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 Unusual galaxies were selected from lists by Zwicky, Vorontsov-Velyaminov, and unpublished lists by A. G. Wilson, E. Herzog, Wirtanen, the author, and others.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 $\delta = -27°$. 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).[1] 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.

[1] 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 Kowal, 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 λ 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 λ 3600 cutoff of the f/3.67 corrector lens on the 200-inch telescope and the λ 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 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

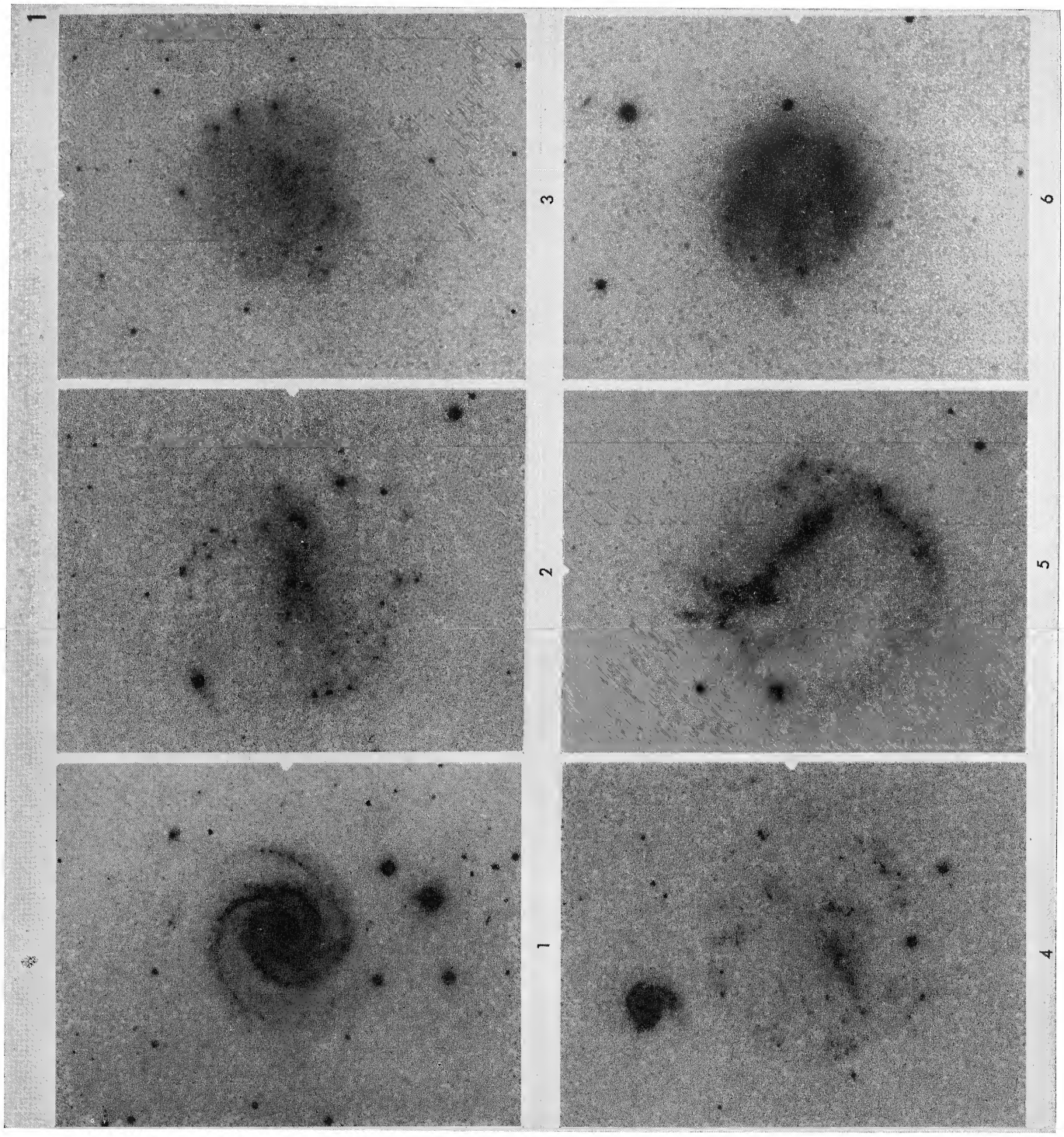
The 338 photographs shown in the following fifty-seven pages of the *Atlas* all have a notch marking the north point. West is 90° clockwise. The prints represent magnifications from the original plates of 1×, 2×, 4×, 6×, 8×, and 10×. Since all the 200-inch plates in this program were taken with the Ross 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.

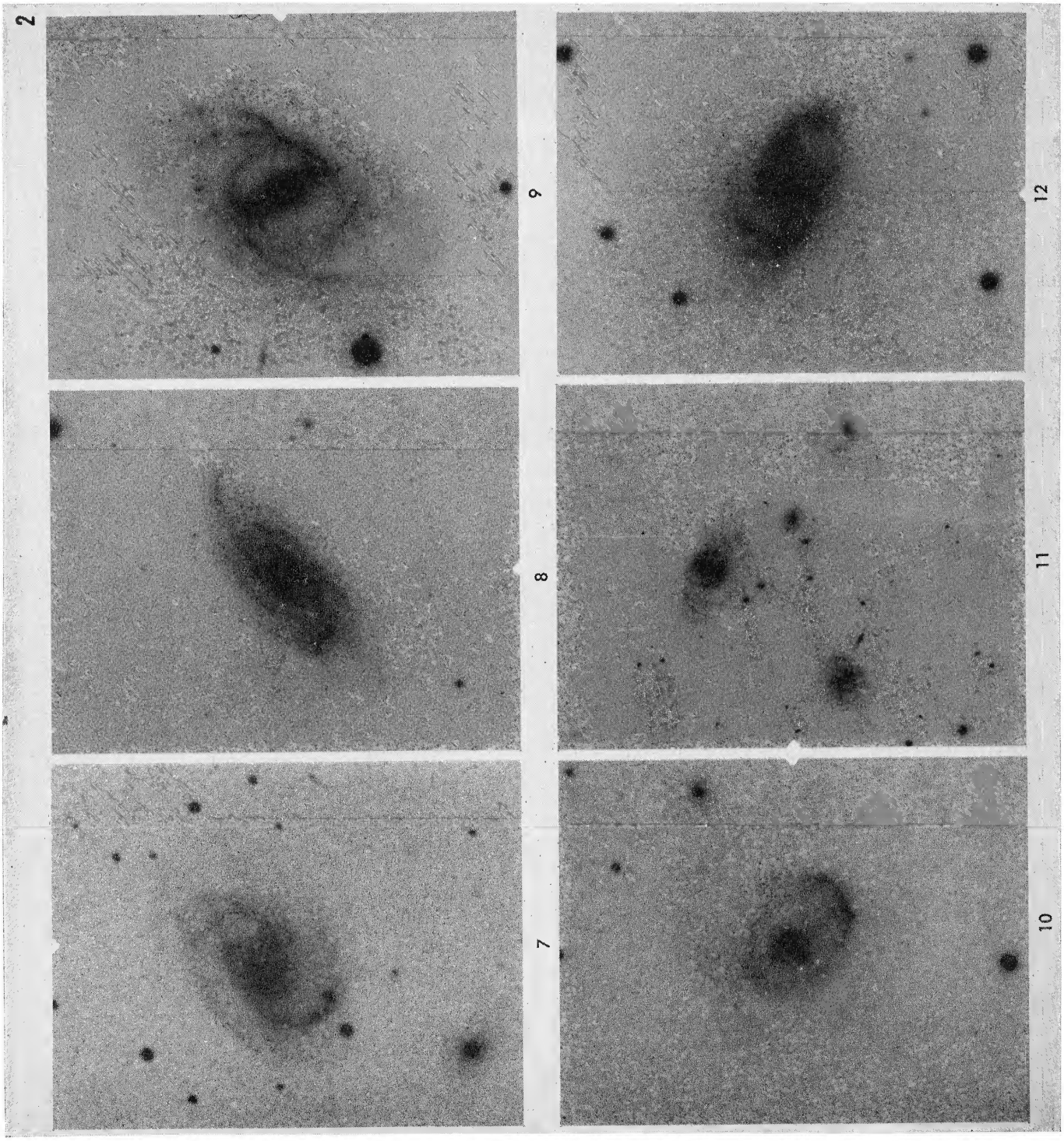
About one-third of the prints were made by an automatic, fluorescent screen dodging process, i.e., by compressing the density range so that one can see very faint features and yet see into the brighter inner regions on the same print. In some cases the automatic dodging has introduced slightly lighter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

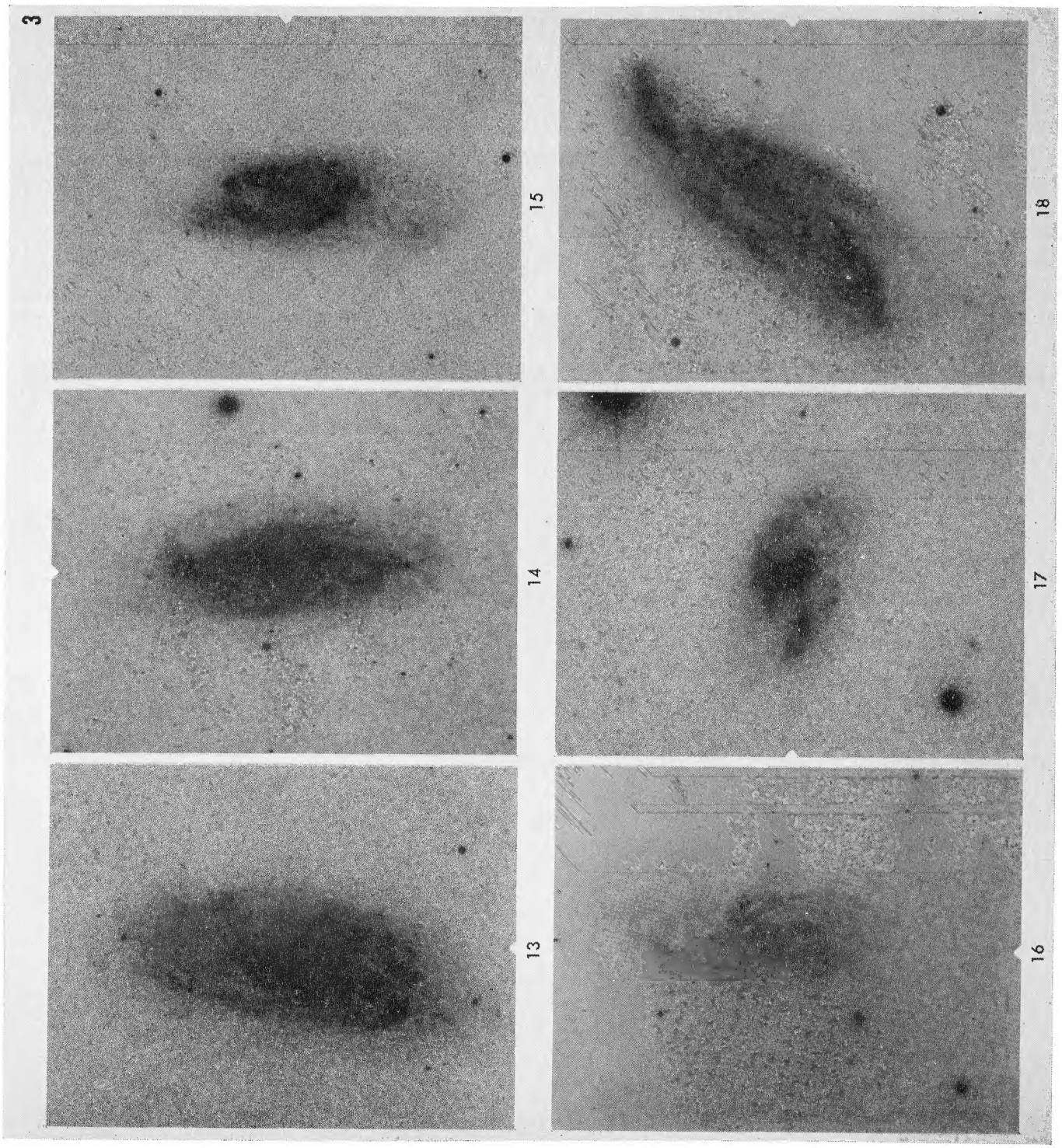
THE CATALOGUE

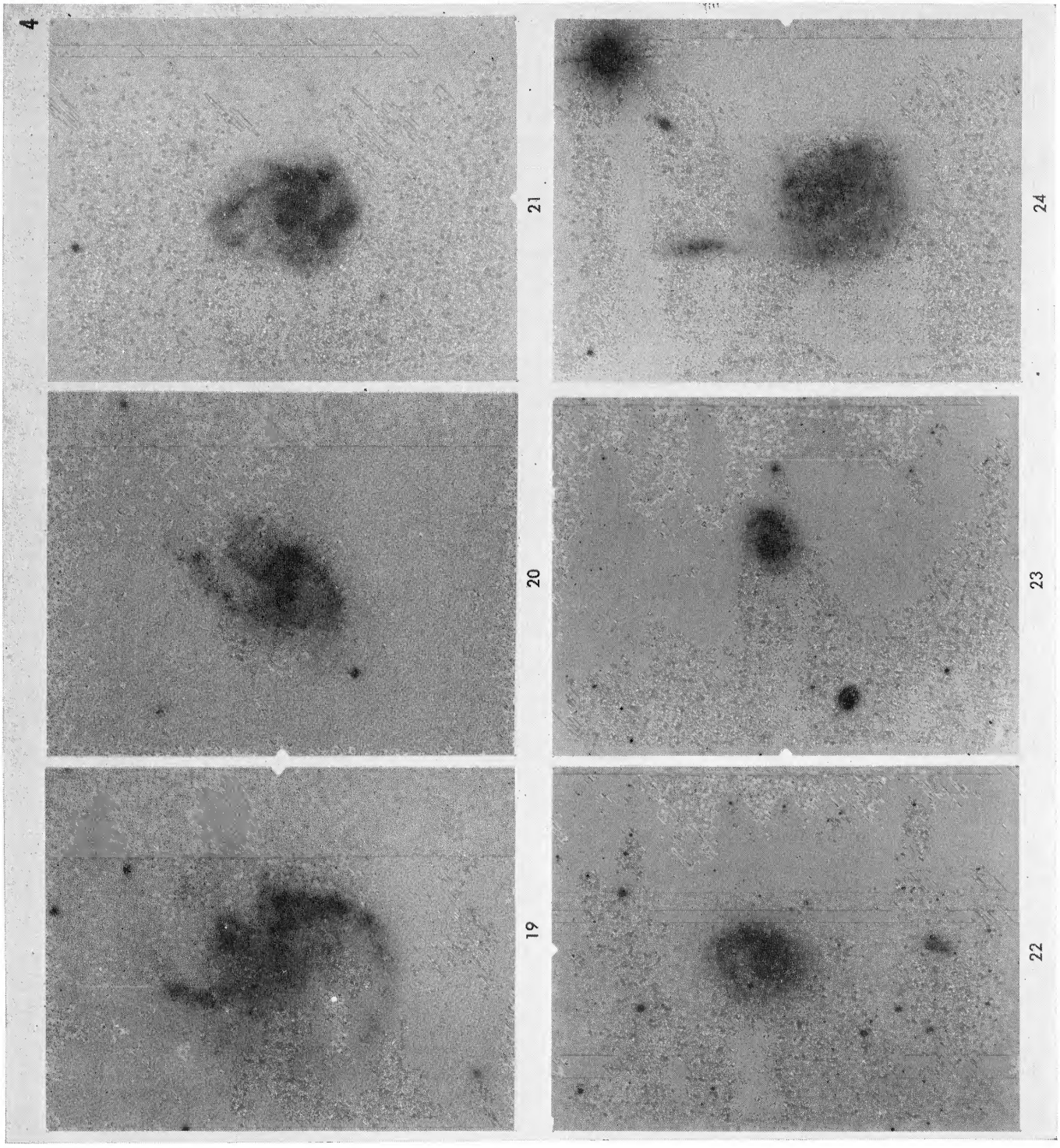
Col. 1: Identification number in this catalogue. See Figure 1 for arrangement of types of objects.

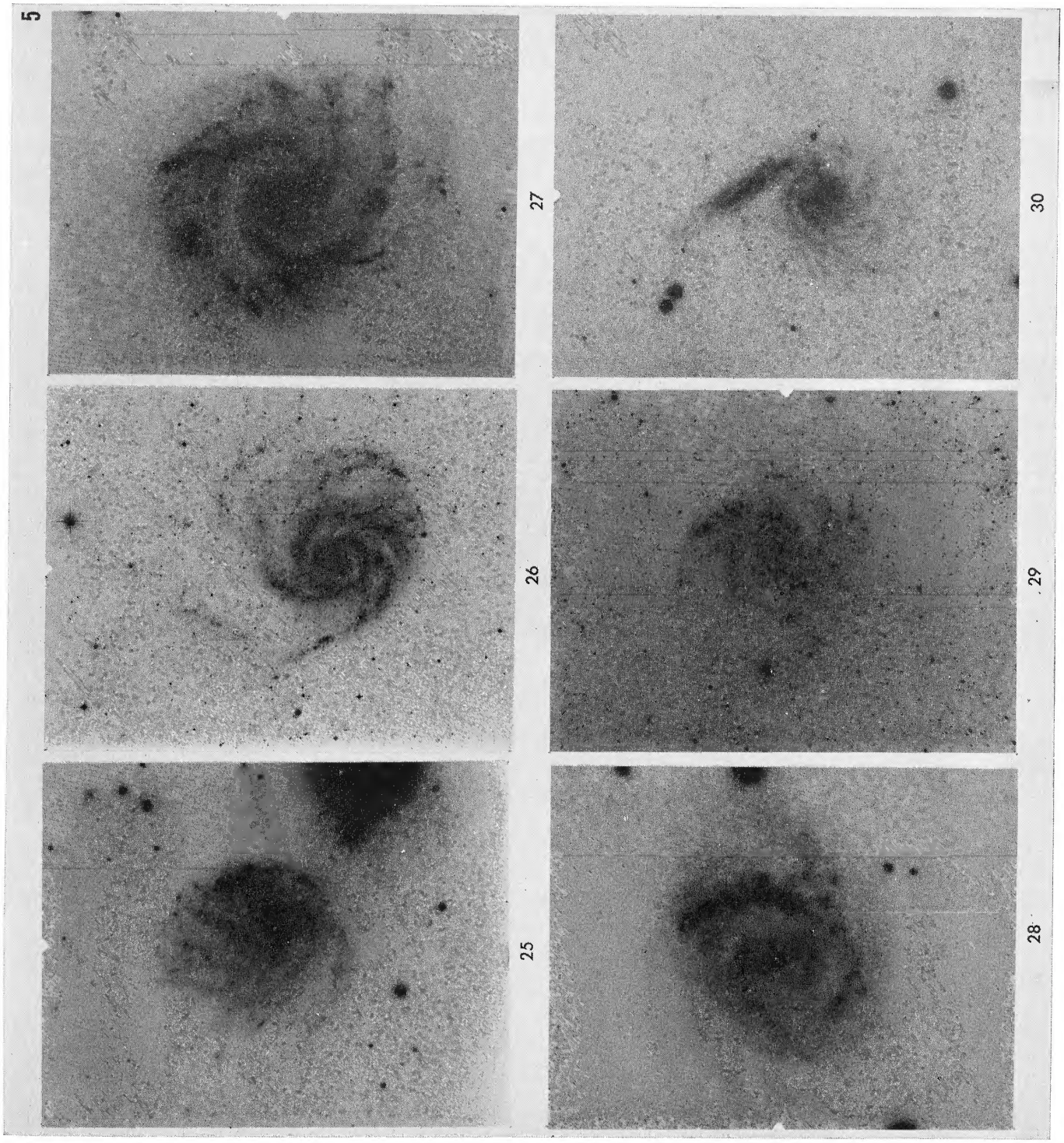
Cols. 2–3: Right ascension and declination of objects for 1970 epoch. Positions are from three sources: (1) NGC positions where available. If more than one NGC object is pictured, the position of the westernmost (smallest number) is given. (2) Positions from

