

# ATLAS OF PECULIAR GALAXIES

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## ABSTRACT

The *Atlas of Peculiar Galaxies* presents the results of more than four years of direct photography with the 200-inch telescope. Unusual galaxies were selected from lists by Zwicky, Vorontsov-Velyaminov, and unpublished lists by A. G. Wilson, E. Herzog, Wirtanen, the author, and others. Plate files of Mount Wilson and Palomar Observatories were searched for suitable objects, and some of these plates are reproduced. For the most part, however, limiting, good-seeing exposures were obtained on blue-visual sensitive plates at the prime focus (11"1/mm) of the 200-inch.

The objects are arranged 6 on a page, 57 pages, for a total of 338 objects. Magnifications range from 1× to 10×. They are ordered empirically according to their form and visual appearance. Tabular material presents known data for the objects including positions, plate data, radial velocities when known, references, and remarks on both over-all and detailed peculiarities.

The *Atlas* is also available in large size, 11 × 14-inch photographic reproduction, from the California Institute of Technology Bookstore for a price of about \$60 bound.

## PREFACE

Forty years after the discovery that galaxies were independent stellar systems, we still have not penetrated very far into the mystery of how they maintain themselves or what physical forces are responsible for shaping their observed forms. The galaxies are the constituent units of mass and energy in the Universe, and yet we are still challenged by such questions as: What causes the characteristic shape of spiral galaxies? How are elliptical galaxies related to spirals? How are galaxies formed, and how do they evolve?

It is difficult to resist an oversimplified impression of what a galaxy is because the Hubble classification divides the galaxies into the well-known categories of smooth, amorphous ellipticals, and flattened spirals with star-studded arms. But far from all galaxies fit the Hubble sequence of nebular forms. In fact, when looked at closely enough, every galaxy is peculiar. Appreciation of these peculiarities is important in order to build a realistic picture of what galaxies are really like. But the peculiarities are also important for the reason that, if we could analyze a galaxy in the laboratory, we would deform it, shock it, probe it in order to discover its properties. The peculiarities of the galaxies pictured in this *Atlas* represent perturbations, deformations, and interactions which should enable us to analyze the nature of the real galaxies which we observe and which are too remote to experiment on directly. In general, the more conspicuous the peculiarity, the more illustrative it is of special events and reactions that occur in galaxies. From this range of experiments which nature furnishes us, then, it is our task to select and study which will give the most insight into the composition and structure and the forces which govern a galaxy.

The present *Atlas* specifically started from an attempt to better understand spiral galaxies. Despite even recent analyses from a contrary standpoint, I believe that gravitational orbits in a stellar assemblage will not alone furnish satisfactory explanations of galaxies. It is clear that the convolution which spiral arms are seen to undergo in certain galaxies cannot be performed by loci of stellar orbits. In the investigation of these special spiral properties, therefore, galaxies which showed unusual or perturbed arms or filamentary extensions were sampled with high-resolution photographs with the Palomar 200-inch telescope. Subjects were first drawn from the pioneering work of Zwicky and Vorontsov-Velyaminov. So many important objects emerged under high-resolution,

limiting-magnitude study, however, that the investigation into the nature of spiral arms was temporarily postponed in order to organize systematically these new phenomena into groups and publish a representative sample of the best objects.

The *Atlas* as it has been realized in the following pages illustrates again that galaxies cannot be characterized as just assemblages of stars, radiation, and gravitation. The following *Atlas* pictures emphasize the importance of dust in some; they particularly imply a much more important role for the gas in general and point to the existence of either new forces or forces which previously have been little considered. For example, the twisted, distorted shapes and curious linkages pictured here attest to the fact that there are viscosity-like forces present that in some cases are dominant. Probably these forces are due to magnetic effects. Vorontsov-Velyaminov has stressed in the past the probable magnetic nature of these effects. Magnetic forces are very difficult to study, but may be very important in our Universe. The recent radio-astronomy discoveries of violent events in galaxies reveal sources of energetic charged particles. These charged particles interact with magnetic fields and offer the hope of mapping, measuring, and understanding cosmic magnetic fields. Exploration of the connection between the plasmas observed with the radio telescopes and the optical evidences of plasma effects pictured in the present *Atlas* is now open to us.

The over-all aim of this *Atlas* is to present a number of examples of various kinds of peculiar galaxies. They are presented in groupings that appear roughly similar, thereby furnishing also a rough, initial classification. Phenomena which each group represent may then be investigated by picking the most favorable members in size or brightness, studying different members of the group in different orientations, and, finally, making some preliminary statistics of certain kinds of phenomena and their relationship to other observable parameters. It is hoped that this investigative procedure will not only clarify the workings of galaxies themselves but will also reveal physical processes and how they operate in galaxies, and ultimately furnish a better understanding of the workings of the Universe as a whole.

It is a pleasure to acknowledge the help of William Miller, who photographically copied the original glass negatives; Lowell Peterson, of Graphic Arts at the California Institute of Technology, who supervised the large-size photographic reproduction of the *Atlas*; Frank Brueckel, who carried out many computational tasks connected with the *Atlas*; and, of course, all those astronomers who suggested candidates for the *Atlas* from their own personal store of knowledge and who gave advice and encouragement.

#### INTRODUCTION

The *National Geographic Society-Palomar Observatory Sky Survey* was completed in 1956. For seven years the 48-inch Schmidt telescope had surveyed the sky north of  $\delta = -27^\circ$ . The 1758 highest-quality plates that were finally accepted penetrated about three times deeper into space than any previous survey had ever reached. Astronomers are still studying and cataloguing the information contained in this survey, and will continue to do so for many years to come.

One of the first astronomers to use the prints of the *Sky Survey Atlas* for a systematic study was Professor Vorontsov-Velyaminov of the Sternberg Astronomical Institute in Moscow (2).<sup>1</sup> In 1959 he published positions, with copies of *Sky Survey* pictures, of 355 peculiar and interacting galaxies that he had discovered on *Survey* prints. The publication of this list enabled the undertaking of one kind of project for which the 48- and 200-inch telescopes on Palomar Mountain were originally designed. The fast-focal-ratio, wide-field Schmidt telescope was intended to survey objects of interest. The maximum light-gathering power and resolution of the 200-inch could then be turned individually on the most interesting objects.

<sup>1</sup> For numbered references see the Bibliography at the end of the text.

When selected members of Vorontsov-Velyaminov's catalogue were photographed with the 200-inch, some turned out to be much more interesting than on the smaller-scale plates, while others turned out to be less interesting or ordinary. After some preliminary experience with the 200-inch scale, it soon became possible to inspect the Vorontsov-Velyaminov objects first on the *Survey* prints to cull out the less interesting objects. In the process of inspecting these objects and checking their positions, other very unusual galaxies were noticed on the same *Survey* prints and included in the 200-inch program. This demonstrated that not all the important objects had been catalogued, and efforts were made to compile from other sources a more complete list of candidates for peculiar galaxies.

One additional source of peculiar-galaxy candidates was the set of notes which A. G. Wilson had made upon inspecting the original *Sky Survey* plates as they were taken. These were kindly put at my disposal. Another list of peculiar objects was given me by E. Herzog, who has carefully searched the *Survey* plates for such objects. Thornton Page contributed a list of peculiar objects he knew and a list of peculiar galaxies which C. A. Wirtanen had compiled from the *Lick Position Survey*. Holmberg's pairs of galaxies were inspected.

Special objects were also contributed by W. W. Morgan, F. Zwicky, Charles Kówal, and Gibson Reaves. Finally, the plates of Minkowski and Baade, which are stored at the Mount Wilson Observatory, were searched for peculiar objects. A surprising result was that none of these lists, including my own, had very much overlap with one other. The conclusion seems to be that, aside from the brighter and therefore well-known peculiar galaxies, the fainter peculiars have not been fully catalogued, and that the fainter peculiar galaxies pictured in this *Atlas* represent only a sample of that group.

At first the photographs with the 200-inch were made with various plate and filter combinations to discover in which wavelengths the peculiar features would show best. Although red wavelengths sometimes showed features better, in general, the filaments, connections, and faint outer features were more conspicuous on blue-sensitive (Eastman Kodak 103aO) plates. At that time, however, the sky was becoming so dark because of sunspot minimum, that it was possible to reach fainter limiting magnitudes by exposing blue plates for 60–70 min. To make the project possible in terms of available observing time, the band pass was widened by using 103aD plates and including the visual as well as blue wavelengths in a limiting exposure of the order of 30 min. Finally, it became clear that the night-sky emission line at  $\lambda$  5577 was contributing appreciably to the brightness of night-sky background, and the emulsion was changed to 103aJ from then until the conclusion of the project. The 103aJ plates registered light roughly between the  $\lambda$  3600 cutoff of the f/3.67 corrector lens on the 200-inch telescope and the  $\lambda$  5400 photographic emulsion cutoff. That, in general, is the region of maximum contrast for galaxies (10), and the very deep exposures made here (to densities of 0.7 to 1.0 for sky background), the very dark night skies, and the 20 per cent increases in development time give, on the average, a set of photographs that show fainter stars—and particularly fainter surface-brightness features—than ever before detected in galaxy subjects. The reproduction of these prints in the Mount Wilson and Palomar photographic laboratory by William Miller was a difficult job which was carefully controlled so that almost all the original features on the plates, even the faintest, are reproduced in the *Atlas*.

Whenever possible, poor-seeing plates were repeated under better seeing conditions, so that the final *Atlas* contains only plates taken with seeing 2 or better. The star images on the plates taken with the 200-inch presented in this *Atlas* are therefore generally between 1" and 2" diameter. Search of the Observatory plate records located some of the prospective *Atlas* galaxies which had been already photographed. I am grateful to Zwicky, Sandage, and Baum for allowing me to reproduce some of the photographs of these objects, and they are credited under the listed plate numbers in Table 1. Most of the 338 photographs shown in the *Atlas* are from plates taken with the 200-inch tele-

scope. Occasionally a very large object is shown in a print from a 48-inch telescope plate (designated PS) in order to emphasize its correct sequence in the order of forms.

Because so many of the physical processes pictured are not understood, no rigorous attempt at classification has been made. The galaxies have been grouped empirically, putting together all the objects that look alike. Special emphasis is on the form of the galaxies or the nature of the peculiarity and the gradual change of the peculiarity from object to object. Sometimes an object will belong in more than one category, and then it is cross-referenced in Table 1 or shown under different magnification in different sections of the *Atlas*. The schematic plan of arrangement of the different kinds of galaxies is shown in Figure 1. The largest class involves peculiar spiral galaxies (Nos. 1–102). The largest subclass of peculiar spirals are spirals with companions attached to spiral arms (Nos. 37–102). Then there is a group of elliptical or E-like galaxies (Nos. 102–145). Of course, there is overlap, and in the very interesting group ranging from Nos. 91 to 114 it is impossible to say whether the E is a companion to the spiral galaxy or vice versa. The third major group (Nos. 146–268) involves galaxies or groups of objects that are not primarily classifiable as either E's or spirals, or whose most outstanding peculiarity does not fall in the first two major categories. In the fourth major category (Nos. 269–327), group character is the most important consideration. Six objects classifiable only as miscellaneous are shown at the end (Nos. 332–338).

