please refer to Tully[1987]
Only one of the galaxies in our study presents a large scale long HI tail (Hogg & Roberts 2001), namely NGC 6239, a galaxy not associated with any large scale (cloud) substructure, and no large scale companion within 20 diameters.

Our study identifies companion galaxies only within certain projected distances and having similar systemic velocities as each barred galaxy in our list; true spatial separations remain to be estimated as distances to each individual barred galaxy and companion are determined (see below for M82 system).

Tables 2 and 3 indicate that the one Sy 1 galaxy, NGC 3783, has no large scale companions within a distance of 20 diameters (38° [425 kpc]); 6 out of 10 Sy 2 galaxies have no companions within 10 diameters; 7/10 Sy 2 galaxies have one or no companions and 3/10 Sy 2 galaxies have three or more companions within a separation distance between 10 and 20 diameters; 3 Sy 2 galaxies show circumnuclear structures with no companions within 10 diameters. 1 Sy 2 galaxy has one companions at a distance between 10 and 20 diameters 1 Sy 2 galaxy has four companions at a distance between 10 and 20 diameters. The only Sy 2-like galaxy has no companions within 10 diameters and one companion within a separation distance between 10 and 20 diameters and yet it presents a bipolar radio continuum emission with large scale (12 kpc in diameter) lobes straddling the nucleus (García-Barreto et al. 1998, García-Barreto et al. 2002). From the group of galaxies with circumnuclear structures (CNS), 6 out of 12 have 1 or more companions at distances within 10 diameters and 6/12 have 2 or more companions within a distance between 10 and 20 diameters. From the group of galaxies with peculiar disk morphology (PM), 7/14 have no companions, 4/14 have one companion within 10 diameters; 11/14 have one or no companions and 3/14 have two or more companions within a distance between 10 and 20 diameters. From the group of galaxies not associated with any large scale (cloud) [NA] substructure 10/13 have no companions within 10 diameters, 9/13 have no companions and 4/13 have 1 or more companions within a distance between 10 and 20 diameters. From the group of galaxies with normal disk morphology (ND), 11/38 have no companions, 13/38 have 1 companion and 14/38 have 2 or more companions within 10 diameters, 12/38 have no companions, 10/38 have 1 companion and 16/38 have 2 or more companions within a separation distance between 10 and 20 diameters. Figure 1 shows two histograms one with number of Seyfert 2 galaxies versus number of companions, the other, with galaxies with circumnuclear structures versus number of companions. Figure 2 shows the corresponding histograms for galaxies with peculiar morphology and normal disk morphology. Finally Figure 3 shows the histogram of galaxies not associated with any large scale cloud structure versus the number of companions.

As seen in Table 3 the galaxies with more companions within 20 diameters are NGC 4435 (SB0), NGC 4535 (SBc) and NGC 4654 (SBc) which are in the Virgo cluster of galaxies and present normal disk morphology. The galaxies having circumnuclear structures NGC 1326, NGC 1415, NGC 3351, and NGC 4314, have 7 or more companions within 20 diameters; each of them belongs to a group of galaxies.

As an extension (check) of the method used for finding the companions of barred galaxies we have done a similar search for 4 known spiral galaxies that exhibit different central activity; these galaxies are NGC 1068, NGC 1097, M82 and NGC 5548. These galaxies are listed in Table 4. Companions to these galaxies are listed in Table 5 and a summary of companions to these galaxies within a separation distance less than 10 diameters and between 10 and 20 diameters is in Table 6. NGC 5548 type (R')SA(s)0/a, X-ray emitter and Sy 1.5 galaxy has no companions within 10 diameters and 3 at
projected separations larger than 300 kpc; NGC 1068, Sy 1, has one companion at 43 kpc (10′.2) and two others at projected distances more than 300 kpc; NGC 1097, Sy 1, has one companion at 14 kpc (3′.4) and two others at 195 and 303 kpc; M82, a starburst galaxy, has 6 companions within 10 diameters and 7 more at projected separations from 121 kpc to 204 kpc.

All companions found for our list of barred galaxies are considering projected distances but one must be aware that true spatial distance to companions remain to be determined on a case by case basis; M82 system is a good example when one is considering the question: is the projected separation distance representative of the true spatial distance separation? M82 has, among others, the companions M81 and NGC 3077 at projected separations of only 39 kpc and 73 kpc respectively assuming that M82 is at the cosmological distance of 3.6 Mpc as M81; however, M82 and NGC 3077 previous cosmological distance were estimated to be 5.2 Mpc and 2.1 Mpc, respectively (T88). The detection of HI in the system M81, M82, NGC 3077 (Yun, Ho & Lo 1994) supports the idea that the three galaxies are at the same (cosmological) distance as M81 as determined by HST Cepheids (Freeman et al. 1994); true spatial distances, though, remain to be estimated after cosmological distances to M82 and NGC 3077 are determined individually.

3. CONCLUSIONS

We have made a detailed study of likely physical companions to a sample of 78 nearby barred spirals, initially chosen on the basis of IRAS properties and fairly representative of bright barred spirals. We do not find a strong correlation between the presence of a companion within 10 or 20 projected diameters and nuclear activity in these barred galaxies. Histograms indicate a wide range of companion numbers for each of our subcategories of barred galaxies. Nuclear activity (as Seyfert type) in barred galaxies is not necessarily due to an enhanced presence of companions to these galaxies, a result which is in agreement with other studies indicating that for Seyfert 1 galaxies there is no clear evidence of any excess of companion galaxies within 100 kpc or within 3 diameters (Dultzin-Hacyan et al. 1999); in fact, the only Seyfert 1 galaxy in our study, namely, NGC 3783, has no companions within a projected separation of 20 diameters or 425 kpc. Six out of ten Seyfert 2 galaxies (Seyfert 2 galaxies are thought to have companions within a search radius of 100 kpc [Dultzin-Hacyan et al. 1999]), in our study, have no companions within a projected distance of 10 diameters, three barred Sy 2 galaxies have no companions between 10 and 20 diameters, two barred Sy 2 galaxies have one companion between a distance of 10 and 20 diameters, and one barred Sy 2 galaxy has two companions between 10 and 20 diameters. Finally our study suggests that having a large-scale stellar bar and nearby companions are not sufficient for a spiral galaxy to present nuclear activity: at present it is beyond the scope of this paper to explain why barred galaxies not associated with any large scale cloud of galaxies and therefore no companions do not present nuclear activity as does the only Seyfert 1 in our study, NGC 3783 (which has no companions); or for that matter explain why NGC 4435 or NGC 4535, two barred galaxies with the most number of companions do not present any nuclear activity (in case tidal interactions was an important mechanism). In a forthcoming paper we will present major and minor diameters of large scale stellar bars from 46 nearby bright barred galaxies; this could be another factor for the difference in activity in barred spirals.
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| Galaxy NGC/IC | Hubble Type | Characteristic $^a$ | Tully’s Group $^b$ | Distance Mpc |
|---------------|-------------|---------------------|--------------------|--------------|
| N 3185        | SBa(s)      | Sy 2                | 21-6+6             | 21.3         |
| N 3367        | SBC(s)      | Sy 2-like, CNS, PM  | 32-4+4             | 43.6         |
| N 3783        | SBa(r)      | Sy 1                | 31+11+10           | 38.5         |
| N 4477        | SBa          | Sy 2                | 11-1               | 16.8         |
| N 4507        | SBb(rs)     | Sy 2                | -                  | 45.0         |
| N 4725        | SBb(r)      | Sy 2                | 14-2+1             | 12.4         |
| N 5135        | SBb          | Sy 2, CNS           | -                  | 53.2         |
| N 5347        | SBb(s)      | Sy 2, CNS, NA      | 42-0+1             | 30.7         |
| N 5728        | SBb(s)      | Sy 2, CNS           | 41+15+15           | 42.2         |
| N 6217        | RSBbc(s)    | Sy 2, NA            | 44-0+5             | 23.9         |
| N 6951        | SBb(rs)     | Sy 2, CNS, NA      | 40-0               | 24.1         |
| N 7479        | SBbc(s)     | Sy 2                | 64-2+1             | 32.4         |
| N 1022        | SBa(r)      | CNS                 | 52-1+1             | 18.5         |
| N 1326        | SBa          | CNS                 | 51-1+1             | 16.9         |
| N 1415        | SBa          | CNS                 | 51-4+4             | 17.7         |
| N 3318        | SBbc        | CNS                 | 31-6+6             | 37.9         |
| N 3351        | SBb          | CNS                 | 15-1+1             | 8.1          |
| N 4314        | SBa          | CNS                 | 14-1+1             | 10.0         |
| N 5430        | SBb          | CNS                 | -                  | 38.0         |
| N 3319        | SBc(s)      | PM                  | 15+7               | 11.5         |
| N 1637        | SBc          | PM                  | 53-20+20           | 8.9$^c$      |
| N 2139        | SBc(s)      | PM                  | 34+1               | 22.4         |
| N 2798        | SBa(s)      | PM                  | 21-6+16            | 27.1         |
Table 1: Shapley Ames Barred Spiral Galaxies