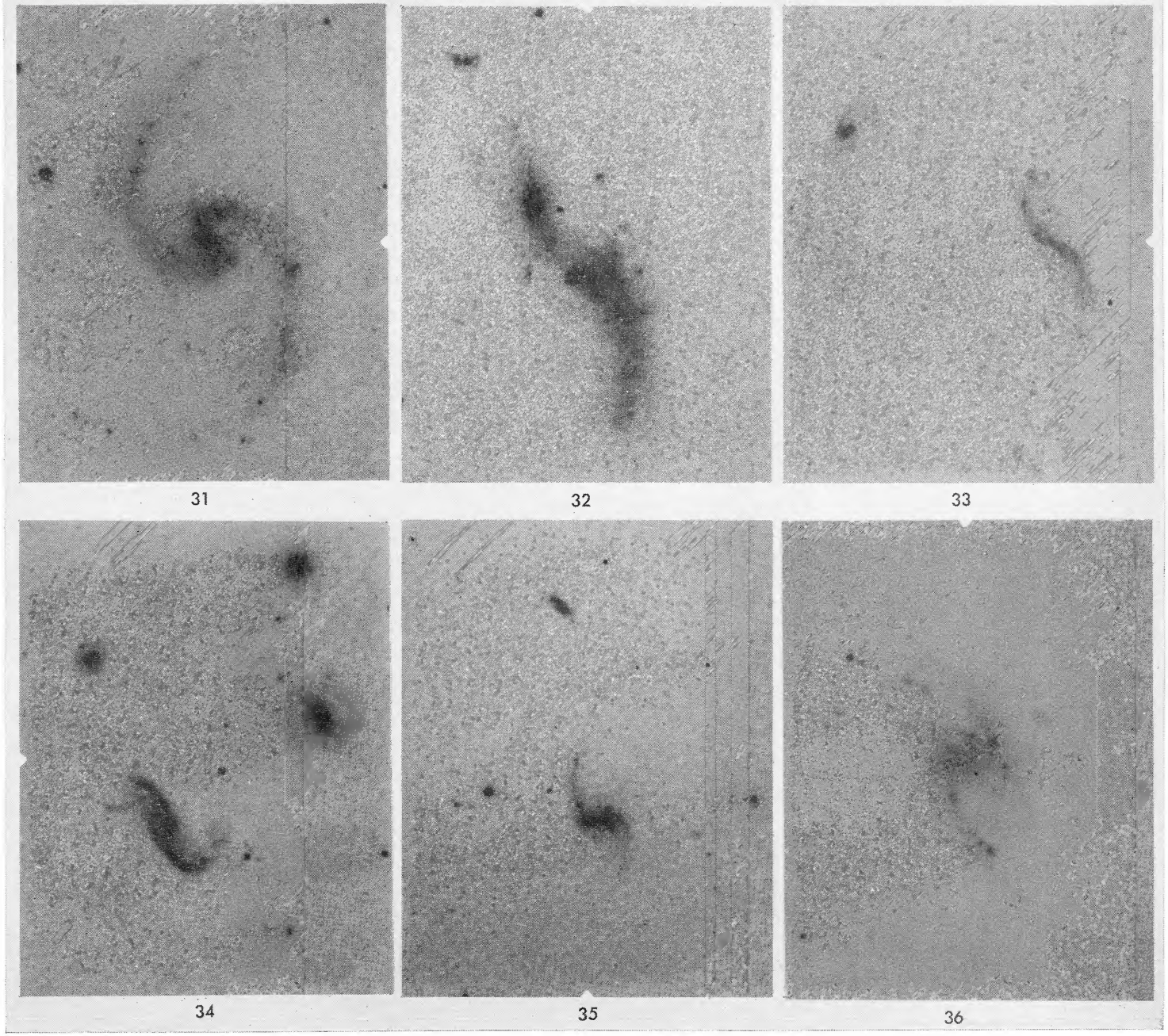


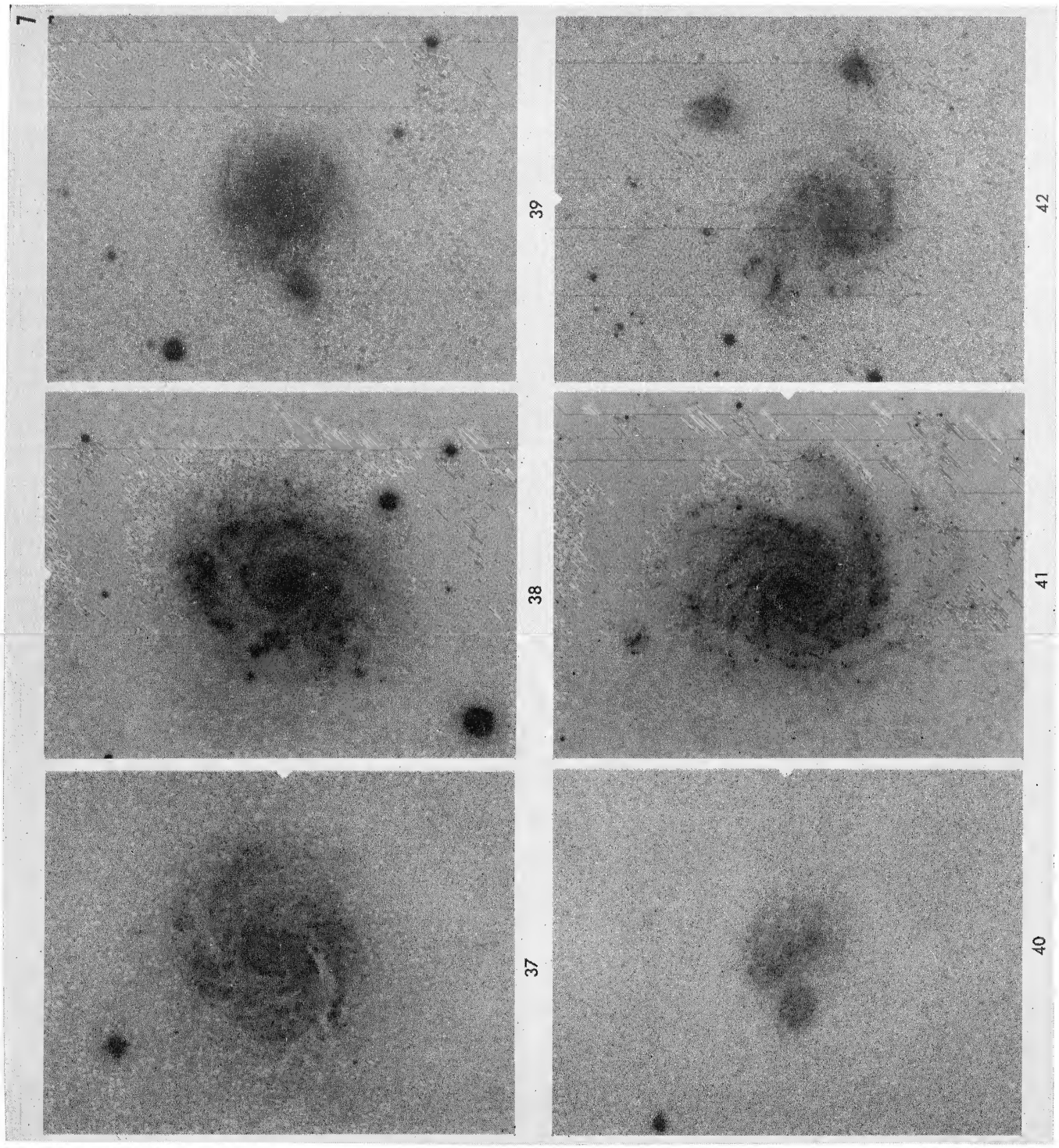


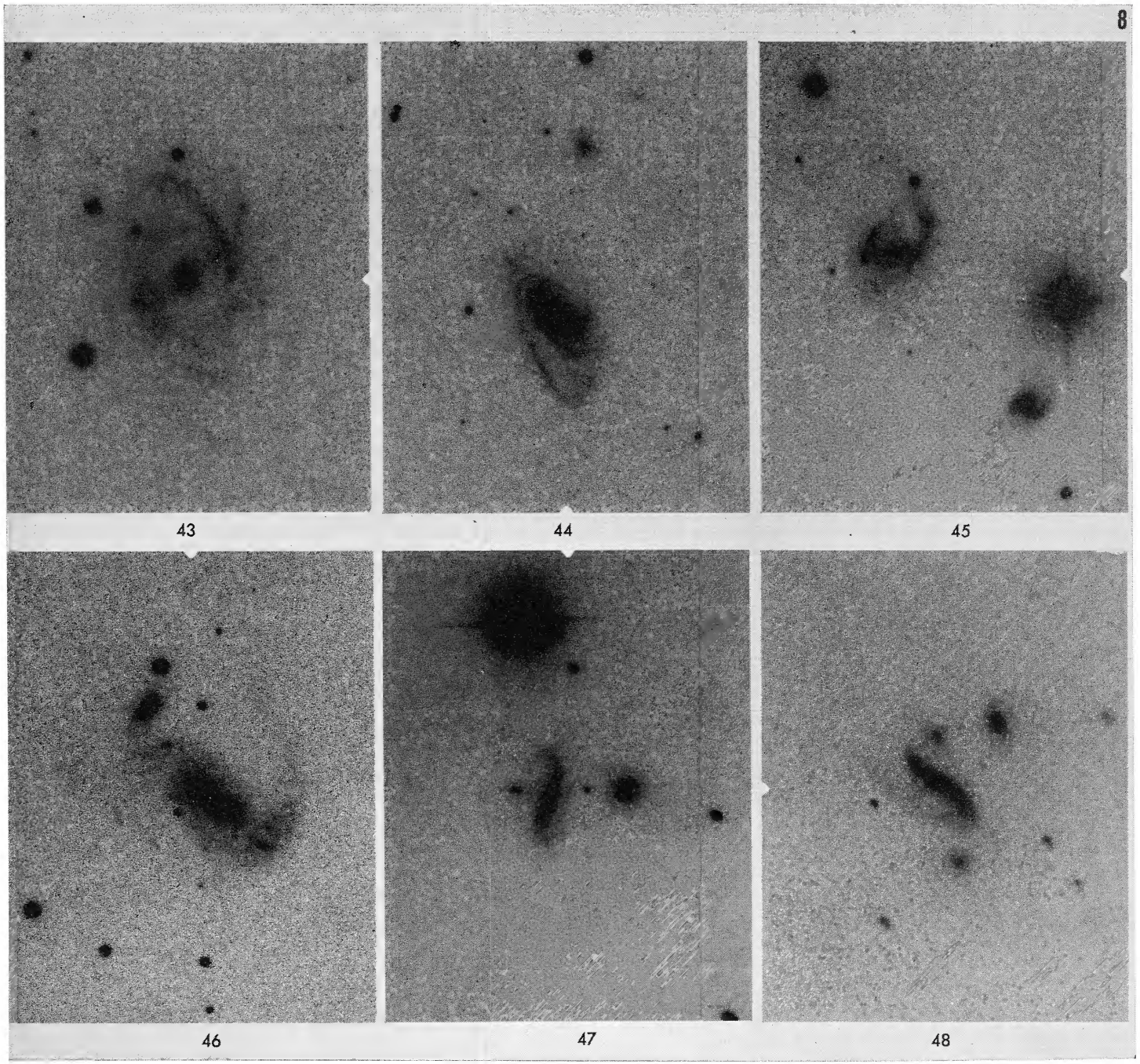


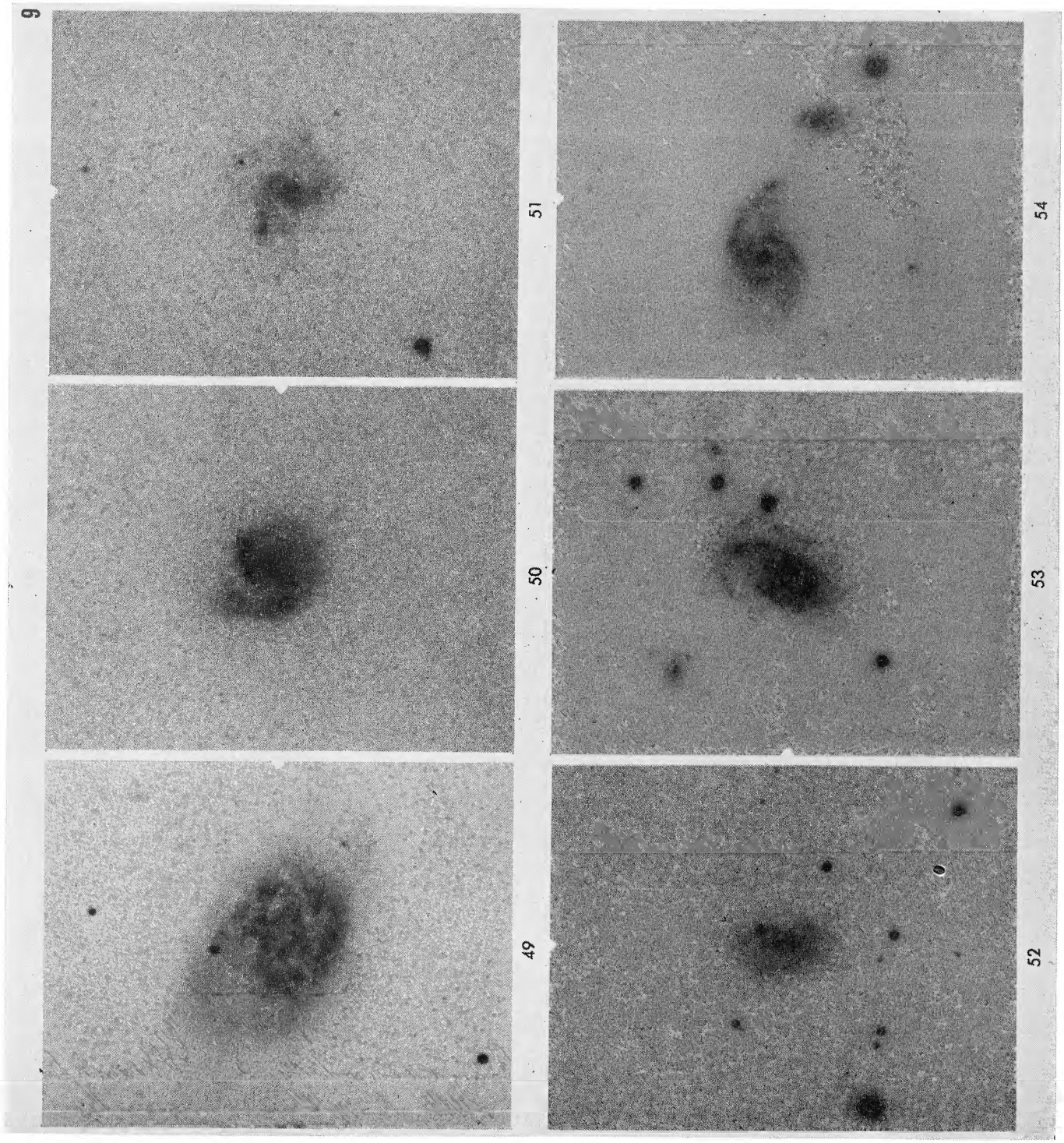


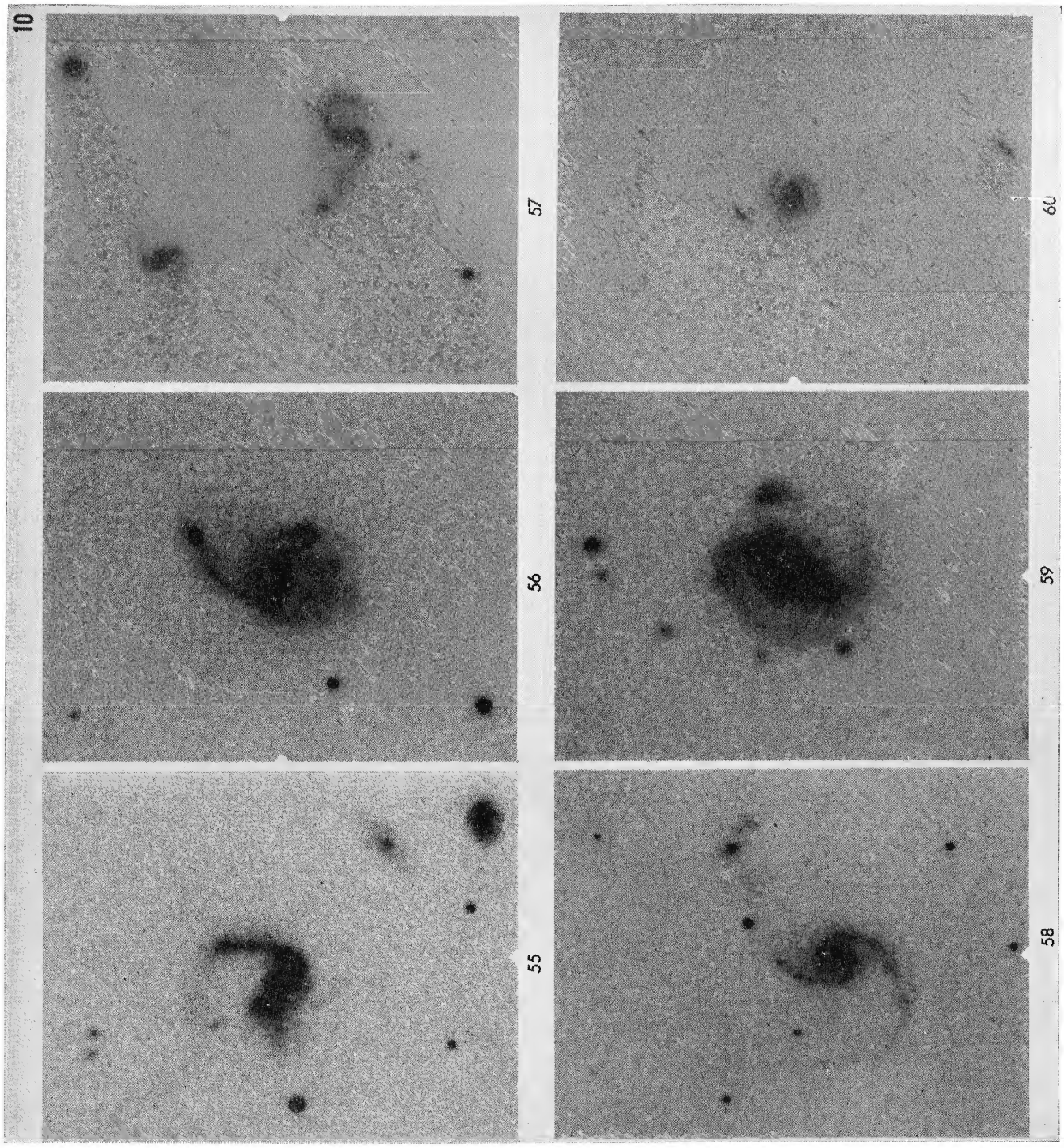


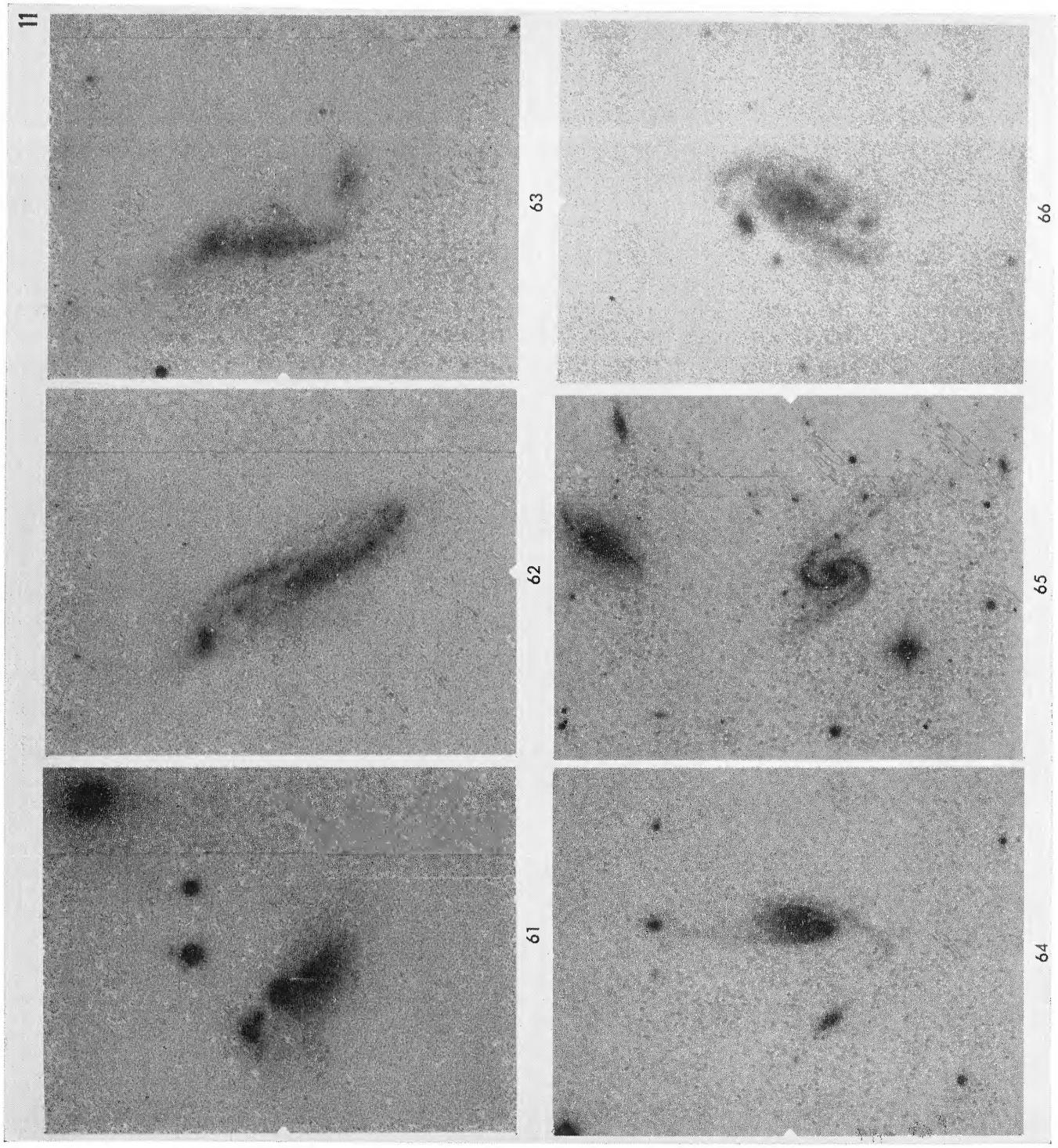


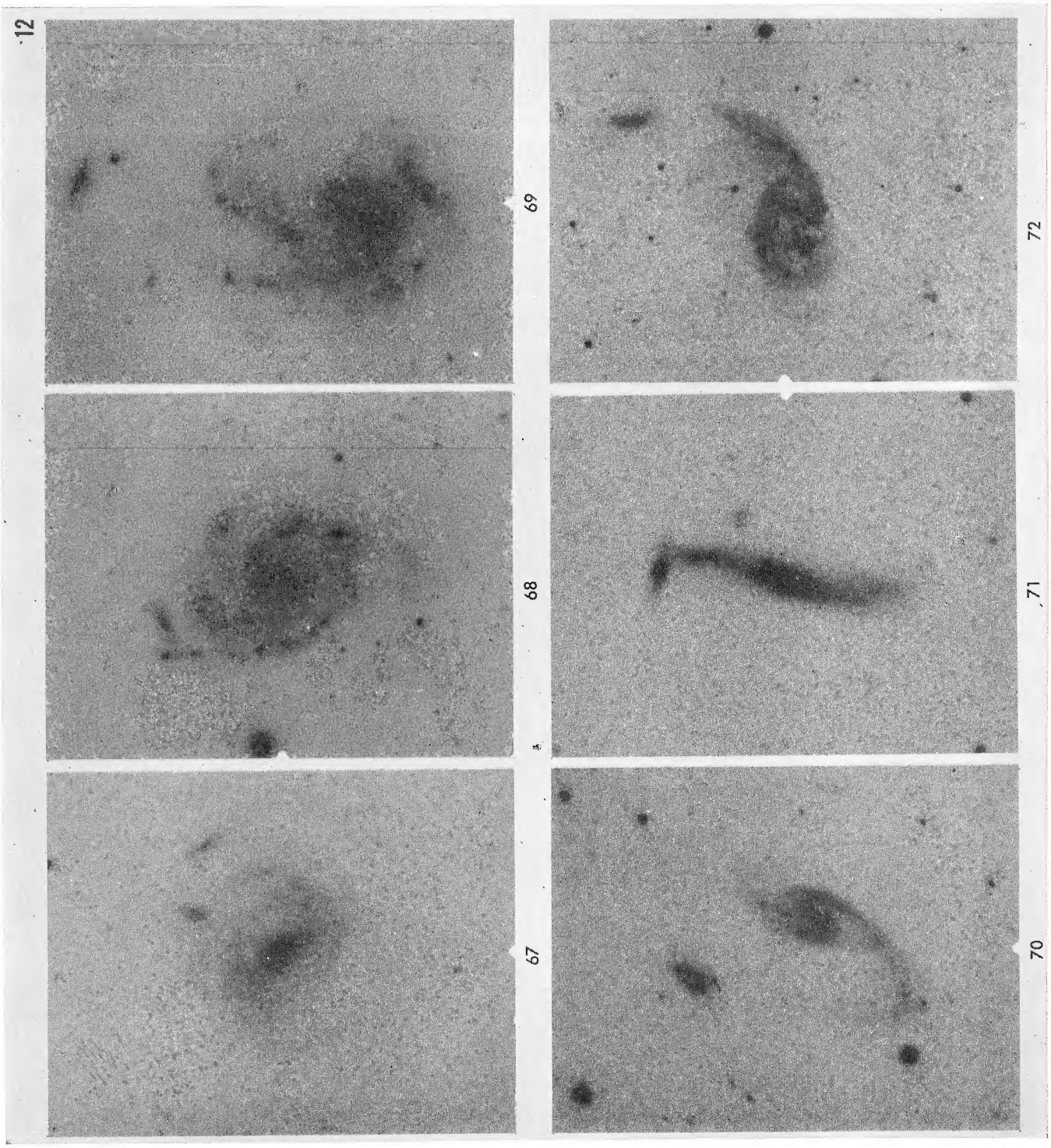


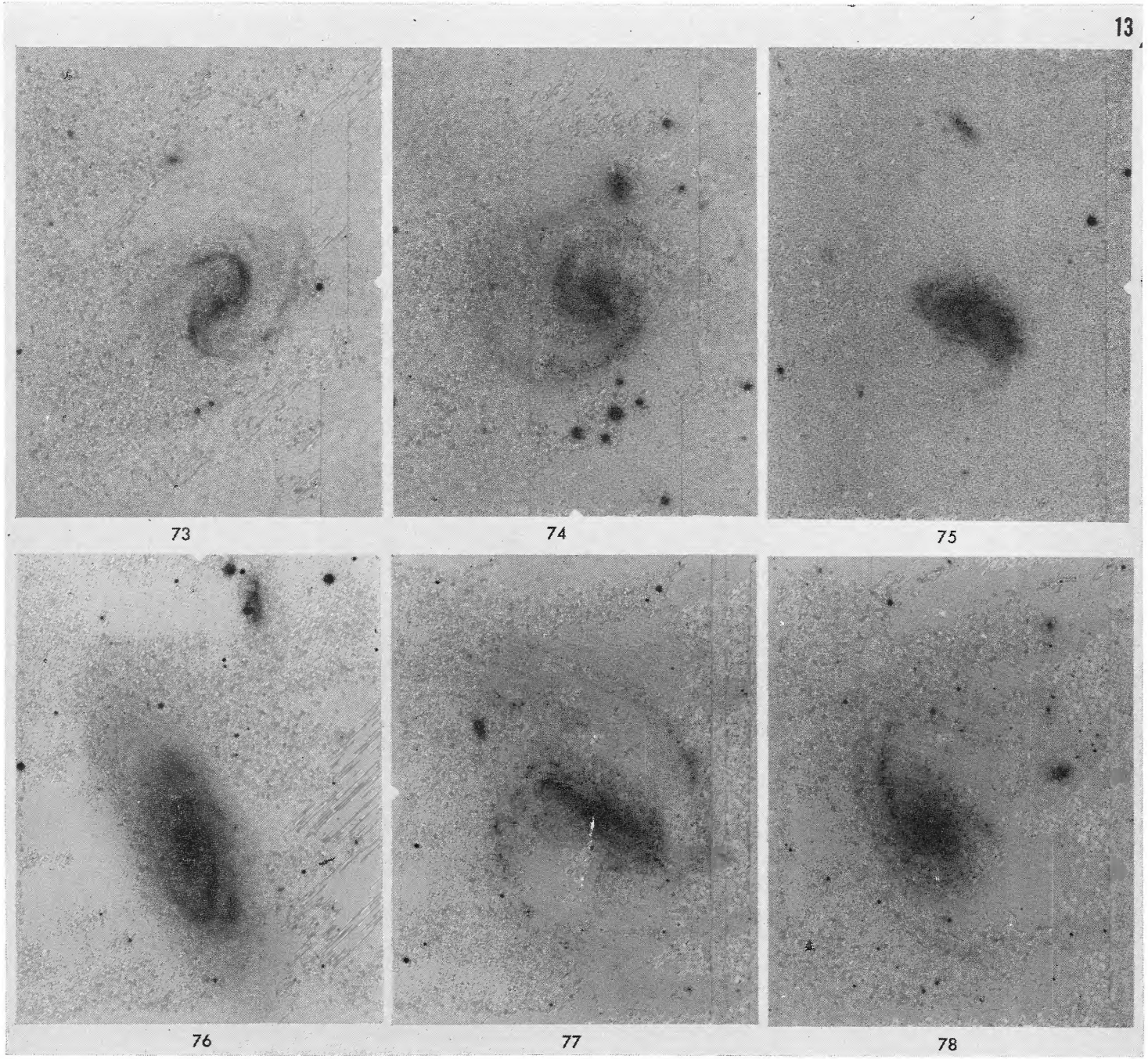












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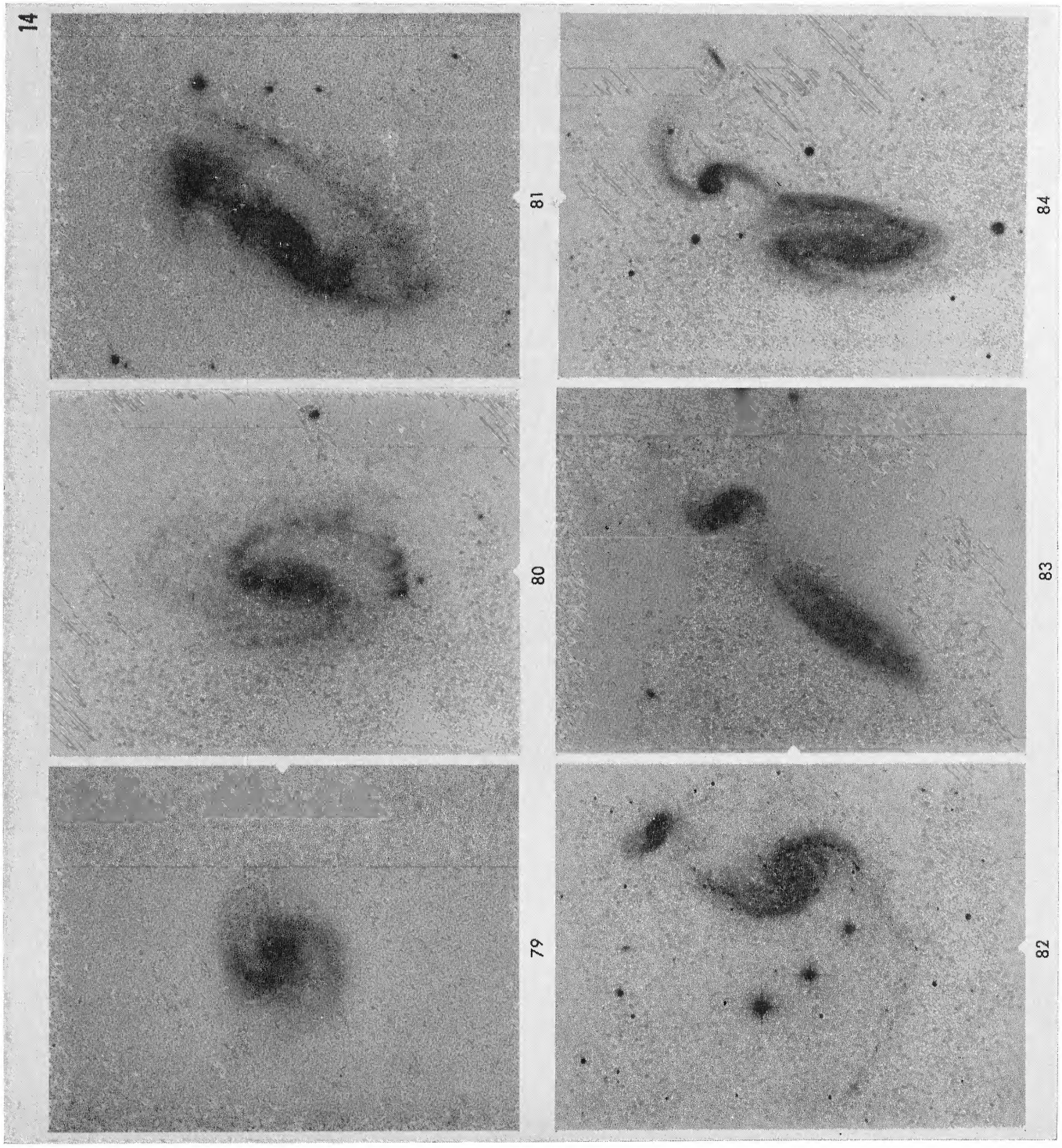

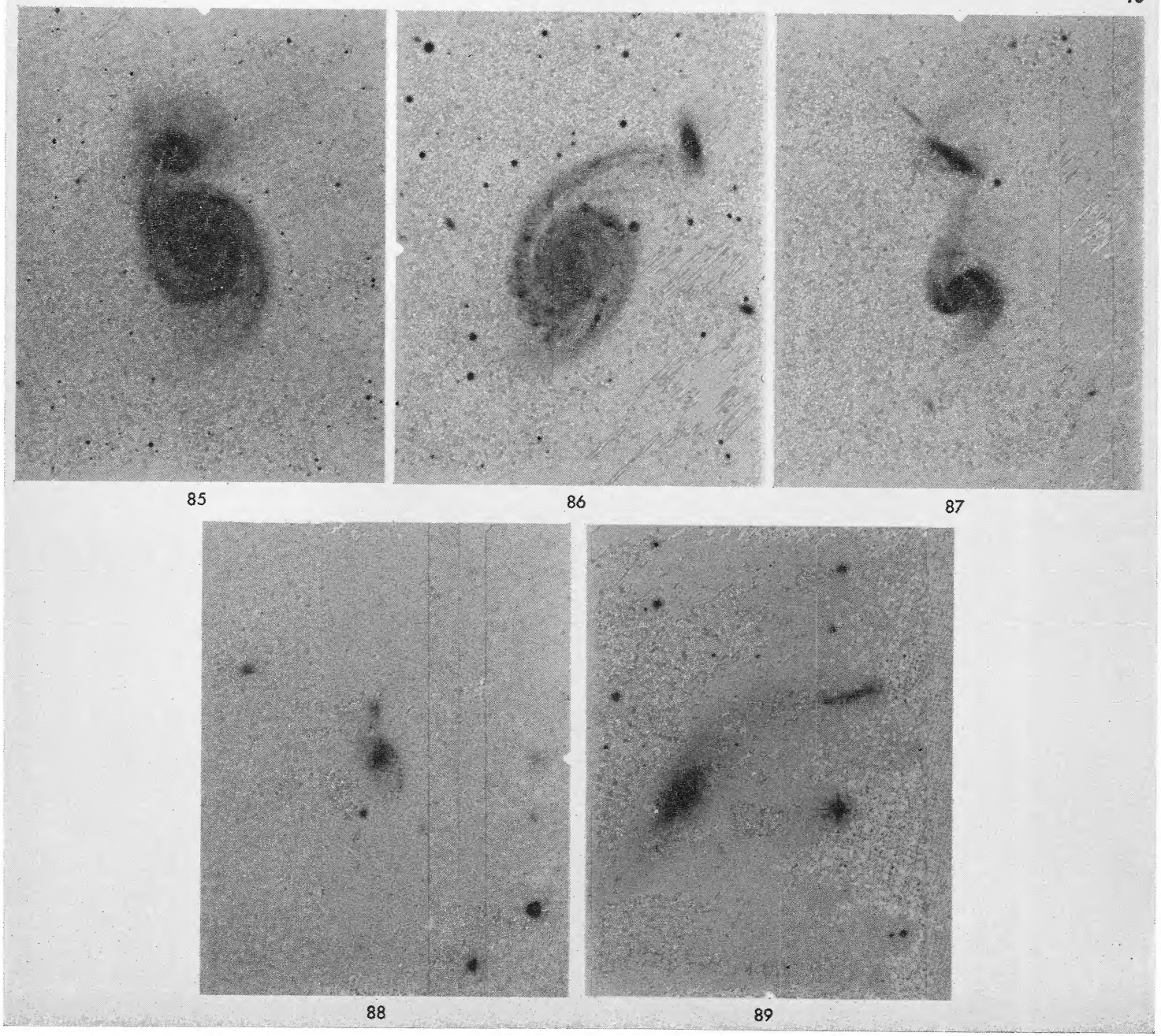

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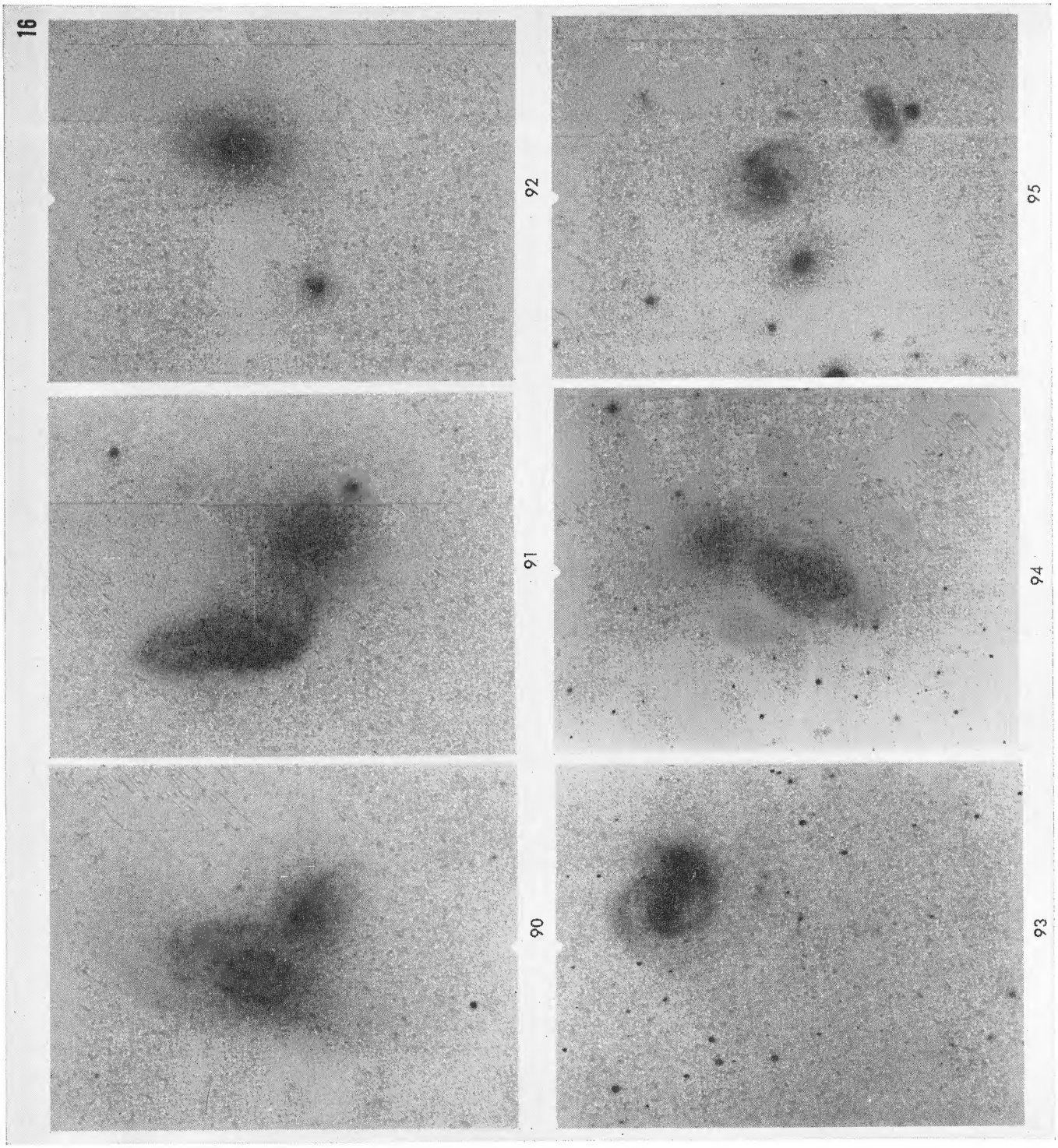