When possible, information has been gathered from the literature regarding apparent magnitude, redshift velocities, and any known spectral peculiarities. Table 2 lists all the objects in this *Atlas* in order of right ascension and gives references to known redshift velocities. In Table 3 all coincidences of *Atlas* objects with catalogue radio sources are noted and referenced. With the exception of bright radio sources such as Fornax A, *Atlas* objects were not selected because they were radio sources—although Minkowski's plates were generally taken in search of radio-source identifications. In many cases, however, nothing more is known about an object than what is shown in the *Atlas*. An important task in the future will be to undertake photometric and spectroscopic observations of these objects. Then, when distances, absolute magnitudes, and spectral characteristics are known, a more meaningful classification and interpretation of the objects in this *Atlas* can take place.

#### THE ATLAS AND THE CATALOGUE

The 338 photographs shown in the following fifty-seven pages of the *Atlas* all have a notch marking the north point. West is 90° clockwise. The prints represent magnifications from the original plates of 1×, 2×, 4×, 6×, 8×, and 10×. Since all the 200-inch plates in this program were taken with the Ross f/3.67 corrector lens, the scales on the original prints therefore vary from 11"/mm to 1".1/mm. The natural scale of the few prints from Schmidt plates is 67"/mm. In reproduction of the large-size photographic edition, all these scales have been reduced by a factor of 0.97. In the reproduction in the *Astrophysical Journal Supplement*, the original print scale has been reduced by a factor of 0.54.

About one-third of the prints were made by an automatic, fluorescent screen dodging process, i.e., by compressing the density range so that one can see very faint features and yet see into the brighter inner regions on the same print. In some cases the automatic dodging has introduced slightly lighter halos around the stars.

#### THE CATALOGUE

*Col. 1:* Identification number in this catalogue. See Figure 1 for arrangement of types of objects.

*Cols. 2–3:* Right ascension and declination of objects for 1970 epoch. Positions are from three sources: (1) NGC positions where available. If more than one NGC object is pictured, the position of the westernmost (smallest number) is given. (2) Positions from

200-inch dial readings calibrated by objects with known positions. (3) Measurements on 48-inch *Sky Survey* plates (whenever possible, differential measurements from nearby NGC objects). The final accuracy of these positions, from cross-checking the different methods is on the average better than  $\pm 0^m.2$  in R.A. and  $\pm 2'$  in decl. A few positions are from Vorontsov-Velyaminov.

*Col. 4:* Designation. NGC or IC numbers are given when object has one; otherwise designation is blank.

*Col. 5:* Plate number. PH designates 200-inch Hale telescope; PS designates 48-inch Schmidt. Plates taken by Arp unless designated B = Baade, Bm = Baum, M = Minowski, S = Sandage, Z = Zwicky.

*Col. 6:* Exposure in minutes.

*Col. 7:* Kind of emulsion used—"bk" designates baked and "b" designates lightly baked; "exp" designates experimental.

*Col. 8:* Identifies the filter used, if any.

*Col. 9:* Seeing. On a scale in which image size is about  $1''$  to  $1\frac{1}{2}''$  for seeing 3. Each unit poorer than three-image size roughly doubles and approximately halves for each unit better.

*Col. 10:* Magnification (varies from  $1\times$  to  $10\times$ ).

*Col. 11:* Source. As far as can be determined, the person who first noticed the peculiar object is named. Vorontsov-Velyaminov ("VV") numbers are given when they exist. "DDO" is David Dunlap Observatory.

*Col. 12:* Remarks on objects shown in photographs. Major peculiarities are described in Figure 1; additional peculiarities and remarks are noted here.

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[NOTE.—The numbered references below are cited by number in Tables 1 and 2. There is no Reference No. (42). The references in categories A and B are in chronological order; those in category C are in alphabetical order except No. (47), which was added to the list later.]

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TABLE 1  
DATA FOR ILLUSTRATIONS

No.	$\alpha$ <sup>a</sup> (1970)	$\delta$ <sup>b</sup> (1970)	Designation	Plate No.	Exp. (min)	Emul.	Fil- ter	See- ing	Mag	Source	Remarks
1	9 22.9	+49 28	NGC 2857	PH-4448	30	103a-J	-	2	4X	DDO 204	High contrast print of low surface brightness spiral.
2	16 15.1	+47 7		3990	30	103a-O lb	GG 13	3	6X		Low surface brightness dwarf. Large bright knot in arm appears almost stellar.
3	22 34.8	- 3 6		3987	45	103a-O lb	GG 13	3	4X	DDO 214	Low surface brightness dwarf.
4	1 47.0	-12 31	NGC 3664	4014	30	103a-O lb	GG 13	4	6X	DDO 14	Not known if both galaxies are at the same distance.
5	11 22.7	+ 3 29	NGC 2587	4139	25	103a-D	-	3	8X	DDO 95, VV 251	Fainter dwarf 6'S.
6	8 11.1	+46 5		4122	30	103a-D	-	3	8X	VV138	
7	8 49.1	-16 30		4125	30	103a-D	-	3	8X	VV28	
8	1 20.9	- 1 1	NGC 497	4387	25	103a-D	-	2	6X		Bifurcated arm does not start at end of bar.
9	8 11.6	+73 42	NGC 2523	4689	25	103a-J	-	2	6X	Wilson 13	Nucleus off center in ring.
10	2 16.6	+ 5 30		4360	25	103a-D	-	3	8X		Position of larger spiral. Outer arms do not start at termination of bar.
11	1 7.9	+14 11		4278	30	103a-D	-	3	4X	VV348	
12	8 33.4	+28 41	NGC 2608	4348	40	103a-O	-	1-2	6X		Nucleus may be double or superposed star.
13	22 58.6	+15 49	NGC 7448	3999	30	103a-O lb	GG 13	4	8X		High surface brightness.
14	22 34.1	-26 12	NGC 7314	3994	30	103a-O lb	GG 13	3	4X		Almost no nucleus. (3)
15	22 50.0	- 5 43	NGC 7393	4011	30	103a-D lb	-	4	8X	VV68	Feature appears to be a ruptured or obscured ring. Member of group. (18)
16	11 18.6	+13 11	NGC 3627	3540Z	30	103a-D	GG 11	2-3	2X		See also 317. Large concentration at end of S arm. (3)
17	7 41.3	+73 52		4378	25	103a-D	-	3	10X	VV349	
18	12 4.0	+50 42	NGC 4088	4426	30	103a-J	-	1-2	4X		End of one spiral arm partially disconnected. (3) (33)
19	0 30.2	- 5 19	NGC 145	266M	20	103a-O	-	1-2	8X		
20	4 18.4	+ 2 1		276M	20	103a-O	-	1-2	10X		
21	11 3.2	+30 15		4451	30	103a-J	-	2	10X		
22	11 58.0	-19 6	NGC 4027	4454	25	103a-J	-	2	2X	VV66	
23	12 40.1	+41 19	NGC 4618	4456	30	103a-J	-	3	1X	VV73	
24	10 52.8	+57 9	NGC 3445	4393	25	103a-D	-	2	6X	VV14	
25	7 17.9	+85 50	NGC 2276	4418	30	103a-D	GG 11	2	4X		See also 114. Tubular arm, straight at first, then bent. Secondary arm from straight portion.
26	14 2.1	+54 29	NGC 5457	PS-8271	50	103a-J	Wr. #4	4-3	4X*	M101, VV344	Note straight arm, bright knot on East appears almost stellar. (3)
27	11 19.4	+53 21	NGC 3631	PH-4477	20	103a-J	-	3	4X		Note straight arms, absorption tube crossing from inside to outside of S arm.
28	23 27.1	+22 15	NGC 7678	4683	30	Ia-O bkd	-	3	8X		Note straight heavy arm.
29	20 34.3	+60 2	NGC 6946	3973	25	103a-O	-	3	1X		Supernova once observed in tip of thick arm. (31)(46)
30	17 22.5	+62 11		4275	30	103a-D	-	3	8X	VV232	Comp. appears physically connected to flat-on spiral system.
31	1 49.4	+21 45		4315	30	103a-O	-	2	6X		High surface brightness irregularity is 5'N.
32	17 12.5	+59 22		4274	30	103a-D	-	3	10X	VV89	
33	13 36.1	+ 6 35		4537	25	103a-J	-	3	6X	VV6	Position of larger spiral. See 326 for smaller scale picture. Part of galaxy chain.
34	12 40.0	+26 14		4479	30	103a-J	-	2-3	4X		
35	0 20.7	- 1 34		4371	40	103a-O	-	3	4X	VV257	Radio source M00-01 is 50"W.
36	13 32.9	+31 35		4458	30	103a-J	-	3	8X	VV4	Knots in arms approach appearance of small companions.
37	2 41.1	- 0 8	NGC 1068	4288	15	103a-O	Polaroid	2	6X		Seyfert galaxy. Small knot in arm. (3)(16)(39)
38	17 30.1	+75 45	NGC 6412	4691	30	103a-O	-	3	6X		Small ring in arm on N side, part of large ring on E side shows in H $\alpha$ only.
39	3 28.5	-22 22	NGC 1347	4110	30	103a-D	-	1	6X	VV23	Absorption off edge of small galaxy obscure part of large galaxy.
40	13 28.1	+37 34	IC 4271	4185	30	103a-D	-	3	10X	VV355	Possible connection.
41	3 8.4	-20 41	NGC 1232	4308	30	103a-O	-	3	2X		Companion spiral wound in same sense as parent. Note split of companion's arm further into center. (3)

\* Plate taken with 48-inch Schmidt.