| Galaxy NGC/IC | Hubble Type | Characteristic | Tully's Group $^a$ | Distance Mpc |
|---------------|-------------|----------------|-------------------|--------------|
| N 4618        | SBbc(rs)    | PM             | 14-4              | 7.3          |
| N 5534        | SBbc        | PM             | -                 | 35.0         |
| N 5597        | SBc(s)      | PM             | 41-14+14          | 38.6         |
| N 5691        | SBb         | PM             | 41-2+1            | 30.2         |
| N 5757        | SBb(rs)     | PM             | 41+15+15          | 39.5         |
| N 5915        | SBbc(s)     | PM             | 41-10+10          | 33.7         |
| N 6907        | SBbc        | PM             | -                 | 42.0         |
| I 1953        | SBbc        | NA, PM         | 51-0+4            | 22.1         |
| N 2525        | SBc         | NA, PM         | 31-0              | 21.1         |
| N 2787        | SBa(s)      | NA             | 12-0              | 13.0         |
| N 3359        | SBc(s)pec   | NA             | 12-0+1            | 19.2         |
| N 4561        | SBc         | NA             | 11-0+1            | 12.3         |
| N 4691        | SB0         | NA             | 11-0+10           | 22.5         |
| N 5669        | SBc(r)      | NA             | 41-0+1            | 24.9         |
| N 5921        | SBbc(s)     | NA             | 41-0+1            | 25.2         |
| N 6239        | SBc pec     | NA             | 44-0              | 18.9         |
| I 5273        | SBc         | NA, PM         | 61-0+16           | 16.0         |
| N 672         | SBbc(s)     | ND             | 17-5+5            | 7.5          |
| N 1784        | SBbc(r)     | ND             | 34+5+4            | 28.7         |
| N 1832        | SBb(r)      | ND             | 34-3+3            | 23.5         |
| N 2217        | SBa(s)      | ND             | 34-1+1            | 19.5         |
| N 2223        | SBbc(r)     | ND             | 34-8+8            | 33.7         |
| N 2336        | SBbc(r)     | ND             | 42-17+16          | 32.9         |
| N 2339        | SBc(s)      | ND             | 30+1              | 30.9         |
Table 1: Shapley Ames Barred Spiral Galaxies

| Galaxy NGC/IC | Hubble Type | Characteristic $^a$ | Tully's Group $^b$ | Distance Mpc |
|---------------|-------------|---------------------|-------------------|--------------|
| N 2366        | SBm IV      | ND                  | 14-10             | 2.9          |
| N 2545        | SBbc(r)     | ND                  | -                 | (45.1)       |
| N 2835        | SBc(rs)     | ND                  | 54-3+1            | 10.8         |
| N 2935        | SBb(s)      | ND                  | 3-12              | 30.6         |
| N 3287        | SBc(s)      | ND                  | 21-6              | 20.6         |
| N 3504        | SBb(s)      | ND                  | 21-7+7            | 26.5         |
| N 3513        | SBc(s)      | ND                  | 54-5+5            | 17.0         |
| N 3686        | SBc(s)      | ND                  | 21-1              | 23.5         |
| N 3729        | SB(r)       | ND                  | 12-1              | 17.0         |
| N 3912        | SB(late)    | ND                  | 13-9+9            | 30.0         |
| N 3953        | SBbc(r)     | ND                  | 12-1              | 17.0         |
| N 3992        | SBb(rs)     | ND                  | 12-1              | 17.0         |
| N 4123        | SBbc(rs)    | ND                  | 22-11+11          | 25.3         |
| N 4214        | SBm III     | ND                  | 14-7              | 3.5          |
| N 4236        | SBd IV      | ND                  | 14+10             | 2.2          |
| N 4242        | SBd III     | ND                  | 14-4              | 7.5          |
| N 4385        | SBbc(s)     | ND                  | 11-25+24          | 33.5         |
| N 4435        | SB0         | ND                  | 11-1              | 16.8         |
| N 4487        | SBc(s)      | ND                  | 11-14+10          | 19.9         |
| N 4496A       | SBm(rs)     | ND                  | 11-4+1            | 13.1         |
| N 4535        | SBc(s)      | ND                  | 11-1              | 16.8         |
| N 4654        | SBc(rs)     | ND                  | 11-1              | 16.8         |
| N 4688        | SBc(s)      | ND                  | 11+2+1            | 17.1         |
| N 4902        | SBb(s)      | ND                  | 11-30             | 39.2         |
Table 1: Shapley Ames Barred Spiral Galaxies

| Galaxy NGC/IC | Hubble Type | Main Characteristic | Tully’s Group | Distance Mpc |
|---------------|-------------|---------------------|---------------|--------------|
| N 4981        | SBbc(rs)    | ND                  | 11-17+10      | 27.8         |
| N 5068        | SBc(s)      | ND                  | 14+17         | 6.7          |
| N 5792        | SBb(sr)     | ND                  | 41+2+1        | 30.6         |
| N 5850        | SBb(sr)     | ND                  | 41-1          | 28.5         |
| N 7640        | SBc(s)      | ND                  | 65-4          | 8.4          |
| N 7723        | SBb(rs)     | ND                  | 63-6          | 23.7         |
| N 7741        | SBc(s)      | ND                  | 65-3          | 12.3         |

a Main Characteristic: Sy: Seyfert type; CNS: circumnuclear structure; PM: peculiar disk morphology; NA: galaxies not associated with any substructure, according to Tully(1987,1988)[refer to section 1 for a brief description when a galaxy is associated to a group or spur]; ND : normal disk.

b T88; first digit specifies one of seven regions in T88, the second digit identifies a specific cloud within the general region; for a complete description refer to section 1 of this paper and Tully(1987) 11: Virgo cluster; 12: Ursa Major cloud; 13: Ursa Major Southern Spur; 14: Coma I Sculptur cloud; 15: Leo Spur; 17: Triangulum Spur; 21: Leo cloud; 22: Crater cloud; 31: Antlia-Hydra cloud; 32: Cancer Leo cloud; 34: Lepus Cloud; 40: Leo clouds; 41: Virgo Libra cloud; 42: Canes Venatici Camelopardalis cloud; 44: Draco cloud; 51: Fornax cluster and Eridanus cloud; 52: Cetus-Aries cloud; 53: Dorado cloud; 61: Telescopium Grus cloud; 63: Piscis Australis cloud; 64: Pegasus cloud.