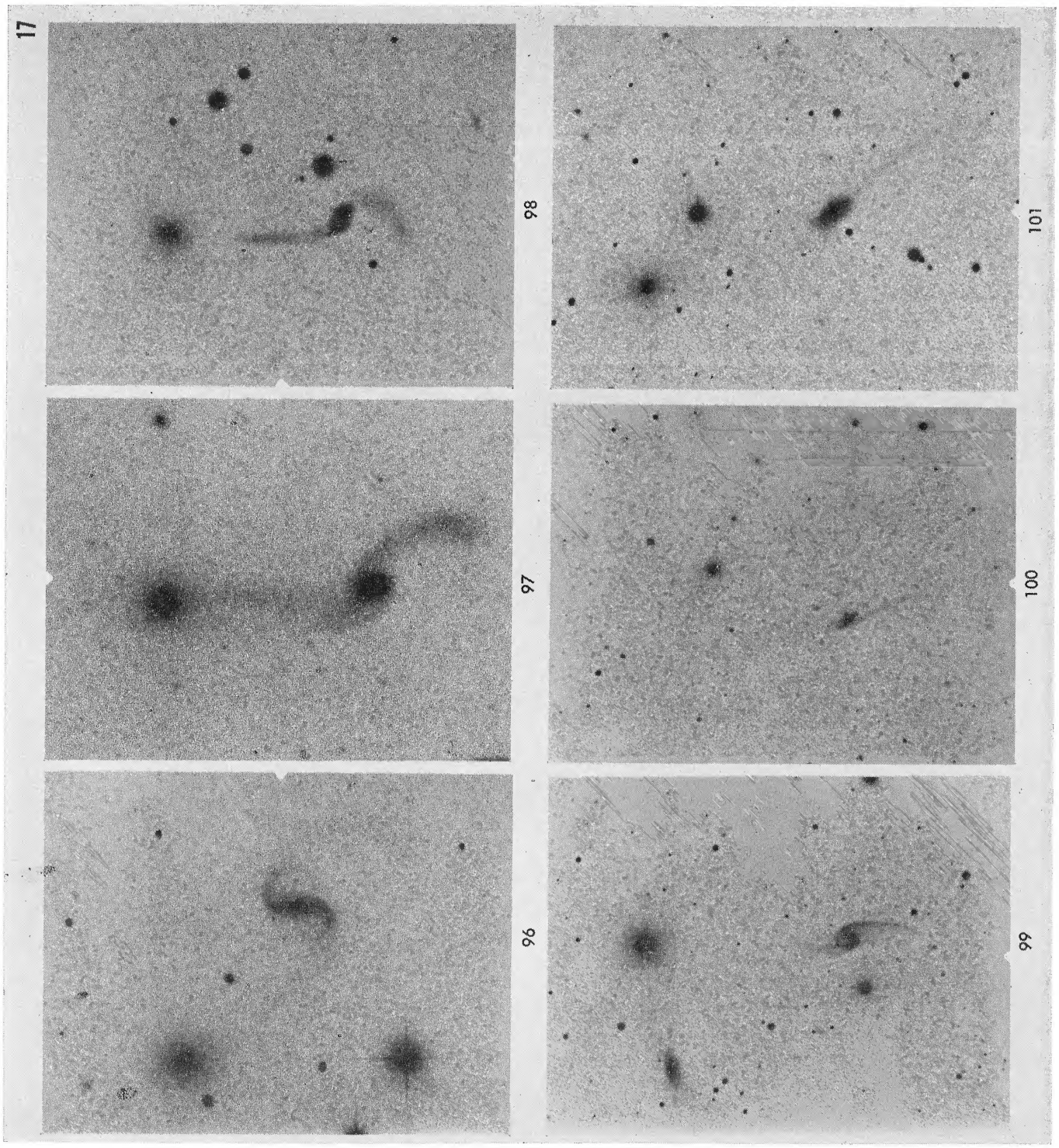

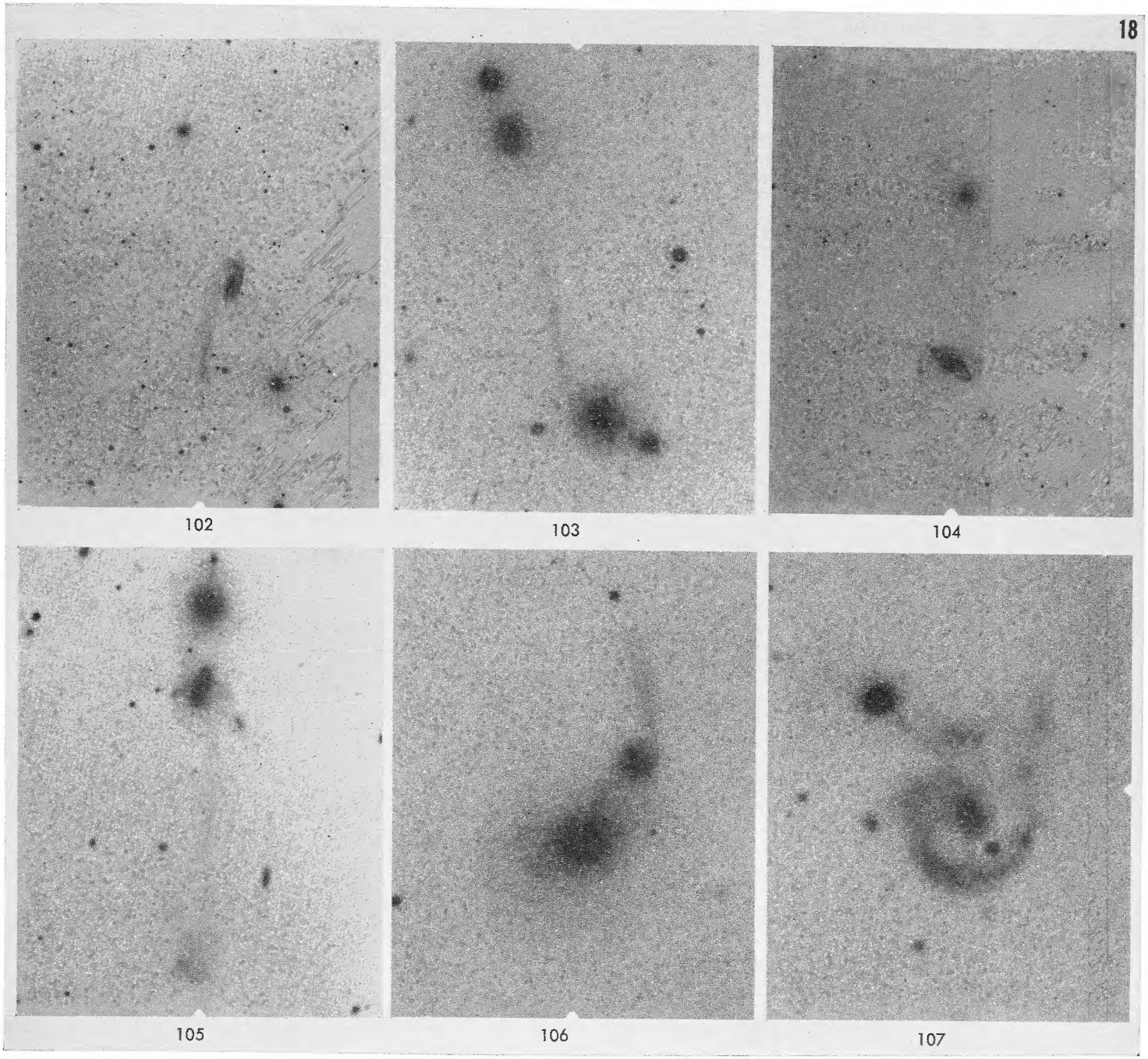

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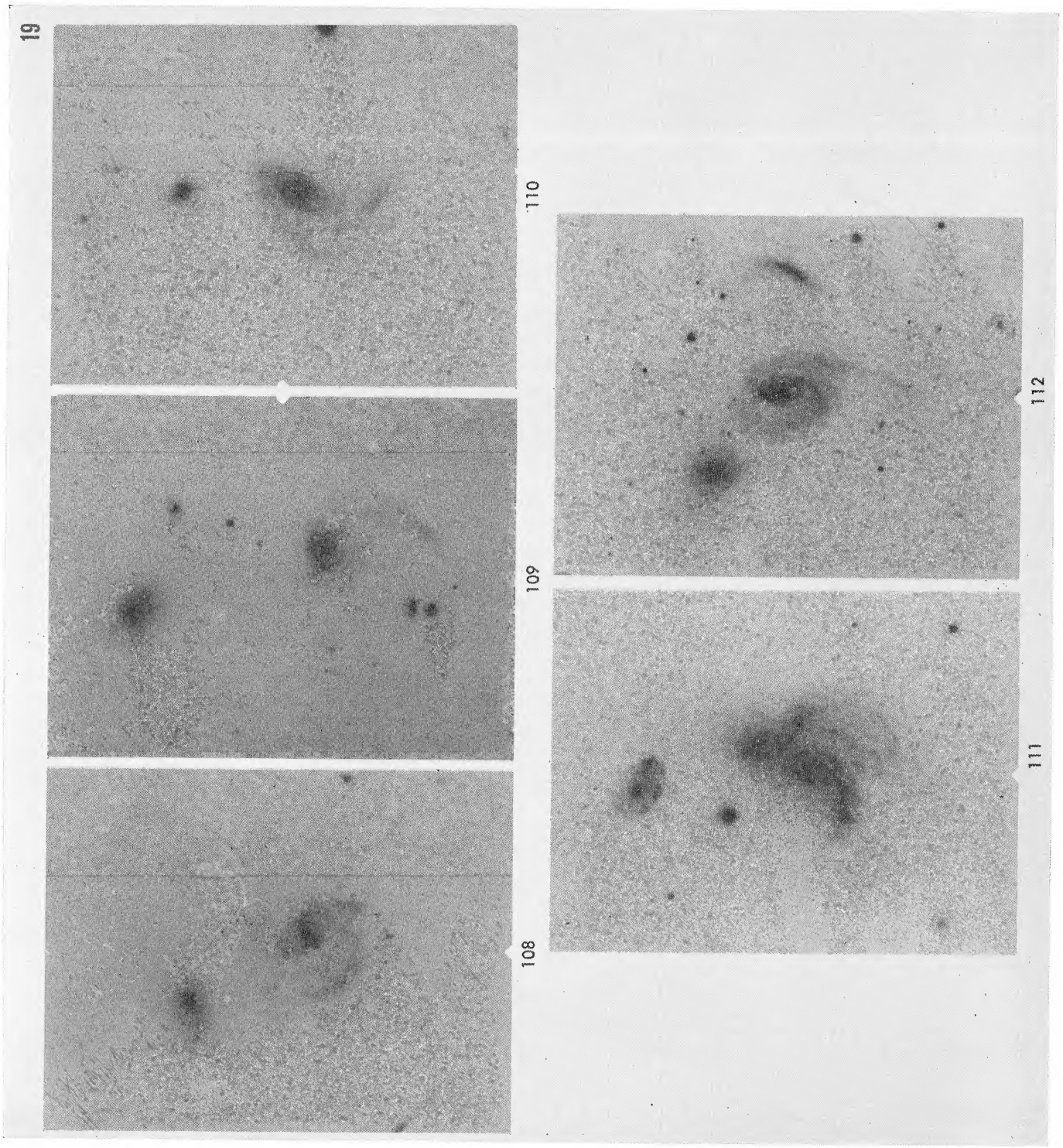

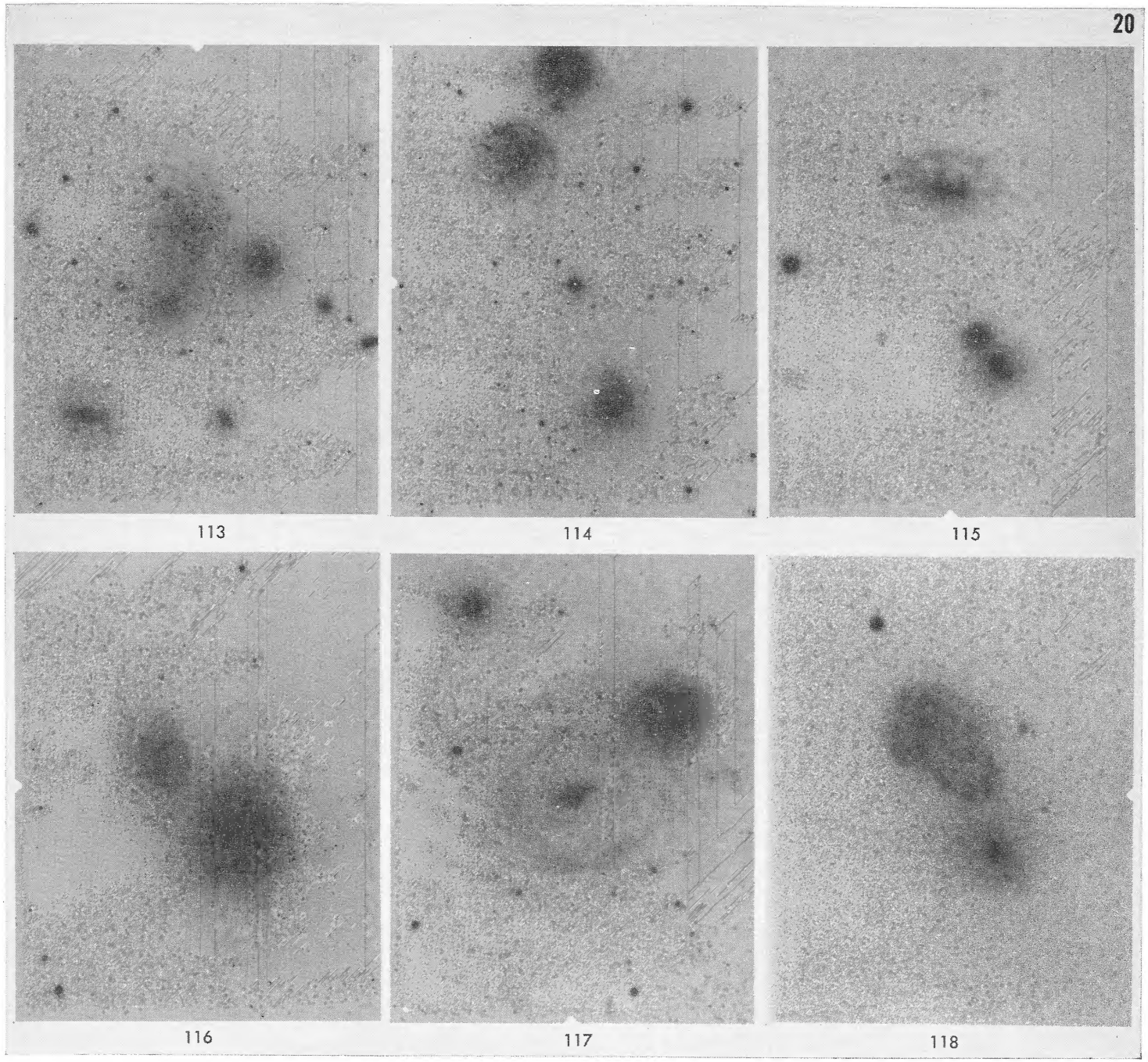

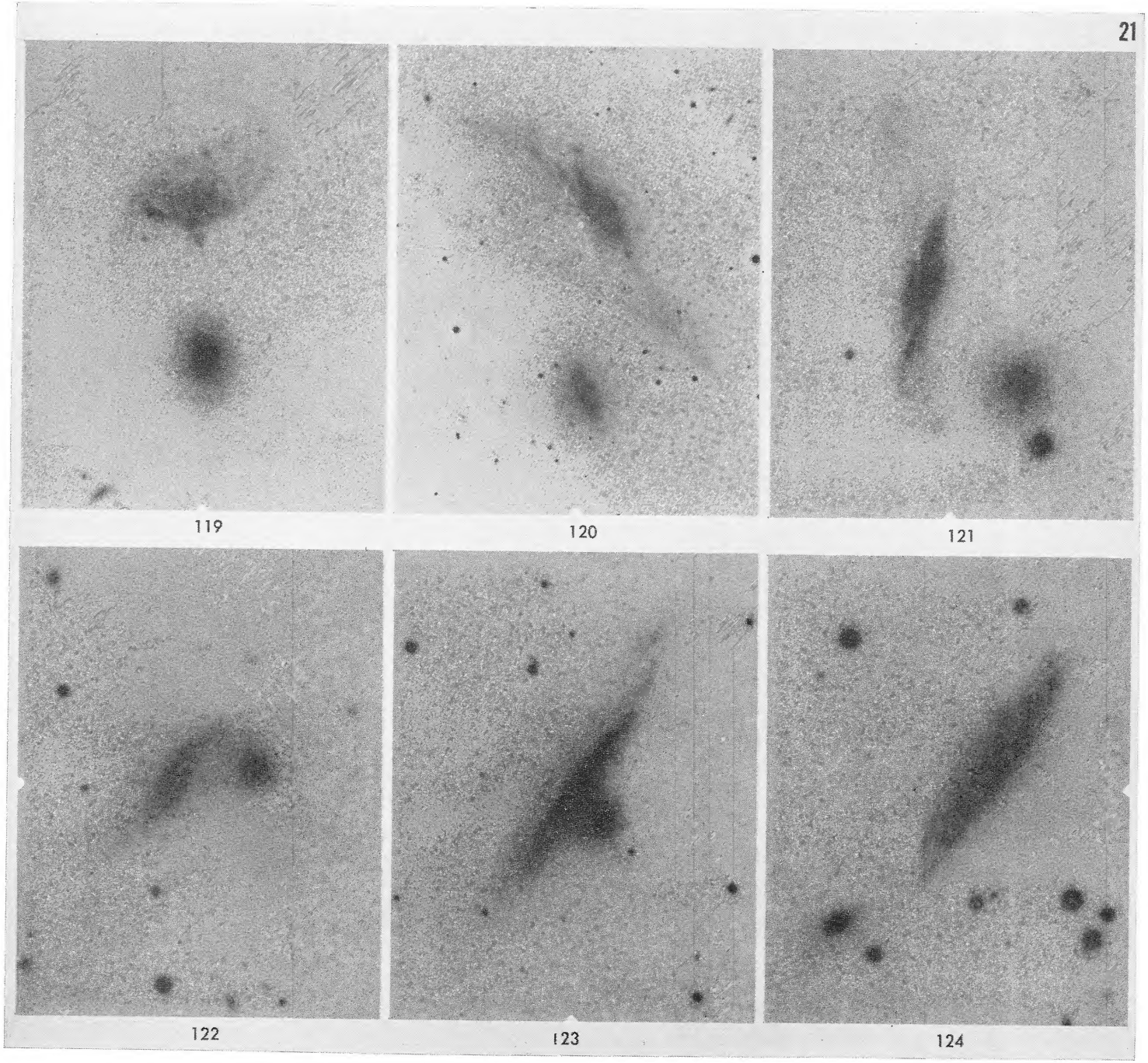

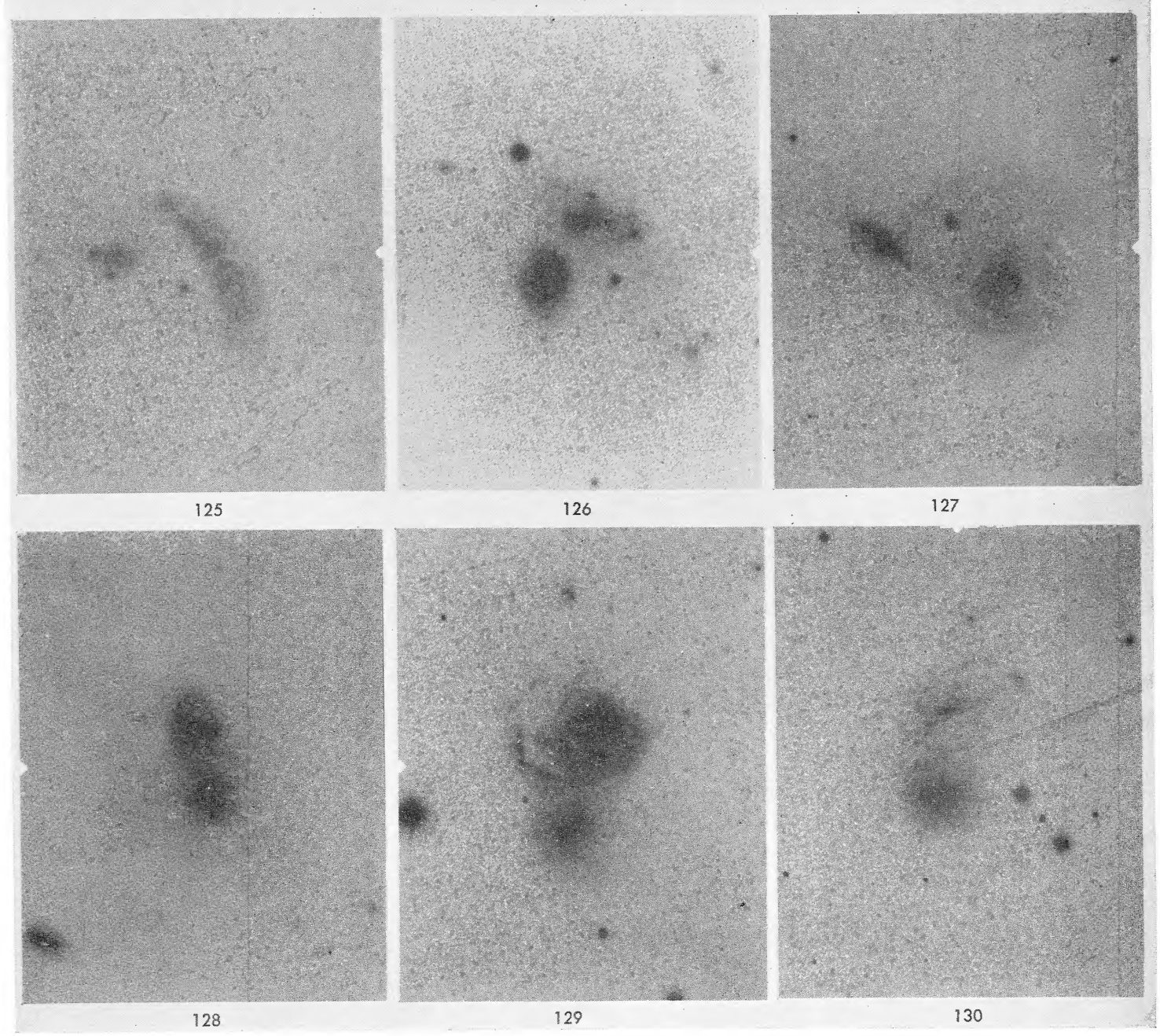

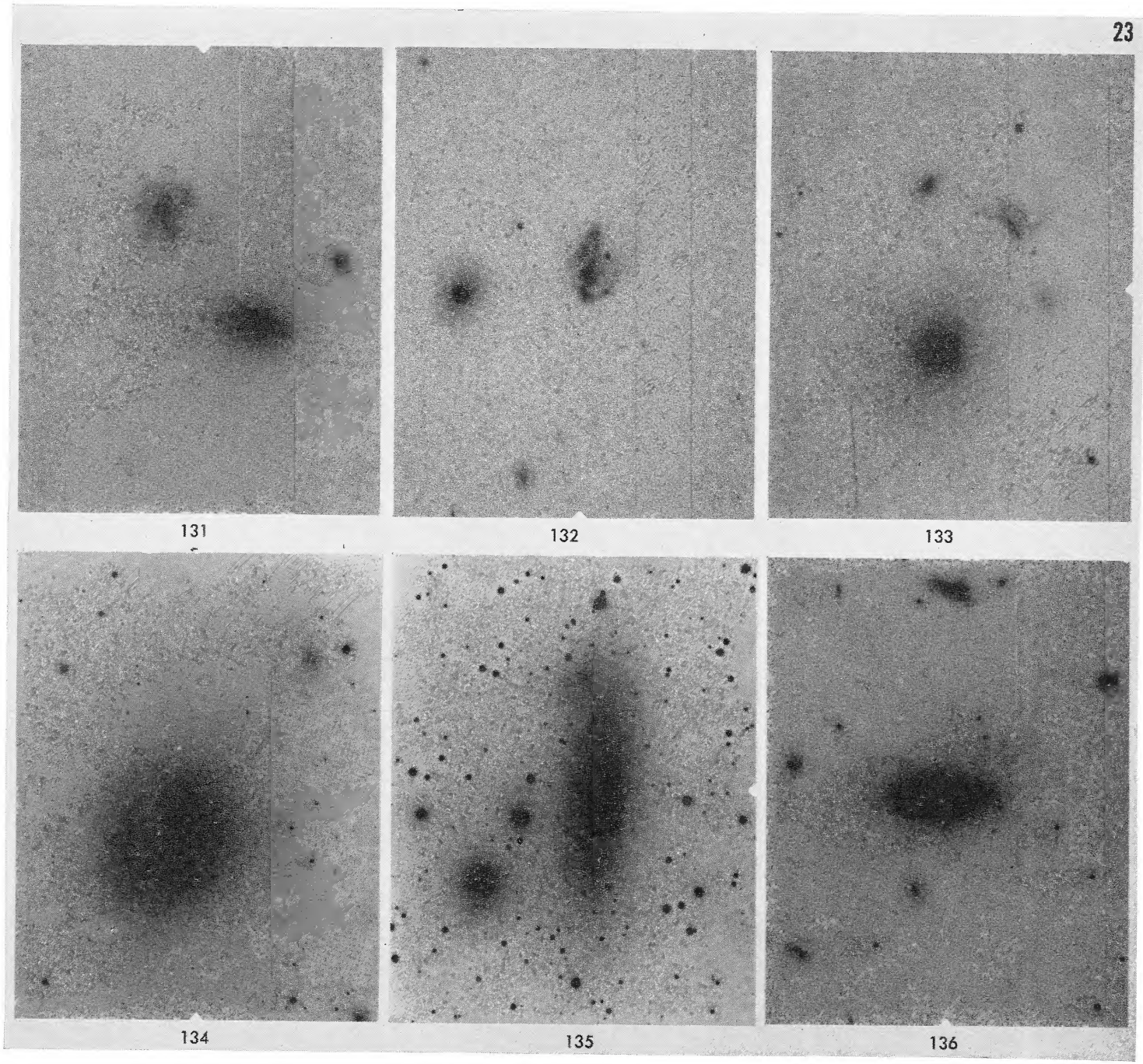

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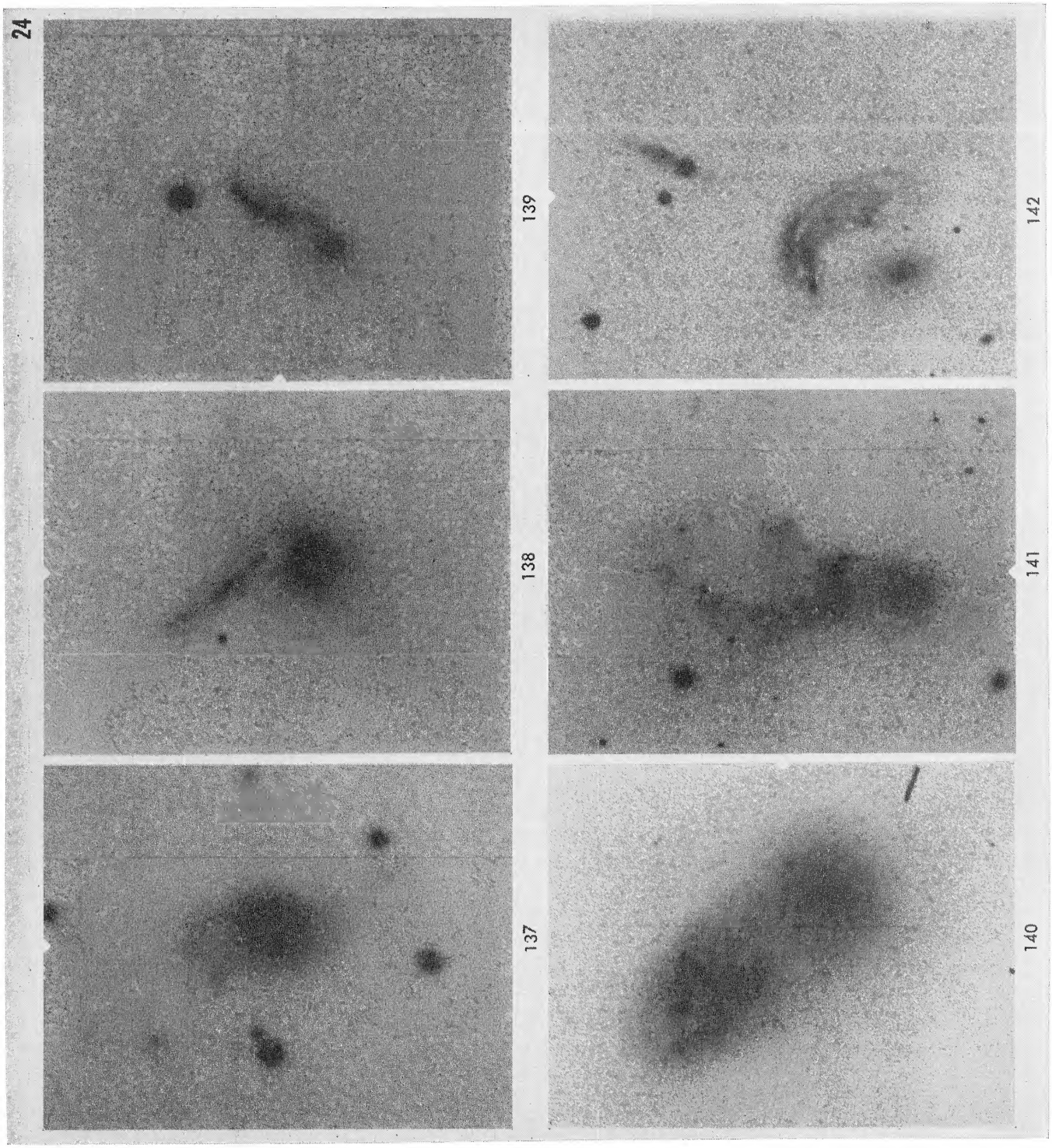

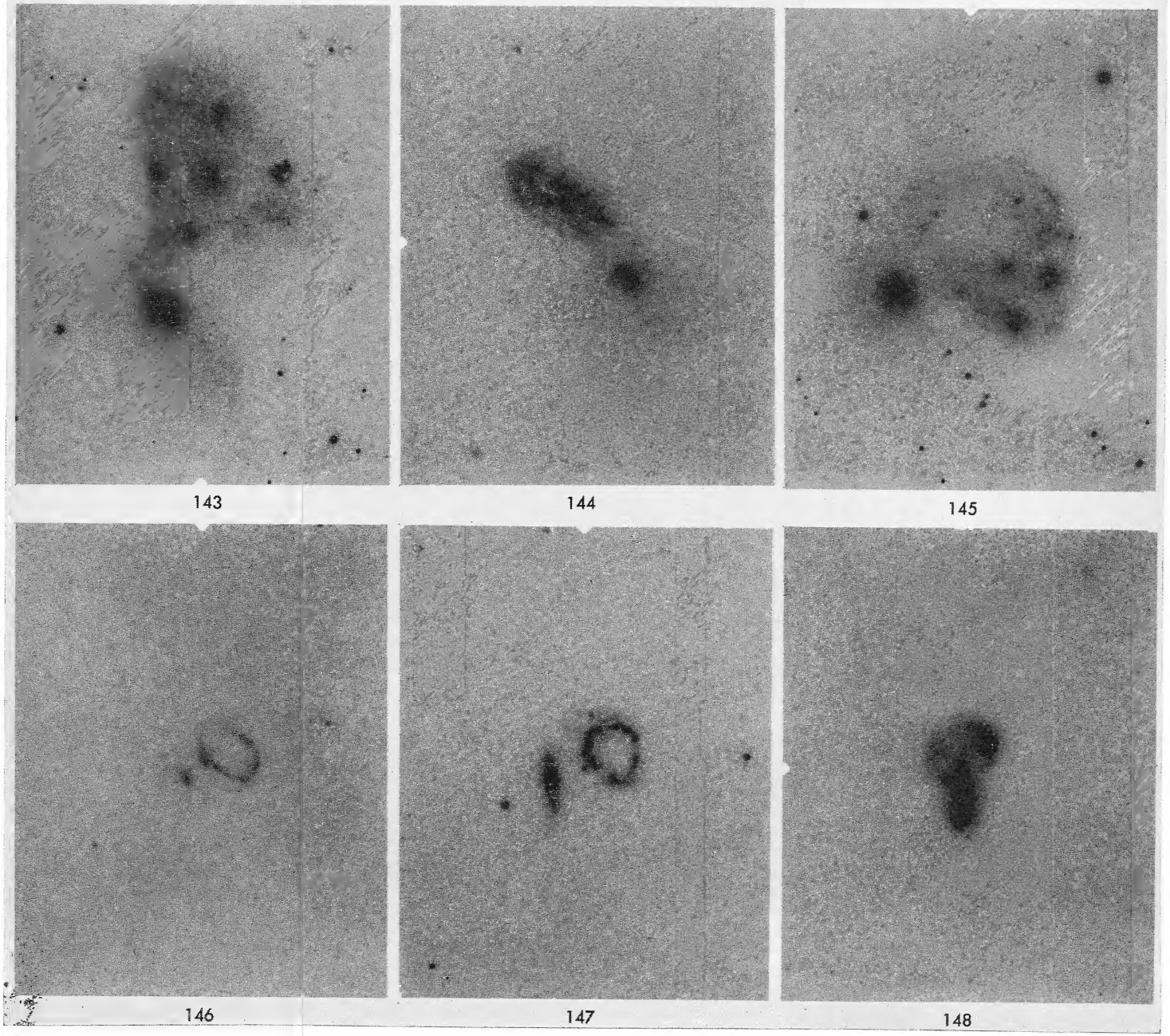

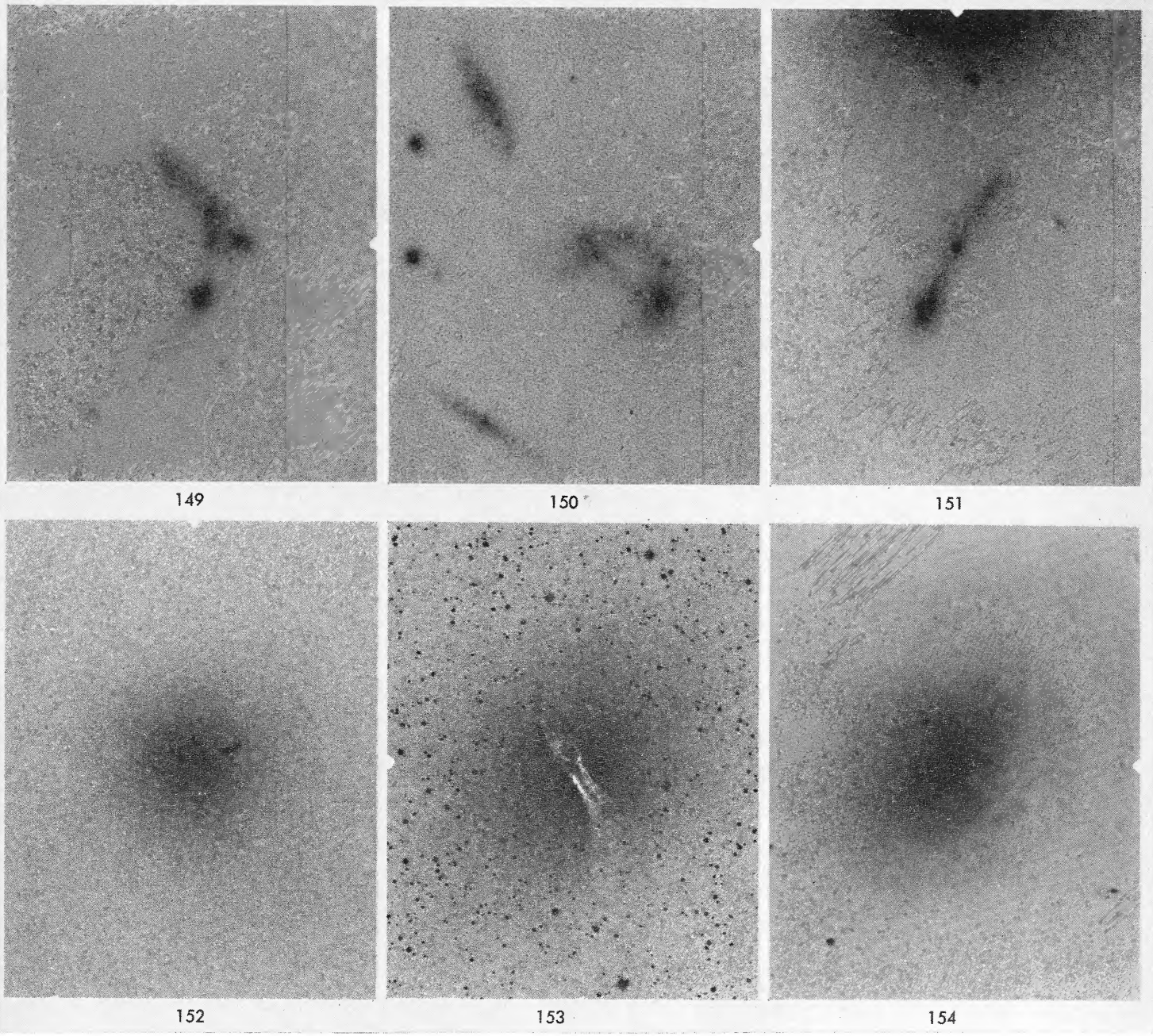

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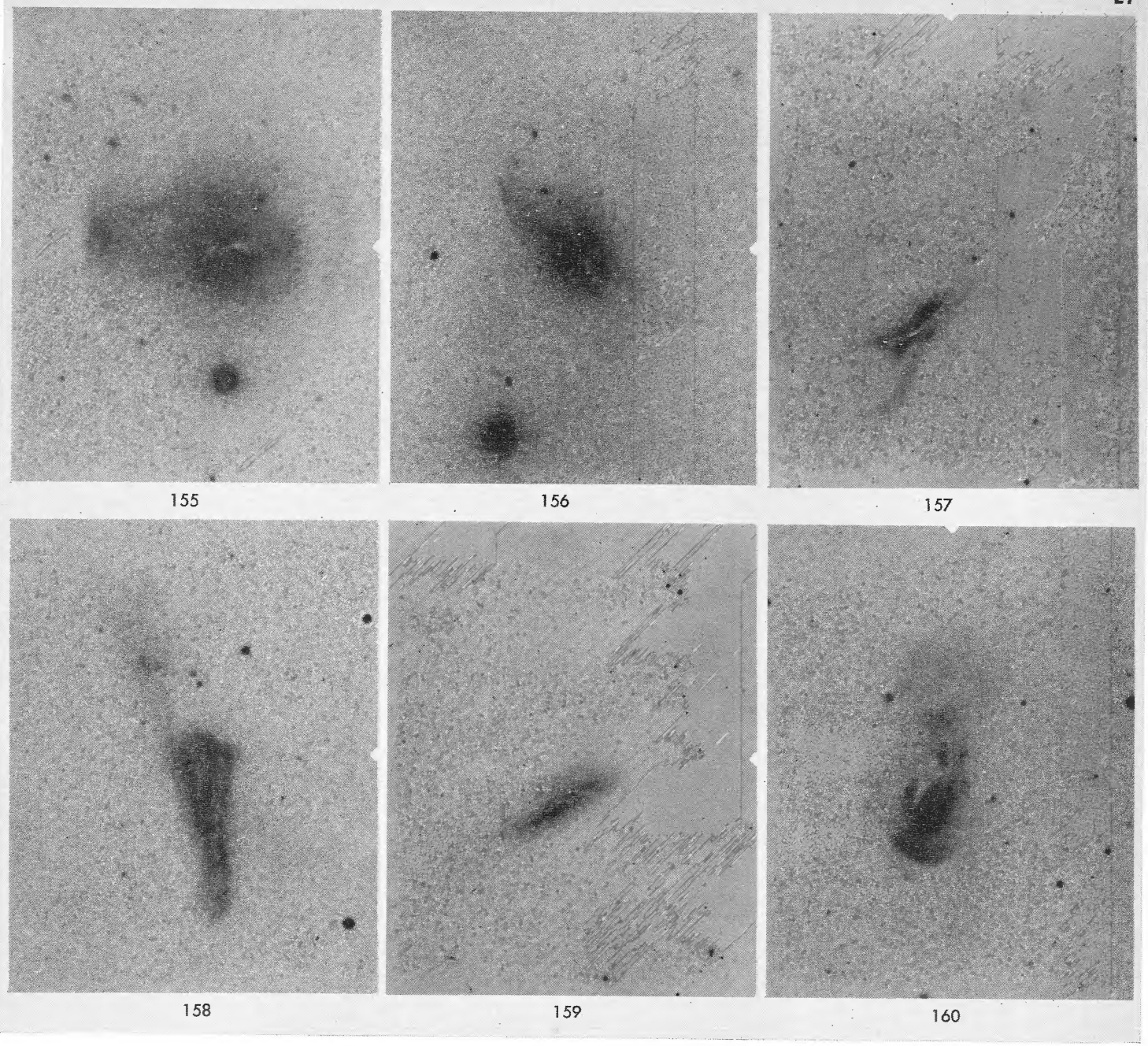