TABLE 1 (cont'd)

No.	$\alpha$	$\delta$ (1970)	Designation	Plate No.	Exp. (min)	Emul.	Fil-ter	See-ing	Mag	Source	Remarks
42	15 1.4	+23 27	NGC 5829	PH-4255	30	103a-D	-	2	6X	VV7	Faint bifurcated arm to comp., one faint arm on comp. colled same direction as parent. (3)
43	10 22.3	+16 53		4421	35	103a-O	-	3	8X		One side of ring obscured or disrupted; other side has low S. B. comp.
44	10 24.1	- 2 3	IC 609	4168	30	103a-D	-	2-3	6X	VV354	Directions inverted; N is opposite tab mark. One arm leads toward large comp., other toward small comp.
45	14 18.7	+52 0		4254	30	103a-D	-	2	8X	VV2	Companion connected to main spiral.
46	23 32.2	+29 52		4284	30	103a-D	-	2	10X	VV314	
47	14 45.8	+18 59		4487	35	103a-J	-	3	8X		
48	1 18.5	+12 11		4374	25	103a-D	-	3	10X		
49	14 30.9	+ 8 12	NGC 5665	4528	25	103a-J	-	3	8X		
50	23 56.4	-14 12	IC 1520	4067	30	103a-D	-	1	10X	VV25	Appearance of wake from stellar object in E arm.
51	0 4.2	-13 36		4088	30	103a-D	-	3	10X		
52	5 18.0	+ 3 42	3110M	4100	25	103a-O	-	2-3	10X		
53	10 33.6	-17 00	NGC 3290	4452	25	103a-J	-	2	8X	Wirtanen 18	Radio source M10-17 is 1" 6 W, 10'S
54	2 23.0	- 4 47		4390	25	103a-D	-	2	8X	Wilson 14	Arm toward companion split, contains nodule.
55	9 13.9	+44 27		4163	30	103a-D	-	2	8X	VV155	Arm has four separate condensations in line. North at bottom.
56	1 55.6	+17 4		4117	30	103a-D	-	2	10X	VV12	
57	13 15.2	+14 35		4482	25	103a-J	-	2	8X	VV298	Small companion connected to end of arm.
58	8 30.2	+19 19		4362	25	103a-D	-	2-3	8X	Wilson 18	Comp. on end of broken arm nearly star-like.
59	0 59.0	- 9 19	NGC 341	4343	30	103a-D	-	1	8X	Wilson 8	
60	13 13.2	+26 16		4536	25	103a-J	-	3	10X		Third arm in direction of companion.
61	4 35.2	- 2 21	284M	284M	20	103a-J	-	1-2	10X	VV286	One arm leads to companion.
62	11 52.1	+43 36		4495	25	103a-J	-	3	10X	VV82	High surface brightness companion.
63	9 37.4	+32 27	NGC 2944	4100	25	103a-D	-	3	8X	Herzog 1	Both arms lead toward companions.
64	14 43.8	+19 36		4529	30	103a-J	-	3	8X	Wilson 2	Position of open spiral. Comps. lie off projected ends of both spiral arms.
65	0 20.3	+22 13		4358	30	103a-J	-	3	8X		
66	16 26.1	+51 36		4670	30	103a-O	-	2	8X		Comps. lie on inner and outer spiral arms.
67	1 19.8	- 0 42		4359	25	103a-D	-	3	8X		Many star-like knots lined up along straight arm.
68	23 47.0	+ 3 57	NGC 7756	4678	30	103a-J	-	2	6X		Three-armed spiral.
69	14 19.2	+35 19	NGC 5879+80	4246	30	103a-D	-	3	8X	VV142	
70	1 21.8	+30 37		4303	30	103a-D	-	3	8X	VV341	
71	16 3.8	+17 46		4273	30	103a-D	-	2	10X		Herc. cluster. (3)
72	15 45.7	+18 00	NGC 5996+94	4253	30	103a-D	-	3	6X	VV16	Faint material from arm to and around comp. Opposite arm faint, sweeps around East of galaxy.
73	16 34.2	+46 17	IC 1222	4541	25	103a-J	-	3	8X		Arm leads toward, but not up to companion.
74	2 6.4	-41 20		4361	25	103a-D	-	2-3	8X	Wilson 12	Broad, diffuse extension of arm leads to companion.
75	1 49.8	- 4 12	NGC 702	267M	20	103a-O	-	1	6X		3C53 is 2"E, M01-013 is 1"E, 26'N. Very faint extension to companion.
76	12 35.3	+13 19	NGC 4569	4181	30	103a-D	-	3	2X	M 90	Apparent gap between arm and companion. (3)
77	2 45.2	-30 24	NGC 1097	4662	20	103a-J	-	3	2X		Material of arm seems to flow "around" comp. Similar to 26.(3)(29) N at left of picture. Comp. is NGC 770. Faint material toward each of two dwarf comps.
78	1 57.7	+18 52	NGC 772	4305	45	103a-O	-	3	2X		Small separation between two knots in arm.
79	14 08.5	+17 46		4428	25	103a-D	-	1	10X		End of one arm heavy; absorption break in same arm near nucleus.
80	8 45.0	+74 14	NGC 2633	4690	20	103a-J	-	2	6X	VV247	Companion resembles M 51 companion. (19)
81	18 13.4	+68 18	NGC 6621+22	3998	45	103a-D	-	3	8X		Arm opposite comp. extremely long.
82	8 9.4	+25 18	NGC 2535+36	4085	30	103a-D	-	3	4X	VV9	Some hazy material at juncture of two arms; high surface bright-ness, S shape inside comp. (35)
83	11 38.6	+15 29	NGC 3799+3800	4422	25	103a-D	-	2-3	6X	VV350	Arms of high S. B. around nucleus of companion.
84	13 57.4	+37 35	NGC 5394+95	4187	30	103a-D	-	3	4X	VV48	Faint plumes and extensions from companion. (3)(25)(33)(47)
85	13 28.6	+47 21	PG-8559	40	40	103a-D	Wr. #23A	3	6X*	M 51, VV1	Double arm leading to companion.
86	23 45.6	+29 19	NGC 7753+52	PH-3986	45	103a-D	-	2-3	4X	VV5	



TABLE 1 (cont'd)

No.	$\alpha$ (1970)	$\delta$ (1970)	Designation	Plate No.	Exp. (min)	Emul.	Fil-ter	See-Ing	Mag	Source	Remarks
87	1 <sup>h</sup> 39 <sup>m</sup> .4	+22° 37'	NGC 3808	PH-4386	25	103a-D	-	2	6X	VV300	Position of larger member. Arm appears wrapped around cylindrical comp.
88	1 17.5	+12 19		4374	25	103a-D	-	3	10X		Incipient spiral in arm.
89	8 41.0	+14 24	NGC 2648	4667	25	103a-J	-	4	4X	Wilson 20	Position of larger spiral. Absorption lanes in comp. Diffuse arm extends beyond comp.
90	15 25.4	+41 46	NGC 5930+29	4486	25	103a-J	-	3	8X	Holmberg 710	N opposite tab mark on picture. Absorption lanes around comp.(33 N at top of picture. Broad pec. arm to comp., then absorption; faint extension from comp.)
91	15 33.2	+15 18	NGC 5953+54	4247	30	103a-D	-	2-3	8X	VV244	
92	23 17.3	+ 0 5	NGC 7603	4681	40	103a-E	GG 11	3	8X	VV74	Very faint connection shows better in red.
93	22 27.0	-25 0	NGC 7285+84	3993	45	103a-D	-	3	4X		Long faint plume bifurcates from arm, E comp. in other arm. Suggested rotation of axis of spiral.
94	10 21.8	+20 3	NGC 3226+27	4126	30	103a-D	-	3	2X	VV209	Comp. on edge of large, very faint loop extending opposite galaxy. Light line E-W is plate defect.(25)
95	14 33.8	+26 39	IC 4461	4499	25	103a-J	-	2	8X	VV303	Star-like condensation in spiral. Connection to E galaxy inferred, not seen.
96	6 50.8	+86 36		4082	30	103a-D	-	3	6X	VV248	Faint diffuse counter arm, and arm leading to companion.
97	12 04.5	+31 14		3891	60	103a-E	GG 11	2-3	8X	VV13	High surface brightness S inside spiral, similar to 96.
98	1 30.5	+31 57		4091	30	103a-D	-	3	8X	VV301	Connection not seen, but note difference in arms toward and away from E galaxy. Note also material between West spiral and E galaxy.
99	23 18.8	+18 48	NGC 7550	4107	30	103a-D	-	1	2X		Radio source M00-11 is 1.6 E.
100	0 27.0	-11 45	IC 18	4068	30	103a-D	-	2	2X	VV234	
101	16 3.1	+14 57		3989	45	103a-D	-	3	4X	VV318	
102	17 18.7	+49 5		3971	50	103a-O	-	3	2X	Zwicky, VV10	VV position wrong. Note loop E side of spiral; diffuse, very faint connection to E galaxy.
103	16 48.8	+45 30		3978	75	103a-O	-	2-3	6X	Zwicky	Incomplete connection, blue knots in southern member (18)(43)(45)
104	13 31.1	+62 52	NGC 5216+18	81Z	30	103a-O	-	1-2	2X	Keenan, VV33	Known as Keenan's system, (32)(44)
105	11 9.6	+28 51	NGC 3561	3887	40	103a-D	-	1-2	4X	Zwicky, VV237	Supernova found in disk of spiral. (5)(44)(45)(46)
106	12 14.0	+28 21		3892	60	103a-E	GG 11	3	8X	VV199	
107	10 50.6	+30 15		4176	30	103a-D	-	1	6X	VV233	Double arm leads to E gal., diffuse material out other side of E galaxy.
108	3 1.9	-22 19		4119	30	103a-D	-	2	8X	VV346	Third arm leads toward E companion.
109	15 48.1	+69 31		4256	30	103a-D	-	2	6X	VV291	
110	22 52.5	-15 22		4692	24	103a-O	-	4	10X		Arm bent at root.
111	14 0.4	+33 58	NGC 5421	4459	35	103a-J	-	3	8X	VV120	E galaxy apparently bending arm at root.
112	23 59.9	+31 17	NGC 7806+05	4001	25	103a-D lb	-	4	6X	VV226	
113	0 16.9	+29 55	NGC 70	4277	30	103a-D	-	3	4X	VV166	
114	7 17.9	+85 50	NGC 2276+2300	4418	30	103a-D	GG 11	2	2X		Spiral somewhat pec., may be perturbed. See No. 25.
115	11 41.5	+26 26		4367	30	103a-J	-	2	8X	VV353	Object slightly S of northern gal. is just perceptibly non-stellar.
116	12 42.0	+11 45	NGC 4647+49	367B	30	103a-O	GG 1	2-3	2X		Absorption heavier on spiral side away from E galaxy.
117	14 8.6	+17 49	IC 982+983	4428	25	103a-D	-	1	4X		Flattening of spiral's nucleus appears to be in different plane than arms.
118	2 53.6	- 0 17	NGC 1143+44	269	20	103a-O	-	2-<1	10X	Wilson 16, Herzog, VV331	Arms and loops seem attracted to E galaxy.
119	1 17.9	+12 18		4374	25	103a-D	-	3	8X	VV347	Some material seems attracted, some repelled.
120	12 26.3	+13 10	NGC 4438	4425	30	103a-J	-	2	2X	VV188	E galaxy breaking up a spiral. (19)(25)(30)
121	0 57.9	- 4 57		4370	25	103a-D	-	3	8X	Wilson 7	E galaxy wrapping spiral.
122	16 03.1	+17 46	NGC 6039	4273	30	103a-D	-	2	8X	VV212	Herc. cluster. (3)
123	5 21.1	-11 31	NGC 1888+89	4447	30	103a-J	-	2	6X	Page	Faint parallel feature on opposite side from S0 galaxy.
124	17 18.5	+60 38	NGC 6361	4292	45	103a-O	-	1	6X		