c New Cepheid distance has been determined to be 11.7 Mpc (Leonard et al. 2003). This new distance does not modify any of the analysis in this paper.
Table 2: Large Scale Galaxy Nearest Neighbors$^a$

| Galaxy NGC/IC | Characteristic | $V_{sys}^b$ km s$^{-1}$ | $V_c^c$ km s$^{-1}$ | Companion$^d$ | Hubble type | $V_{sys}^e$ km s$^{-1}$ | Separation $^f$ kpc |
|----------------|----------------|-------------------------|---------------------|--------------|-------------|-----------------------|--------------------|
| N 3185         | Sy 2           | 1237                    | 124                 | N3190        | Sa          | 1271                  | 66                 |
|                |                |                         |                     | N3187        | SBC(s)      | 1521                  | 70                 |
|                |                |                         |                     | N3193        | E2          | 1399                  | 98                 |
|                |                |                         |                     | N3177        | SAB(rs)     | 1302                  | 230                |
| N 3367         | Sy 2-like, CNS, PM | 3045                   | 0                   | N3391        | S           | 2956                  | 563                |
| N 3783         | Sy 1           | 2910                    |                     |              |             |                       |                    |
| N 4477         | Sy 2           | 1263                    | 715                 | N4479        | SB0(s)      | 876                   | 25                 |
|                |                |                         |                     | N4473        | E5          | 2244                  | 62                 |
|                |                |                         |                     | N4474        | S0          | 1610                  | 127                |
|                |                |                         |                     | N4461        | SB0(s)      | 1931                  | 150                |
| N 4507         | Sy 2           | 3525                    |                     | N4747        | SBcd        | 1190                  | 87                 |
| N 4725         | Sy 2           | 1210                    |                     | Mrk 1338     | E           | 1069                  | 141                |
|                |                |                         |                     | KVG 1249+263 | Irr         | 1225                  | 146                |
|                |                |                         |                     | N4670        | SB0/a       | 1069                  | 431                |
|                |                |                         |                     | N4565        | Sb(s)       | 1282                  | 694                |
|                |                |                         |                     | UGCA 294     | S0 pec      | 947                   | 701                |
|                |                |                         |                     | N4562        | SBdm(s)     | 1353                  | 728                |
| N 5135         | Sy 2, CNS      | 4157                    |                     | I4248        | E           | 4133                  | 218                |
|                |                |                         |                     | CEN77 09     | Irr         | 4413                  | 224                |
|                |                |                         |                     | N5152        | SBb(s)      | 4147                  | 472                |
|                |                |                         |                     | N5124        | E6          | 3976                  | 476                |
|                |                |                         |                     | N5153        | E1          | 4281                  | 483                |
|                |                |                         |                     | E444-G021    | Sc          | 4265                  | 515                |
|                |                |                         |                     | E444-G030    | Sa          | 4225                  | 670                |
| N 5347         | Sy 2, CNS, NA  | 2386                    |                     |              |             |                       |                    |
| N 5728         | Sy 2, CNS      | 2780                    |                     | N5744        | Sa          | 2692                  | 1190               |
Table 2: Large Scale Galaxy Nearest Neighbors$^a$

| Galaxy NGC/IC | Characteristic | $V_{sys}^b$ km s$^{-1}$ | $V_{\sigma}^c$ km s$^{-1}$ | Companion$^d$ | Hubble type | $V_{sys}^e$ km s$^{-1}$ | Separation $^f$ kpc |
|---------------|----------------|------------------------|------------------------|--------------|-------------|------------------------|------------------|
| N 6217        | Sy 2           | 1359                   |                        |              |             |                        |                  |
| N 6951        | Sy 2, CNS, NA  | 1426                   |                        |              |             |                        |                  |
| N 7479        | Sy 2           | 2384                   | 134                    | U12300       | SBa         | 2294                   | 650              |
|               |                |                        |                        | U12281       | Sd          | 2568                   | 1071             |
| N 1022        | CNS            | 1574                   | 99                     | N 961        | SBm(rs)     | 1300                   | 216              |
|               |                |                        |                        | UGCA 038     | SBm(s)      | 1327                   | 242              |
| N 1326        | CNS            | 1364                   | 434                    | N1326A       | SBm(s)      | 1836                   | 77               |
|               |                |                        |                        | N1326B       | SBm(s)      | 1006                   | 86               |
|               |                |                        |                        | N1316C       | RSA0        | 1800                   | 172              |
|               |                |                        |                        | N1317        | RSAB0(rl)   | 1941                   | 201              |
|               |                |                        |                        | N1316        | RSAB0(s)    | 1760                   | 231              |
|               |                |                        |                        | N1310        | SBed(rs)    | 1805                   | 253              |
|               |                |                        |                        | N1341        | SABab(rs)   | 1813                   | 312              |
| N 1415        | CNS            | 1553                   | 110                    | N1401        | SB0(s)      | 1518                   | 125              |
|               |                |                        |                        | N1426        | E4          | 1443                   | 193              |
|               |                |                        |                        | N1395        | E2          | 1717                   | 227              |
|               |                |                        |                        | N1414        | SBbc(s)     | 1681                   | 262              |
|               |                |                        |                        | N1422        | SBab        | 1637                   | 275              |
|               |                |                        |                        | N1438        | SB0(r)      | 1555                   | 336              |
|               |                |                        |                        | N1439        | E1          | 1670                   | 340              |
| N 3318        | CNS            | 2910                   | 52                     | N3318B       | SBc(s)      | 2756                   | 113              |
|               |                |                        |                        | E318-G003    | Sc          | 2767                   | 521              |
| N 3351        | CNS            | 780                    | 112                    | N3368        | Sab(s)      | 897                    | 99               |
|               |                |                        |                        | CGCG065-086  | dS0         | 778                    | 112              |
|               |                |                        |                        | N3379        | E0          | 911                    | 182              |
|               |                |                        |                        | 1046+1234    |             | 887                    | 186              |
|               |                |                        |                        | N3384        | SB0(s)      | 704                    | 199              |
Table 2: Large Scale Galaxy Nearest Neighbors

| Galaxy NGC/IC | Characteristic | $V_{sys}^b$ km s$^{-1}$ | $V_{c}^c$ km s$^{-1}$ | Companion$^d$ | Hubble type | $V_{sys}^e$ km s$^{-1}$ | Separation $^j$ kpc |
|---------------|----------------|-------------------------|------------------------|---------------|-------------|-------------------|--------------------|
| N 4314        | CNS            | 980                     | 266                    | N3299         | SABdm(s)     | 641               | 297                |
|               |                |                         |                        | N3412         | SB0(s)       | 841               | 340                |
|               |                |                         |                        | N3377         | E6           | 665               | 348                |
|               |                |                         |                        | U7457         | Sc           | 659               | 101                |
|               |                |                         |                        | N4274         | Sa(s)        | 930               | 117                |
|               |                |                         |                        | N4286         | SA0(r)       | 644               | 122                |
|               |                |                         |                        | N4310         | RSAB0(r)     | 913               | 124                |
|               |                |                         |                        | N4283         | E0           | 1076              | 136                |
|               |                |                         |                        | N4278         | E1           | 649               | 145                |
|               |                |                         |                        | I3247         | Sd           | 569               | 182                |
|               |                |                         |                        | N4245         | SBa(s)       | 815               | 199                |
| N 5430        | CNS            | 2960                    |                        | N5402         | S            | 3021              | 385                |
| I 1953        | PM, NA         | 1859                    |                        | E548-G034     | SB           | 1664              | 163                |
|               |                |                         |                        | I1962         | SBdm(s)      | 1806              | 186                |
|               |                |                         |                        | N1377         | S0           | 1792              | 346                |
| N 1637        | PM             | 717                     | 31                     |               |             |                  |                    |
| N 2139        | PM             | 1843                    |                        |               |             |                  |                    |
| N 2525        | PM, NA         | 1585                    |                        |               |             |                  |                    |
| N 2798        | PM             | 1744                    | 124                    | N2799         | SBm(s)       | 1865              | 12                 |
|               |                |                         |                        | KTG 22        | -            | 1799              | 23                 |
|               |                |                         |                        | UGC 04904     | SB           | 1670              | 43                 |
| N 3319        | PM             | 744                     |                        |               |             |                  |                    |
| N 4618        | PM             | 544                     | 58                     | VV 073A       | -            | 562               | 2                  |
|               |                |                         |                        | N4625         | SABm(rs)     | 609               | 17                 |
|               |                |                         |                        | UGC 07751     | Im           | 605               | 153                |
Table 2: Large Scale Galaxy Nearest Neighbors