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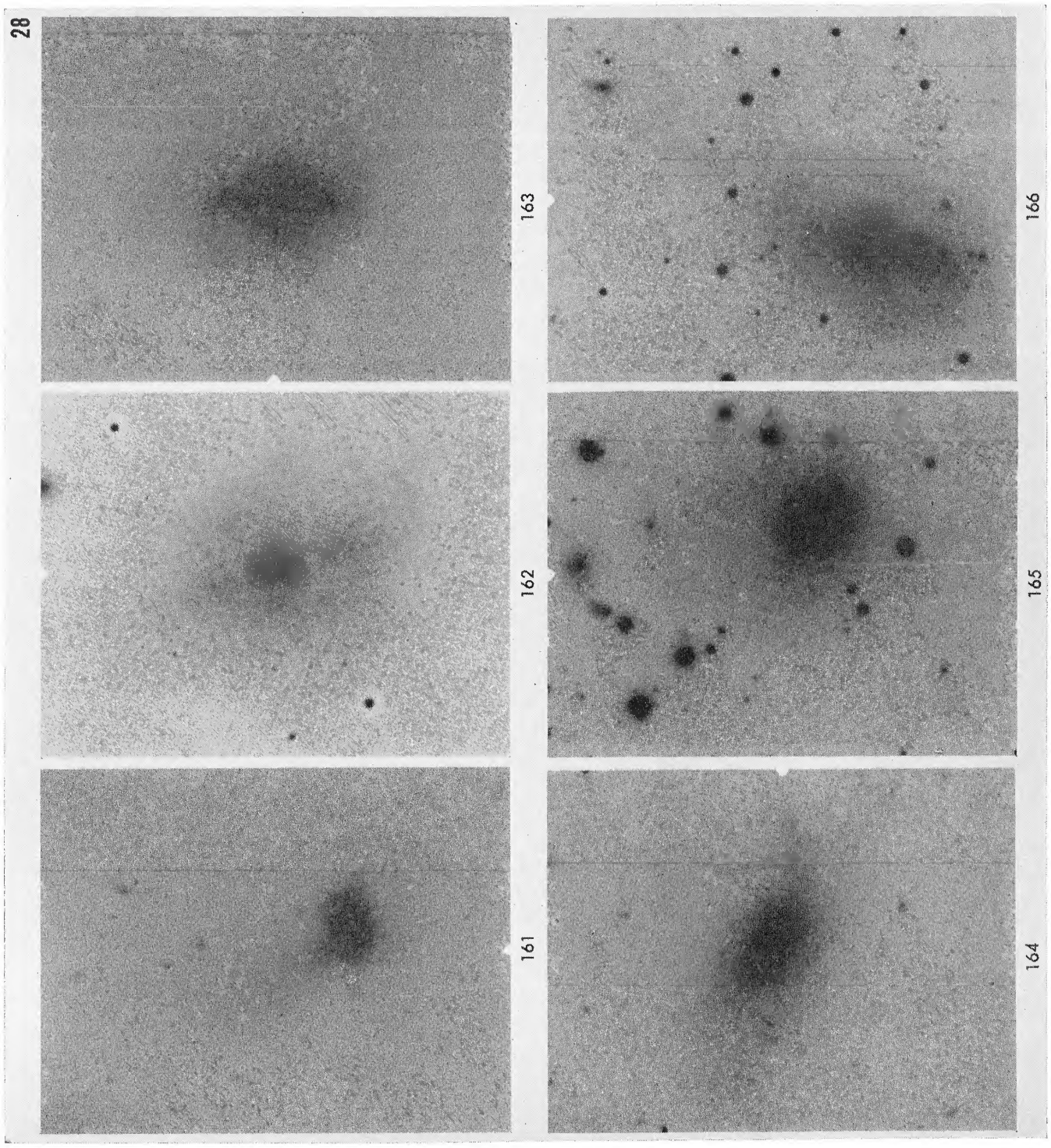

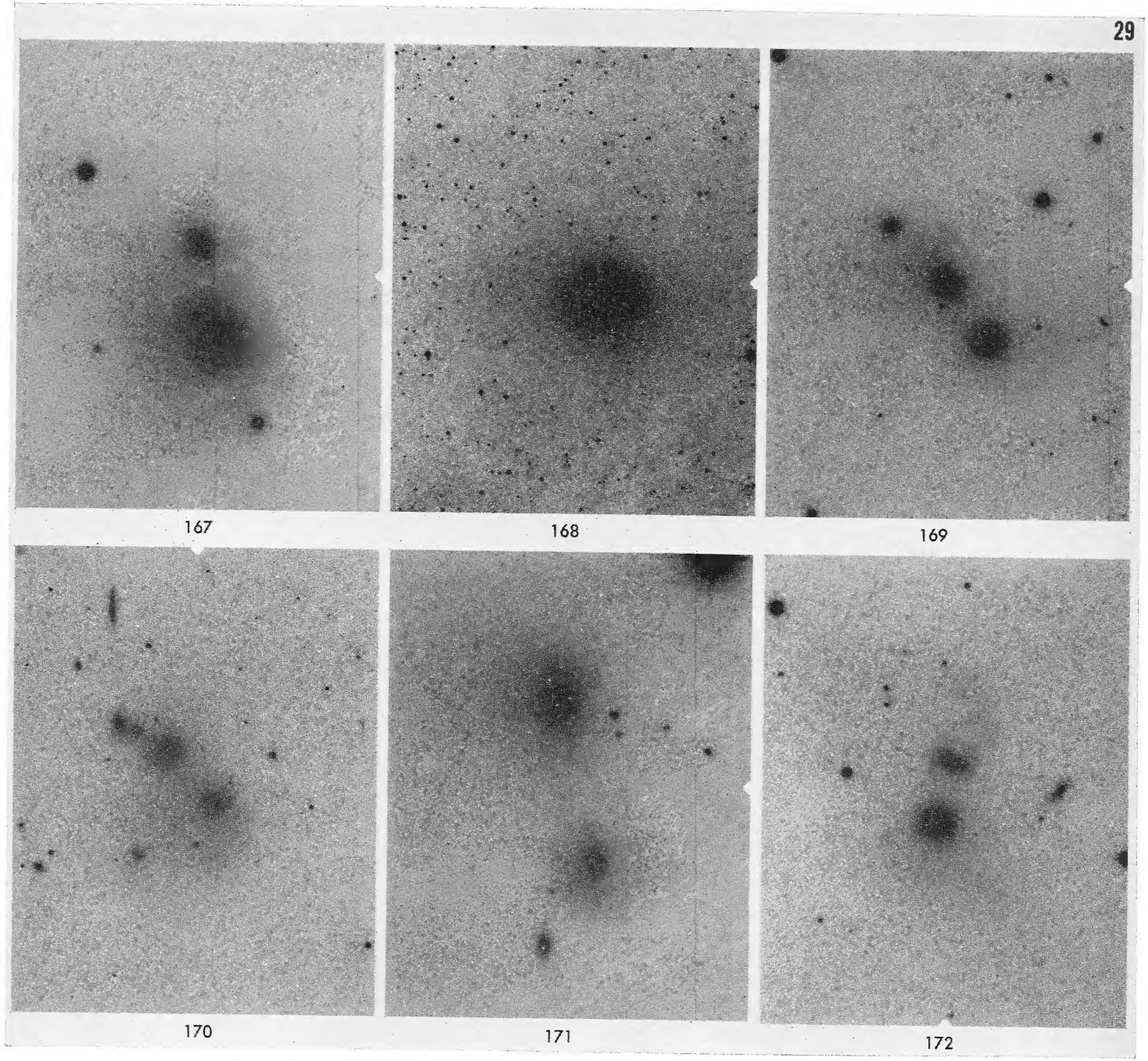

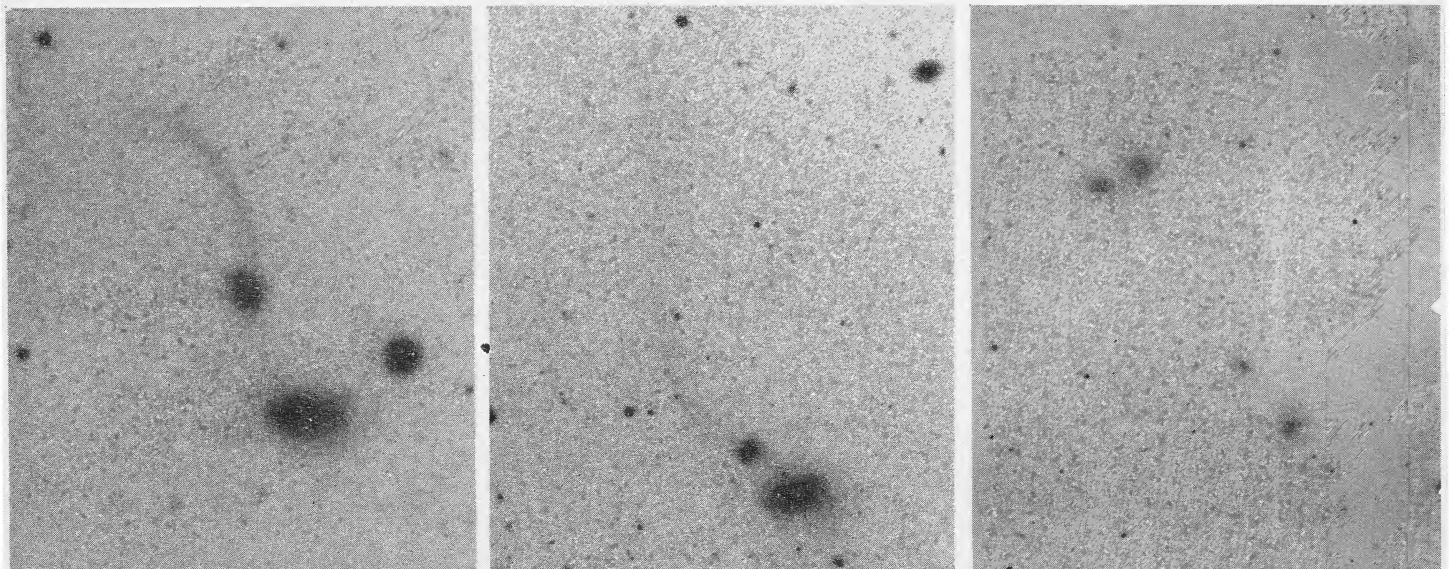

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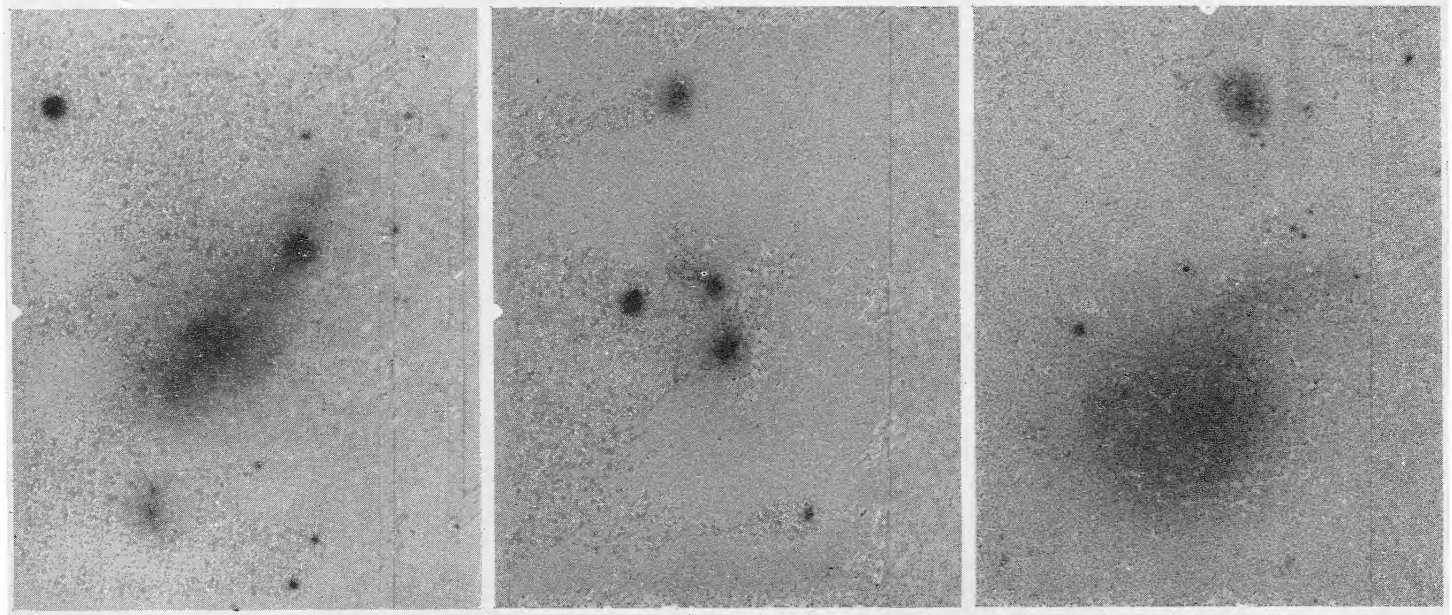

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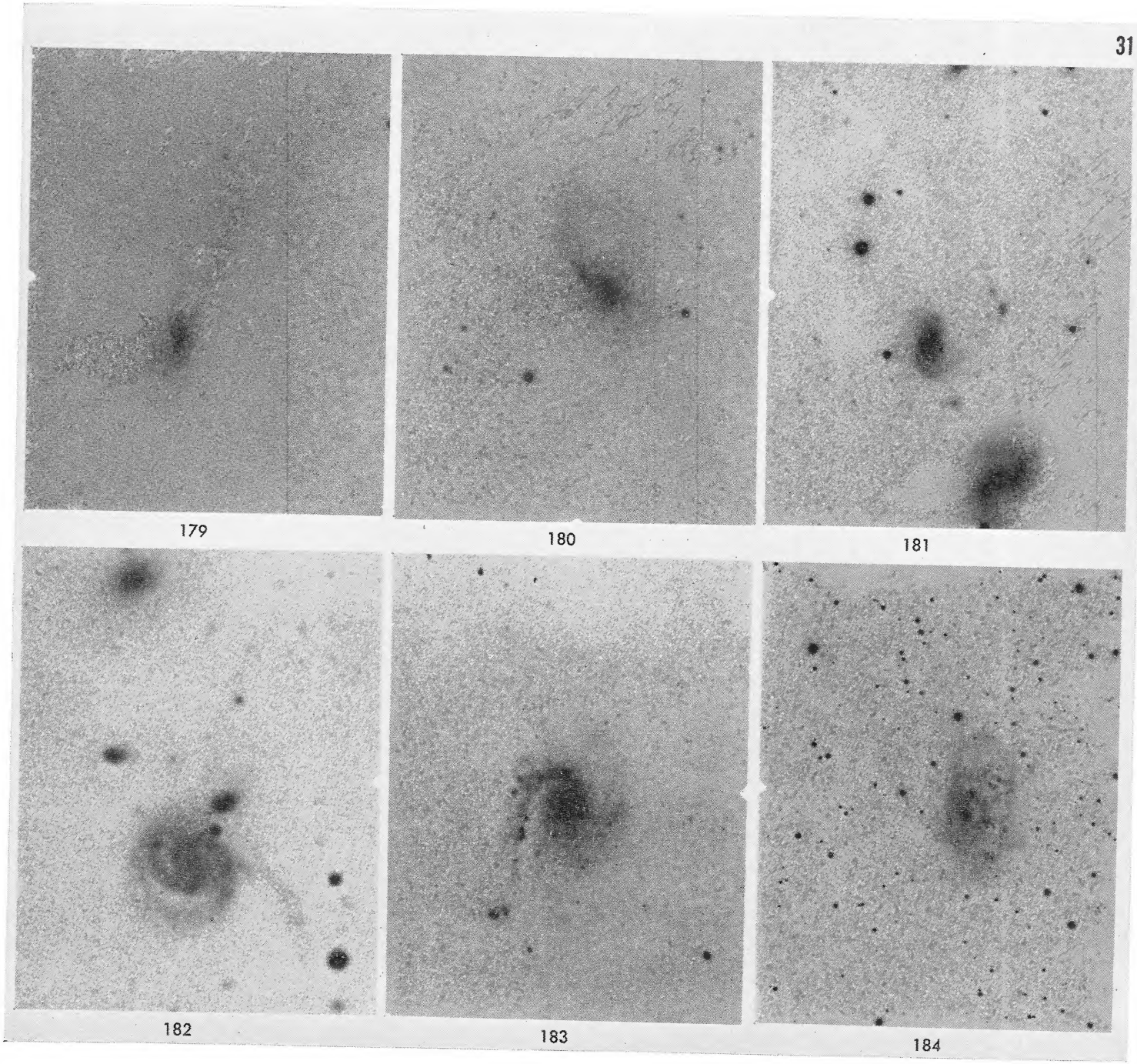

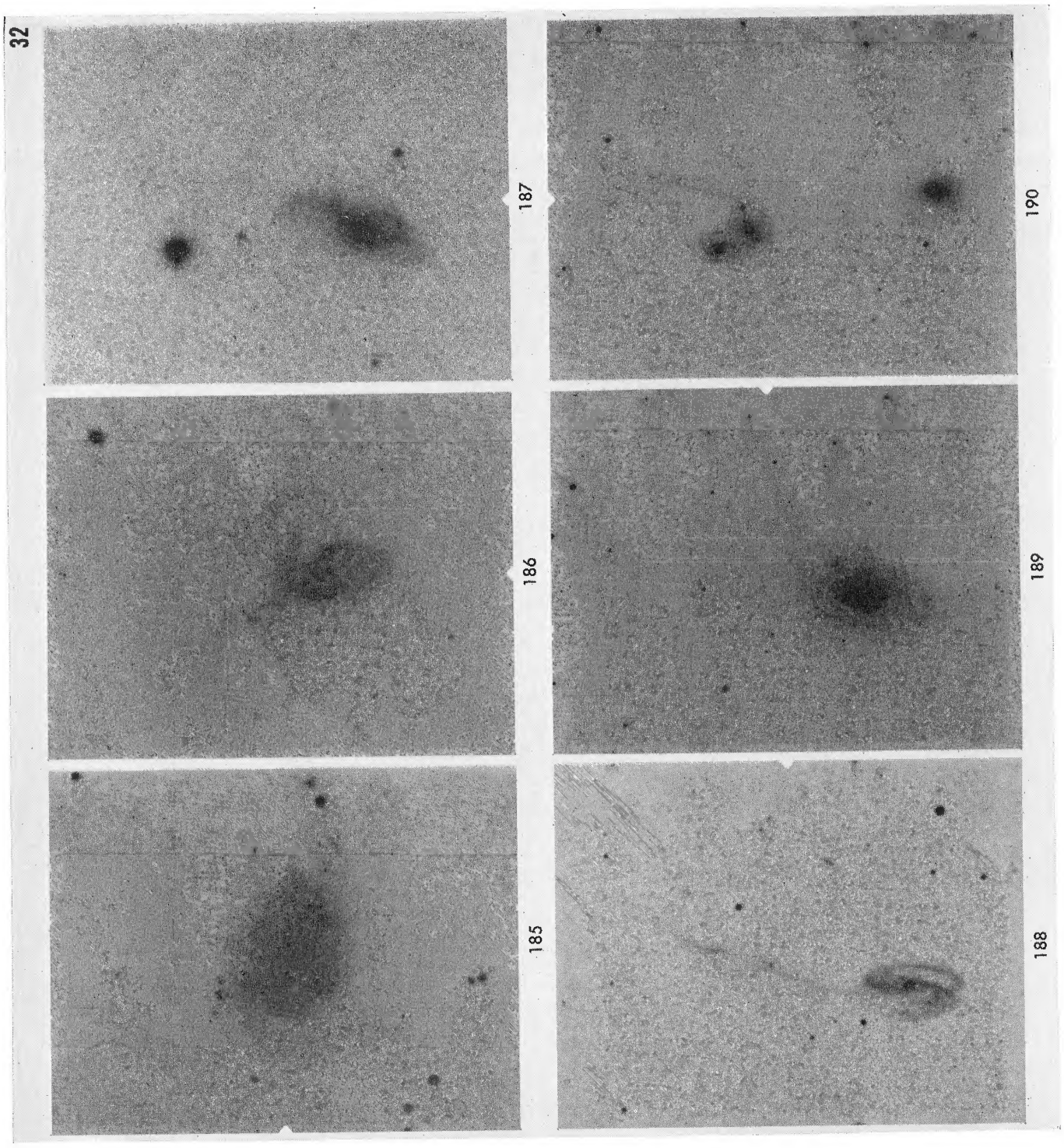

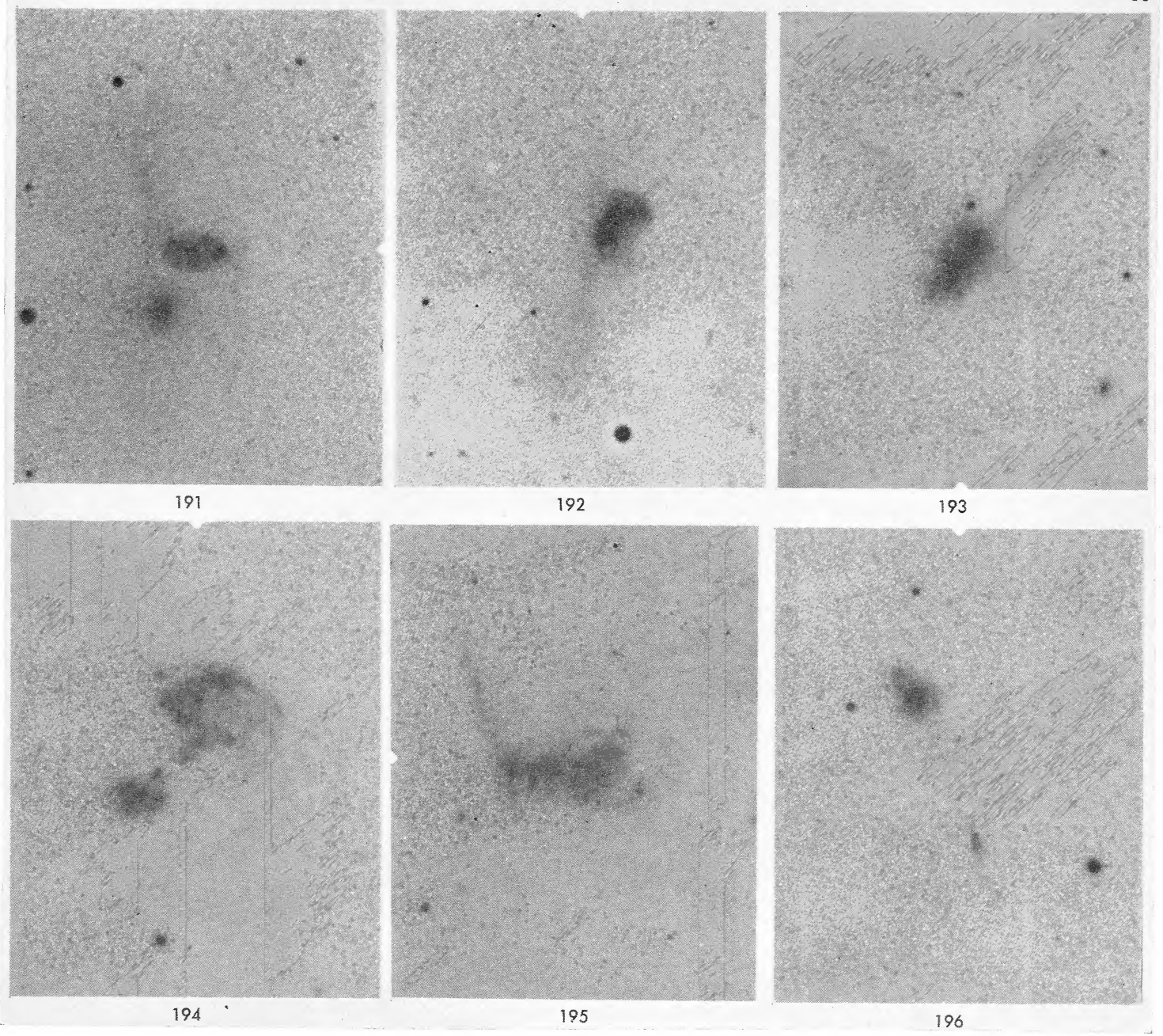

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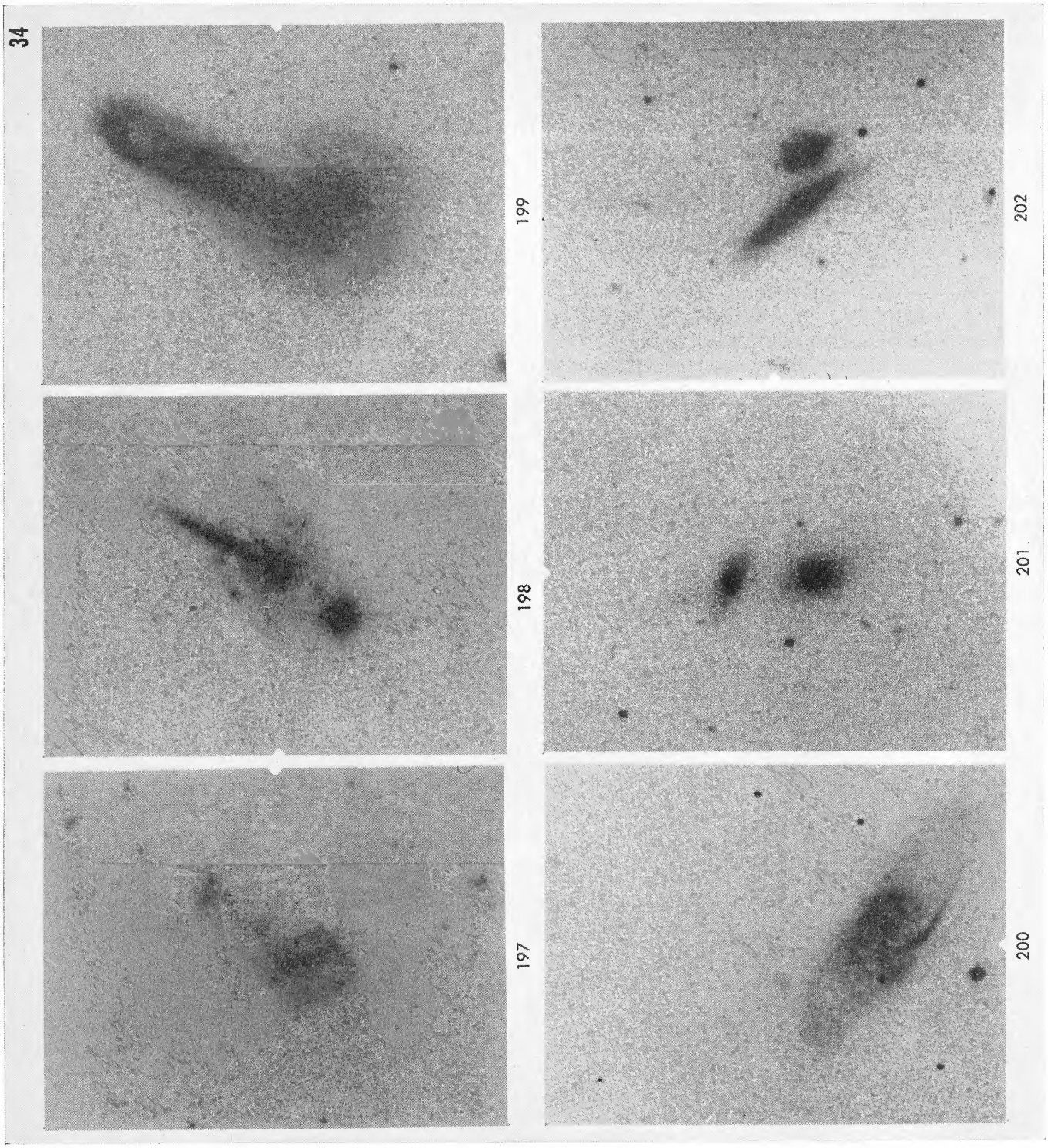

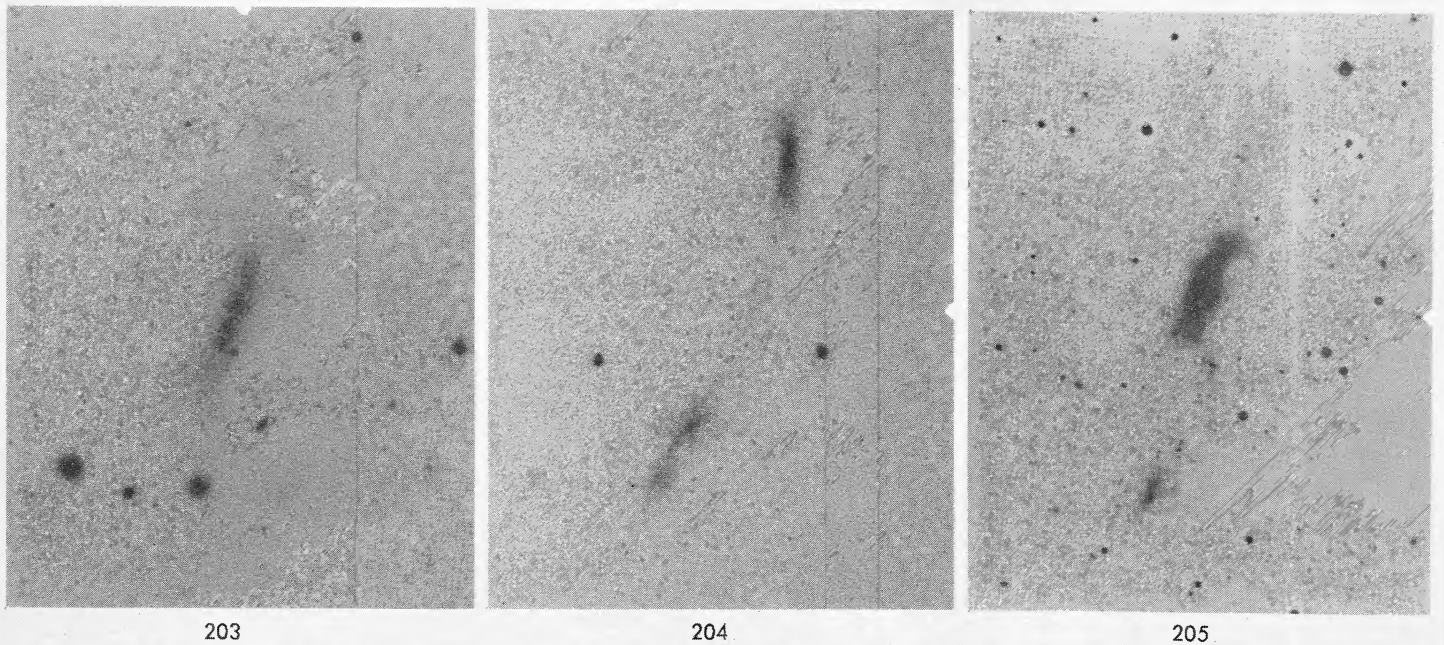

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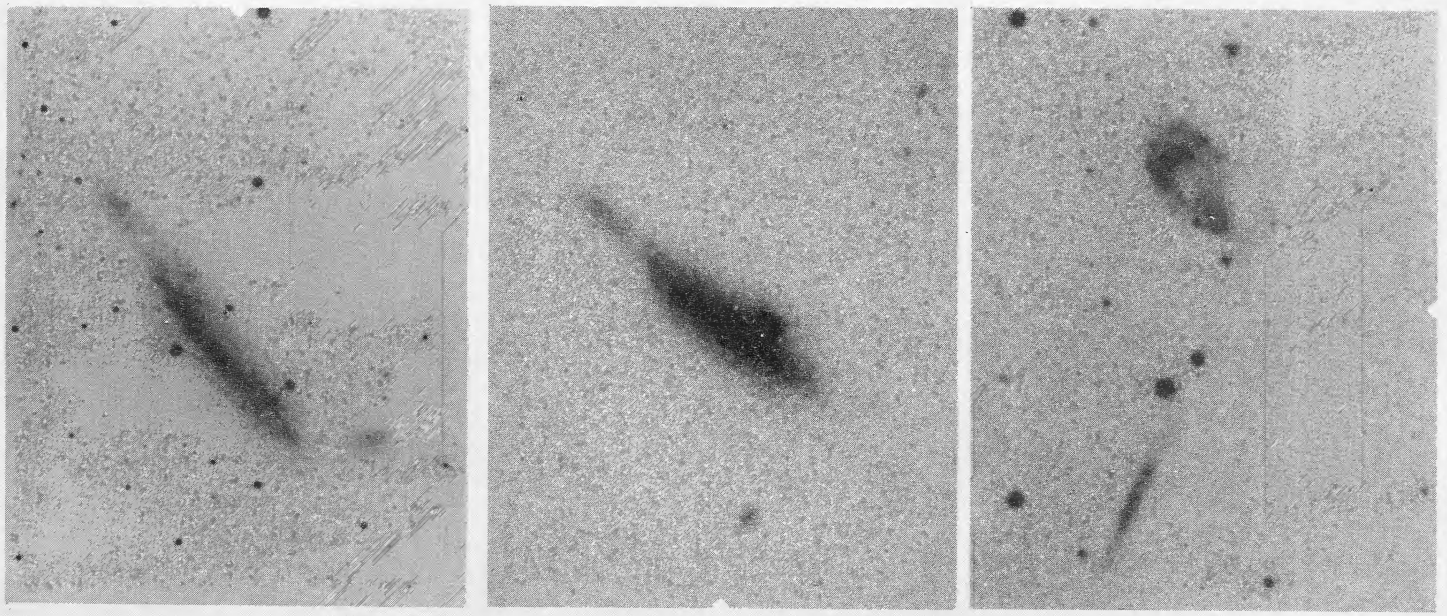