TABLE 1 (Cont'd)

No.	$\alpha$ (1970)	$\delta$ (1970)	Designation	Plate No.	Exp. (min)	Emul.	Filter	See-Ing	Mag	Source	Remarks
125	16 37.2	+41 59		PH-4503	30	103a-J	-	2	10X	Wilson 37	
126	1 56.6	+2 57		4298	30	103a-D	-	2	8X	VV122	
127	0 37.4	-9 10		4660	25	103a-J	-	3	8X		(15)
128	1 16.0	+14 33	NGC 191	4295	30	103a-D	-	1-2	10X	VV205	Sharp absorption lanes over N side of perturbing galaxy.
129	9 37.7	+32 29		4100	25	103a-D	-	3	10X	VV83	
130	0 1.4	+16 29		4286	30	103a-D	-	3	8X	VV263	
131	2 45.9	-14 54		4388	25	103a-D	-	2	8X	VV336	
132	11 17.9	-2 56		3225M	25	103a-O	-	2	10X		
133	1 24.2	-1 32	NGC 541	4307	60	103a-O	Polaroid	3	8X	M 49	North inverted Radio source M11-02 is 3'N.
134	12 28.3	+8 10	NGC 4472	35B	30	103a-O	-	2	2X	Wilson 15	Central member of galaxy group associated with 3C40.
135	2 38.5	+38 57	NGC 1023	4345	30	103a-J	-	2	2X	Morgan	Similar nebulosity about one diameter further east.
136	14 57.8	+54 0	NGC 5820	4530	35	103a-J	-	3	6X	Wilson 21	Faint streamers off one end of E galaxy.
137	9 32.5	+10 14		4363	25	103a-D	-	2	10X	VV216	
138	11 57.2	+25 13	NGC 4015	4396	45	103a-O	-	2	10X	Herzog 8	Absorption leads directly into E galaxy.
139	13 6.0	+26 53		4498	25	103a-J	-	2	10X	VV81	
140	0 49.5	-7 13	NGC 274+75	4090	30	103a-D	-	3	8X	VV123	(15)(36)
141	7 10.8	+73 32		4083	30	103a-D	-	3	8X	VV316	
142	9 36.2	+2 53	NGC 2936+87	4133	30	103a-D	-	3	6X	VV117	
143	7 45.0	+39 11	NGC 2444+45	4084	30	103a-D	-	3	6X	VV272	Diffuse counter filament. (12)(19)(36)
144	0 4.4	-13 34	NGC 7828+29	4088	30	103a-D	-	3	8X	Minkowski,	
145	2 21.0	+41 4		163S	30	103a-O	WG2	4	8X	Gates, Reeves	
146	0 5.0	-6 54		3114M	20	103a-O	-	3-4	10X	Dewhurst	
147	3 9.6	+1 12		4664	25	103a-J	-	4	10X	Kowal	
148	11 2.2	+41 0		4353	30	103a-D	-	2	10X	Mayall, VV32	Known as Mayall's object. (23)
149	12 38.0	+16 46		4478	25	103a-J	-	3	10X	Herzog 42	
150	23 18.0	+9 20	NGC 7609	4023Z	25	103a-O	-	2-	10X	VV20	Radio source M23+09 is 2" east.
151	11 23.9	+54 33		4449	25	103a-J	-	3	10X	VV144	(22)
152	12 29.3	+12 34	NGC 4486	363B	10	103a-O	GG 1	2-3	8X	M 87	Short exp. to show jet, Virgo A radio source. (9)(9)(32)(33)(34)
153	13 23.6	-42 51	NGC 5128	PS-8272	10	103a-J	Wr. #4	1-2	6X*		Cent A radio source. (3)(7)(11)(38)(41) and refs. in Searle.
154	3 21.5	-37 20	NGC 1316	PH-4684	15	103a-O	-	2	4X		For A radio source. Short exp. to show absorption in center.
155	11 21.9	+54 1	NGC 3656	4159	30	103a-D	-	2	8X	VV22	(20)(25)(38)(41)
156	10 40.3	+77 37		4380	35	103a-J	-	3	8X		Very faint oval loop in NE-SW direction.
157	1 23.0	+3 38	NGC 520	1096B	30	103a-D	GG 1	4	2X	Baade, VV231	Note segment in NE direction. (3)
158	1 23.5	+33 52	NGC 523	4389	25	103a-D	-	2	6X	Reaves	
159	12 50.3	+25 57	NGC 4747	4535	20	103a-J	-	3	2X		Very faint plume extending NE.
160	12 12.6	+54 42	NGC 4194	4455	25	103a-J	-	3	6X		$\lambda$ 3727 em. (32)
161	11 40.6	+0 31		4423	38	103a-J	-	2	8X	Wilson 27	Faint, diffuse material extends away from neck.
162	10 49.7	+28 9	NGC 3414	4532	15	103a-J	-	3	6X		
163	12 43.8	+27 17	NGC 4670	289M	20	103a-O	-	1-2	10X		
164	1 14.4	+5 2	NGC 455	4296	30	103a-D	-	2	6X		Fainter of two streamers curved in SE dir. May be faint knots on ends of streamers.
165	7 34.9	+17 57		4347	30	103a-J	-	2	6X	Wilson 17	
166	1 55.8	+33 4	NGC 750+51	4297	30	103a-D	-	1-2	6X	VV189	Small spiral at end of plume. (3)(44)
167	8 47.7	+19 12	NGC 2672	4419	15	103a-D	-	3	8X		Comp. galaxy very condensed, has curved plume.
168	0 41.1	+40 42	NGC 221	PS-8273	50	103a-J	Wr. #4	4-3	8X*	M32	Faint diffuse plume curved away from M 31 disk.
169	22 13.3	+13 42	NGC 7236+37	PH-4285	30	103a-D	-	2	6X		Faint diffuse plumes coming away from two galaxies. 3C442.
170	23 15.8	+18 32	NGC 7578	4000	25	103a-D lb	-	4	6X	VV181	
171	14 38.5	+3 36		4484	25	103a-J	-	3	8X		
172	16 4.2	+17 43		3984	45	103a-D	-	2	6X	VV194	M14+010 is 2" west.

TABLE 1 (Cont'd)

No.	$\alpha$ (1970)	$\delta$ (1970)	Designation	Plate No.	Exp. (min)	Emul.	Fil-ter	See-Ing	Mag	Source	Remarks
173	14 50.0	+9 29		PH-4429	25	103a-D	-	1	6X	VV 296	Smaller galaxy very condensed.
174	9 56.7	+28 59		3886	60	103a-E	-	2	4X	Zwicky?	Can see connection only 2/3 way to SE galaxy. (18)(44)
175	12 31.4	+11 34	IC 3481+83	54Z	40	103a-E	-	1	2X	Zwicky, VV 43	Companion galaxy very condensed.
176	13 2.2	-11 20	NGC 4933	4497	25	103a-J	-	2-3	6X		Very small plume comes off comp. galaxy opposite larger.
177	14 54.5	+24 43		4485	25	103a-J	-	3	10X	VV 77	Ring off center, broad ejected plume from condensation in ring.
178	14 22.9	+34 59		4252	30	103a-D	-	3	6X		Condensed offset center.
179	3 0.3	- 4 49		259M	25	103a-O	-	2	10X		South arm kinks back, thin filament connects nuclei.
180	4 51.9	- 4 50		279M	20	103a-O	-	1-2	8X		Long faint filament extends westward from south arm.
181	10 24.2	+80 00	NGC 3210+12	4879	25	103a-D	-	3	6X	VV 319	Long straight, very faint filament like bow wave from comp.
182	23 26.3	+ 8 37		4675	120	IIa-O exp.	-	1	6X	VV 343	Three faint patches constitute third arm or filament.
183	13 33.6	+31 33		4458	30	103a-J	-	3	6X		Two long straight arms or filaments tangent to NE side of galaxy.
184	5 39.0	+69 25	NGC 1961	4688	30	103a-O	-	3	2X		Condensed nucleus. Faint outer arms less curved than inner arms.
185	16 33.8	+78 16	NGC 6217	4676	30	103a-O	-	1-2	4X		Radio source M04-012 is 44°W, 3°S; 3C121 is 38°W, 17°S.
186	4 32.9	- 8 39	NGC 1614	261M	25	IIa-O	-	< 1-1	8X		Radio source M05-10 is 6°N. Faint filament points to dense nucleus.
187	5 3.5	-10 17		3145M	30	IIa-O	-	1-2	10X		Possible fainter filament toward compact galaxy to NW.
188	16 5.0	+55 37		3977	50	103a-O	-	1-2	4X	Zwicky, VV 29	VV position. Disturbance inside W arm, filament may originate there. (44)
189	12 42.2	+16 33	NGC 4651	165Z	30	103a-O	-	2	2X	VV 56	Radio source near tail apparently not associated. (44)
190	2 48.6	+12 46		4875	35	103a-J	-	3	4X	VV 221	Filament seems to originate from stellar image; no spectra available.
191	11 5.7	+18 36		4436	30	103a-J	-	2	8X	VV 239	Acute bend in link between galaxies; plumes from stellar-like images.
192	10 35.4	+18 17	NGC 3303	4433	40	103a-D	GG 11	1-2	6X	Wilson 25	Diffuse faint arms off both sides, spike comes from stellar companion.
193	13 19.2	+34 17	IC 883	4483	25	103a-J	-	2-3	8X	Herzog 24	Faint straight outer spikes, hard knots in main body. (23)
194	11 56.2	+36 36		4496	30	103a-O	-	3	8X	VV 126	Outer material connected by thin filament to very hard nucleus.
195	8 52.0	+35 15		4392	30	103a-J	-	2	8X	VV 243	Absorption edge on connection to nucleus.
196	13 13.0	+26 18		4536	25	103a-J	-	3	10X	Herzog 21	Nucleus out of plane of ring! Attachment to companion.
197	11 29.4	+20 38	IC 701	4183	30	103a-D	-	3	8X	VV 3	Straight filament off one end of bar, kink at end of filament.
198	10 58.2	+17 49		4394	30	103a-J	-	2-3	8X	VV 267	Spikes points toward small nucleus; no spectra available.
199	14 15.8	+36 42	NGC 5544+45	384Z		103a-O	-	2	10X	VV 210	Spirals appear disturbed.
200	2 52.0	+12 53	NGC 1134	4665	20	103a-J	-	4	6X	VV 38	Splash appearance on W side of gal. points to low S. B. comp. 7°S.
201	0 22.1	- 0 40		4073	30	103a-D	-	3-4	10X		VV connection between galaxies not seen here or on Survey prints.
202	8 58.4	+35 51	NGC 2719	4461	30	103a-J	-	2	6X	Holmberg 105, Page	Faint tail from smaller galaxy.
203	11 30.1	+28 40	NGC 3712	4493	25	103a-J	-	3	6X		Faint plumes coming off both ends of bar.
204	13 24.0	+84 39		4540	25	103a-J	-	3	8X	VV 39	
205	10 52.9	+54 28	NGC 3448	4352	30	103a-D	-	2	2X		
206	10 50.8	+36 48	NGC 3432	4351	30	103a-D	-	2	2X	VV 11	
207	9 27.6	+76 36		4124	30	103a-D	-	2	10X	VV 58	
208	16 50.0	+47 17		4248	30	103a-D	-	2-3	8X	VV 271	
209	16 4.0	+20 38	NGC 6052	4005	45	103a-D	-	3	10X	VV 86, Mayall?	Chaotic with loops.
210	4 28.9	+64 48	NGC 1569	1793B	30	103a-O	GG 1	3-4	6X	Baade	Much absorption, resolution into stars.
211	12 35.8	+38 55		4534	30	103a-J	-	3	10X	VV 42	Resolution into stars. Diameter about 0.3 x 0.15.
212	23 19.0	+17 4	NGC 7625	3992	45	103a-D	-	3	8X	VV 280	Narrow chaotic absorption tubes across one end.
213	4 4.6	+69 45	IC 356	1607B	30	103a-D	GG 11	3-4	4X	Baade	Faint straight absorption lanes lead toward nucleus, become triple.
214	11 31.0	+53 14	NGC 3718	1909B	20	103a-D	GG 13	3-4	2X	Baade	Barred spiral, sharp nucleus, narrow absorption lanes through center. (9)(25)
215	9 12.2	+40 14	NGC 2782	1608B	25	103a-D	GG 1	3-4	4X	Baade	Diffuse outer arms. (25)
216	23 27.2	+ 3 22	NGC 7679+82	4013	45	103a-D	-	4	2X	VV 329	Patches north of disturbed spiral, emission strong. (25)