| Galaxy NGC/IC | Characteristic | \( V^b_{\text{sys}} \) km s\(^{-1} \) | \( V^c_{\sigma} \) km s\(^{-1} \) | Companion\(^d\) | Hubble type | \( V^c_{\text{sys}} \) km s\(^{-1} \) | Separation \( f \) kpc |
|--------------|----------------|-----------------|-----------------|---------------|-------------|-----------------|-----------------|
| N 5534 PM    |                | 2633            |                 | N5595         | SABc(rs)     | 2711            | 46              |
| N 5597 PM    |                | 2683            | 136             | N5705         | Sd           | 300             |                 |
|              |                |                 |                 | N5713         | SABd(rs)     | 1757            | 303             |
| N 5691 PM    |                | 1870            |                 | N5691         | SD:J143\(^g\) |                 |                 |
| N 5757 PM    |                | 2678            |                 | N5915         | SBC          | 2727            | 44              |
|              |                |                 |                 | E580-G034     | SBR          | 2596            | 476             |
| N 5915 PM    |                | 2274            | 90              | N6916         | SBa(rs)      | 2302            | 43              |
|              |                |                 |                 | E580-G029     | SBr          |                 |                 |
| N 6907 PM    |                | 3180            |                 | N6908         | SBC(s)       | 2292            | 45              |
|              |                |                 |                 | I5005         | S           | 3112            | 749             |
| N 2787 NA    |                | 700             |                 | U4998         | Im           | 623             | 222             |
| N 3359 NA    |                | 1018            |                 |               |              |                 |                 |
| N 4561 NA    |                | 1407            |                 |               |              |                 |                 |
| N 4691 NA    |                | 1098            |                 |               |              |                 |                 |
| N 5669 NA    |                | 1371            |                 | KUG142        | BCD          | 1382            | 44              |
| N 5921 NA    |                | 1480            |                 | N5921: [KSF97]B |              | 1532            | 15              |
| N 6239 NA    |                | 922             |                 |               |              |                 |                 |
| I 5273 NA, PM|                | 1320            |                 | E406-G040     | Irr          | 1248            | 150             |
|              |                |                 |                 | E406-G042     | SABnm(s)     | 1375            | 232             |
|              |                |                 |                 | N7418         | Sc(rs)       | 1446            | 247             |
Table 2: Large Scale Galaxy Nearest Neighbors

| Galaxy  | Characteristic | $V_{sys}^{b}$ km s$^{-1}$ | $V_{e}^{c}$ km s$^{-1}$ | Companion$^{d}$ | Hubble type | $V_{sys}^{e}$ km s$^{-1}$ | Separation $^{f}$ kpc |
|---------|----------------|--------------------------|--------------------------|----------------|-------------|--------------------------|---------------------|
| N 0672  | ND             | 408                      | 57                       | [HKK97] L010  | Irr         | 338                      | 18                  |
|         |                |                          |                          | LE166062      | Irr         | 368                      | 90                  |
|         |                |                          |                          | ED F476-08    | Irr         | 420                      | 95                  |
| N 1784  | ND             | 2316                     | -                        | F0523         | Sd          | 2358                     | 278                 |
| N 1832  | ND             | 1938                     | 58                       | M-02-14-002   | Sb          | 1970                     | 361                 |
| N 2217  | ND             | 1612                     | 93                       | E426-G001     | Sb          | 1804                     | 111                 |
|         |                |                          |                          | UA126         | Sb          | 1696                     | 351                 |
| N 2223  | ND             | 2718                     | -                        | E489-G050     | S0          | 2892                     | 143                 |
|         |                |                          |                          | N2216         | SABab(r)    | 2871                     | 610                 |
| N 2336  | ND             | 2204                     | 111                      | I0467         | SABc(s)     | 2042                     | 199                 |
|         |                |                          |                          | U03604        | S           | 2158                     | 753                 |
|         |                |                          |                          | U04103        | Sd          | 2133                     | 1000                |
|         |                |                          |                          | U03671        | dIr         | 2292                     | 1140                |
| N 2339  | ND             | 2261                     | -                        | 2MASXJ07$^{g}$| S           | 2256                     | 62                  |
| N 2366  | ND             | 100                      | 108                      | N2363         | Irr         | 70                       | 0.8                 |
| N 2545  | ND             | 3384                     | 88                       | UA162         | IBm(s)      | 850                      | 157                 |
| N 2835  | ND             | 890                      | 68                       | N3301         | RSBA(rs)    | 1321                     | 197                 |
| N 2935  | ND             | 2276                     | 168                      | N3512         | SABC(rs)    | 1376                     | 92                  |
| N 3287  | ND             | 1307                     | 124                      | N3511         | SABC(s)     | 1106                     | 53                  |
| N 3504  | ND             | 1540                     | 95                       | N3511         | SABC(s)     | 1106                     | 53                  |
| N 3513  | ND             | 1194                     | 62                       | N3684         | SABC(rs)    | 1163                     | 95                  |
| N 3686  | ND             | 1157                     | 220                      | N3691         | Sb          | 1085                     | 131                 |
|         |                |                          |                          | N3681         | SABbc(r)    | 1239                     | 191                 |
|         |                |                          |                          | LSBC D570-02  | Ir          | 1208                     | 270                 |
|         |                |                          |                          | LSBC D570-01  | Sm          | 1019                     | 286                 |
|         |                |                          |                          | [RC3]112$^{g}$| Ir          | 1067                     | 388                 |
Table 2: Large Scale Galaxy Nearest Neighbors

| Galaxy | Characteristic | $V_{sys}^a$ km s$^{-1}$ | $V_{sys}^b$ km s$^{-1}$ | Companion$^d$ | Hubble type | $V_{sys}^c$ km s$^{-1}$ | Separation$^d$ kpc |
|--------|----------------|-----------------|-----------------|--------------|-------------|-----------------|-----------------|
| N 3729 | ND             | 1064            | 148             | N3718        | SBa(s)      | 993             | 57              |
| N 3912 | ND             | 1789            | 0               | US:U422      | Scd         | 1824            | 153             |
|        |                |                 |                 | U06791       | Scd         | 1852            | 159             |
| N 3953 | ND             | 1047            | 148             | U06840       | SBm(rs)     | 1046            | 101             |
|        |                |                 |                 | N3917A       | SA0         | 837             | 152             |
|        |                |                 |                 | N3917        | SAcd        | 965             | 204             |
|        |                |                 |                 | U06802       | Sd          | 1256            | 219             |
|        |                |                 |                 | SB1147$^g$   |            | 1257            | 250             |
|        |                |                 |                 | U06983       | SBcd(rs)    | 1082            | 265             |
|        |                |                 |                 | U06923       | Im          | 1062            | 281             |
|        |                |                 |                 | U06940       | Scd         | 1118            | 322             |
|        |                |                 |                 | N3992        | SBbc(rs)    | 1048            | 353             |
|        |                |                 |                 | U06969       | Im          | 1119            | 393             |
|        |                |                 |                 | U06956       | SBm(s)      | 917             | 468             |
|        |                |                 |                 | U06922       | Scd         | 877             | 469             |
|        |                |                 |                 | N4026        | S0          | 930             | 479             |
|        |                |                 |                 | U06667       | Scd         | 973             | 563             |
|        |                |                 |                 | U06917       | SBm         | 911             | 576             |
|        |                |                 |                 | N4102        | SABb(s)     | 846             | 577             |
|        |                |                 |                 | N3922        | S0/a        | 906             | 655             |
|        |                |                 |                 | U06849       | Sm          | 995             | 681             |
Table 2: Large Scale Galaxy Nearest Neighbors

| Galaxy NGC/IC | Characteristic | $V_{sys}^b$ km s$^{-1}$ | $V_{c}^c$ km s$^{-1}$ | Companion$^d$ | Hubble type | $V_{sys}^e$ km s$^{-1}$ | Separation $^f$ kpc |
|---------------|----------------|-------------------------|------------------------|--------------|-------------|------------------------|-------------------|
| N 3992        | ND             | 1053                    | 148                    | U06940       | Scd         | 1118                   | 43                |
|               |                |                         |                        | U06969       | Im          | 1119                   | 54                |
|               |                |                         |                        | U06923       | Im          | 1062                   | 72                |
|               |                |                         |                        | U06983       | SBcd(rs)    | 1082                   | 209               |
|               |                |                         |                        | N3953        | SBbc(r)     | 1047                   | 354               |
|               |                |                         |                        | U06894       | Scd         | 849                    | 392               |
|               |                |                         |                        | N4102        | SABb(s)     | 846                    | 438               |
|               |                |                         |                        | U06840       | SBm(rs)     | 1046                   | 449               |
|               |                |                         |                        | N3917A       | SA0         | 837                    | 498               |
|               |                |                         |                        | N3982        | SABb(r)     | 1109                   | 521               |
|               |                |                         |                        | N4142        | SBd(s)      | 1157                   | 534               |
|               |                |                         |                        | N3917        | SAc(d)      | 965                    | 553               |
|               |                |                         |                        | U06802       | Sd          | 1256                   | 562               |
|               |                |                         |                        | N3972        | SAbc(s)     | 852                    | 582               |
|               |                |                         |                        | SB1147$^g$   |             | 1257                   | 597               |
|               |                |                         |                        | N3998        | SA0(r)      | 1040                   | 616               |
|               |                |                         |                        | N3913        | RSAd(rs)    | 954                    | 659               |
|               |                |                         |                        | U06919       | Sdm         | 1357                   | 670               |
|               |                |                         |                        | N4026        | S0          | 930                    | 720               |
|               |                |                         |                        | U06956       | SBm(s)      | 917                    | 730               |
|               |                |                         |                        | SB1211$^g$   |             | 907                    | 732               |
| N 4123        | ND             | 1327                    | 0                      | N4116        | SBdm(rs)    | 1309                   | 102               |
|               |                |                         |                        | U07185       | SAM(rs)     | 1296                   | 359               |
|               |                |                         |                        | U07178       | IABm(rs)    | 1339                   | 496               |
|               |                |                         |                        | U07035       | SBa(r)      | 1232                   | 507               |
Table 2: Large Scale Galaxy Nearest Neighbors