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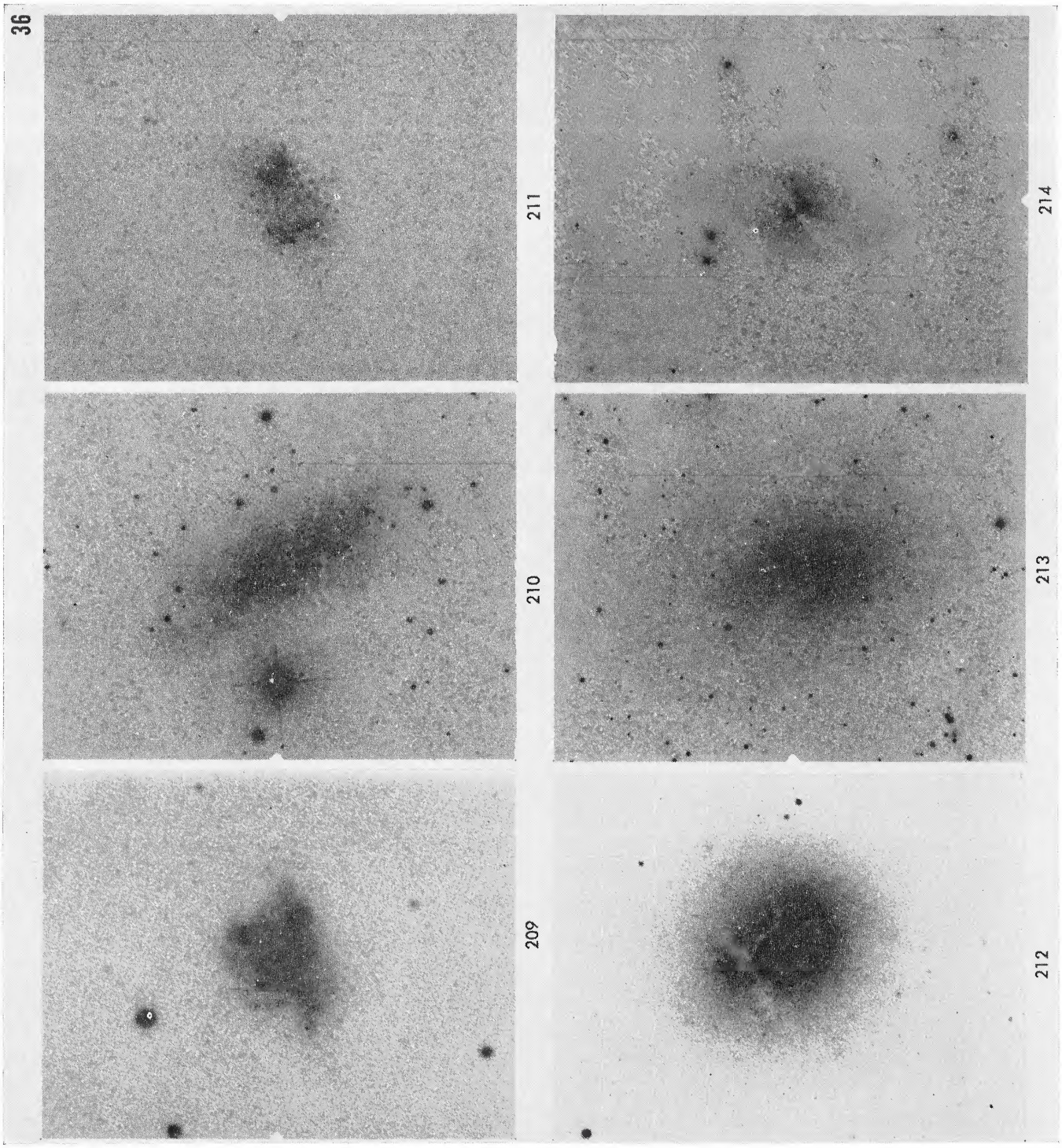

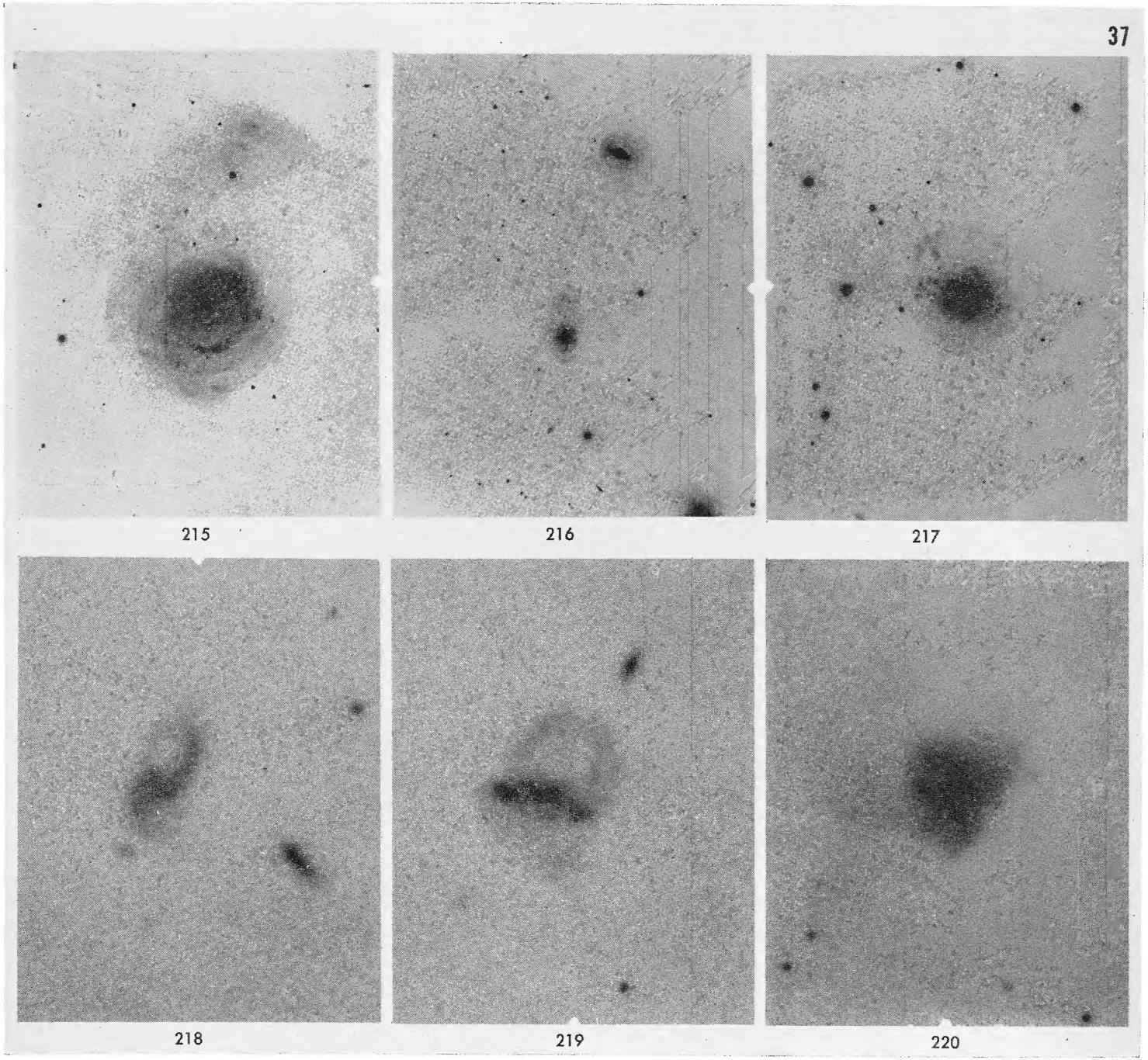

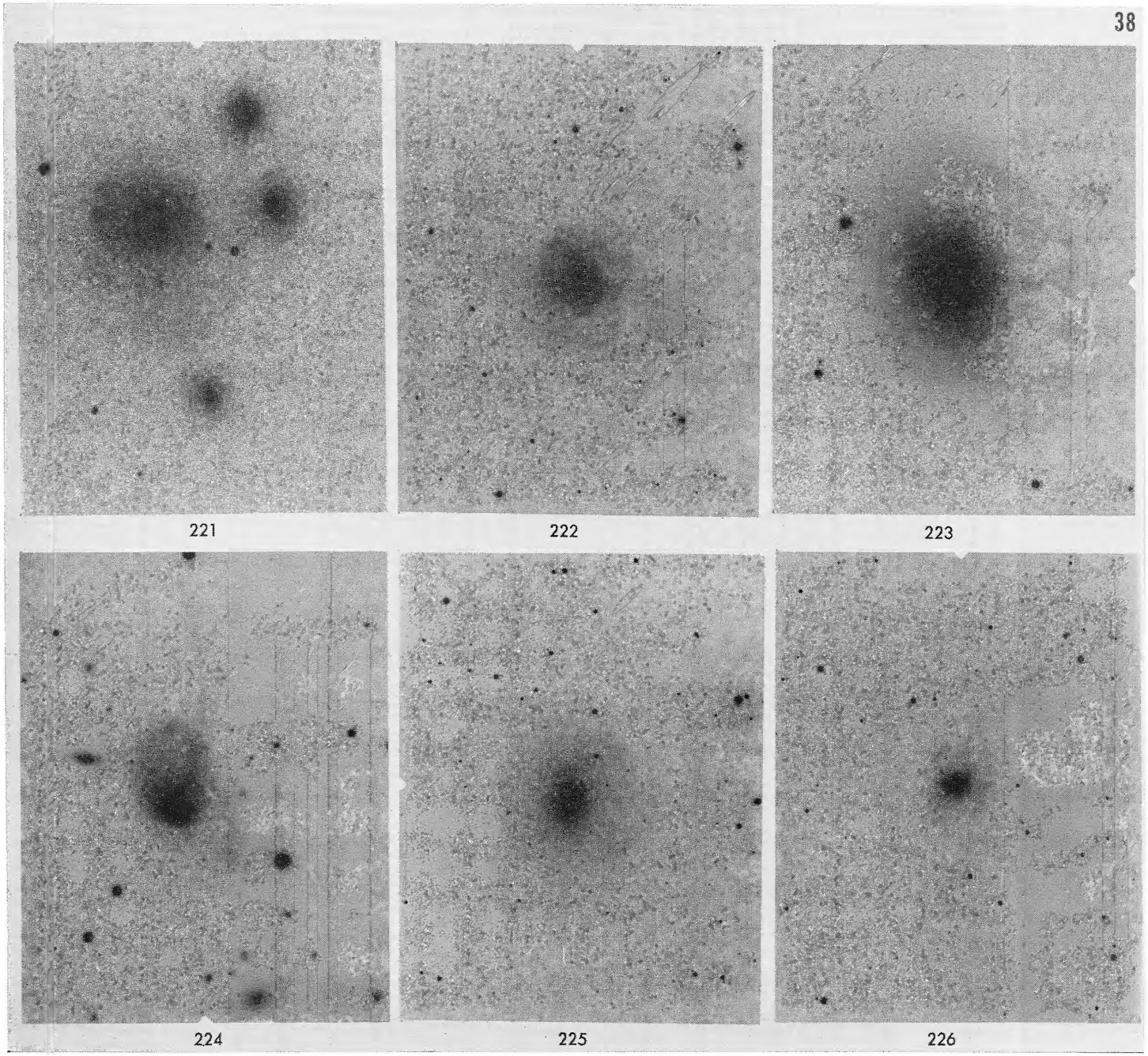

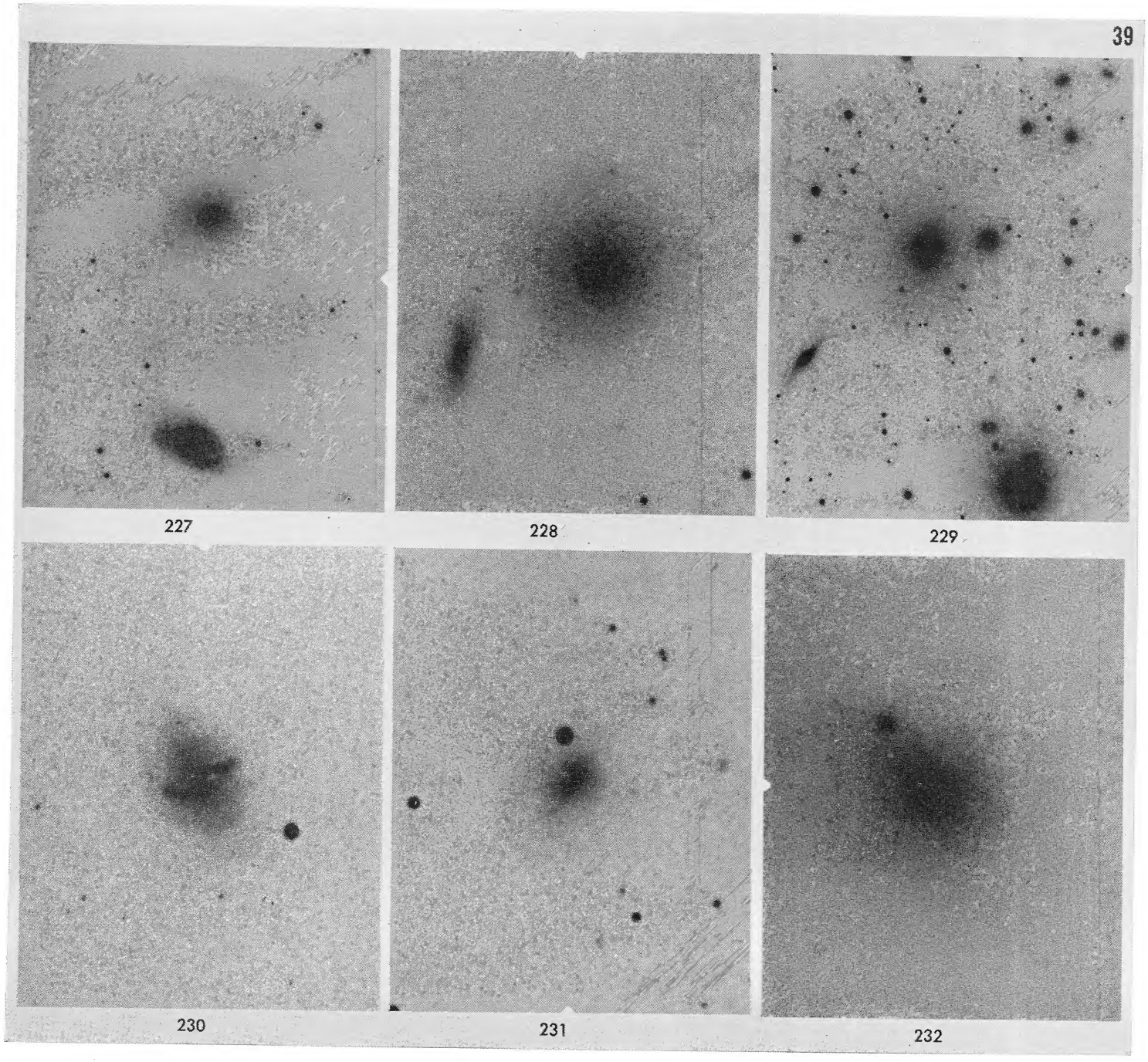

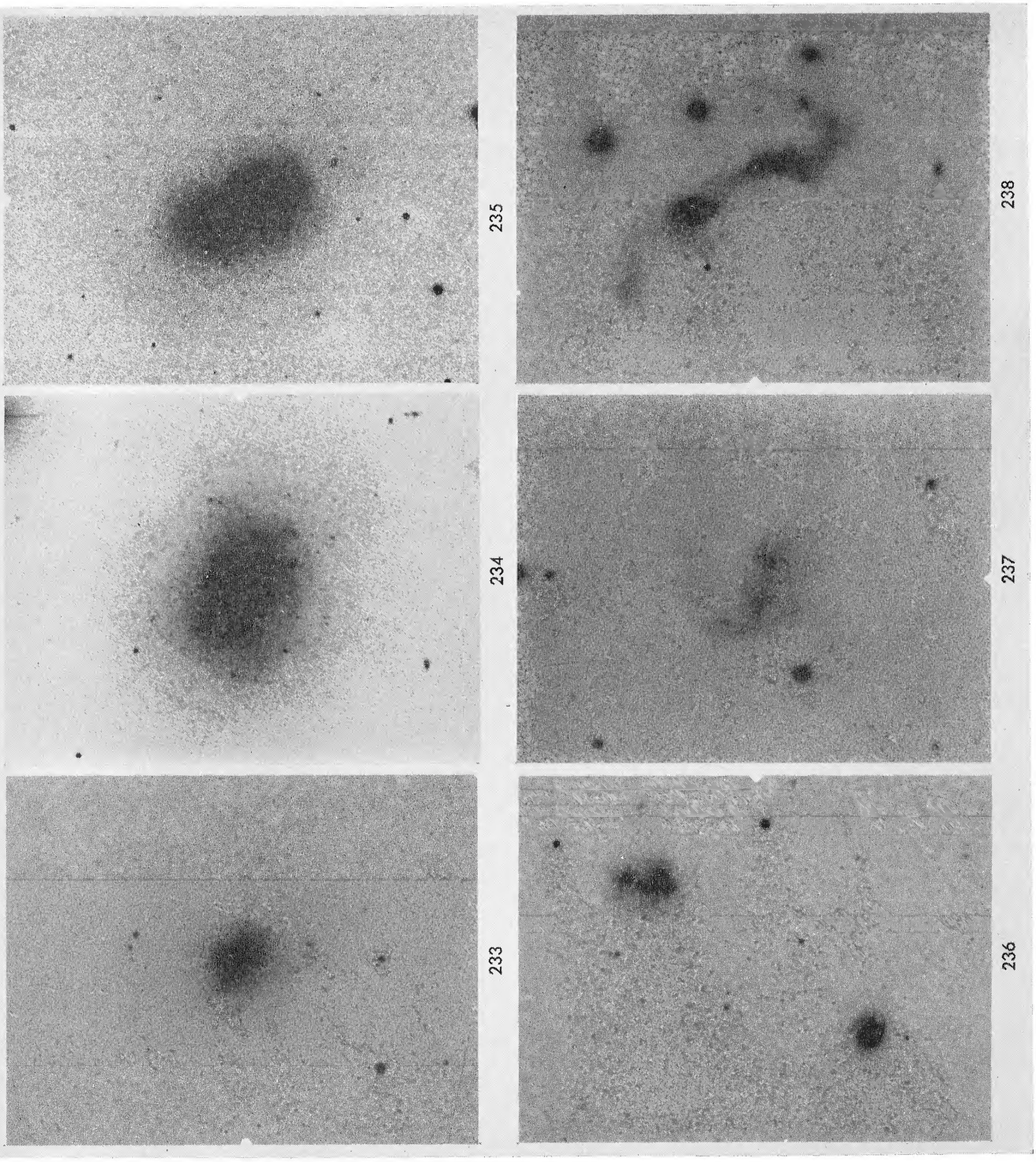

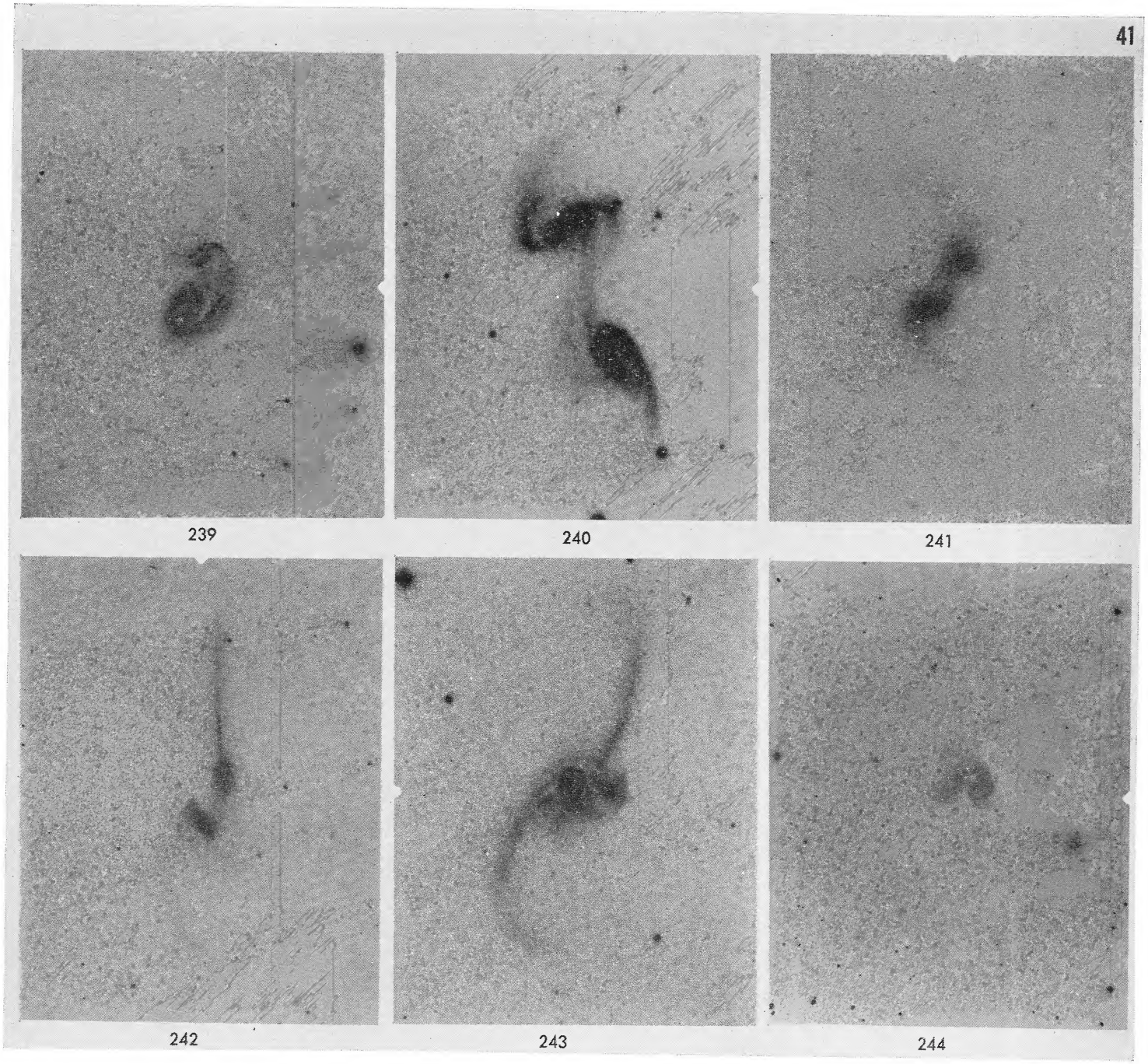

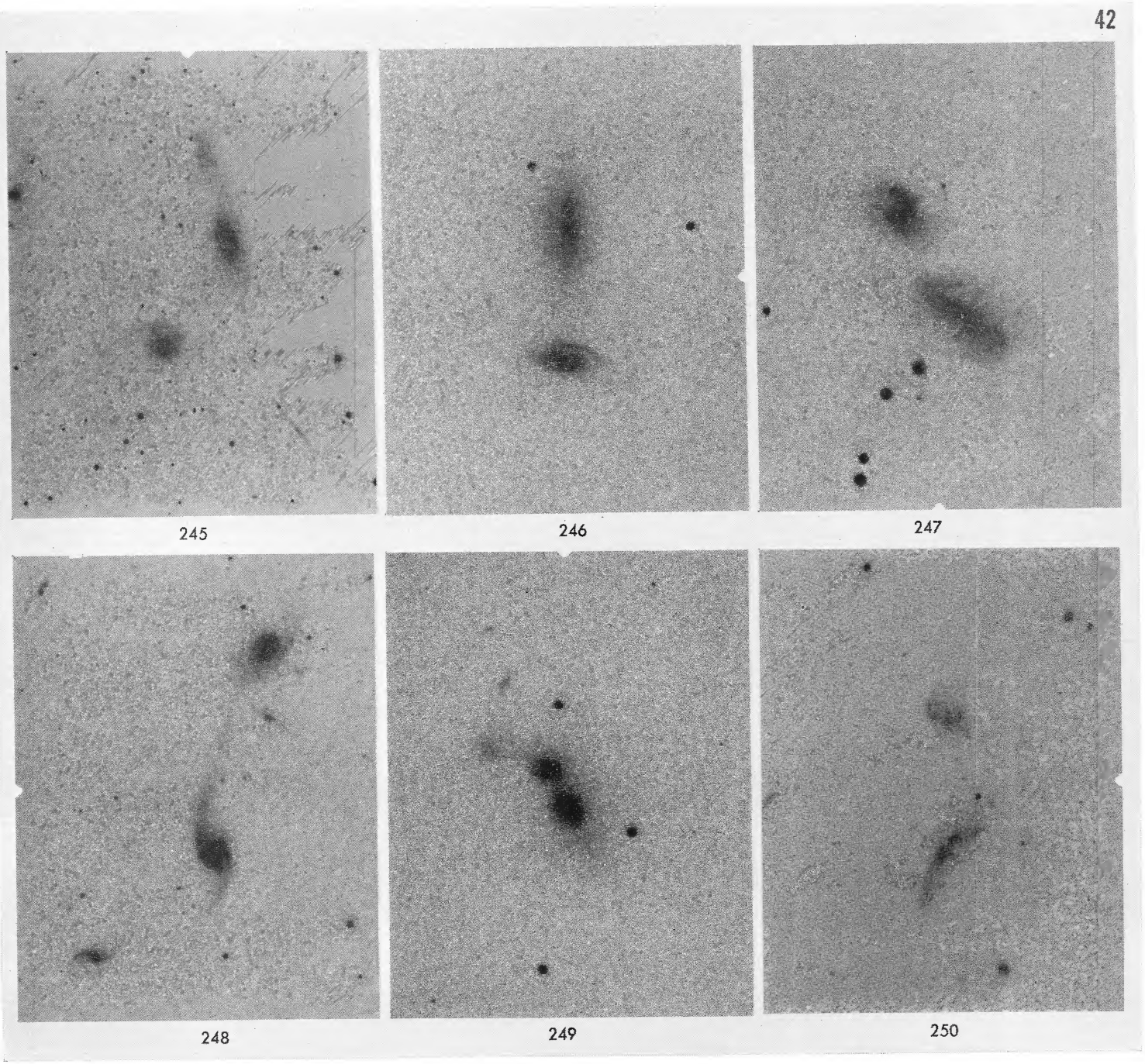

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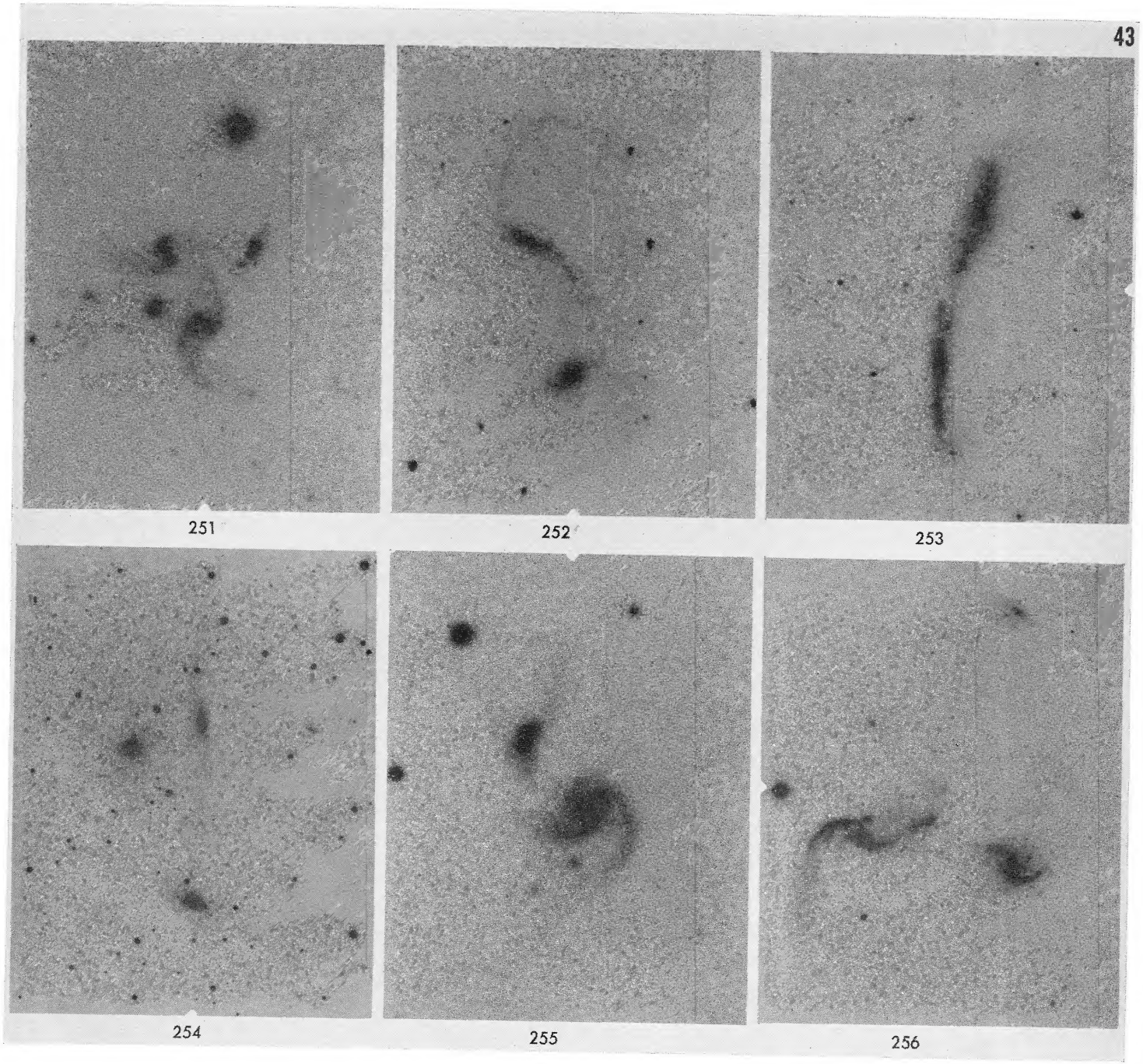