TABLE 1 (Cont'd)

No.	$\alpha$ (1970)	$\delta$ (1970)	Designation	Plate No.	Exp. (min)	Emul.	F11-ter	See-ing	Mag	Source	Remarks
217	10 36.9	+53 40	NGC 3310	PH-4364	40	103a-O	-	1-2	2X	VV 311	Much H $\alpha$ emission incl. half arc outside galaxy. (1)
218	15 52.3	+18 42		4290	30	103a-D	-	1	10X	Minkowski	Faint arc and filament on N side.
219	3 38.4	- 2 13	IC 4553	3142M	25	103a-O	-	1-2	10X	Wilson 84	Faint diffuse material to south, bright filament to hard image on NW side of nucleus.
220	15 33.6	+23 35		4502	35	103a-J	-	2	8X		Amorphous arms. (25)
221	9 35.0	-11 11		4167	30	103a-D	-	2-3	8X		Straight filament leads to bright, offset nucleus. (19)
222	23 38.3	-12 27	NGC 7727	4002	25	103a-D lb	-	3	2X	VV 67	Very faint diffuse outer arms, absorption one side of nucleus. (25)
223	23 16.4	- 4 49	NGC 7585	4673	30	103a-J	-	2	6X	Morgan	Loops, filaments at various angles.
224	11 43.5	+55 15	NGC 3921	4424	25	103a-D	-	2	4X	VV 81	Pos. of spiral. S0 is E and a little N. Very faint rings extend to diameter of 7'.4.
225	8 52.1	+78 21	NGC 2655	718B	20	103a-D	GG 1	2	2X	Baade	Defects on blue Survey print in both VV 53 and VV 54.
226	22 19.1	-24 50	NGC 7252	4677	40	Ia-O bkd	-	2	2X	Morgan	Circular or near circular rings of small density difference.
227	1 18.5	+ 3 16	NGC 474	4386	35	103a-J	-	3	2X	Wilson 9	Inner and outer shells visible in direction of axis only.
228	1 47.3	+10 23	IC 162	4069	30	103a-D	-	2	8X	VV 53	Faintest arc extends about 2'S of nucleus with absorption.
229	1 21.9	+33 6	NGC 507+08	4314	30	103a-D	-	1	2X	VV 207	Absorption lane reaching away from galaxy.
230	0 44.8	-13 37		4369	25	103a-D	-	3	6X	Wilson 5	Considerable resolution into stars and absorption tubes.
231	0 42.0	- 4 17	IC 1575	4342	30	103a-D	-	1	4X	Wilson 4	Faint outer oval and resolution into stars.
232	9 32.2	+10 16		4363	25	103a-D	-	2	10X		Faint outer arm curves around through 270°.
233	10 30.4	+54 32		54 Bm 20	20	103a-O	-	1 $\frac{1}{2}$	8X	Haro No. 2	Knott in arm as large, not quite as bright as nucleus.
234	11 34.2	+54 41	NGC 3738	1138B	30	103a-D	GG 1	4-5	6X	Baade	VV position somewhat uncertain. Double nuclei, N nucleus has third arm.
235	0 7.2	+15 39	NGC 14	4072	30	103a-D	-	3	6X	VV 80	Smaller galaxy is fairly symmetrical spiral.
236	1 6.2	-17 38	IC 1623	4357	24	103a-O	-	3	4X	VV 114	
237	9 26.1	+12 25		4462	30	103a-J	-	2	8X	Wirtanen 16	
238	(13 13.4)	(+62 18)		4457	30	103a-J	-	3	8X	VV 250	
239	13 40.5	+55 49	NGC 5278+79	383Z	30	103a-O	-	2	5X	VV 19, 383Z	
240	13 38.4	+ 0 59	NGC 5257+58	374Z	40	103a-O	-	2	5X	VV 55	
241	14 36.4	+30 35		4500	25	103a-J	-	1-2	10X	VV 264	
242	12 44.7	+30 54	NGC 4676	3790	30	103a-D	GG 13	3	4X	VV 224, Baade	
243	8 36.6	+25 52	NGC 2623	1137B	30	103a-O	GG 1	4-5	8X	Baade, VV 79	Very thin, bright tail from north nucleus which has strong absorption. (15)(17)(19)
244	12 0.3	-18 42	NGC 4038+39	422Z	20	103a-O	-	1-2	1X	VV 245	Some very small bright knots resolved in interior. (44)
245	9 44.3	-14 11	NGC 2992+93	4395	25	103a-D	-	2	2X	Wilson 23	Very faint diffuse connection from both ends of N spiral to S spiral.
246	0 5.4	+ 8 12		4384	25	103a-D	-	3	10X	Wilson 1	May not be physically connected.
247	8 21.9	+21 26		4476	30	103a-J	-	3	8X	Herzog 10	Spirals have common arm, N spiral arm continues NE.
248	11 44.9	- 3 26	IC 2338+39	3893	60	103a-E	GG 11	3	4X	VV 35, Wild	Three spirals connected together. (18)(44)(45)
249	23 58.9	+22 50		3996	30	103a-O	-	1-3	10X	VV 186	Straight connection from faint material on E to middle galaxy.
250	7 33.8	+35 26		3121M	20	103a-O	-	3-4	10X	Minkowski	Outside arms diffuse and bifurcate.
251	0 52.1	-14 2		4356	25	103a-D	-	3	10X	Wilson 6	Radio source M09-19.
252	9 43.4	-19 33		4381	25	103a-D	-	4	8X	Wilson 22	Some resolution of stars or H II regions.
253	9 41.9	- 5 9		4135	30	103a-D	-	3	6X	VV 52	Position of brighter galaxy, companion south.
254	15 19.9	- 7 15		4501	30	103a-J	-	2	2X	Wilson 33	Faint arm extends beyond high S. B. companion.
255	9 51.5	+ 8 1		4174	30	103a-D	-	1-2	8X	VV 342	Resolution into knots. Note small ragged galaxy W of pair. Radio source M00-10 is 7'.5.
256	0 17.2	-10 32		3115M	20	103a-O	-	3-4	8X	Minkowski	Galaxies joined by segment of thin arc.
257	8 50.1	- 2 15		4098	30	103a-D	-	3	8X	VV 41	Resolution into knots on larger galaxy. (15)
258	2 37.4	+18 15		4070	30	103a-D	-	2	6X	VV 143	Material extends SE toward peculiar round spiral.
259	5 0.2	- 4 18	NGC 1741	278M	20	103a-O	-	1-2	6X	Minkowski	Possibly lines of faint condensations extending south.
260	12 12.1	+16 18		4533	25	103a-J	-	3	8X	Herzog 17	Some condensations resolved, similar smaller galaxy appears north. (19)
261	14 47.8	-10 2		4538	25	103a-J	-	3	2X	VV 140	Diffuse outer filaments, bright knots inside.
262	23 55.3	+16 39		4116	30	103a-D	-	2	8X	VV 255	
263	10 23.4	+17 19	NGC 3239	4157	30	103a-D	-	1-3	4X	VV 95	

TABLE 1 (Cont'd)