| Galaxy | Characteristic | $V_{sys}^b$ (km s$^{-1}$) | $V_{c}^c$ (km s$^{-1}$) | Companion$^d$ | Hubble type | $V_{sys}^e$ (km s$^{-1}$) | Separation$^f$ (kpc) |
|--------|----------------|--------------------------|--------------------------|---------------|-------------|--------------------------|-----------------------|
| N 4214 | ND             | 291                      | 51                       | US:U480 NED29 | Im          | 268                      | 0.1                   |
|        |                |                           |                          |               |             |                          |                       |
|        |                |                           |                          | N4190         | Im          | 228                      | 30                    |
|        |                |                           |                          | KUG1207$^g$   | S           | 339                      | 70                    |
|        |                |                           |                          | N4244         | SAcd(s)     | 244                      | 93                    |
|        |                |                           |                          | U07559        | IBm         | 218                      | 149                   |
|        |                |                           |                          | U07605        | Im          | 309                      | 165                   |
|        |                |                           |                          | U07599        | Sm          | 278                      | 167                   |
| N 4236 | ND             | 5                        |                          | IRAS1214$^g$  |             | 95                       | 2                     |
|        |                |                           |                          | U07242        | Scd         | 68                       | 130                   |
|        |                |                           |                          | U08201        | Im          | 37                       | 187                   |
| N 4242 | ND             | 518                      | 58                       | U07408        | IAm         | 462                      | 89                    |
|        |                |                           |                          | U07320        | dS0         | 521                      | 106                   |
|        |                |                           |                          | N4288         | SBdm(s)     | 535                      | 113                   |
| N 4385 | ND             | 2150                     | 55                       | DDO121        | IBm(s)      | 2061                     | 219                   |
| N 4435 | ND             | 725                      | 715                      | I3355         | Im          | 162                      | 64                    |
|        |                |                           |                          | VCC0967       | dE4         | 1135                     | 76                    |
|        |                |                           |                          | I3393         | dE          | 476                      | 87                    |
Table 2: Large Scale Galaxy Nearest Neighbors

| Galaxy | Characteristic | $V_{sys}^{b}$ km s$^{-1}$ | $V_{\sigma}^{c}$ km s$^{-1}$ | Companion$^{d}$ | Hubble type | $V_{sys}^{e}$ km s$^{-1}$ | Separation$^{f}$ kpc |
|--------|----------------|---------------------------|-----------------------------|----------------|-------------|--------------------------|---------------------|
| N4458  | E0             | 635                       | 113                         |                |             |                          |                     |
| N4402  | Sb             | 232                       | 110                         |                |             |                          |                     |
| VCC0916| dE             | 1115                      | 126                         |                |             |                          |                     |
| VCC0872| dE0            | 1183                      | 128                         |                |             |                          |                     |
| VCC0833| dE0            | 720                       | 138                         |                |             |                          |                     |
| VCC0854| dE8            | 684                       | 153                         |                |             |                          |                     |
| I3363  | dE7            | 790                       | 158                         |                |             |                          |                     |
| N4387  | E5             | 561                       | 161                         |                |             |                          |                     |
| VCC1001| I              | 338                       | 187                         |                |             |                          |                     |
| VCC0765| dE1            | 854                       | 191                         |                |             |                          |                     |
| I3349  | dE1            | 1563                      | 192                         |                |             |                          |                     |
| M84    | E1             | 1060                      | 194                         |                |             |                          |                     |
| M87    | E0             | 500                       | 223                         |                |             |                          |                     |
| N4440  | SBa(rs)        | 724                       | 230                         |                |             |                          |                     |
| N4431  | SA0(r)         | 934                       | 231                         |                |             |                          |                     |
| N4477  | SB0(s)         | 1355                      | 234                         |                |             |                          |                     |
| ARK363 | dS0            | 125                       | 235                         |                |             |                          |                     |
| N4479  | SB0(s)         | 876                       | 237                         |                |             |                          |                     |
| VCC0823| dE             | 1691                      | 267                         |                |             |                          |                     |
| N4486B | cE0            | 1555                      | 267                         |                |             |                          |                     |
| VCC0684| dE             | 537                       | 270                         |                |             |                          |                     |
| N4476  | SA0(r)         | 1970                      | 271                         |                |             |                          |                     |
Table 2: Large Scale Galaxy Nearest Neighbors

| Galaxy  | Characteristic | $V_{sys}$ | $V_c$ | Companion | Hubble Type | $V_{sys}$ | Separation |
|---------|----------------|-----------|-------|-----------|-------------|-----------|------------|
| NGC/IC  |                | km s$^{-1}$ | km s$^{-1}$ |           |             | km s$^{-1}$ | kpc        |
| N 4487  | ND             | 1037      | 106   | N4504     | SAcd(s)     | 1003      | 200        |
|         |                |           |       | UA289     | SABdm(s)    | 991       | 396        |
| N 4496A | ND             | 1732      | 124   | VCC0985   | BCD         | 1638      | 260        |
|         |                |           |       | I3474     | Sd          | 1727      | 297        |
| N 4535  | ND             | 1956      | 715   | VCC1514   | dE7         | 532       | 109        |
|         |                |           |       | U07688    | Im          | 609       | 138        |
|         |                |           |       | N4519A    | dS0         | 1434      | 159        |
|         |                |           |       | VCC1455   | I           | 1340      | 163        |
|         |                |           |       | VCC1675   | S           | 1795      | 168        |
|         |                |           |       | N4492     | SAa(s)      | 1774      | 245        |
|         |                |           |       | N4488     | SB0(s)      | 980       | 257        |
|         |                |           |       | VCC1725   | Sm III      | 1067      | 265        |
|         |                |           |       | N4522     | SBcd(s)     | 2330      | 291        |
|         |                |           |       | VCC1596   | I           | 1286      | 294        |
|         |                |           |       | U07802    | Sdm         | 1788      | 305        |
|         |                |           |       | I3521     | SBm pec     | 595       | 306        |
| VIII ZW 189 |            |           |       |           |             |           |            |
|         |                |           |       | VIII ZW 189 |            |           |            |
|         |                |           |       | UA284     | E           | 1155      | 314        |
| N4570   | S0(7)/E       | 1730      |       |           |             |           |            |
| M49     | E2            | 997       |       |           |             |           |            |
| VCC1199 | E2            | 900       |       |           |             |           |            |
| N4471   | E             | 809       |       |           |             |           |            |
| N4467   | E2            | 1426      |       |           |             |           |            |
| N4483   | SB0(s)        | 875       |       |           |             |           |            |
Table 2: Large Scale Galaxy Nearest Neighbors