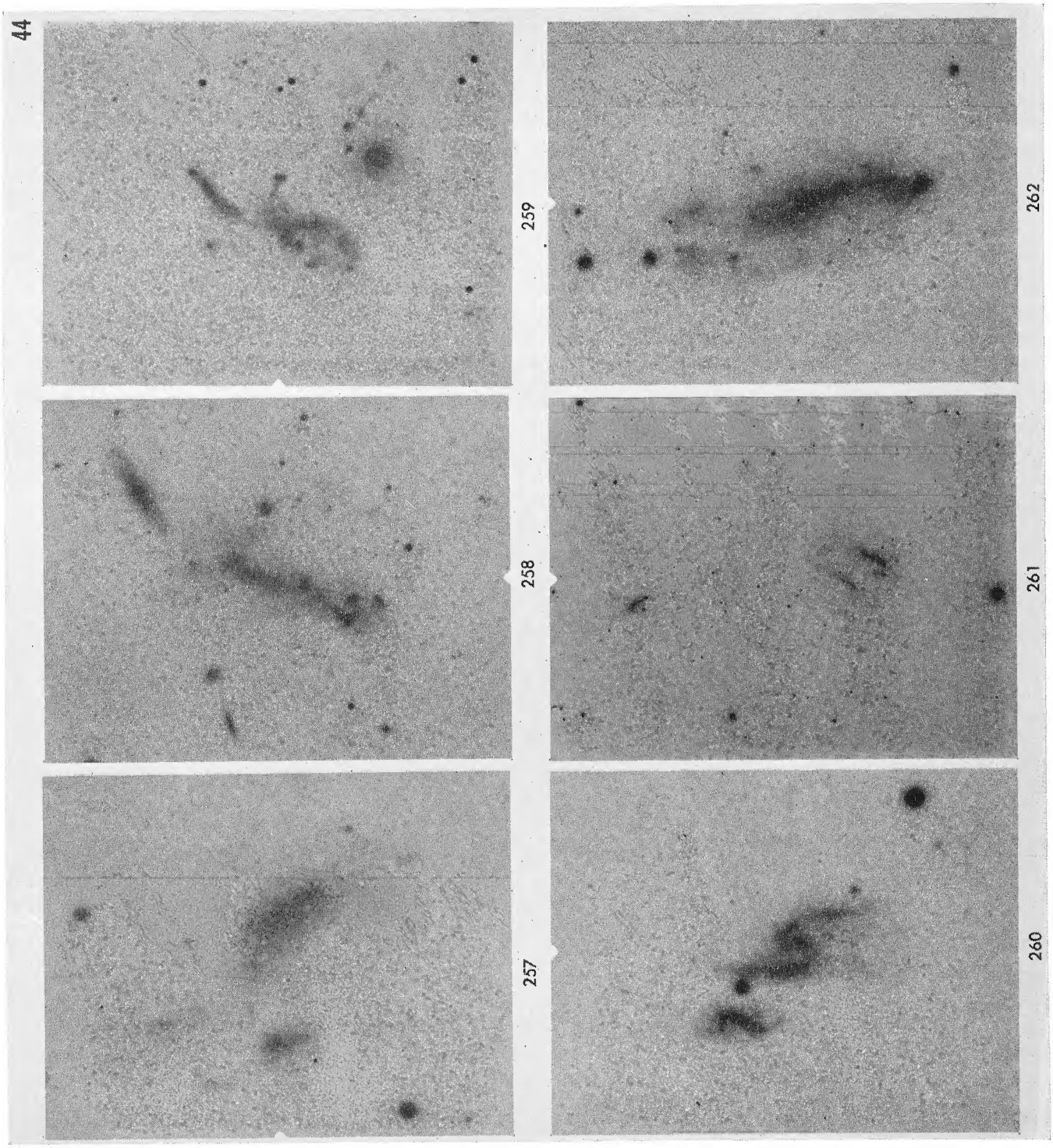

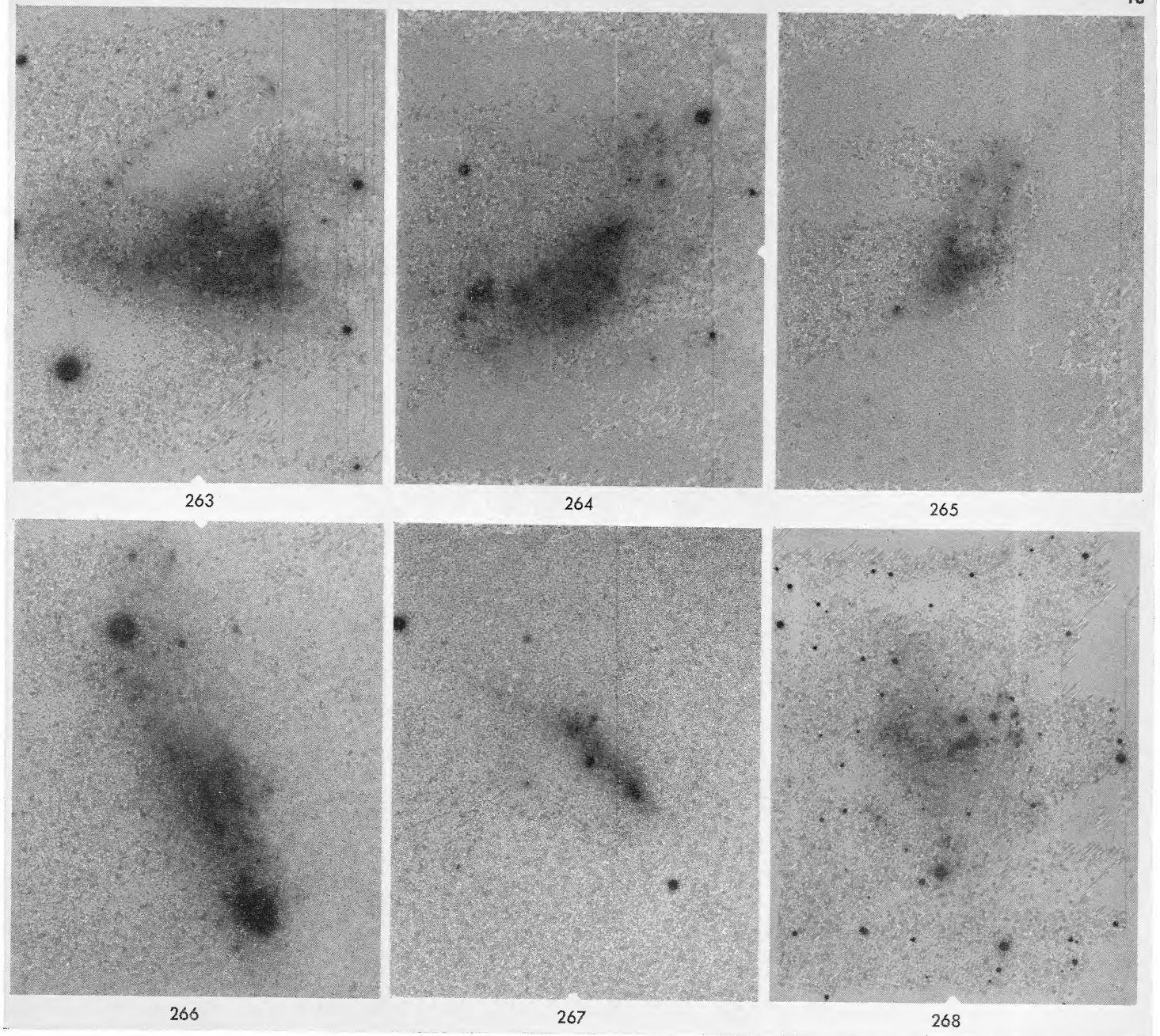

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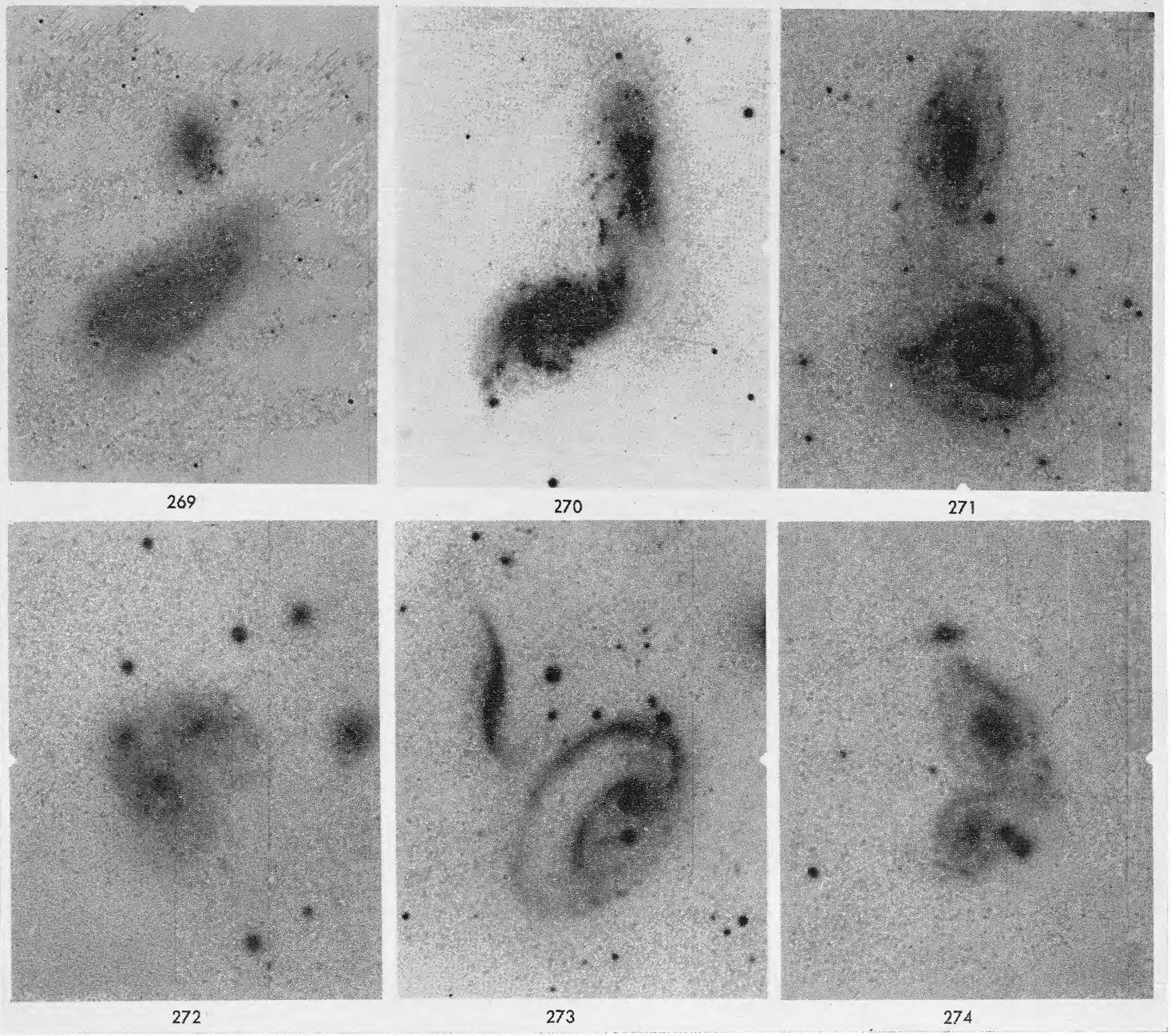

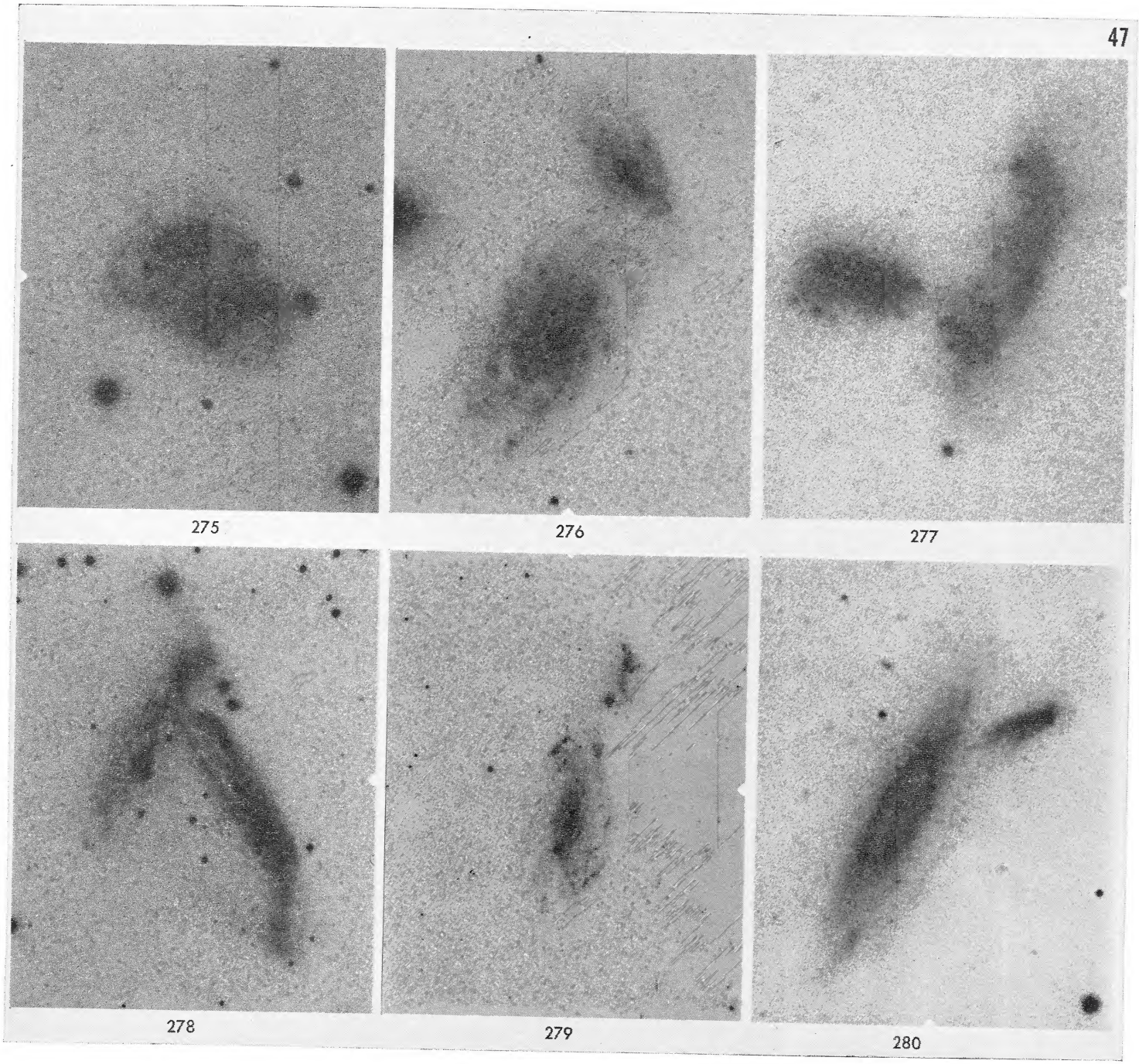

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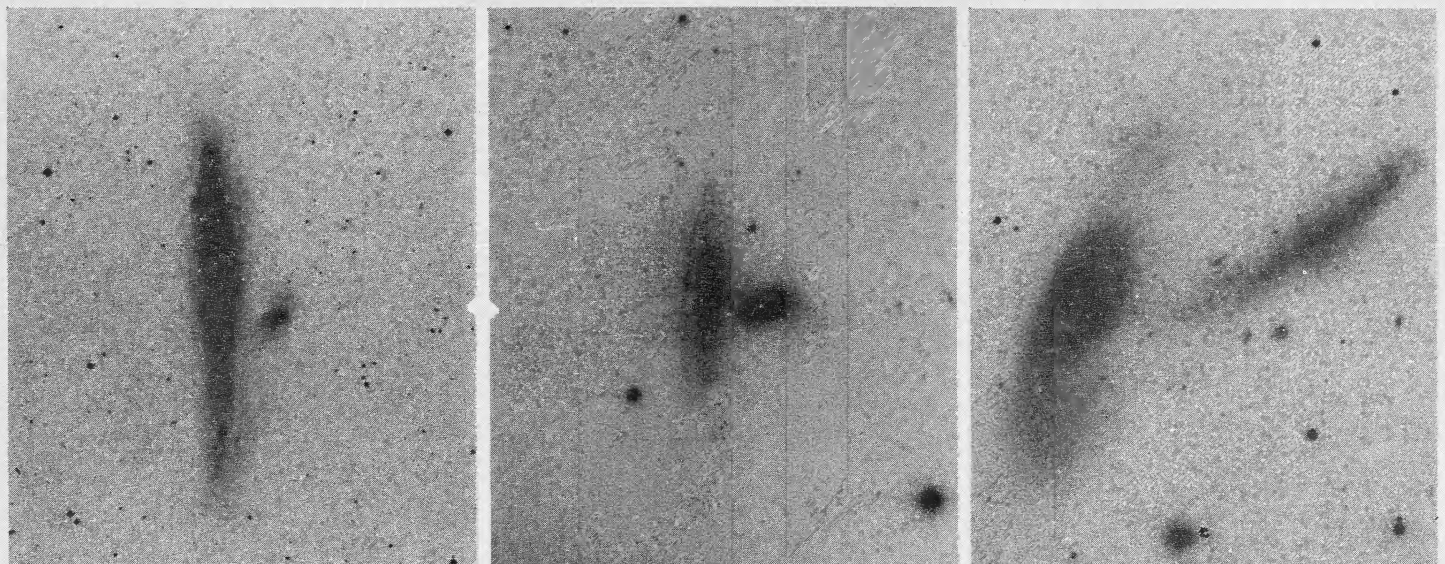

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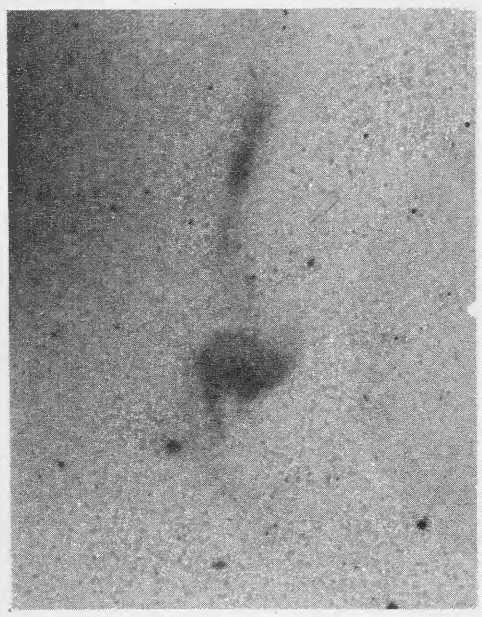

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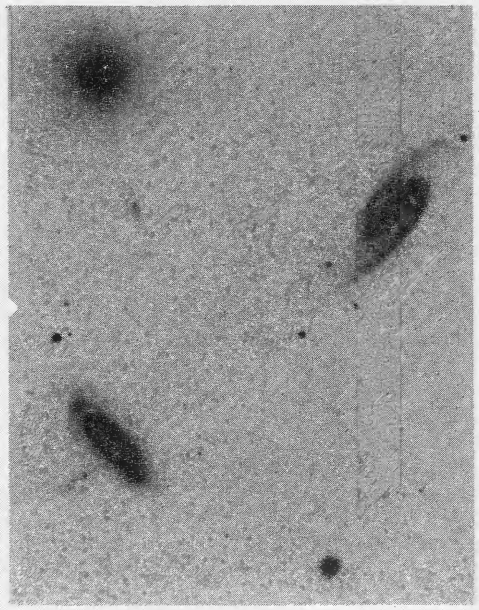

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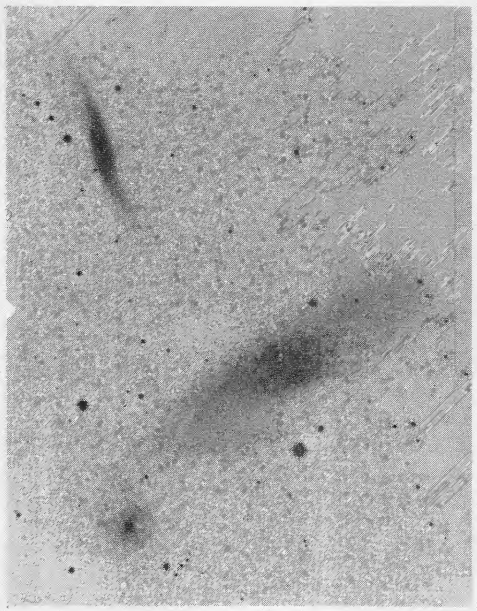

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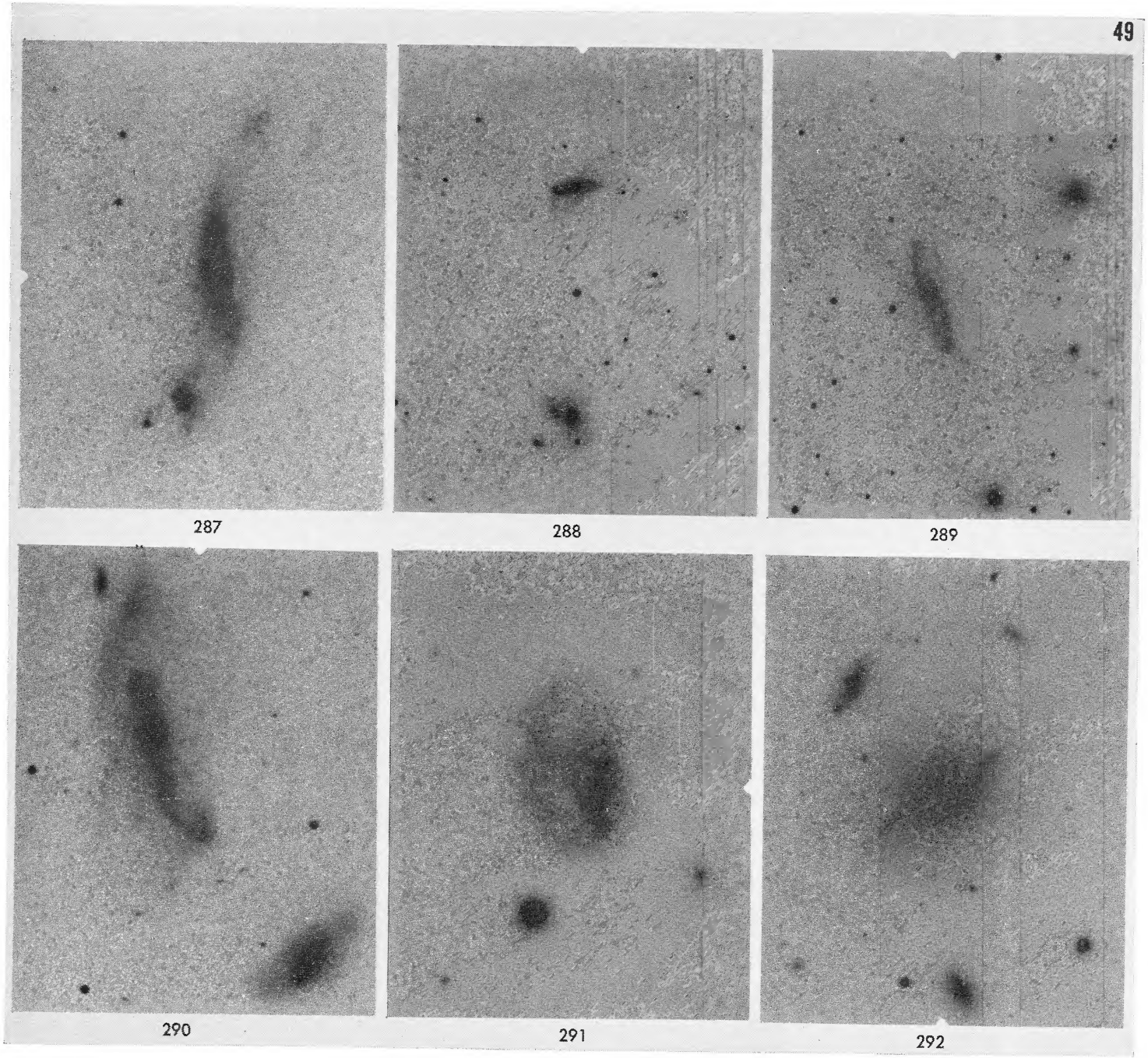

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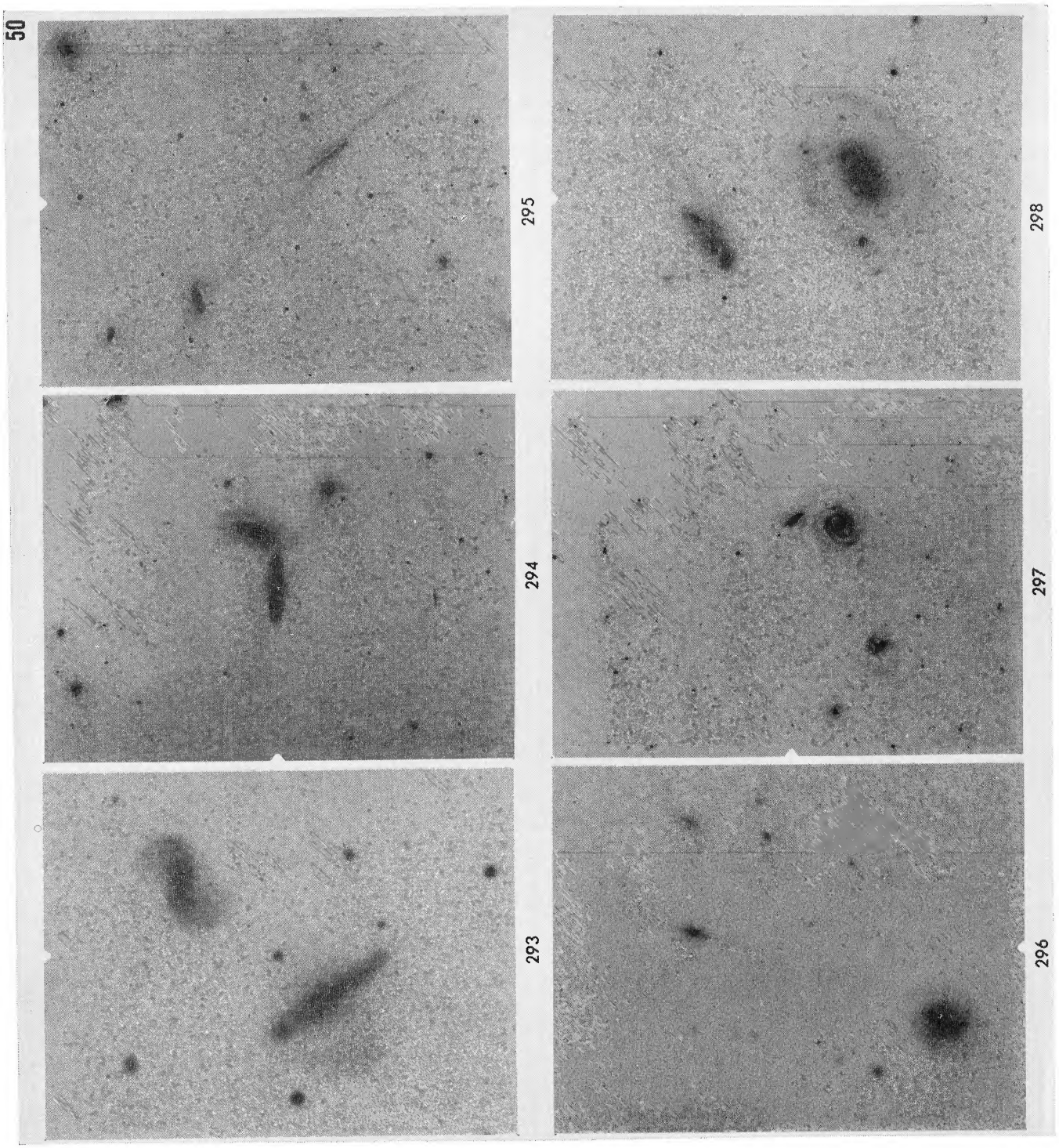