No.	$\alpha$ (1970)	$\delta$ (1970)	Designation	Plate No.	Exp. (min)	Emul.	Fil-ter	See-ing	Mag	Source	Remarks
264	10 21.0	+40 52	NGC 3104	PH-3745S	25	103a-O	GG 13	3	6X	VV 119	Faint diffuse outer material.
265	12 52.5	+36 15	IC 3862	3746S	25	103a-O	GG 13	3	10X	VV 266	Resolution of stars or knots.
266	12 57.5	+35 2	NGC 4861	4439	25	103a-D	-	1-2	6X	-	Resolution into knots, bright knot at S end. (19)
267	10 35.0	+31 43	-	4435	35	103a-J	-	2	8X	Wilson 26	Semi-stellar nucleus, faint oval ring outside.
268	8 15.9	+70 50	NGC 4490+85	3481	30	103a-O	GG 13	1	2X	DDO 50	Resolution of stars. Note linear loop of emission regions.
269	12 29.3	+41 48	NGC 3395+96	4186	30	103a-D	-	3	2X	VV 30	Resolution of knots, emission regions and dust lanes only.
270	10 48.2	+33 9	NGC 5426+27	4251	30	103a-D	-	3	6X	VV 246	Note arc form of emission knots. (32)(35)
271	14 1.8	-5 55	NGC 6054	3984	45	103a-D	-	3	4X	VV 21	Arms linked. Note bifurcation in arm of N spiral.
272	16 4.0	+17 52	NGC 6054	4071	30	103a-D	-	2	10X	VV 323	Arms join at dense knot or nucleus. Herc. cluster. (9)(19)
273	2 19.6	+39 14	-	4460	30	103a-D	-	2	6X	-	Position of large spiral. Bright long well defined arms, but smooth, not patchy.
274	14 33.5	+5 29	NGC 2881	4460	25	103a-D	-	3	8X	-	Perturbation of arm by small galaxy to east.
275	9 24.4	-11 52	IC 1801+NGC 935	4166	30	103a-D	-	2	10X	VV 293	Both intersecting edges seem dimmed.
276	2 26.1	+19 27	NGC 4809+10	4376	25	103a-D	-	3	8X	VV 238	Resolution of knots.
277	12 54.3	+2 42	NGC 7253	381Z	30	103a-O	-	2	10X	-	Diffuse material between galaxies, many internal absorption lanes.
278	22 18.1	+29 14	NGC 1253	4009	30	103a-D lb	-	4	8X	VV 242	-
279	3 12.7	-2 55	NGC 3769	4079	30	Ia-O	GG 13	3	2X	DDO 31	-
280	11 36.2	+48 4	NGC 4631	4169	30	103a-D	-	2-3	6X	-	-
281	12 40.8	+32 42	NGC 4631	PS-8270	51	103a-J	Wr. #4	2	6X*	-	Knots resolved with 48-inch. Diffuse counter tail on companion. (9)(24)(25)(29)(33)(40)
282	0 35.3	+23 50	NGC 169	PH-4385	25	103a-D	-	3	6X	Wilson 3	Companion appears to rain into nucleus of spiral.
283	9 15.7	+42 5	NGC 2798+99	4099	30	103a-D	-	3	6X	VV50	Arc of barely resolved knots curves into nucleus of larger galaxy.
284	23 34.7	+2 0	NGC 7714+15	4012	30	103a-D lb	-	4	4X	VV 51	Some very small knots in connecting streamer. (32)
285	9 22.1	+49 23	NGC 2854+56	4448	30	103a-J	-	2	4X	Wirtanen 15	Narrow tail leads away from northern nucleus.
286	14 18.8	+4 6	NGC 5566+60+69	908S	45	103a-D	GG 11	2-3	2X	-	Connection not visible.
287	9 1.0	+26 3	NGC 5221+22+26	4123	30	103a-D	-	3	8X	VV 40	Slanted parallel streamers off each edge of main galaxy.
288	13 33.5	+13 58	NGC 3981	4427	35	103a-J	-	1-2	2X	VV 315	Streamers in both directions from edge of spiral.
289	11 54.7	-19 44	IC 196+95	4182	30	103a-D	-	2	2X	VV 8	Very faint diffuse streamers.
290	2 2.3	+14 35	IC 196+95	4299	30	103a-D	-	2	6X	VV 309	VV position incorrect.
291	10 41.2	+13 37	IC 575	4463	17	103a-J	-	1	8X	VV 112	Main body has cylindrical appearance.
292	9 53.1	-6 43	IC 575	4136	30	103a-D	-	3	8X	VV 111	Position of central object. Edge-on Sa, some indication of absorption streaming off edges.
293	16 58.1	+58 58	-	4291	30	103a-D	-	1	6X	-	Position of larger galaxy. Companion NW. Diffuse arc SE of brighter galaxy.
294	11 38.1	+32 5	NGC 3786+88	373Z	40	103a-O	-	2	2X	VV 228	Peculiar filaments. (35)
295	23 39.9	-3 44	IC 1505	3980	75	103a-O	-	2-3	2X	VV 34, Zwicky	SW gal. is IC 1505. Polarized bridge. (6)(32)(44)
296	11 27.1	+58 42	NGC 3690+IC 694	4354	30	103a-D	-	2	6X	-	Long st. filament almost to attachment with arm of spiral.
297	14 44.1	+38 52	NGC 5754+55	4539	30	103a-J	-	3	2X	Wilson 31	Position of larger spiral. Companion on arm has long tail extending westward.
298	23 1.7	+8 42	NGC 7469	3976	26	103a-O	-	3	6X	-	Absorption, knots. Note apparent re-entrant spiral arm on southern galaxy.
299	11 27.3	+58 43	-	4354	30	103a-D	-	2	6X	VV 118	Bright internal knots.
300	9 25.4	+68 32	-	4165	30	103a-D	-	3	6X	VV 106	Position between pair. Note elongated feature pointing toward nucleus of larger spiral.
301	11 8.3	+24 27	-	4434	25	103a-D	-	2	8X	VV 229	-
302	14 55.7	+24 44	IC 563+64	4485	25	103a-J	-	3	8X	VV 340	Position between pair.
303	9 44.7	+3 12	NGC 1241+42	4309	30	103a-D	-	3	6X	Wirtanen 17	-
304	3 9.8	-9 2	NGC 4016+17	4453	25	103a-J	-	2	2X	VV 334	Segment breaking from arm of S gal., weak filaments reach to N gal., which has figure 8 loops.
305	11 57.0	+27 44	NGC 4016+17	4453	25	103a-J	-	2	2X	-	VV position. Resolution, diffuse, hooked counter tail.
306	1 31.0	+4 27	NGC 2872+74	4077	30	103a-D	-	3	4X	VV 173+174	Position between pair. Possibly not interacting.
307	9 24.2	+11 34	-	4492	25	103a-J	-	3	6X	-	-

TABLE 1 (Cont'd)

No.	$\alpha$ (1970)	$\delta$ (1970)	Designation	Plate No.	Exp. (min)	Emul.	Fil-ter	See-Ing	Mag	Source	Remarks
308	1 24.2	- 1 31	NGC 545+47	PH-4307	60	103a-O	Polaroid	3	8X		Close ellipticals. Position of central galaxy (NGC 541). Peculiar absorption ring, possibly broken.
309	2 26.9	-10 58	NGC 942+43	4118	30	103a-D	-	3	6X	VV 217	Very close E galaxies. Picture is 10X of following (No. 311) area.
310	17 26.9	+58 33	IC 1259	3985	45	103a-D	-	3	10X	VV 101	Same as 310, but shows surrounding field and group. Picture is 4X of preceding (No. 310) area.
311	17 26.9	+58 33	IC 1259	3985	45	103a-D	-	3	4X	VV 101	Diffuse connection between central members of group. Linear strings of knots like deformed spiral arms. Strong [O II] emission. (32)
312	16 49.0	+46 45	NGC 3994+95	4283	30	103a-D	-	2	8X	VV 197	Faint filament leads SE to faint dwarf. Pos. of W spiral. Companion E is quite compact.
313	11 56.1	+32 27	NGC 3994+95	4170	30	103a-D	-	3	2X	Mayall, VV 249	Edge-on spiral shows signs of interaction.
314	22 56.3	- 3 57		3974	50	103a-O	-	3	2X	VV 295	See also 16. Both galaxies on east show signs of interaction. Position of NGC 833. Faint, diffuse streamers, peculiar galaxies.
315	9 18.0	+33 54	NGC 2832	4432	30	103a-D	GG 11	2	8X		Position of NGC 7317. Stefan's Quintet. (13)(18)
316	10 16.5	+21 59	NGC 3190	PS-8268	50	103a-J	Wr. #4	2	8X*	Leo Group, VV 307	Position of close triplet. Large companion NW.
317	11 18.6	+13 10	NGC 3627+23+28	PS-8269	50	103a-J	Wr. #4	2	2X*	VV 308	VV position. Sharp absorption lane in connection to southern most galaxy. (18)
318	2 7.9	-10 16	NGC 833+35+38+39	PH-4372	30	103a-J	-	4	2X		Near NGC 3718. See No. 214. (18)
319	22 34.5	+33 47	NGC 7317 thru 19	4657	20	103a-J	-	2	2X	VV 288	Diffuse elongation of E's along line joining them.
320	11 36.3	+22 11		4444	25	103a-D	-	2	4X	VV 282	Position of integral sign spiral. Five spirals in approx. chain. No. 33 gives larger scale picture.
321	9 37.4	- 4 42		3725S	25	103a-O	GG 13	2	8X	VV 116	Three distorted galaxies in general line toward east. Six galaxies more or less in line; center one has semi-stellar component.
322	11 31.1	+53 7		1909B	20	103a-O	GG 13	3	8X	VV 150	Plate defect on northern most galaxy. (18)(19)
323	23 52.6	+ 0 13	NGC 7783	4661	20	103a-J	-	4	6X	VV 208	Five galaxies in chain quite compact; 6th of low surface brightness.
324	16 0.8	+16 2		PS-8521	50	103a-J	Wr. #4	2	10X*	VV 159	Position of NGC 383. Symmetry around large central galaxy. Velocities known. (1)
325	22 1.7	-21 12		PH-4302	30	103a-O	-	3	10X	VV 167	Different types of galaxies in chain.
326	13 36.1	+ 6 35		4537	25	103a-J	-	3	2X	VV 6	Thin circular arms, star in SE superposed on wisp.
327	5 20.2	+ 6 39	NGC 1875	4666	20	103a-J	-	4	8X	VV 169	Second "star" south not quite stellar.
328	14 46.5	+19 11		4487	35	103a-J	-	3	4X	VV 165	Large luminous system. (19)
329	11 30.4	+70 58		4450	85	103a-J	-	2	8X	VV 172	E is to right of N, W to left. (3)(14)(26)
330	16 48.3	+53 27		4654	20	103a-E	GG 11	2	2X	Makarlan	Internal explosion. (3)(8)(20)(21)(25)(29)(37)
331	1 5.7	+32 15	NGC 375 thru 388	4668	25	103a-E	GG 11	2	LX	Makarlan	
332	3 7.2	-23 10	IC 1832	4373	25	103a-J	-	3	LX	VV 260 + VV 337	
333	2 37.6	+10 43	NGC 1024	4318	45	103a-O	-	1	4X		
334	13 29.1	+31 47		4440	25	103a-D	-	2	6X		
335	11 1.8	+ 4 56	NGC 3509	4180	30	103a-D	-	3	8X	VV 75	
336	8 53.8	+58 55	NGC 2685	663S	30	103a-O	-	2	3X	Hubble	
337	9 53.6	+69 51	NGC 3034	5Bm	30	103a-O	WG 2	3	2X	M 82	
338	10 9.5	- 7 46		3233M	20	103a-O	-	1-2	10X		