| Galaxy | Characteristic | $V_{sys}$ | $V_{q}$ | Companion$^d$ | Hubble type | $V_{sys}$ | Separation | km s$^{-1}$ | km s$^{-1}$ | km s$^{-1}$ | km s$^{-1}$ |
|--------|----------------|-----------|---------|--------------|-------------|-----------|------------|-------------|-------------|-------------|-------------|
| N4470  | Sa             | 2340      |         |              |             |           |            | 359         |             |             |             |
| I3487  | E6             | 1157      |         |              |             |           |            | 361         |             |             |             |
| N4464  | E3             | 1243      |         |              |             |           |            | 362         |             |             |             |
| I3617  | SBm III        | 2088      |         |              |             |           |            | 375         |             |             |             |
| N4466  | Sab            | 753       |         |              |             |           |            | 380         |             |             |             |
| I3430  | Im III         | 2015      |         |              |             |           |            | 393         |             |             |             |
| I3518  | dS0            | 1440      |         |              |             |           |            | 418         |             |             |             |
| I3591  | SBm III        | 1632      |         |              |             |           |            | 422         |             |             |             |
| N4598  | SB0            | 1961      |         |              |             |           |            | 429         |             |             |             |
| VCC1357| I              | 603       |         |              |             |           |            | 431         |             |             |             |
| U07596 | Im             | 560       |         |              |             |           |            | 438         |             |             |             |
| N4578  | SA0(r)         | 2273      |         |              |             |           |            | 459         |             |             |             |
| U07590 | Sbc            | 1117      |         |              |             |           |            | 464         |             |             |             |
| U07580 | S0(4)          | 716       |         |              |             |           |            | 467         |             |             |             |
| N4434  | E0             | 1071      |         |              |             |           |            | 488         |             |             |             |
| I3576  | Sm             | 1075      |         |              |             |           |            | 491         |             |             |             |
| N4532  | IBm            | 2012      |         |              |             |           |            | 507         |             |             |             |
| N4451  | Sbc            | 864       |         |              |             |           |            | 515         |             |             |             |
| VCC1804| Im             | 1898      |         |              |             |           |            | 523         |             |             |             |
| I3562  | Im III         | 2051      |         |              |             |           |            | 523         |             |             |             |
| U07567 | Im             | 867       |         |              |             |           |            | 524         |             |             |             |
| VCC1164| E              | 1040      |         |              |             |           |            | 525         |             |             |             |
| VCC1141| BCD            | 1040      |         |              |             |           |            | 532         |             |             |             |
| VCC0989| S              | 1846      |         |              |             |           |            | 535         |             |             |             |
Table 2: Large Scale Galaxy Nearest Neighbors

| Galaxy | Characteristic | $V_{sys}^b$ km s$^{-1}$ | $V_{e}^c$ km s$^{-1}$ | Companion Type | Hubble type | $V_{sys}^e$ km s$^{-1}$ | Separation $J$ kpc |
|--------|----------------|--------------------------|-----------------------|----------------|-------------|--------------------------|------------------|
| I3414  | SABdm          | 543                      |                       |                |             |                          |                  |
| VCC1617| dS0            | 1607                     |                       |                |             |                          |                  |
| N4416  | SBcd(rs)       | 1392                     |                       |                |             |                          |                  |
| Holm VII | Im            | 2039                     |                       |                |             |                          |                  |
| N4415  | S0             | 910                      |                       |                |             |                          |                  |
| VCC1822| Im             | 1012                     |                       |                |             |                          |                  |
| N4411b | SABcd(s)       | 1270                     |                       |                |             |                          |                  |
| N4612  | RSAB0          | 1875                     |                       |                |             |                          |                  |
| VCC0888| I              | 1096                     |                       |                |             |                          |                  |
| U07557 | Sm             | 933                      |                       |                |             |                          |                  |
| N4623  | SB0            | 1892                     |                       |                |             |                          |                  |
| VCC1013| I              | 1712                     |                       |                |             |                          |                  |
| N4411  | SBc(rs)        | 1281                     |                       |                |             |                          |                  |
| VCC0867| I              | 1304                     |                       |                |             |                          |                  |
| N4543  | E3             | 2464                     |                       |                |             |                          |                  |
| I3602  | dE6            | 1279                     |                       |                |             |                          |                  |
| I3468  | E1             | 1288                     |                       |                |             |                          |                  |
| I3412  | I              | 764                      |                       |                |             |                          |                  |
| VCC1744| BCD            | 1150                     |                       |                |             |                          |                  |
| N4422  | SB0(s)         | 532                      |                       |                |             |                          |                  |
| VCC1952| Im IV          | 1308                     |                       |                |             |                          |                  |
Table 2: Large Scale Galaxy Nearest Neighbors

| Galaxy | Characteristic | $V_{sys}^b$ km s$^{-1}$ | $V_{sys}^c$ km s$^{-1}$ | Companion$^d$ | Hubble type | $V_{sys}^e$ km s$^{-1}$ | Separation $^f$ kpc |
|--------|----------------|--------------------------|--------------------------|--------------|-------------|--------------------------|----------------------|
| VCC1605 | S              | 1077                     |                         |              |             |                          | 638                  |
| VCC1661 | dE0            | 1400                     |                         |              |             |                          | 658                  |
| VCC1933 | S              | 2409                     |                         |              |             |                          | 661                  |
| N4417   | SB0            | 843                      |                         |              |             |                          | 678                  |
| VCC1896 | dSB0           | 1731                     |                         |              |             |                          | 683                  |
| I3322A  | SBcd(s)        | 995                      |                         |              |             |                          | 690                  |
| VCC1993 | E0             | 875                      |                         |              |             |                          | 57                   |
| N4639   | SABbc(rs)      | 1010                     |                         |              |             |                          | 85                   |
| VCC1941 | dE1            | 1213                     |                         |              |             |                          | 93                   |
| VCC1931 | I              | 1100                     |                         |              |             |                          | 99                   |
| N4659   | S0/a           | 510                      |                         |              |             |                          | 116                  |
| I3742   | SBC(s)         | 963                      |                         |              |             |                          | 128                  |
| N4620   | S0             | 1156                     |                         |              |             |                          | 149                  |
| I3735   | E              | 1895                     |                         |              |             |                          | 193                  |
| I3718   | S              | 849                      |                         |              |             |                          | 234                  |
| N4640   | dS0            | 1931                     |                         |              |             |                          | 255                  |
| I3635   | dE             | 1517                     |                         |              |             |                          | 275                  |
| U07906  | Im IV          | 1010                     |                         |              |             |                          | 296                  |
| VCC1886 | dE5            | 1159                     |                         |              |             |                          | 305                  |
| N4641   | S0             | 2017                     |                         |              |             |                          | 320                  |
| N4689   | SAbc(rs)       | 1616                     |                         |              |             |                          | 330                  |
| 2MASXJ124$^g$ | S0 | 1159         |                         |              |             |                          | 305                  |
| VCC1816 | Im IV          | 1006                     |                         |              |             |                          | 342                  |
| N4634   | SBcd           | 297                      |                         |              |             |                          | 354                  |
Table 2: Large Scale Galaxy Nearest Neighbors$^a$

| Galaxy | Characteristic | $V_{sys}^b$ km s$^{-1}$ | $V_{sys}^c$ km s$^{-1}$ | Companion$^d$ | Hubble type | $V_{sys}^e$ km s$^{-1}$ | Separation $^f$ kpc |
|--------|----------------|--------------------------|--------------------------|--------------|-------------|--------------------------|------------------|
| NGC/IC |                |                          |                          |              |             |                          |                  |
| I3779  | dE5            | 1193                     | 372                      |              |             |                          |                  |
| N4633  | SABdm(s)       | 291                      | 373                      |              |             |                          |                  |
| N4584  | SABa(s)        | 1779                     | 403                      |              |             |                          |                  |
| N4607  | SBb            | 2257                     | 413                      |              |             |                          |                  |
| N4606  | SBA(s)         | 1664                     | 415                      |              |             |                          |                  |
| I0809  | E              | 206                      | 422                      |              |             |                          |                  |
| N4647  | SABc(rs)       | 1422                     | 453                      |              |             |                          |                  |
| M59    | E5             | 410                      | 454                      |              |             |                          |                  |
| M60    | E2             | 1117                     | 461                      |              |             |                          |                  |
| N 4688 | ND             | 981                      |                          |              |             |                          |                  |
|        | CGCG043-029    |                          |                          |              |             |                          |                  |
|        | I              | 1051                     | 32                       |              |             |                          |                  |
|        | CGCG043-030    |                          |                          |              |             |                          |                  |
|        | I              | 1040                     | 108                      |              |             |                          |                  |
|        | U07983         |                          |                          |              |             |                          |                  |
|        | Im             | 694                      | 210                      |              |             |                          |                  |
| N 4701 | SAc(s)         | 723                      | 302                      |              |             |                          |                  |
| N 4902 | ND             | 2621                     | 74                       |              |             |                          |                  |
|        | N4887          |                          |                          |              |             |                          |                  |
|        | S0 pec         | 2687                     | 117                      |              |             |                          |                  |
|        | N4899          |                          |                          |              |             |                          |                  |
|        | SBc(rs)        | 2658                     | 389                      |              |             |                          |                  |
|        | PGC0451114     |                          |                          |              |             |                          |                  |
|        | I              | 2612                     | 443                      |              |             |                          |                  |
|        | PGC045101      |                          |                          |              |             |                          |                  |
|        | I              | 2555                     | 440                      |              |             |                          |                  |
| N 4981 | ND             | 1677                     | 106                      |              |             |                          |                  |
| N 5068 | ND             | 671                      |                          |              |             |                          |                  |
| N 5792 | ND             | 1924                     |                          |              |             |                          |                  |
|        | CGCG020-040    |                          |                          |              |             |                          |                  |
|        | U09601         |                          |                          |              |             |                          |                  |
|        | SBCd(s)        | 1901                     | 218                      |              |             |                          |                  |
|        | U09682         |                          |                          |              |             |                          |                  |
|        | SBm(s)         | 1839                     | 325                      |              |             |                          |                  |
|        | Mrk1390        |                          |                          |              |             |                          |                  |
|        | S              | 1756                     | 826                      |              |             |                          |                  |
|        | 2MASXJ1457$^g$ |                          |                          |              |             |                          |                  |