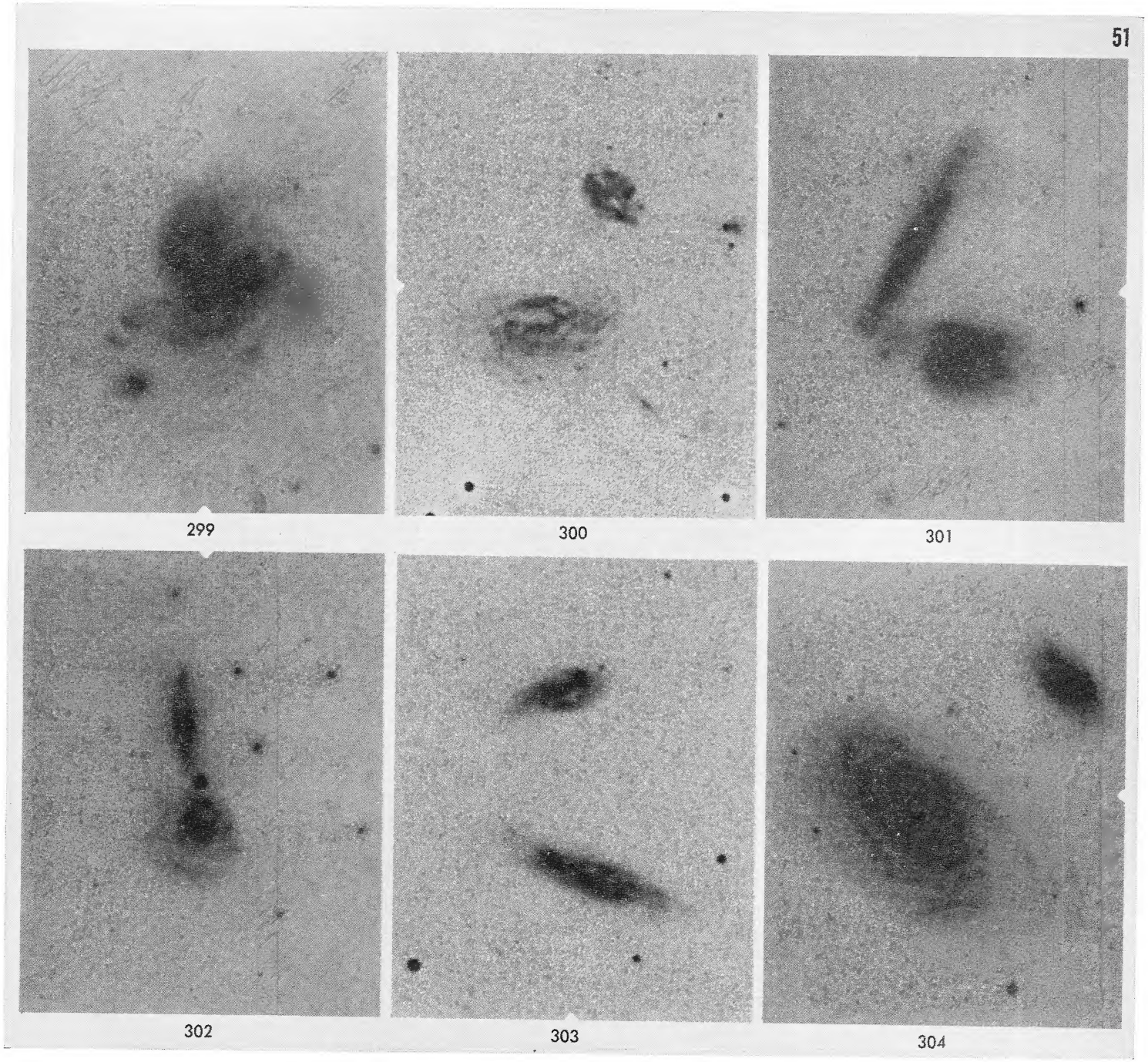

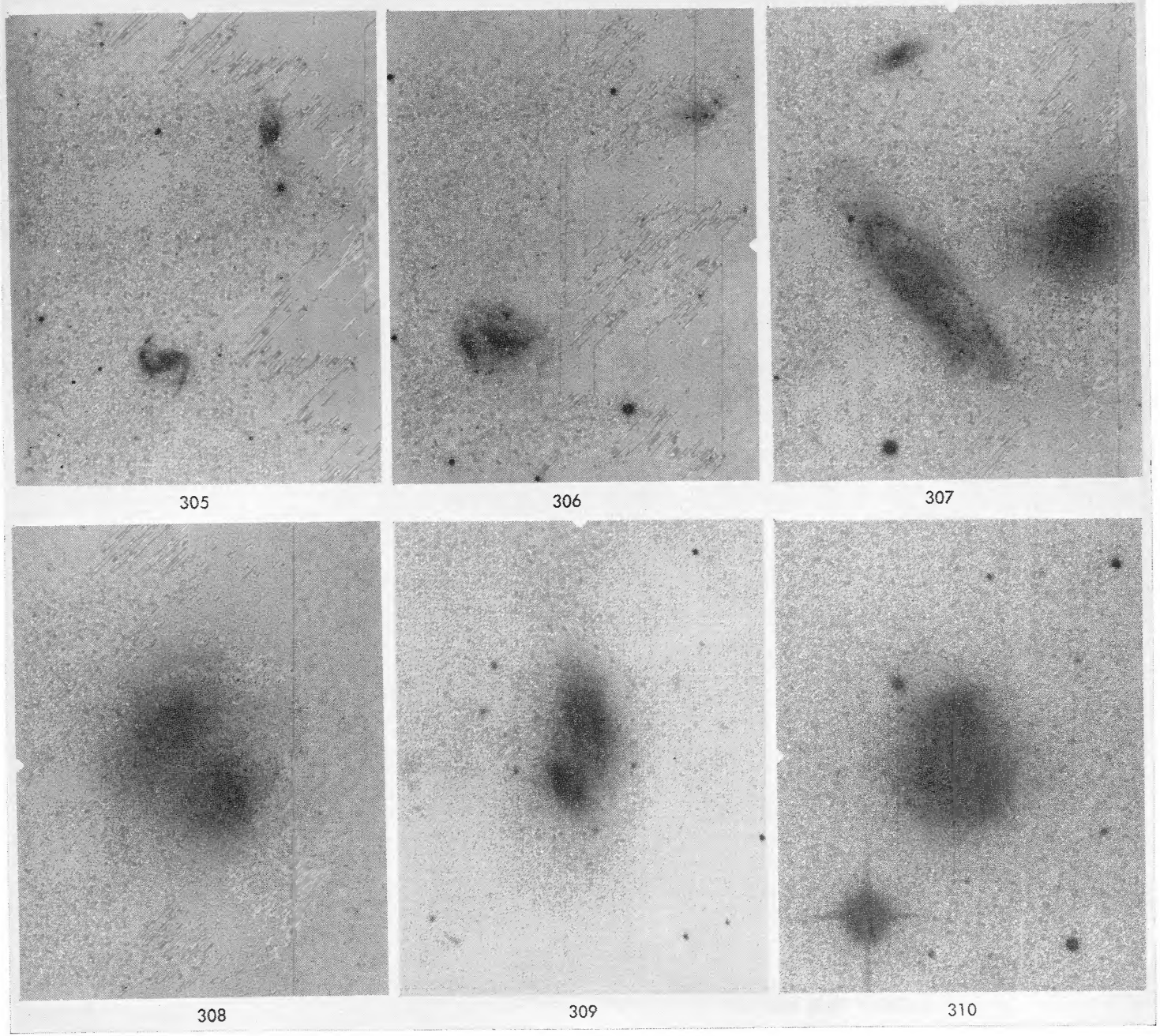

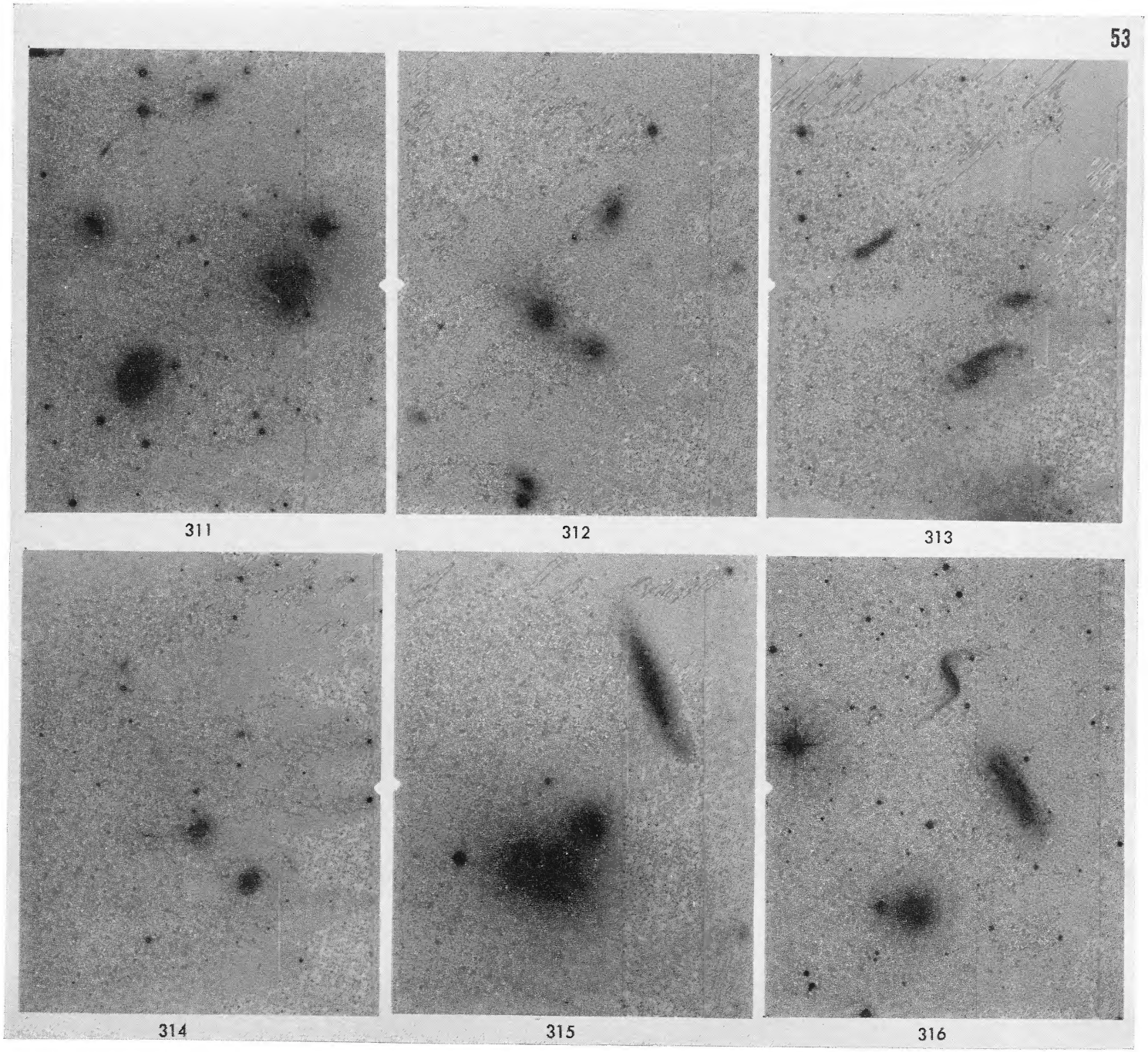

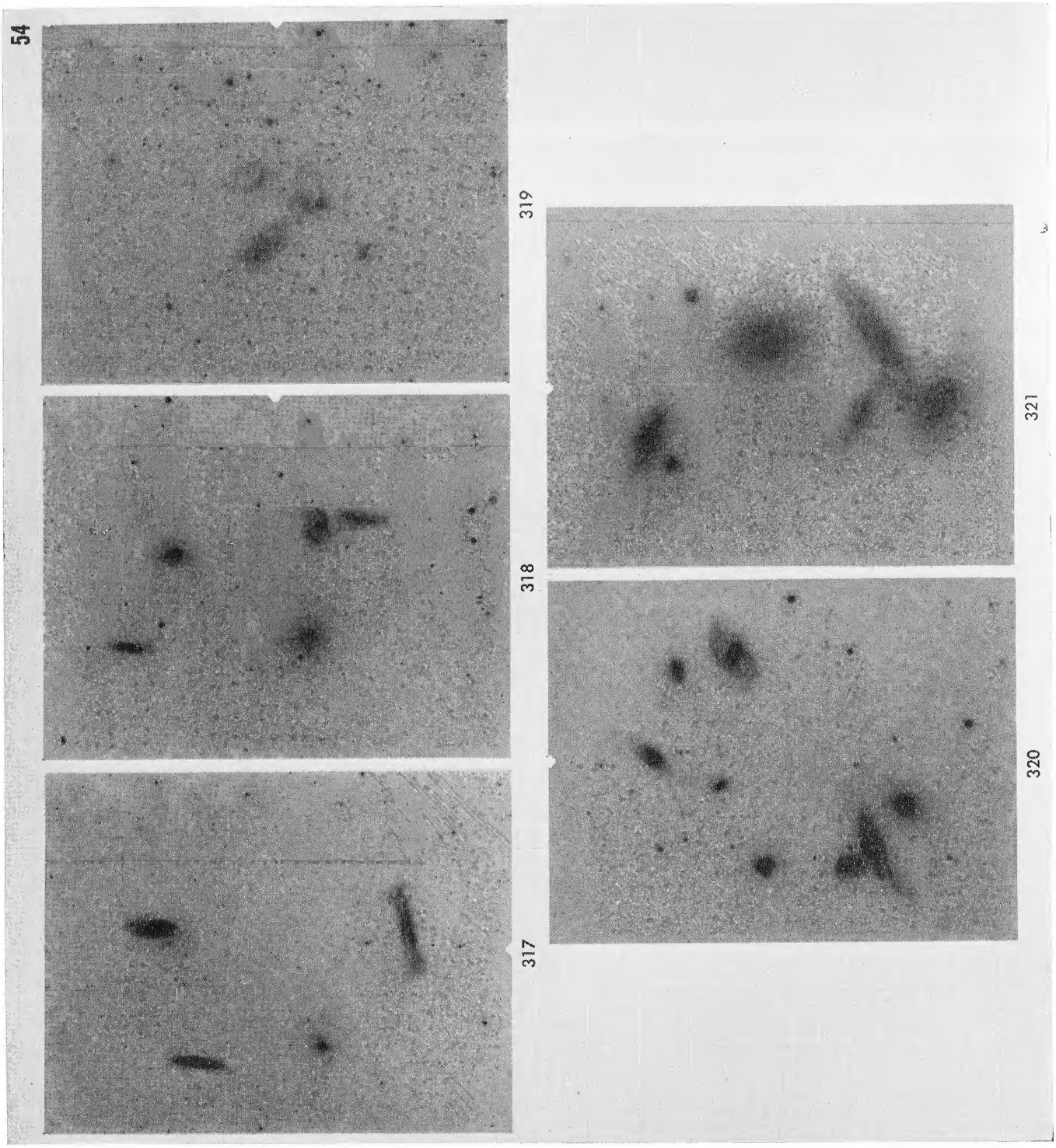

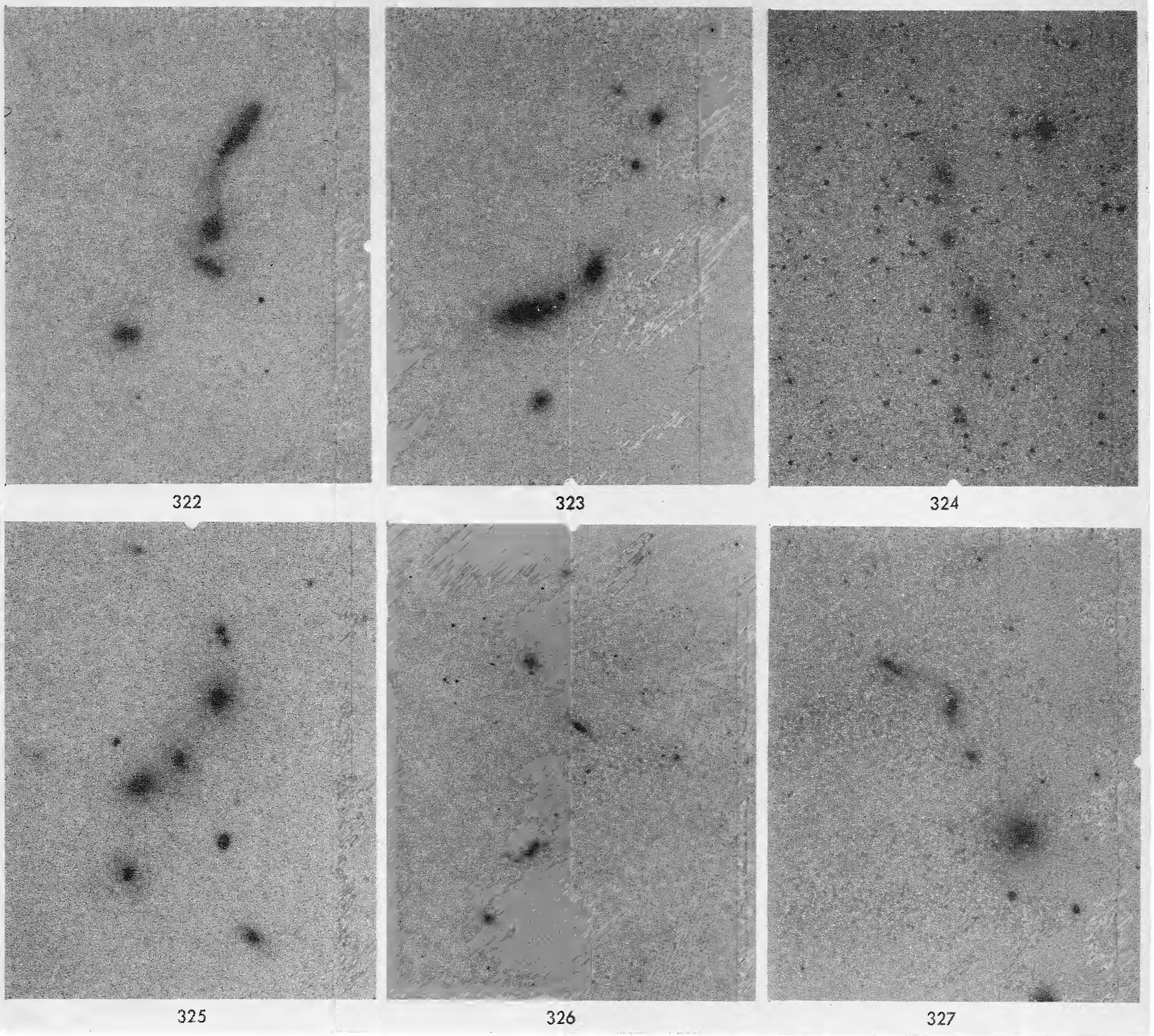

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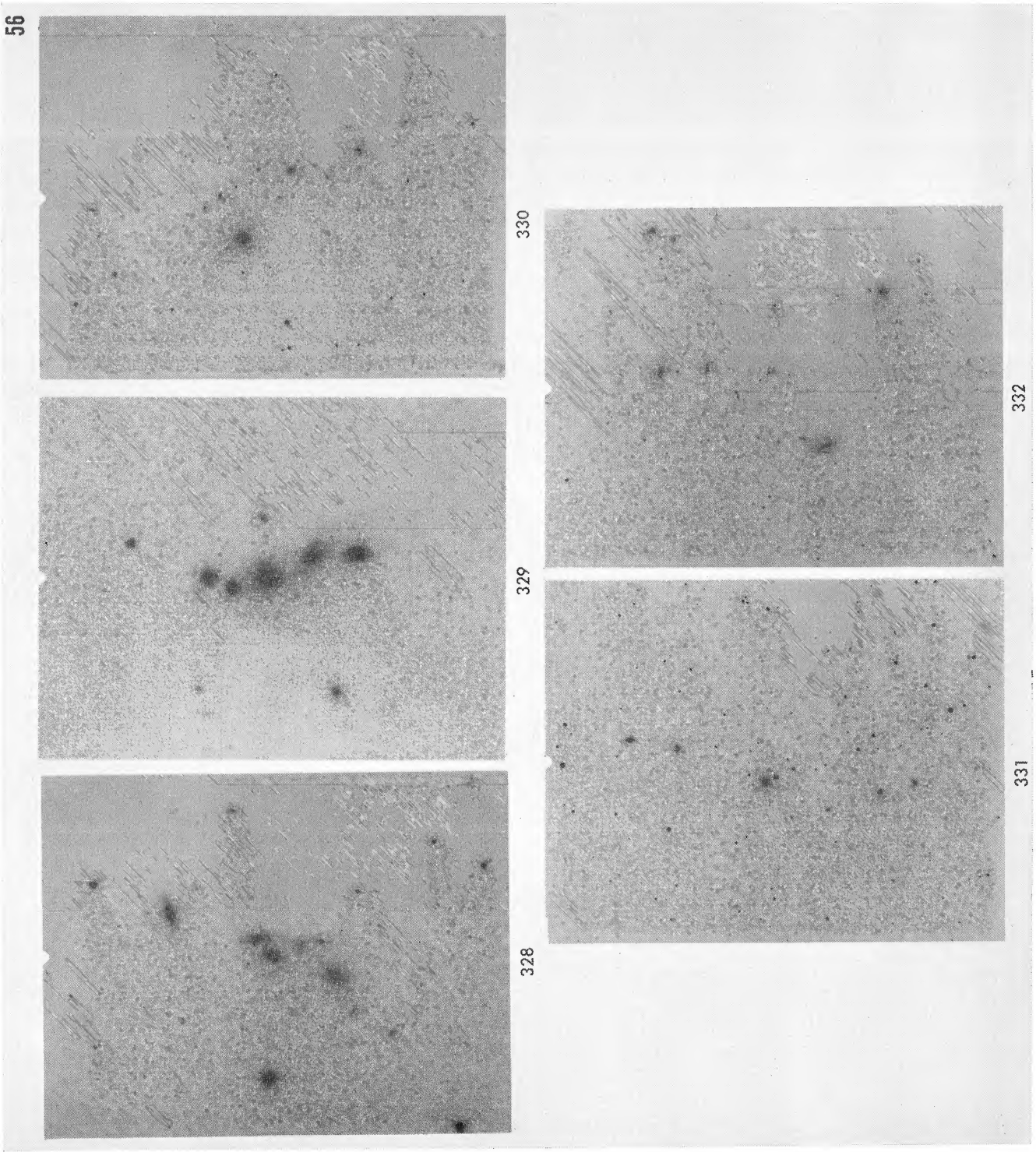
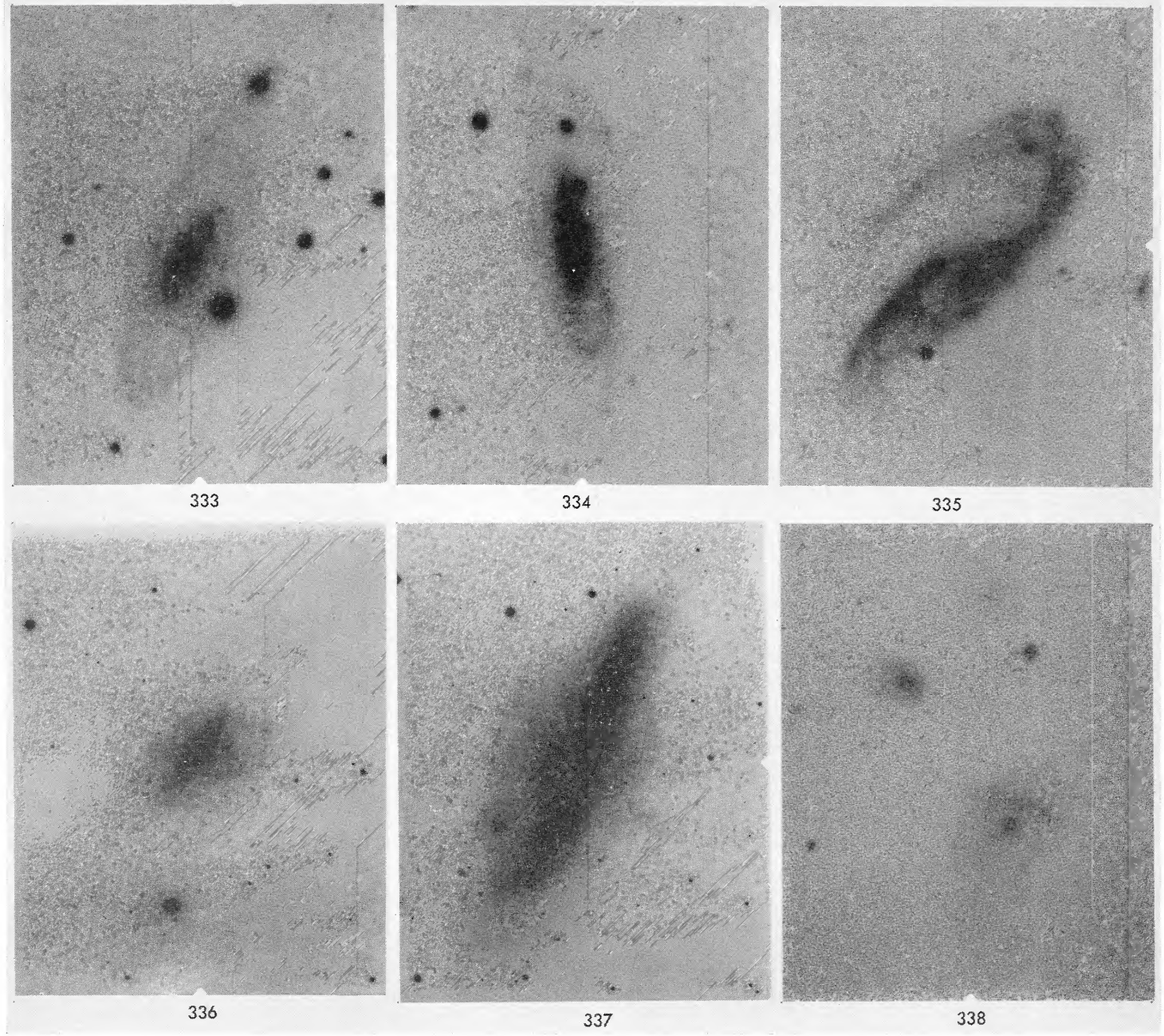
325 326 327





333 334 335

336 337 338

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 = Minkowski, 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 1½″ 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× to 10×).

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.	α (1970) h m	δ(1970) ° ′	Designation	Plate No.	Exp. (min)	Emul.	Filter	Seeing	Mag	Source	Remarks
1	9 22.9	+49 28	NGC 2857	PH-4448	30	103a-J	-	2	4X		High contrast print of low surface brightness spiral.
2	16 15.1	+47 7		3990	30	103a-O lb	GG 13	3	6X	DDO 204	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		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 3664	4139	25	103a-D	-	3	8X	DDO 95, VV 251	Fainter dwarf 6'S.
6	8 11.1	+46 5	NGC 2537	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		
9	8 11.6	+73 42	NGC 2523	4689	25	103a-J	-	2	6X		Bifurcated arm does not start at end of bar.
10	2 16.6	+ 5 30		4360	25	103a-D	-	3	8X	Wilson 13	Nucleus off center in ring.
11	1 7.9	+14 11		4278	30	103a-D	-	3	4X	VV348	Position of larger spiral. Outer arms do not start at termination of bar.
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	IIa-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 Hα only.
39	3 28.5	-22 22	NGC 1347	4110	30	103a-D	-	1	6X	VV23	
40	13 28.1	+37 34	IC 4271	4185	30	103a-D	-	3	10X	VV355	Absorption off edge of small galaxy obscure part of large galaxy. 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.	α (1970)	δ(1970)	Designation	Plate No.	Exp. (min)	Emul.	Filter	Seeing	Mag	Source	Remarks
42	15h 1.4m	+23° 27′	NGC 5829	PH-4255	30	103a-D	-	2	6X	VV7	Faint bifurcated arm to comp., one faint arm on comp. coiled 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	
45	14 18.7	+52 0		4254	30	103a-D	-	2	8X	VV2	Directions inverted; N is opposite tab mark. One arm leads toward large comp., other toward small comp.
46	23 32.2	+29 52		4284	30	103a-D	-	2	10X	VV314	Companion connected to main spiral.
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		Appearance of wake from stellar object in E arm.
50	23 56.4	-14 12	IC 1520	4067	30	103a-D	-	1	10X	VV25	
51	0 4.2	-13 36		4088	30	103a-D	-	3	10X		
52	5 18.0	+ 3 42		3110M	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	20	103a-O	-	1	10X		One arm leads to companion.
62	11 52.1	+43 36		4495	25	103a-J	-	1-2	10X	VV286	High surface brightness companion.
63	9 37.4	+32 27	NGC 2944	4100	25	103a-D	-	3	10X	VV82	
64	14 43.8	+19 36		4529	30	103a-J	-	3	8X	Herzog 1	Both arms lead toward companions.
65	0 20.3	+22 13		4358	30	103a-J	-	3	4X	Wilson 2	Position of open spiral. Comps. lie off projected ends of both spiral arms.
66	16 26.1	+51 36		4670	30	103a-O	-	2	8X		
67	1 19.8	- 0 42		4359	25	103a-D	-	3	8X		Comps. lie on inner and outer spiral arms.
68	23 47.0	+ 3 57	NGC 7756	4678	30	103a-J	-	2	6X		Many star-like knots lined up along straight arm.
69	14 19.2	+35 19	NGC 5579+80	4246	30	103a-D	-	3	8X	VV142	Three-armed spiral.
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 2.2E; M01-013 is 1.1E, 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)
78	1 57.7	+18 52	NGC 772	4305	45	103a-O	-	3	2X		N at left of picture. Comp. is NGC 770. Faint material toward each of two dwarf comps.
79	14 08.5	+17 46		4428	25	103a-D	-	1	10X		Small separation between two knots in arm.
80	8 45.0	+74 14	NGC 2633	4690	20	103a-J	-	2	6X		End of one arm heavy; absorption break in same arm near nucleus.
81	18 13.4	+68 18	NGC 6621+22	3998	45	103a-D	-	3	8X	VV247	Companion resembles M 51 companion. (19)
82	8 9.4	+25 18	NGC 2535+36	4085	30	103a-D	-	3	4X	VV9	Arm opposite comp. extremely long.
83	11 38.6	+15 29	NGC 3799+3800	4422	25	103a-D	-	2-3	6X	VV350	Some hazy material at juncture of two arms; high surface brightness, S shape inside comp. (35)
84	13 57.4	+37 35	NGC 5394+95	4187	30	103a-D	-	3	4X	VV48	Arcs of high S. B. around nucleus of companion.
85	13 28.6	+47 21	NGC 5194+95	PS-8559	40	103a-D	Wr. #23A	3	6X*	M 51, VV1	Faint plumes and extensions from companion. (3)(25)(33)(47)
86	23 45.6	+29 19	NGC 7753+52	PH-3986	45	103a-D	-	2-3	4X	VV5	Double arm leading to companion.

TABLE 1 (cont'd)

No.	α (1970)	δ(1970)	Designation	Plate No.	Exp. (min)	Emul.	Filter	Seeing	Mag	Source	Remarks
87	11h 39.4	+22° 37′	NGC 3808	PH-4368	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.(35)
91	15 33.2	+15 18	NGC 5953+54	4247	30	103a-D	-	2-3	8X	VV244	N at top of picture. Broad pec. arm to comp., then absorption; faint extension from comp.
92	23 17.3	+ 0 5	NGC 7603	4681	40	103a-E	GG 11	3	8X		Very faint connection shows better in red.
93	22 27.0	-25 0	NGC 7285+84	3993	45	103a-D	-	3	4X	VV74	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	
98	1 30.5	+31 57		4091	30	103a-D	-	3	8X	VV301	High surface brightness S inside spiral, similar to 96.
99	23 13.8	+18 48	NGC 7550	4107	30	103a-D	-	1	2X		Connection not seen, but note difference in arms toward and away from E galaxy. Note also material between West spiral and E galaxy.
100	0 27.0	-11 45	IC 18	4068	30	103a-D	-	2	2X	VV234	Radio source M00-11 is 1.″6 E.
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	3387	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 1b	-	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 warping 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.	α (1970)	δ(1970)	Designation	Plate No.	Exp. (min)	Emul.	Filter	Seeing	Mag	Source	Remarks
	h m	° ′									
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	(15)
127	0 37.4	- 9 10	NGC 191	4660	25	103a-J	-	3	8X		Sharp absorption lanes over N side of perturbing galaxy.
128	1 16.0	+14 33		4295	30	103a-D	-	1-2	10X	VV205	
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		North inverted. Radio source M11-02 is 3'N.
133	1 24.2	- 1 32	NGC 541	4307	60	103a-O	Polaroid	3	8X		Central member of galaxy group associated with 3C40.
134	12 28.3	+ 8 10	NGC 4472	35B	30	103a-O	-	2	2X	M 49	
135	2 38.5	+38 57	NGC 1023	4345	30	103a-J	-	2	2X	Wilson 15	Similar nebulosity about one diameter further east.
136	14 57.8	+54 0	NGC 5820	4530	35	103a-J	-	3	6X	Morgan	Faint streamers off one end of E galaxy.
137	9 32.5	+10 14		4363	25	103a-D	-	2	10X	Wilson 21	
138	11 57.2	+25 13	NGC 4015	4396	45	103a-O	-	2	10X	VV216	Absorption leads directly into E galaxy.
139	13 6.0	+26 53		4498	25	103a-J	-	2	10X	Herzog 8	
140	0 49.5	- 7 13	NGC 274+75	4090	30	103a-D	-	3	8X	VV81	
141	7 10.8	+73 32		4083	30	103a-D	-	3	8X	VV123	(15)(36)
142	9 36.2	2 53	NGC 2936+37	4133	30	103a-D	-	3	6X	VV316	
143	7 45.0	+39 11	NGC 2444+45	4084	30	103a-D	-	3	6X	VV117	Diffuse counter filament. (12)(19)(36)
144	0 4.4	-13 34	NGC 7828+29	4088	30	103a-D	-	3	8X	VV272	
145	2 21.0	+41 4		163S	30	103a-O	WG2	4	8X	Minkowski, Gates, Reaves	
146	0 5.0	- 6 54		3114M	20	103a-O	-	3-4	10X	Dewhirst	
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 2ᵐ 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. (3)(9)(32)(33)(34)
153	13 23.6	-42 51	NGC 5128	PS-8272		103a-J	Wr. #4	1-2	6X*		Cen 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. (20)(25)(38)(41)
155	11 21.9	+54 1	NGC 3656	4159	30	103a-D	-	2	8X	VV22	
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		λ3727 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		
165	7 34.9	+17 57		4347	30	103a-J	-	2	6X	Wilson 17	Fainter ot two streamers curved in SE dir. May be faint knots on ends of streamers.
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 1b	-	4	6X	VV181	
171	14 38.5	+ 3 36		4484	25	103a-J	-	3	8X		M14+010 is 2ᵐ west.
172	16 4.2	+17 43		3984	45	103a-D	-	2	6X	VV194	

TABLE 1 (Cont'd)

No.	α (1970)	δ(1970)	Designation	Plate No.	Exp. (min)	Emul.	Filter	Seeing	Mag	Source	Remarks
173	14h 50.0	+°9 29		PH-4429	25	103a-D	-	1	6X	VV 296	
174	9 56.7	+28 59		3886	60	103a-E	-	2	4X	Zwicky?	Smaller galaxy very condensed.
175	12 31.4	+11 34	IC 3481+83	54Z	40	103a-O	-	1	2X	Zwicky, VV 43	Can see connection only 2/3 way to SE galaxy. (18)(44)
176	13 2.2	-11 20	NGC 4933	4497	25	103a-J	-	2-3	6X		Companion galaxy very condensed.
177	14 54.5	+24 43		4485	25	103a-J	-	3	10X		Very small plume comes off comp. galaxy opposite larger.
178	14 22.9	+34 59		4252	30	103a-D	-	3	6X	VV 77	Ring off center, broad ejected plume from condensation in ring.
179	3 0.3	- 4 49		259M	25	103a-O	-	2	10X		Condensed offset center.
180	4 51.9	- 4 50		279M	20	103a-O	-	1-2	8X		South arm kinks back, thin filament connects nuclei.
181	10 24.2	+80 00	NGC 3210+12	4379	25	103a-D	-	3	6X	VV 319	Long faint filament extends westward from south arm.
182	23 26.3	+ 8 37		4675	120	IIa-O exp.	-	1	6X	VV 343	Long straight, very faint filament like bow wave from comp.
183	13 33.6	+31 33		4458	30	103a-J	-	3	6X		Three faint patches constitute third arm or filament.
184	5 39.0	+69 25	NGC 1961	4688	30	103a-O	-	3	2X		Two long straight arms or filaments tangent to NE side of galaxy.
185	16 33.8	+78 16	NGC 6217	4676	30	103a-O	-	1-2	4X		Condensed nucleus. Faint outer arms less curved than inner arms.
186	4 32.9	- 8 39	NGC 1614	261M	25		-	< 1-1	8X		Radio source M04-012 is 44°W, 3'S; 3C121 is 38°W, 17'S.
187	5 3.5	-10 17		3145M	30	IIa-O	-	1-2	10X		Radio source M05-10 is 6'N. Faint filament points to dense nucleus. 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		4375	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	Spike points toward small nucleus; no spectra available.
199	14 15.8	+36 42	NGC 5544+45	384Z	30	103a-O	-	2	10X	VV 210	Spirals appear disturbed.
200	2 52.0	+12 53	NGC 1134	4665	20	103a-J	-	4	6X		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 38	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!5.
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. (3)(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.	α (1970) h m	δ(1970) ° ′	Designation	Plate No.	Exp. (min)	Emul.	Filter	Seeing	Mag	Source	Remarks
217	10 36.9	+53 40	NGC 3310	PH-4364	40	103a-O	-	1-2	2X		Much Hα emission incl. half arc outside galaxy. (1)
218	15 52.3	+18 42		4290	30	103a-D	-	1	10X	VV 311	
219	3 38.4	- 2 13		3142M	25	103a-O	-	1-2	10X	Minkowski	Faint arc and filament on N side.
220	15 33.6	+23 35	IC 4553	4502	35	103a-J	-	2	8X	Wilson 34	
221	9 35.0	-11 11		4167	30	103a-D	-	2-3	8X		Faint diffuse material to south, bright filament to hard image on NW side of nucleus.
222	23 38.3	-12 27	NGC 7727	4002	25	103a-D lb	-	3	2X	VV 67	Amorphous arms. (25)
223	23 16.4	- 4 49	NGC 7585	4673	30	103a-J	-	2	6X	Morgan	
224	11 49.5	+55 15	NGC 3921	4424	25	103a-D	-	2	4X	VV 31	Straight filament leads to bright, offset nucleus. (19)
225	8 52.1	+78 21	NGC 2655	718B	20	103a-D	GG 1	2	2X	Baade	Very faint diffuse outer arms, absorption one side of nucleus. (25)
226	22 19.1	-24 50	NGC 7252	4677	40	IIa-O bkd	-	2	2X	Morgan	Loops, filaments at various angles.
227	1 18.5	+ 3 16	NGC 474	4386	35	103a-J	-	3	2X	Wilson 9	Pos. of spiral. S0 is E and a little N. Very faint rings extend to diameter of 7!4.
228	1 47.3	+10 23	IC 162	4069	30	103a-D	-	2	8X	VV 53	Defects on blue Survey print in both VV 53 and VV 54.
229	1 21.9	+33 6	NGC 507+08	4314	30	103a-D	-	1	2X	VV 207	Circular or near circular rings of small density difference.
230	0 44.8	-13 37		4369	25	103a-D	-	3	6X	Wilson 5	Inner and outer shells visible in direction of axis only.
231	0 42.0	- 4 17	IC 1575	4342	30	103a-D	-	1	4X	Wilson 4	Faintest arc extends about 2'S of nucleus with absorption.
232	9 32.2	+10 16		4363	25	103a-D	-	2	10X		Absorption lane reaching away from galaxy.
233	10 30.4	+54 32		54 Bm	20	103a-O	-	1½	8X	Haro No. 2	Narrow faint absorption lane in SE direction. (27)
234	11 34.2	+54 41	NGC 3738	1138B	30	103a-D	GG 1	4-5	6X	Baade	Considerable resolution into stars and absorption tubes.
235	0 7.2	+15 39	NGC 14	4072	30	103a-D	-	3	6X	VV 80	Faint outer oval and resolution into stars.
236	1 6.2	-17 38	IC 1623	4357	24	103a-O	-	3	4X	VV 114	Faint outer arm curves around through 270°.
237	9 26.1	+12 25		4462	30	103a-J	-	2	8X	Wirtanen 16	Knot in arm as large, not quite as bright as nucleus.
238	(13 13.4)	(+62 18)		4457	30	103a-J	-	3	8X	VV 250	VV position somewhat uncertain. Double nuclei, N nucleus has third arm.
239	13 40.5	+55 49	NGC 5278+79	383Z	30	103a-O	-	2	5X	VV 19, 383Z	Smaller galaxy is fairly symmetrical spiral.
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	Very thin, bright tail from north nucleus which has strong absorption. (15)(17)(19)
243	8 36.6	+25 52	NGC 2623	1137B	30	103a-O	GG 1	4-5	8X	Baade, VV 79	Some very small bright knots resolved in interior.
244	12 0.3	-18 42	NGC 4038+39	422Z	20	103a-O	-	1-2	1X	VV 245	(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	IC 2338+39	4476	30	103a-J	-	3	8X	Herzog 10	Spirals have common arm, N spiral arm continues NE.
248	11 44.9	- 3 26		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	
251	0 52.1	-14 2		4356	25	103a-D	-	3	10X	Wilson 6	Outside arms diffuse and bifurcate.
252	9 43.4	-19 33		4381	25	103a-D	-	4	8X	Wilson 22	Radio source M09-19.
253	9 41.9	- 5 9		4135	30	103a-D	-	3	6X	VV 52	Some resolution of stars or H II regions.
254	15 19.9	- 7 15		4501	30	103a-J	-	2	2X	Wilson 33	Position of brighter galaxy, companion south.
255	9 51.5	+ 8 1		4174	30	103a-D	-	1-2	8X	VV 342	Faint arm extends beyond high S. B. companion.
256	0 17.2	-10 32		3115M	20	103a-O	-	3-4	8X	Minkowski	Resolution into knots. Note small ragged galaxy W of pair. Radio source M00-10 is 7!S.
257	8 50.1	- 2 15		4098	30	103a-D	-	3	8X	VV 41	Galaxies joined by segment of thin arc.
258	2 37.4	+18 15		4070	30	103a-D	-	2	6X	VV 143	Resolution into knots on larger galaxy. (15)
259	5 0.2	- 4 18	NGC 1741	278M	20	103a-O	-	1-2	6X	Minkowski	Material extends SE toward peculiar round spiral.
260	12 12.1	+16 18		4533	25	103a-J	-	3	8X	Herzog 17	Possibly lines of faint condensations extending south.
261	14 47.8	-10 2		4538	25	103a-J	-	3	2X	VV 140	Some condensations resolved, similar smaller galaxy appears north. (19)
262	23 55.3	+16 39		4116	30	103a-D	-	2	8X	VV 255	Some resolution into knots.
263	10 23.4	+17 19	NGC 3239	4157	30	103a-D	-	1-3	4X	VV 95	Diffuse outer filaments, bright knots inside.