TABLE 2  
ATLAS REDSHIFTS

$\alpha$		No.	Designation	Corrected Redshift km/sec	$\delta$		No.	Designation	Corrected Redshift km/sec
h	m				°	'			
0	1.4	+16 29	130		2	2.3	+14 35	290	
0	4.2	-13 36	51		2	6.4	+41 20	74	
0	4.4	-13 34	144	NGC 7828+29	2	7.9	-10 16	318	NGC 833+35+38+39
0	5.0	-6 54	146		2	16.6	+5 30	10	
0	5.4	+8 12	246		2	19.6	+39 14	273	
0	7.2	+15 39	235	NGC 14	2	21.0	+41 4	145	
0	16.9	+29 55	113	NGC 70	2	23.0	-4 47	54	
0	17.2	-10 32	256		2	26.1	+19 27	276	IC 1801, NGC 935
0	20.3	+22 13	65		2	26.9	-10 58	309	NGC 942+43
0	20.7	-1 34	35		2	37.4	+18 15	254	
0	22.1	-0 40	201		2	37.6	+10 43	333	NGC 1024
0	27.0	-11 45	100	IC 18	2	38.5	+38 57	185	NGC 1023
0	30.2	-5 19	19	NGC 145	2	41.1	-0 8	37	NGC 1068
0	35.3	+23 50	282	NGC 169	2	45.2	-30 24	77	NGC 1097
0	37.4	-9 10	127	NGC 191	2	45.9	-14 54	131	
0	41.1	+40 42	168	NGC 221	2	48.6	+12 46	190	
0	42.0	-4 17	231		2	52.0	+12 53	200	NGC 1134
0	44.8	-13 37	230	NGC 274+75	2	53.6	-0 17	118	NGC 1143+44
0	49.5	-7 13	140		3	0.3	-4 49	179	
0	52.1	-14 2	251		3	1.9	-22 19	108	
0	57.9	-4 57	121		3	7.2	-23 10	332	IC 1892
0	58.0	-9 19	59	NGC 341	3	8.4	-20 41	41	NGC 1232
1	5.7	+32 15	331		3	9.6	+1 12	147	NGC 1241+42
1	6.2	-17 38	236	NGC 383	3	9.8	-9 2	304	NGC 1253
1	7.9	+14 11	11	IC 1623	3	12.7	-2 55	279	NGC 1316
1	14.4	+5 2	164	NGC 455	3	21.5	-37 20	154	NGC 1347
1	16.0	+14 33	128		3	28.5	-22 22	39	
1	17.5	+12 19	88		3	38.4	-2 13	219	
1	17.9	+12 18	119		4	4.6	+69 45	213	IC 356
1	18.5	+12 11	48		4	16.4	+2 1	20	NGC 1614
1	18.5	+3 16	227		4	32.9	-8 39	186	
1	19.8	-0 42	67	NGC 474	4	35.2	-2 21	61	NGC 1569
1	20.9	-1 1	8	NGC 497	4	28.9	+64 48	210	+131, +107 (1), +121 (4)
1	21.8	+30 37	70		5	0.2	-4 18	259	NGC 1741
1	21.9	+33 6	229	NGC 507+08	5	3.5	-10 17	187	
1	23.0	+3 38	157	NGC 520	5	18.0	+3 42	52	NGC 1875
1	23.5	+33 52	158	NGC 523	5	20.2	+6 39	327	NGC 1888+89
1	24.2	-1 32	133	NGC 541	5	21.1	-11 31	123	NGC 1961
1	24.2	-1 31	308	NGC 545+47	5	39.0	+69 25	184	+2310, +2395 (1), +2334 (4)
1	30.5	+31 57	98		6	50.8	+86 36	96	+4032 (1), +4027 (4)
1	31.0	+4 27	306		7	10.8	+73 32	141	NGC 2276
1	47.0	-12 31	4	IC 162	7	17.9	+85 50	25	+2595 (1)
1	47.3	+10 23	228		7	17.9	+85 50	114	+2292 (1), +2189 (4)
1	49.4	+21 45	31	NGC 702	7	33.8	+35 26	250	
1	49.8	-4 12	75						
1	55.6	+17 4	56						
1	55.6	+33 4	166	NGC 750+51					
1	56.6	+2 57	126						
1	57.7	+18 52	78	NGC 772					

TABLE 2 (Cont'd)

$\alpha$ (1970)		$\delta$		No.	Designation	Corrected Redshift km/sec	$\alpha$ (1970)		$\delta$		No.	Designation	Corrected Redshift km/sec
h	m	°	'				h	m	°	'			
7	34.9	+17	57	165			10	21.8	+20	3	94	NGC 3226+27	+1006 (1), +1233 (1)
7	41.3	+73	52	17	NGC 2444+45	+3951 (4)	10	22.3	+16	53	43	NGC 3239	+763 (1), +761 (4)
7	45.0	+39	11	143			10	23.4	+17	19	263	IC 609	
8	9.4	+25	18	82	NGC 2535+36	+4153 (1), +3983 (4), +4046 (4)	10	24.1	-2	3	44	NGC 3210+12	
8	11.1	+46	5	6	NGC 2537	+415, +289 (1), +422 (4)	10	30.4	+54	32	233	NGC 3290	
8	11.6	+73	42	9	NGC 2523	+3604 (1)	10	33.6	-17	0	53		
8	15.9	+70	50	268	IC 2338+39		10	35.0	+31	43	267	NGC 3303	+1061 (1), +1090 (4)
8	21.9	+21	26	247			10	35.4	+18	17	192	NGC 3310	
8	30.2	+19	19	58	NGC 2608	+2041 (1)	10	36.9	+53	40	217		
8	33.4	+28	41	12	NGC 2623	+5342 (1)	10	40.3	+77	37	156		
8	36.6	+25	52	243	NGC 2643		10	41.2	+13	37	291	NGC 3395+96	+1715 (1), +1622 (4), +1607 (1), +1611 (4)
8	41.0	+14	24	89	NGC 2648	+2382 (4)	10	48.2	+33	9	270	NGC 3414	+1392 (1)
8	45.0	+74	14	80	NGC 2633	+4100 (1)	10	49.7	+28	9	162		
8	47.7	+19	12	167	NGC 2672		10	49.7	+28	9	162	NGC 3432	+588 (1), +594 (4)
8	49.1	-16	30	7			10	50.6	+30	15	107	NGC 3445	
8	50.1	-2	15	257	NGC 2655	+1473 (1)	10	50.8	+36	48	206	NGC 3448	
8	52.0	+35	15	195	NGC 2685	+961 (1), +957 (4)	10	52.8	+57	9	24		
8	52.1	+78	21	225	NGC 2719	+3073 (4)	10	52.9	+54	28	205		
8	53.8	+58	55	336			10	58.2	+17	49	198		
8	58.4	+35	51	202			11	1.8	+4	56	335	NGC 3509	+7443 (4)
9	1.0	+26	3	287			11	2.2	+41	0	148		
9	12.2	+40	14	215	NGC 2782	+2502 (1), +2514 (4)	11	3.2	+30	15	21		
9	13.9	+44	27	55			11	5.7	+18	36	191		
9	15.7	+42	5	283	NGC 2798+99	+1699 (1)	11	8.3	+24	27	301	NGC 3561	
9	18.0	+33	54	315	NGC 2832	+6895 (1)	11	9.6	+28	51	105		
9	22.1	+49	23	285	NGC 2854+56		11	17.9	-2	56	132	NGC 3627	+633 (1), +591 (4)
9	22.9	+49	28	1	NGC 2857		11	18.6	+13	10	317	NGC 3627	
9	24.2	+11	34	307	NGC 2872+74	+2803 (4), +3443 (4)	11	18.6	+13	10	317	NGC 3631	+1162 (1)
9	24.4	-11	52	275	NGC 2881		11	19.4	+53	21	27	NGC 3656	
9	25.4	+68	32	300			11	21.9	+54	1	155	NGC 3664	+6232 (22)
9	26.1	+12	25	237			11	22.7	+3	29	5		
9	27.6	+76	36	207			11	23.9	+54	33	151	NGC 3690+IC 694	
9	32.2	+10	16	232			11	27.1	+58	42	296		
9	32.5	+10	14	137			11	27.3	+58	43	299	IC 701	
9	35.0	-11	11	221	NGC 2936+37		11	29.4	+20	38	197	NGC 3712	+1128 (1)
9	36.2	+2	53	142	NGC 2944		11	30.1	+28	40	203		
9	37.4	+32	27	63			11	30.4	+70	58	329		
9	37.4	-4	42	321			11	31.0	+53	14	214	NGC 3718	
9	37.7	+32	29	129			11	31.1	+53	7	322	NGC 3738	
9	41.9	-5	9	253			11	34.2	+54	41	234	NGC 3769	+804 (4)
9	43.4	-19	33	252	NGC 2992+93		11	36.2	+48	4	280		
9	44.3	-14	11	245			11	36.3	+22	11	320	NGC 3786+88	+2737, +2327 (4)
9	44.7	+3	12	303			11	38.1	+32	5	294	NGC 3799+3800	+3424, +3469 (4)
9	51.5	+8	1	255			11	38.6	+15	29	83	NGC 3808	
9	53.1	-6	43	292	IC 575		11	39.4	+22	37	87		
9	53.6	+69	51	337	NGC 3034	+400, +410 (1), +322 (4)	11	40.6	+0	31	161		
9	56.7	+28	59	174			11	41.5	+26	26	115		
10	2.0	+40	52	264	NGC 3104		11	44.9	-3	26	248	NGC 3921	+6023 (4)
10	9.5	-7	46	338			11	49.5	+55	15	224	NGC 3981	
10	16.5	+21	59	316	NGC 3190	+1220, +1284 (1), +1255 (4)	11	52.1	+43	46	62	NGC 3994+95	+3338 (1), +3126 (4), +3356 (4)



TABLE 2 (Cont'd)