$^a$ Table adapted from Table 2 of the original document.
Table 2: Large Scale Galaxy Nearest Neighbors

| Galaxy | Characteristic | \( V_{\text{sys}}^b \) | \( V_{\sigma}^c \) | Companion\(^d\) | Hubble type | \( V_{\text{sys}}^e \) | Separation \( \ell \) |
|--------|----------------|----------------|----------------|----------------|-------------|----------------|----------------|
| N 5850 | ND             | 2558           | 344            | N5846A         | cE2-3       | 2201          | 83             |
|        |                 |                |                | CGCG021-015    |             | 2148          | 130            |
|        |                 |                |                | CGCG021-011    | S           | 2035          | 150            |
|        |                 |                |                | N5846:62\(^g\) |             | 2222          | 168            |
|        |                 |                |                | N5846:39\(^g\) |             | 2133          | 222            |
|        |                 |                |                | N5846:33\(^g\) |             | 2303          | 241            |
|        |                 |                |                | CGCG021-009    |             | 1970          | 242            |
|        |                 |                |                | N5846:28\(^g\) |             | 1966          | 326            |
|        |                 |                |                | N5846:49\(^g\) |             | 2377          | 329            |
|        |                 |                |                | N5846:17\(^g\) |             | 2002          | 497            |
|        |                 |                |                | U09760         | Sd          | 2023          | 614            |
|        |                 |                |                | N5869          | S0          | 2087          | 631            |
|        |                 |                |                | SD:J1506\(^g\) |             | 2019          | 665            |
| N 7640 | ND             | 374            | 29             | U12588         | Sdm         | 415           | 103            |
|        |                 |                |                | U12632         | Sm          | 422           | 220            |
| N 7723 | ND             | 1861           | 0              | MCG0260\(^g\)  | SBd(rs)     | 1944          | 255            |
|        |                 |                |                | N7727          | SABa(s)     | 1855          | 293            |
|        |                 |                |                | N7724          | RSBB(r)     | 1927          | 305            |
Table 2: Large Scale Galaxy Nearest Neighbors

| Galaxy | Characteristic | $V_{sys}^b$ | $V_{q}^c$ | Companion$^d$ | Hubble type | $V_{sys}^e$ | Separation$^f$ |
|--------|----------------|------------|----------|--------------|-------------|------------|-------------|
| NGC/IC |                | km s$^{-1}$| km s$^{-1}$|              | km s$^{-1}$ | km s$^{-1}$| kpc         |
| N 7741 | ND             | 753        | 20       | U12791       | im          | 792        | 241         |

$^a$ Extracted from NED (angular separation and systemic velocity) and T88 (members of groups).
$^b$ Systemic velocity from HI observations (Huchtmeier & Richter 1989).
$^c$ Probable velocity dispersion of galaxies in cloud or group (Tully 1987).
$^d$ Nomenclature according to catalog, E:ESO; ED:ESOD; F:FGC; I:IC; LE: LEDA; M:MCG; N:NGC; SB:SBS; SD:SDSS; U:UGC; UA:UGCA; US: USGC
$^e$ Systemic velocity of companion.
$^f$ Calculated from angular separation (from NED) and distance.
$^g$ IRAS1214: IRAS 12140+6947; KUG1207: KUG 1207+367; MCG0260: MCG-02-60-010; N5846:XX: NGC 5846[ZM98]00XX; [RC3]112: [RC3]1127.3+1642; SB1147: SBS 1147+520; SB1211: SBS 1211+540; SD:J143: SDSS J143950.03-004222.9; SD:J1506: SDSS J150634.25+001255.7; 2MASXJ07: 2MASX J07084902+1845271; 2MASXJ12: 2MASX J12412460+1210328; 2MASXJ1457: 2MASX J14575308+0056035;
$^h$ Separation estimated from angular separation on the plane of the sky (from NED) but without redshift or systemic velocity information of NGC 6908; alignment is probably a chance superposition since the Hα image from NGC 6907 shows no emission from NGC 6908 (García-Barreto et al. 1996).
| Galaxy NGC/IC | Characteristic       | Companions at $d \leq 10D^a$ | Companions at $10D \leq d \leq 20D^b$ |
|--------------|----------------------|-------------------------------|-------------------------------------|
| N 3185       | Sy 2                 | 3                             | 1                                   |
| N 3367       | Sy 2-like, CNS, PM   | 0                             | 1                                   |
| N 3783       | Sy 1                 | 0                             | 0                                   |
| N 4477       | Sy 2                 | 4                             | 0                                   |
| N 4507       | Sy 2                 | 0                             | 1                                   |
| N 4725       | Sy 2                 | 3                             | 4                                   |
| N 5135       | Sy 2, CNS            | 2                             | 5                                   |
| N 5347       | Sy 2, CNS, NA        | 0                             | 0                                   |
| N 5728       | Sy 2, CNS            | 0                             | 0                                   |
| N 6217       | Sy 2, NA             | 0                             | 0                                   |
| N 6951       | Sy 2, CNS, NA        | 0                             | 1                                   |
| N 7479       | Sy 2                 | 0                             | 2                                   |
| N 1022       | CNS                  | 0                             | 2                                   |
| N 1326       | CNS                  | 3                             | 4                                   |
| N 1415       | CNS                  | 2                             | 5                                   |
| N 3318       | CNS                  | 1                             | 1                                   |
| N 3351       | CNS                  | 2                             | 6                                   |
| N 4314       | CNS                  | 5                             | 4                                   |
| N 5430       | CNS                  | 0                             | 1                                   |
| N 1637       | PM                   | 0                             | 0                                   |
| N 2798       | PM                   | 2                             | 1                                   |
| N 3319       | PM                   | 0                             | 0                                   |
| N 4618       | PM                   | 2                             | 1                                   |
Table 3: Companions within 10 and 20 diameters

| Galaxy NGC/IC | Characteristic | Companions at $d \leq 10D^a$ | Companions at $10D \leq d \leq 20D^b$ |
|---------------|----------------|-------------------------------|----------------------------------------|
| N 5534        | PM             | 0                             | 0                                      |
| N 5597        | PM             | 1                             | 0                                      |
| N 5691        | PM             | 0                             | 3                                      |
| N 5757        | PM             | 1                             | 1                                      |
| N 5915        | PM             | 2                             | 0                                      |
| N 6907        | PM             | 1                             | 1                                      |
| I 1953        | NA, PM         | 1                             | 2                                      |
| N 2525        | NA, PM         | 0                             | 0                                      |
| N 2787        | NA             | 0                             | 1                                      |
| N 3359        | NA             | 0                             | 0                                      |
| N 4561        | NA             | 0                             | 0                                      |
| N 4691        | NA             | 0                             | 0                                      |
| N 5669        | NA             | 1                             | 0                                      |
| N 5921        | NA             | 1                             | 0                                      |
| N 6239        | NA             | 0                             | 0                                      |
| IC 5273       | NA, PM         | 0                             | 3                                      |
| N 0672        | ND             | 4                             | 0                                      |
| N 1784        | ND             | 1                             | 0                                      |
| N 1832        | ND             | 0                             | 1                                      |
| N 2217        | ND             | 1                             | 1                                      |
| N 2223        | ND             | 1                             | 1                                      |
| N 2336        | ND             | 1                             | 3                                      |
| N 2339        | ND             | 1                             | 0                                      |
Table 3: Companions within 10 and 20 diameters