TABLE 1 (Cont'd)

No.	α (1970) h m	δ(1970) ° '	Designation	Plate No.	Exp. (min)	Emul.	Filter	Seeing	Mag	Source	Remarks
264	10 2.0	+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		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 4490+85	4186	30	103a-D	-	3	2X	VV 30	Resolution of knots, emission regions and dust lanes only.
270	10 48.2	+33 9	NGC 3395+96	4138	30	103a-D	-	3	6X	VV 246	Note arc form of emission knots. (32)(35)
271	14 1.8	- 5 55	NGC 5426+27	4251	30	103a-D	-	3	4X	VV 21	Arms linked. Note bifurcation in arm of N spiral.
272	16 4.0	+17 52	NGC 6054	3984	45	103a-D	-	2	10X		Arms join at dense knot or nucleus. Herc. cluster. (3)(19)
273	2 19.6	+39 14		4071	30	103a-D	-	2	6X	VV 323	Position of large spiral. Bright long well defined arms, but smooth, not patchy.
274	14 33.5	+ 5 29		4460	25	103a-D	-	3	8X		Perturbation of arm by small galaxy to east.
275	9 24.4	-11 52	NGC 2881	4166	30	103a-D	-	2	10X	VV 293	
276	2 26.1	+19 27	IC 1801+NGC 935	4376	25	103a-D	-	3	8X	VV 238	Both intersecting edges seem dimmed.
277	12 54.3	+ 2 42	NGC 4809+10	381Z	30	103a-O	-	2	10X		Resolution of knots.
278	22 18.1	+29 14	NGC 7253	4009	30	103a-D lb	-	4	8X	VV 242	Diffuse material between galaxies, many internal absorption lanes.
279	3 12.7	- 2 55	NGC 1253	4079	30	IIa-O	GG 13	3	2X	DDO 31	
280	11 36.2	+48 4	NGC 3769	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. (3)(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		4123	30	103a-D	-	3	8X	VV 40	Slanted parallel streamers off each edge of main galaxy.
288	13 33.5	+13 58	NGC 5221+22+26	4427	35	103a-J	-	1-2	2X	VV 315	Streamers in both directions from edge of spiral.
289	11 54.7	-19 44	NGC 3981	4182	30	103a-D	-	3	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		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	Postion 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		4485	25	103a-J	-	3	8X	VV 340	
303	9 44.7	+ 3 12	IC 563+64	4491	25	103a-J	-	3	6X	Wirtanen 17	Position between pair.
304	3 9.8	- 9 2	NGC 1241+42	4309	30	103a-D	-	3	6X	VV 334	
305	11 57.0	+27 44	NGC 4016+17	4453	25	103a-J	-	2	2X		Segment breaking from arm of S gal., weak filaments reach to N gal., which has figure 8 loops.
306	1 31.0	+ 4 27		4077	30	103a-D	-	3	4X	VV 173+174	VV position. Resolution; diffuse, hooked countertail.
307	9 24.2	+11 34	NGC 2872+74	4492	25	103a-J	-	3	6X		Position between pair. Possibly not interacting.

TABLE 1 (Cont'd)

No.	α (1970) h m	δ(1970) ° ′	Designation	Plate No.	Exp. (min)	Emul.	Filter	Seeing	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).
309	2 26.9	-10 58	NGC 942+43	4118	30	103a-D	-	3	6X	VV 217	Peculiar absorption ring, possibly broken.
310	17 26.9	+58 33	IC 1259	3985	45	103a-D	-	3	10X	VV 101	Very close E galaxies. Picture is 10X of following (No. 311) area.
311	17 26.9	+58 33	IC 1259	3985	45	103a-D	-	3	4X	VV 101	Same as 310, but shows surrounding field and group. Picture is 4X of preceding (No. 310) area.
312	16 49.0	+46 45		4283	30	103a-D	-	2	8X	VV 197	Diffuse connection between central members of group.
313	11 56.1	+32 27	NGC 3994+95	4170	30	103a-D	-	3	2X	Mayall, VV 249	Linear strings of knots like deformed spiral arms. Strong [O II] emission. (32)
314	22 56.3	- 3 57		3974	50	103a-O	-	3	2X	VV 295	Faint filament leads SE to faint dwarf. Pos. of W spiral.
315	9 18.0	+33 54	NGC 2832	4432	30	103a-D	GG 11	2	8X		Companion E is quite compact.
316	10 16.5	+21 59	NGC 3190	PS-8268	50	103a-J	Wr. #4	2	8X*	Leo Group, VV 307	Edge-on spiral shows signs of interaction.
317	11 18.6	+13 10	NGC 3627+23+28	PS-8269	50	103a-J	Wr. #4	2	2X*	VV 308	See also 16. Both galaxies on east show signs of interaction.
318	2 7.9	-10 16	NGC 833+35+38+39	PH-4372	30	103a-J	-	4	2X		Position of NGC 833. Faint, diffuse streamers, peculiar galaxies.
319	22 34.5	+33 47	NGC 7317 thru 19	4657	20	103a-J	-	3	2X	VV 288	Position of NGC 7317. Stefan's Quintet. (13)(18)
320	11 36.3	+22 11		4444	25	103a-D	-	2	4X	VV 282	Position of close triplet. Large companion NW.
321	9 37.4	- 4 42		3725S	25	103a-O	GG 13	2	8X	VV 116	VV position. Sharp absorption lane in connection to southern most galaxy. (18)
322	11 31.1	+53 7		1909B	20	103a-O	GG 13	3	8X	VV 150	Near NGC 3718. See No. 214. (18)
323	23 52.6	+ 0 13	NGC 7783	4661	20	103a-J	-	4	6X	VV 208	
324	16 0.8	+16 2		PS-8521	50	103a-J	Wr. #4	2	10X*	VV 159	Diffuse elongation of E's along line joining them.
325	22 1.7	-21 12		PH-4302	30	103a-O	-	3	10X	VV 167	
326	13 36.1	+ 6 35		4537	25	103a-J	-	3	2X	VV 6	Position of integral sign spiral. Five spirals in approx. chain. No. 33 gives larger scale picture.
327	5 20.2	+ 6 39	NGC 1875	4666	20	103a-J	-	4	8X	VV 169	Three distorted galaxies in general line toward east.
328	14 46.5	+19 11		4487	35	103a-J	-	3	4X	VV 165	Six galaxies more or less in line; center one has semi-stellar component.
329	11 30.4	+70 58		4450	35	103a-J	-	2	8X	VV 172	Plate defect on northern most galaxy. (18)(19)
330	16 48.3	+53 27		4654	20	103a-E	GG 11	2	2X	Makarian	Five galaxies in chain quite compact; 6th of low surface brightness.
331	1 5.7	+32 15	NGC 375 thru 388	4668	25	103a-E	GG 11	2	1X	Makarian	Position of NGC 383. Symmetry around large central galaxy. Velocities known. (1)
332	3 7.2	-23 10	IC 1892	4373	25	103a-J	-	3	1X	VV 260 + VV 337	Different types of galaxies in chain.
333	2 37.6	+10 43	NGC 1024	4318	45	103a-O	-	1	4X		Thin circular arms, star in SE superposed on wisp.
334	13 29.1	+31 47		4440	25	103a-D	-	2	6X		Second "star" south not quite stellar.
335	11 1.8	+ 4 56	NGC 3509	4180	30	103a-D	-	3	8X	VV 75	Large luminous system. (19)
336	8 53.8	+58 55	NGC 2685	663S	30	103a-O	-	2	3X	Hubble	E is to right of N, W to left. (3)(14)(26)
337	9 53.6	+69 51	NGC 3034	5Bm	30	103a-O	WG 2	3	2X	M 82	Internal explosion. (3)(8)(20)(21)(25)(29)(37)
338	10 9.5	- 7 46		3233M	20	103a-O	-	1-2	10X		

TABLE 2

ATLAS REDSHIFTS

α (1970) h	m	δ (1970) °	′	No.	Designation	Corrected Redshift km/sec
0	1.4	+16	29	130		
0	4.2	-13	36	51		
0	4.4	-13	34	144	NGC 7828+29	
0	5.0	- 6	54	146		
0	5.4	+ 8	12	246		
0	7.2	+15	39	235	NGC 14	
0	16.9	+29	55	113	NGC 70	
0	17.2	-10	32	256		
0	20.3	+22	13	65		
0	20.7	- 1	34	35		
0	22.1	- 0	40	201		
0	27.0	-11	45	100	IC 18	
0	30.2	- 5	19	19	NGC 145	
0	35.3	+23	50	282	NGC 169	
0	37.4	- 9	10	127	NGC 191	
0	41.1	+40	42	168	NGC 221	+17, +38 (1)
0	42.0	- 4	17	231		
0	44.8	-13	37	230		
0	49.5	- 7	13	140	NGC 274+75	+1854, +1971 (4)
0	52.1	-14	2	251		
0	57.9	- 4	57	121		
0	59.0	- 9	19	59	NGC 341	
1	5.7	+32	15	331	NGC 383	+5086 (1)
1	6.2	-17	38	236	IC 1623	
1	7.9	+14	11	11		
1	14.4	+ 5	2	164	NGC 455	
1	16.0	+14	33	128		
1	17.5	+12	19	88		
1	17.9	+12	18	119		
1	18.5	+12	11	48		
1	18.5	+ 3	16	227	NGC 474	+2402 (1)
1	19.8	- 0	42	67		
1	20.9	- 1	1	8	NGC 497	
1	21.8	+30	37	70		
1	21.9	+33	6	229	NGC 507+08	+5121 (1)
1	23.0	+ 3	38	157	NGC 520	+2177 (1), +2320 (4)
1	23.5	+33	52	158	NGC 523	
1	24.2	- 1	32	133	NGC 541	
1	24.2	- 1	31	308	NGC 545+47	
1	30.5	+31	57	98		
1	31.0	+ 4	27	306		
1	47.0	-12	31	4		
1	47.3	+10	23	228	IC 162	
1	49.4	+21	45	31		
1	49.8	- 4	12	75	NGC 702	
1	55.6	+17	4	56		
1	55.8	+33	4	166	NGC 750+51	+5291 (1), +5295 (1)
1	56.6	+ 2	57	126		
1	57.7	+18	52	78	NGC 772	+2553 (1)
2	2.3	+14	35	290	IC 195+96	
2	6.4	+41	20	74		
2	7.9	-10	16	318	NGC 833+35+38+39	
2	16.6	+ 5	30	10		
2	19.6	+39	14	273		
2	21.0	+41	4	145		
2	23.0	- 4	47	54		
2	26.1	+19	27	276	IC 1801, NGC 935	
2	26.9	-10	58	309	NGC 942+43	
2	37.4	+18	15	254		
2	37.6	+10	43	333	NGC 1024	
2	38.5	+38	57	135	NGC 1023	+709 (1), +729 (4)
2	41.1	- 0	8	37	NGC 1068	+1032, +1133 (1), +1094 (4)
2	45.2	-30	24	77	NGC 1097	+1224, +1322 (1), +1272 (4)
2	45.9	-14	54	131		
2	48.6	+12	46	190		
2	52.0	+12	53	200	NGC 1134	
2	53.6	- 0	17	118	NGC 1143+44	
3	0.3	- 4	49	179		
3	1.9	-22	19	108		
3	7.2	-23	10	332	IC 1892	
3	8.4	-20	41	41	NGC 1232	+1736 (1), +1734 (4)
3	9.6	+ 1	12	147		
3	9.8	- 9	2	304	NGC 1241+42	
3	12.7	- 2	55	279	NGC 1253	
3	21.5	-37	20	154	NGC 1316	+1728 (1), +1715 (4)
3	28.5	-22	22	39	NGC 1347	
3	38.4	- 2	13	219		
4	4.6	+69	45	213	IC 356	
4	18.4	+ 2	1	20		
4	32.9	- 8	39	186	NGC 1614	
4	35.2	- 2	21	61		
4	28.9	+64	48	210	NGC 1569	+131, +107 (1), +121 (4)
4	51.9	- 4	50	180		
5	0.2	- 4	18	259	NGC 1741	
5	3.5	-10	17	187		
5	18.0	+ 3	42	52		
5	20.2	+ 6	39	327	NGC 1875	
5	21.1	-11	31	123	NGC 1888+89	+2310, +2395 (1), +2334 (4)
5	39.0	+69	25	184	NGC 1961	+4032 (1), +4027 (4)
6	50.8	+86	36	96		
7	10.8	+73	32	141		
7	17.9	+85	50	25	NGC 2276	+2595 (1)
7	17.9	+85	50	114	NGC 2276+2300	+2292 (1), +2189 (4)
7	33.8	+35	26	250		

TABLE 2 (Cont'd)

α (1970) h	m	δ (1970) °	'	No.	Designation	Corrected Redshift km/sec
7	34.9	+17	57	165		
7	41.3	+73	52	17		
7	45.0	+39	11	143	NGC 2444+45	+3951 (4)
8	9.4	+25	18	82	NGC 2535+36	+4153 (1), +3983 (4), +4046 (4)
8	11.1	+46	5	6	NGC 2537	+415, +299 (1), +422 (4)
8	11.6	+73	42	9	NGC 2523	+3604 (1)
8	15.9	+70	50	268		
8	21.9	+21	26	247	IC 2338+39	
8	30.2	+19	19	58		
8	33.4	+28	41	12	NGC 2608	+2041 (1)
8	36.6	+25	52	243	NGC 2623	+5342 (1)
8	41.0	+14	24	89	NGC 2648	
8	45.0	+74	14	80	NGC 2633	+2382 (4)
8	47.7	+19	12	167	NGC 2672	+4100 (1)
8	49.1	-16	30	7		
8	50.1	- 2	15	257		
8	52.0	+35	15	195		
8	52.1	+78	21	225	NGC 2655	+1473 (1)
8	53.8	+58	55	336	NGC 2685	+961 (1), +957 (4)
8	58.4	+35	51	202	NGC 2719	+3073 (4)
9	1.0	+26	3	287		
9	12.2	+40	14	215	NGC 2782	+2502 (1), +2514 (4)
9	13.9	+44	27	55		
9	15.7	+42	5	283	NGC 2798+99	+1699 (1)
9	18.0	+33	54	315	NGC 2832	+6895 (1)
9	22.1	+49	23	285	NGC 2854+56	
9	22.9	+49	28	1	NGC 2857	
9	24.2	+11	34	307	NGC 2872+74	+2803 (4), +3443 (4)
9	24.4	-11	52	275	NGC 2881	
9	25.4	+68	32	300		
9	26.1	+12	25	237		
9	27.6	+76	36	207		
9	32.2	+10	16	232		
9	32.5	+10	14	137		
9	35.0	-11	11	221		
9	36.2	+ 2	53	142	NGC 2936+37	
9	37.4	+32	27	63	NGC 2944	
9	37.4	- 4	42	321		
9	37.7	+32	29	129		
9	41.9	- 5	9	253		
9	43.4	-19	33	252		
9	44.3	-14	11	245	NGC 2992+93	
9	44.7	+ 3	12	303		
9	51.5	+ 8	1	255		
9	53.1	- 6	43	292	IC 575	
9	53.6	+69	51	337	NGC 3034	+400, +410 (1), +322 (4)
9	56.7	+28	59	174		
10	2.0	+40	52	264	NGC 3104	
10	9.5	- 7	46	338		
10	16.5	+21	59	316	NGC 3190	+1220, +1284 (1), +1255 (4)
10	21.8	+20	3	94	NGC 3226+27	+1006 (1), +1233 (1)
10	22.3	+16	53	43		
10	23.4	+17	19	263	NGC 3239	+763 (1), +761 (4)
10	24.1	- 2	3	44	IC 609	
10	24.2	+80	0	181	NGC 3210+12	
10	30.4	+54	32	233		
10	33.6	-17	0	53	NGC 3290	
10	35.0	+31	43	267		
10	35.4	+18	17	192	NGC 3303	
10	36.9	+53	40	217	NGC 3310	+1061 (1), +1090 (4)
10	40.3	+77	37	156		
10	41.2	+13	37	291		
10	48.2	+33	9	270	NGC 3395+96	+1715 (1), +1622 (4), +1607,(1) +1611 (4)
10	49.7	+28	9	162	NGC 3414	+1392 (1)
10	50.6	+30	15	107		
10	50.8	+36	48	206	NGC 3432	+588 (1), +594 (4)
10	52.8	+57	9	24	NGC 3445	
10	52.9	+54	28	205	NGC 3448	
10	58.2	+17	49	198		
11	1.8	+ 4	56	335	NGC 3509	+7443 (4)
11	2.2	+41	0	148		
11	3.2	+30	15	21		
11	5.7	+18	36	191		
11	8.3	+24	27	301		
11	9.6	+28	51	105	NGC 3561	
11	17.9	- 2	56	132		
11	18.6	+13	10	317	NGC 3627	+633 (1), +591 (4)
11	18.6	+13	11	16	NGC 3627	
11	19.4	+53	21	27	NGC 3631	+1162 (1)
11	21.9	+54	1	155	NGC 3656	
11	22.7	+ 3	29	5	NGC 3664	
11	23.9	+54	33	151		+6232 (22)
11	27.1	+58	42	296	NGC 3690+IC 694	
11	27.3	+58	43	299		
11	29.4	+20	38	197	IC 701	
11	30.1	+28	40	203	NGC 3712	
11	30.4	+70	58	329		
11	31.0	+53	14	214	NGC 3718	+1128 (1)
11	31.1	+53	7	322		
11	34.2	+54	41	234	NGC 3738	
11	36.2	+48	4	280	NGC 3769	+804 (4)
11	36.3	+22	11	320		
11	38.1	+32	5	294	NGC 3786+88	+2737, +2327 (4)
11	38.6	+15	29	83	NGC 3799+3800	+3424, +3469 (4)
11	39.4	+22	37	87	NGC 3808	
11	40.6	+ 0	31	161		
11	41.5	+26	26	115		
11	44.9	- 3	26	248		
11	49.5	+55	15	224	NGC 3921	+6023 (4)
11	52.1	+43	46	62		
11	54.7	-19	44	289	NGC 3981	
11	56.1	+32	27	313	NGC 3994+95	+3338 (1), +3126 (4), +3356 (4)

TABLE 2 (Cont'd)

α (1970) h	m	δ °	'	No.	Designation	Corrected Redshift km/sec
11	56.2	+36	36	194		
11	57.0	+27	44	305	NGC 4016+17	
11	57.2	+25	13	138	NGC 4015	
11	58.0	-19	6	22	NGC 4027	+1701 (4)
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	NGC 4194	+2684 (1)
12	14.0	+28	21	106		
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	NGC 4618	+541 (1)
12	40.8	+32	42	281	NGC 4631	+611 (1), +646 (4)
12	42.0	+11	45	116	NGC 4647+49	+1321, +1379 (1), +1328(4), +1175(1), +1200(4)
12	42.2	+16	33	189	NGC 4651	
12	43.8	+27	17	163	NGC 4670	+1209 (1)
12	44.7	+30	54	242	NGC 4676	+6515 (A), +6620 (B), (4)
12	50.3	+25	57	159	NGC 4747	
12	52.5	+36	15	265	IC 3862	
12	54.3	+ 2	42	277	NGC 4809+10	+854 (4), +794 (4)
12	57.5	+35	2	266	NGC 4861	+829 (1), +831 (4)
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		
14	2.1	+54	29	26	NGC 5457	+394 (1), +415 (4)
14	8.5	+17	46	79		
14	8.6	+17	49	117	IC 982+983	
14	15.8	+36	42	199	NGC 5544+45	+3265, +3275 (4)
14	18.7	+52	0	45		
14	18.8	+ 4	6	286	NGC 5560+66+69	+1436 (1), +1581 (4)
14	19.2	+35	19	69	NGC 5579+80	
14	22.9	+34	59	178		
14	30.9	+ 8	12	49	NGC 5665	
14	33.5	+ 5	29	274		
14	33.8	+26	39	95	IC 4461	
14	36.4	+30	35	241		
14	38.5	+ 3	36	171		
14	43.8	+19	36	64		
14	44.1	+38	52	297	NGC 5754+55	
14	45.8	+18	59	47		
14	46.5	+19	11	328		
14	47.8	-10	2	261		
14	50.0	+ 9	29	173		
14	54.5	+24	43	177		
14	55.7	+24	44	302		
14	57.8	+54	0	136	NGC 5820	+3444 (1)
15	1.4	+23	27	42	NGC 5829	
15	19.9	- 7	15	254		
15	25.4	+41	46	90	NGC 5930	+2868 (4)
15	33.2	+15	18	91	NGC 5953+54	+2188, +2228 (4)
15	33.6	+23	35	220	IC 4553	
15	45.7	+18	00	72	NGC 5994+96	
15	48.1	+69	31	109		
15	52.3	+18	42	218		
16	0.8	+16	2	324		
16	3.1	+14	57	101		
16	3.1	+17	46	122	NGC 6039	
16	3.8	+17	46	71		
16	4.0	+17	52	272	NGC 6054	
16	4.0	+20	38	209	NGC 6052	
16	4.2	+17	43	172		
16	5.0	+55	37	188		
16	15.1	+47	7	2		
16	26.1	+51	36	66		
16	33.8	+78	16	185	NGC 6217	+1617, +1613 (1)
16	34.2	+46	17	73	IC 1222	
16	37.2	+41	59	125		
16	48.3	+53	27	330		
16	48.8	+45	30	103		
16	49.0	+46	45	312		
16	50.0	+47	17	208		
16	58.1	+58	58	293		
17	12.5	+59	22	32		
17	18.5	+60	38	124	NGC 6361	

TABLE 2 (Cont'd)

α (1970) h	m	δ (1970) °	'	No.	Designation	Corrected Redshift km/sec
17	18.7	+49	5	102		
17	22.5	+62	11	30		
17	26.9	+58	33	310	IC 1259	
17	26.9	+58	33	311	IC 1259	
17	30.1	+75	45	38	NGC 6412	+1751 (1)
18	13.4	+68	18	81	NGC 6621+22	+6490 (4)
20	34.3	+60	2	29	NGC 6946	+371 (4), +330, +221 (1)
22	1.7	-21	12	325		
22	13.3	+13	42	169	NGC 7236+37	+8098, +8093 (4)
22	18.1	+29	14	278	NGC 7253	
22	19.1	-24	50	226	NGC 7252	+4817 (4)
22	27.0	-25	0	93	NGC 7284+85	
22	34.1	-26	12	14	NGC 7314	+1838 (1)
22	34.5	+33	47	319	NGC 7317-19	(1), (13)
22	34.8	- 3	6	3		
22	50.0	- 5	43	15	NGC 7393	+3975 (1), +3972 (4)
22	52.5	-15	22	110		
22	56.3	- 3	57	314		
22	58.6	+15	49	13	NGC 7448	+2649 (1)
23	1.7	+ 8	42	298	NGC 7469	+5015 (4), +4988, +4899 (1)
23	13.8	+18	48	99	NGC 7550	
23	15.8	+18	32	170	NGC 7578	
23	16.4	- 4	49	223	NGC 7585	+3502 (4), +3485, +3538 (1)
23	17.3	+ 0	5	92	NGC 7603	
23	18.0	+ 9	20	150	NGC 7609	
23	19.0	+17	4	212	NGC 7625	+2050 (1), +2009 (4)
23	26.3	+ 8	37	182		
23	27.1	+22	15	28	NGC 7678	+3676 (1), +3680 (4)
23	27.2	+ 3	22	216	NGC 7679+82	+5378, +5278 (1), +5330 (4)
23	32.2	+29	52	46		
23	34.7	+ 2	0	284	NGC 7714+15	+3001 (1), +2963 (1)
23	38.3	-12	27	222	NGC 7727	+1953 (4), +1943, +1982 (1)
23	39.9	- 3	44	295	IC 1505	
23	45.6	+29	19	86	NGC 7752+53	+5108, +5085 (4)
23	47.0	+ 3	57	68	NGC 7756	
23	52.6	+ 0	13	323	NGC 7783	
23	55.3	+16	39	262		
23	56.4	-14	12	50	IC 1520	
23	58.9	+22	50	249		
23	59.9	+31	17	112	NGC 7805+06	

TABLE 3

RADIO OBSERVATIONS ON OR NEAR ATLAS GALAXIES

Atlas	Designation	Radio Source Name	References	Remarks
331	NGC 383	3C31	(1)(5)	Diameter 2!5 ± 1!5
227	NGC 470+74	M01+03	(10)(1)	Also 3C39?
133, 308	NGC 541+45+47	3C40, M01-01	(1)(5)(7)(10)	Double source
78	NGC 772		(3, Table IV)	
37	NGC 1068	M02-00, 3C71	(1)(3)(7)	Seyfert Galaxy
154	NGC 1316	M03-37	(6)(2)(11)	For A
283	NGC 2798-9		(3, Table X, XII)	VV50
252		M09-19	(10)	
337	NGC 3034	3C231	(1)(4)(3, TableIV)(7)(8)	M82
217	NGC 3310		(3, Table X)	
205	NGC 3448		(3, Table X)	
16, 317	NGC 3627+28		(3, Table IV, XII)	VV308
244	NGC 4038+39	M11-18	(3, Table IV, XII)	VV245
18	NGC 4088		(3, Table IV)	
134	NGC 4472		(3, Table IV)	$\Delta\alpha = 0!8$
152	NGC 4486	3C274	(3, Table IV)(1)(7)(8)	M87, Vir A
269	NGC 4490+85		(3, Table XII)	VV30
76	NGC 4569		(3, Table IV)	
281	NGC 4631		(3, Table IV)	
189	NGC 4651	3C275.1	(3, Table IV)(1)	Prob. not assoc. w spiral
153	NGC 5128	M13-42	(9)(2)(7)	Cen A
85	NGC 5194		(3, Table IV, XII)	M51, VV1
84	NGC 5394-5		(3, Table XII)	VV48, Possible radio source
26	NGC 5457		(3, Table IV, XII)	M101, VV344
286	NGC 5566	M14+04	(10)	
29	NGC 6946		(3, Table IV)	
169	NGC 7236+37	3C442	(5)(7)(8)	4' < diam < 10'
298	NGC 7469		(3, Table X)	Confused region

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.

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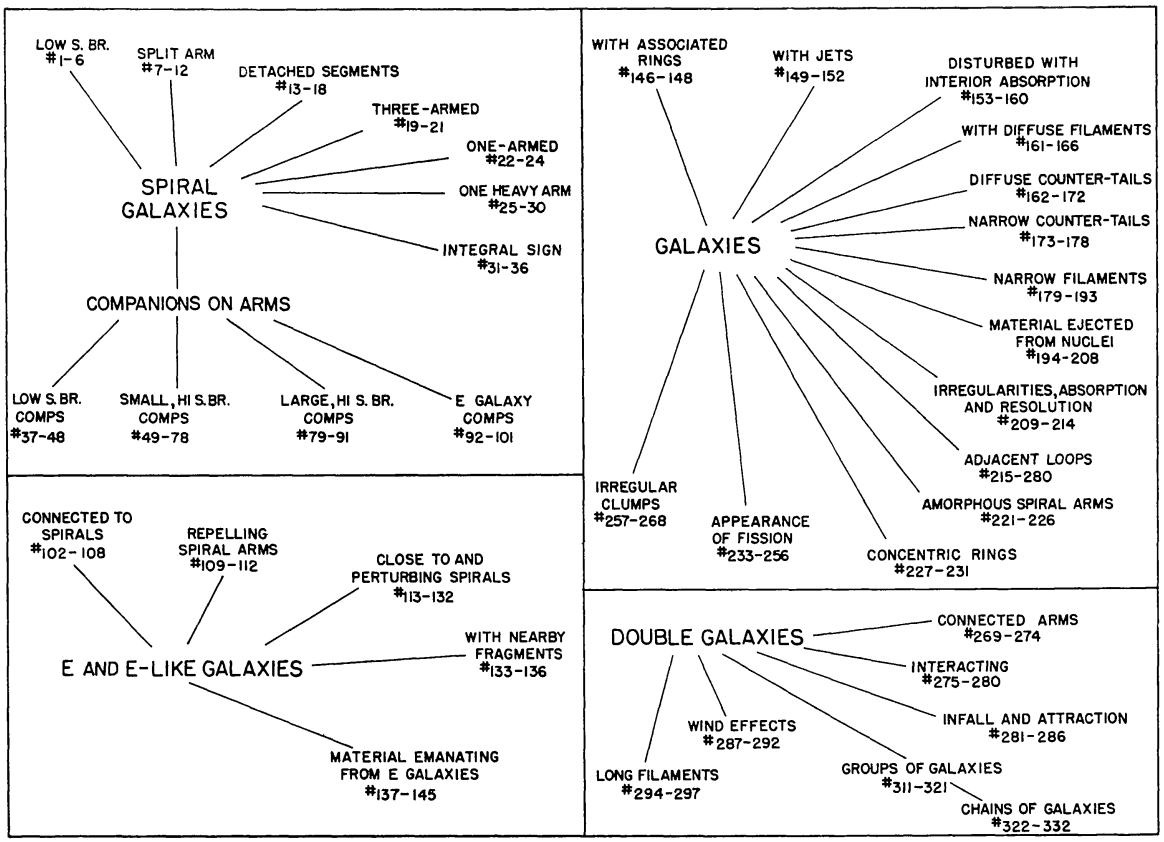

FIG. 1.—Plan of arrangements for the objects in the *Atlas*. The diagram shows major peculiarities which determine classification. Comments on additional peculiarities are given in Table 1. Characterization of peculiarities is sometimes descriptive rather than literal.