$\alpha$ (1970)		No.	Designation	Corrected Redshift km/sec	$\delta$		No.	Designation	Corrected Redshift km/sec
h	m				o	'			
11	56.2	+36 36	194						
11	57.0	+27 44	305	NGC 4016+17					
11	57.2	+25 13	138	NGC 4015	+1701 (4)				
11	58.0	-19 6	22	NGC 4027					
12	0.3	-18 42	244	NGC 4038+39	+1469 (1), +1443 (4), +1456 (1), +1427 (4)				
12	4.0	+50 42	18	NGC 4088	+820 (1), +812 (4)				
12	4.5	+31 14	97						
12	12.1	+16 18	260						
12	12.6	+54 42	160						
12	14.0	+28 21	106	NGC 4194	+2684 (1)				
12	26.3	+13 10	120	NGC 4438	-105 (1)				
12	28.3	+ 8 10	134	NGC 4472	+918 (1), +855 (4)				
12	29.3	+41 48	269	NGC 4485+90	+675 (1), +848 (4), +622 (4)				
12	29.3	+12 34	152	NGC 4486	+1218, +1187 (4), +1124 (1)				
12	31.4	+11 34	175	IC 3481+83	+7011 (1), +31 (4)				
12	35.3	+13 19	76	NGC 4569	+896 (1)				
12	35.8	+38 55	211						
12	38.0	+16 46	149						
12	40.0	+26 14	34						
12	40.1	+41 19	23						
12	40.8	+32 42	281	NGC 4618	+541 (1)				
12	42.0	+11 45	116	NGC 4631	+611 (1), +646 (4)				
12	42.2	+16 33	189	NGC 4647+49	+1321, +1379 (1), +1328 (4), +1175 (1), +1200 (4)				
12	43.8	+20 17	163	NGC 4651	+1209 (1)				
12	44.7	+37 54	242	NGC 4670	+6515 (A), +6620 (B), (4)				
12	50.3	+25 57	159	NGC 4747					
12	52.5	+36 15	265	IC 3862	+854 (4), +794 (4)				
12	54.3	+ 2 42	277	NGC 4809+10	+829 (1), +831 (4)				
12	57.5	+35 2	266	NGC 4861					
13	2.2	-11 20	176	NGC 4933					
13	6.0	+26 53	139						
13	13.0	+26 18	196						
13	13.2	+26 16	60						
(13	13.4)	(+62 18)	238						
13	15.2	+14 35	57						
13	19.2	+34 17	193	IC 883	+6918 (23)				
13	23.6	-42 51	153	NGC 5128	+261 (1), +271 (4)				
13	24.0	+84 39	204						
13	28.1	+37 34	40	IC 4241					
13	28.6	+47 21	85	NGC 5194+95	+546 (1), +552 (4)				
13	29.1	+31 47	334						
13	31.1	+62 52	104	NGC 5216+18					
13	32.9	+31 35	36						
13	33.5	+13 58	288	NGC 5221+22+26					
13	33.6	+31 33	183						
13	36.1	+ 6 35	33						
13	36.1	+ 6 35	326						
13	38.4	+ 0 59	240	NGC 5257+58	+6744, +6569 (4)				
13	40.5	+55 49	239	NGC 5278+79	+7665, +7708 (4),				
13	57.4	+37 35	84	NGC 5394+95	+3651 (1)				
14	0.4	+33 58	111	NGC 5421					
14	1.8	- 5 55	271						

TABLE 2 (Cont'd)

$\alpha$ (1970) $\delta$				$\alpha$ (1970) $\delta$				Designation	Corrected Redshift km/sec	Designation	Corrected Redshift km/sec
h	m	'	''	h	m	'	''				
17	18.7	+49	5	22	58.6	+15	49	102		NGC 7448	+2649 (1)
17	22.5	+62	11	23	1.7	+8	42	30		NGC 7469	+5015 (4), +4988, +4899 (1)
17	26.9	+58	33	23	13.8	+18	48	310		NGC 7550	
17	26.9	+58	33	23	15.8	+18	32	311	+1751 (1)	NGC 7578	
17	30.1	+75	45	23	16.4	-4	49	38		NGC 7585	+3502 (4), +3485, +3538 (1)
18	13.4	+68	18	23	17.3	+0	5	81	+6490 (4)	NGC 7603	
20	34.3	+60	2	23	18.0	+9	20	150		NGC 7609	
22	1.7	-21	12	23	19.0	+17	4	212	+371 (4), +330, +221 (1)	NGC 7625	+2050 (1), +2009 (4)
22	13.3	+13	42	23	26.3	+8	37	325		NGC 7678	+3676 (1), +3680 (4)
22	18.1	+29	14	23	27.1	+22	15	169	+8098, +8093 (4)	NGC 7679+82	+5378, +5278 (1), +5330 (4)
22	19.1	-24	50	23	27.2	+3	22	278		NGC 7714+15	+3001 (1), +2963 (1)
22	27.0	-25	0	23	32.2	+29	52	226	+4817 (4)	NGC 7727	+1953 (4), +1943, +1982 (1)
22	34.1	-26	12	23	34.7	+2	0	93		IC 1505	
22	34.5	+33	47	23	35.3	-12	27	14	+1838 (1)	NGC 7752+53	+5108, +5085 (4)
22	34.8	-3	6	23	39.9	-3	44	319	(1), (13)	NGC 7756	
22	50.0	-5	43	23	47.0	+3	57	3	+3975 (1), +3972 (4)	NGC 7783	
22	52.5	-15	22	23	52.6	+0	13	110		IC 1520	
22	56.3	-3	57	23	56.4	-14	12	15		IC 1520	
				23	58.9	+22	50	249		NGC 7805+06	
				23	59.9	+31	17	314			

TABLE 3  
RADIO OBSERVATIONS ON OR NEAR ATLAS GALAXIES

Atlas	Designation	Radio Source Name	References	Remarks	References
331	NGC 383	3C31	(1)(5)	Diameter $2:5 \pm 1:5$	(1) Edge, D. O., Shakeshaft, J. R., McAdam, W. B., Baldwin, J. E., and Archer, S., R. A. S. Memoirs, LXVIII, 37.
227	NGC 470+74	M01+03	(10)(1)	Also 3C397	(2) Wade, C. M., Pub. Nat. Radio Astr. Obs., Vol. 1, No. 6.
133, 308	NGC 541+45+47	3C40, M01-01	(1)(5)(7)(10) (3, Table IV)	Double source	(3) Heeschen and Wade, A. J., 69, 277 (1964).
78	NGC 772	M02-00, 3C71	(1)(3)(7)	Seyfert Galaxy	(4) Clarke, Margaret E., M. N., 127, 405 (1964).
37	NGC 1068	M03-37	(6)(2)(11)	For A	(5) Bennet, A. S., 1962, Mem. R. A. S. LXVIII, 163.
154	NGC 1316	M09-19	(3, Table X, XII)	VV50	(6) Stanley, G. J. and Slee, O. B. 1950, Astr. J. Sci. Res. A, 3, 234.
283	NGC 2798-9	M09-19	(10)	VV50	(7) Fomalont, E. B., Matthews, T. A., Morris, D. and Wyndham, J. D. 1964, A. J., 68, 772.
252	NGC 3034	3C231	(1)(4)(3, Table IV)(7)(8)	M82	(8) Wyndham, J. D. and Read, R. B. 1965, A. J. 70, 120.
337	NGC 3310		(3, Table X)		(9) Bolton, J. G. 1948, Nature 162, 141.
217	NGC 3448		(3, Table X)		(10) Mills, B. Y., Slee, O. B., and Hill, E. R. 1958, Austr. J. Physics 11, 362.
205	NGC 3627+28	M11-18	(3, Table IV, XII)	VV308	(11) Mills, B. Y., Slee, O. B. and Hill, E. R., 1960, Austr. J. Physics 13, 676.
16, 317	NGC 4038+39		(3, Table IV, XII)	VV245	
244	NGC 4088		(3, Table IV)		
18	NGC 4472	3C274	(3, Table IV)	$\Delta\alpha = 0:8$	
134	NGC 4486		(3, Table IV)(1)(7)(8)	M87, Vir A	
152	NGC 4490+85		(3, Table XII)	VV30	
269	NGC 4569		(3, Table IV)		
76	NGC 4631		(3, Table IV)		
281	NGC 4651	3C275.1	(3, Table IV)(1)	Prob. not assoc. w spiral	
189	NGC 5128	M13-42	(9)(2)(7)	Cen A	
153	NGC 5194		(3, Table IV, XII)	M51, VV1	
85	NGC 5394-5		(3, Table XII)	VV48, Possible radio source	
84	NGC 5457		(3, Table IV, XII)	M101, VV344	
26	NGC 5566	M14+04	(10)		
286	NGC 5946		(3, Table IV)		
29	NGC 7236+37	3C442	(5)(7)(6)	$4' < \text{diam} < 10'$	
169	NGC 7469		(3, Table X)	Confused region	
298			(3, Table X)		

See also remarks after Atlas No. 35, 75, 150, 171, 186, 132, 256, 100, 53

MSH sources designated with first two figures from right ascension plus sign and first two figures from declination.

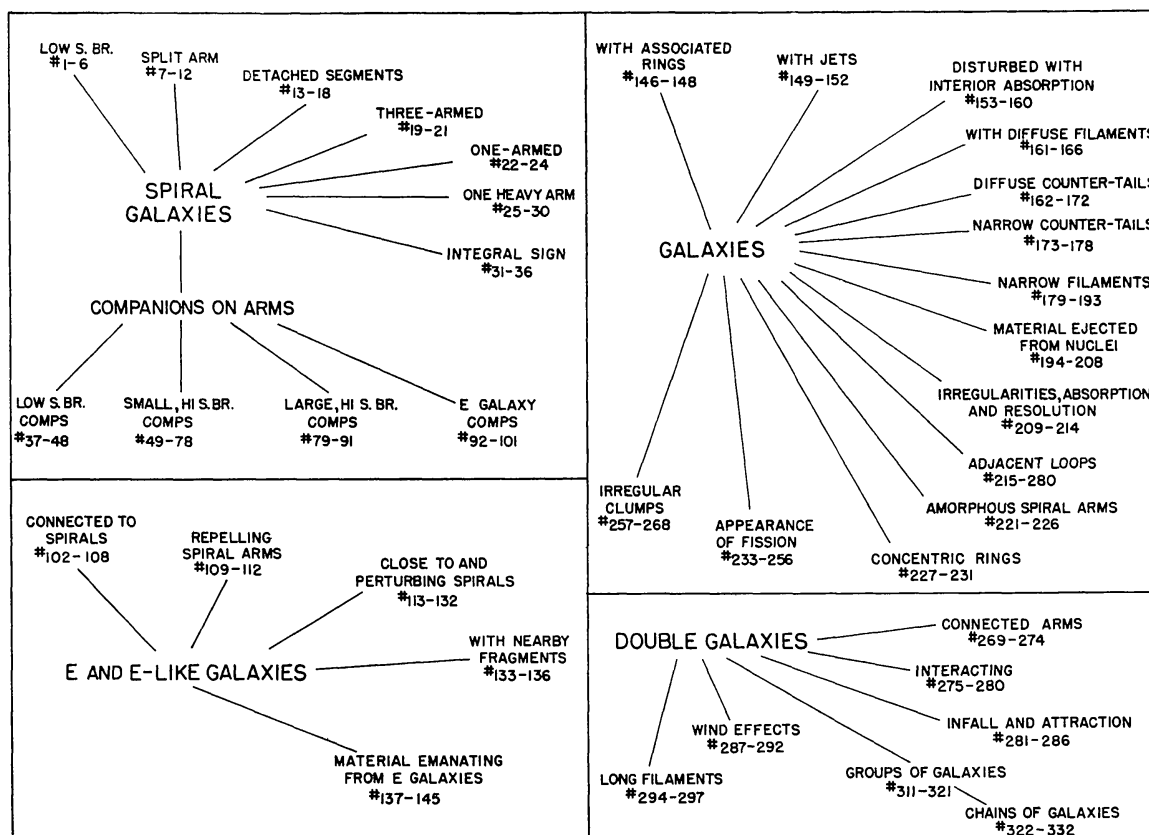


FIG. 1.—Plan of arrangements for the objects in the *Atlas*. The diagram shows major peculiarities which determine classification. Comments on additional peculiarities are given in Table 1. Characterization of peculiarities is sometimes descriptive rather than literal.