| Galaxy | Characteristic | Companions at $d \leq 10D^a$ | Companions at $10D \leq d \leq 20D^b$ |
|--------|----------------|-----------------------------|--------------------------------------|
| N 2366 | ND             | 1                           | 0                                    |
| N 2545 | ND             | 0                           | 0                                    |
| N 2835 | ND             | 1                           | 0                                    |
| N 2935 | ND             | 0                           | 0                                    |
| N 3287 | ND             | 0                           | 1                                    |
| N 3504 | ND             | 1                           | 0                                    |
| N 3513 | ND             | 1                           | 0                                    |
| N 3686 | ND             | 3                           | 3                                    |
| N 3729 | ND             | 1                           | 0                                    |
| N 3912 | ND             | 0                           | 2                                    |
| N 3953 | ND             | 8                           | 10                                   |
| N 3992 | ND             | 5                           | 16                                   |
| N 4123 | ND             | 1                           | 3                                    |
| N 4214 | ND             | 4                           | 4                                    |
| N 4236 | ND             | 2                           | 1                                    |
| N 4242 | ND             | 2                           | 1                                    |
| N 4385 | ND             | 0                           | 1                                    |
| N 4435 | ND             | 7                           | 19                                   |
| N 4487 | ND             | 1                           | 1                                    |
| N 4496A| ND             | 0                           | 2                                    |
| N 4535 | ND             | 16                          | 57                                   |
| N 4654 | ND             | 9                           | 18                                   |
| N 4688 | ND             | 2                           | 2                                    |
| N 4902 | ND             | 1                           | 3                                    |
Table 3: Companions within 10 and 20 diameters

| Galaxy | Characteristic | Companions at $d \leq 10D^a$ | Companions at $10D \leq d \leq 20D^b$ |
|--------|----------------|-------------------------------|----------------------------------------|
| N 4981 | ND             | 0                             | 1                                      |
| N 5068 | ND             | 0                             | 0                                      |
| N 5792 | ND             | 2                             | 3                                      |
| N 5850 | ND             | 9                             | 4                                      |
| N 7640 | ND             | 2                             | 0                                      |
| N 7723 | ND             | 0                             | 3                                      |
| N 7741 | ND             | 0                             | 1                                      |

$^a$ Companions within a distance separation less than or equal to 10 diameters of a given bar galaxy; diameter of each galaxy and angular distances of companions to that galaxy taken from NED.

$^b$ Companions within a distance separation between 10 and 20 diameters of the given bar galaxy.
Table 4: Spiral Active Galaxies: comparison

| Galaxy  | Hubble Type | Characteristic | Tully’s Group | Distance (Mpc) |
|---------|-------------|----------------|---------------|---------------|
| N 1068  | RSAb(rs)    | Sy 1, CNS      | 52-2+1        | 14.4          |
| N 1097  | RSBb(r)     | Sy 1, CNS, PM  | 51-3+1        | 14.5          |
| M 82    | S           | Starburst      | 14-10         | 3.6\(^c\)     |
| N 5548  | RSA0(s)     | Sy 1.5         |               | 68.9          |

\(^a\) Main Characteristic: Sy: Seyfert type; CNS: circumnuclear structure; PM: peculiar disk morphology.

\(^b\) T88; first digit specifies one of seven regions in T88, the second digit identifies a specific cloud within the general region; for a complete description refer to section 1 of this paper and Tully(1987) 14: Coma I Sculptur cloud; 51: Fornax cluster and Eridanus cloud; 52: Cetus-Aries cloud.

\(^c\) Cosmological distance taken similar to M81, 3.63 Mpc (Freeman et al. 1994).
Table 5: Nearest Neighbors\(^a\) of Active Spiral Galaxies

| Galaxy NGC/IC | Characteristic | \(V_{sys}^b\) km s\(^{-1}\) | \(V_{circ}^c\) km s\(^{-1}\) | Companion\(^d\) | Hubble type | \(V_{sys}^e\) km s\(^{-1}\) | Separation \(^f\) kpc |
|---------------|----------------|-----------------|----------------|----------------|-------------|----------------|----------------|
| N 1068 Sy 1   | 1140           | 75              | 2MASXJ024\(^g\) | Irr            | 1083        | 45            |
|               |                |                 | U02162          | IBm(s)         | 1185        | 344           |
|               |                |                 | N1073           | SBc(rs)        | 1211        | 356           |
|               |                |                 | N1097A          | E pec          | 1368        | 14            |
|               |                |                 | E416-032        | Sp             | 1221        | 195           |
|               |                |                 | LS:F416-012     | S              | 1076        | 303           |
|               |                |                 | N1079           | R1R2SABa(rl)   | 1447        | 352           |
| N 1097 Sy 1, CNS, PM | 1278           | 103             | M81             | Sab(s)        | -34         | 39            |
|               |                |                 | Holm IX         | Im             | 46          | 41            |
|               |                |                 | BK 03N          | Im             | -40         | 46            |
|               |                |                 | U05423          | Im             | 350         | 67            |
|               |                |                 | N3077           | I0 pec         | 14          | 73            |
|               |                |                 | The Garland     | Im             | 50          | 76            |
|               |                |                 | N2976           | Sc pec         | 3           | 121           |
|               |                |                 | Holm I          | Im(s)          | 143         | 124           |
|               |                |                 | U05442          | Im             | -18         | 133           |
|               |                |                 | HIJASSJ10\(^g\) | Im             | 46          | 153           |
|               |                |                 | U05692          | Sm             | 180         | 194           |
|               |                |                 | I2574           | SABm(s)        | 57          | 199           |
|               |                |                 | U05428          | Im             | 126         | 204           |
Table 5: Nearest Neighbors\(^a\) of Active Spiral Galaxies

| Galaxy NGC/IC | Characteristic | \(V_{sys}^b\) km s\(^{-1}\) | \(V_c^c\) km s\(^{-1}\) | Companion\(^d\) | Hubble type | \(V_{sys}^e\) km s\(^{-1}\) | Separation \(^f\) kpc |
|---------------|---------------|-----------------|-----------------|-----------------|-------------|-----------------|-----------------|
| N 5548        | Sy 1.5, PM    | 5165            |                 | U09165          | S           | 5259            | 322             |
|               |               |                 |                 | CGCG133-031     | Sbc         | 5358            | 365             |
|               |               |                 |                 | N5559           | SBB         | 5166            | 525             |

\(^a\) Extracted from NED (angular separation and systemic velocity) and T88 (members of groups).  
\(^b\) Systemic velocity from HI observations (Huchtmeier & Richter 1989).  
\(^c\) Probable velocity dispersion of galaxies in cloud or group (Tully 1987).  
\(^d\) Nomenclature according to catalog, E:ESO; I:IC; N:NGC; U:UGC.  
\(^e\) Systemic velocity of companion.  
\(^f\) Calculated from angular separation (from NED) and distance.  
\(^g\) HIJASSJ10: HIJASS J1021+6842; MASXJ024: 2MASX J02420036+0000531;

Table 6: Companions within 10 and 20 diameters of spiral galaxies with known central activity

| Galaxy NGC/IC | Characteristic | Companions at \(d \leq 10D\)^a | Companions at \(10D \leq d \leq 20D\) \(^b\) |
|---------------|---------------|--------------------------------|---------------------------------|
| N 1068        | Sy 1          | 1                              | 2                              |
| N 1097        | Sy 1, CNS, PM | 1                              | 3                              |
| M 82          | Starburst     | 6                              | 7                              |
| N 5548        | Sy 1.5, PM    | 0                              | 3                              |

\(^a\) Companions within a distance separation less than or equal to 10 diameters of the given bar galaxy.  
\(^b\) Companions within a distance separation between 10 and 20 diameters of the given active galaxy.
Fig. 1.— Histograms of number of bar galaxies being of Seyfert 2 type (Sy 2) and bar galaxies with circumnuclear structures (CNS) and their number of companions within 10 diameters (unfilled rectangles) and within a distance between 10 and 20 diameters (filled rectangles).

Fig. 2.— Same as in Figure 1 but for bar galaxies with peculiar disk morphology (PM) and normal disk (ND).
Fig. 3.— Same as in Figure 1 but for bar galaxies not associated with any large scale cloud of galaxies (NA).