OPTICAL REDSHIFTS FOR 719 BRIGHT GALAXIES

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ABSTRACT

New redshifts for 719 galaxies have been measured from ~1000 plates taken at Stromlo and at Palomar since 1968. These together with new positions and galaxy types are listed as a step toward completion of the redshift coverage of the Shapley–Ames catalog. Redshifts that were determined during earlier work on the Hubble constant and on radio-source identification are included. The initial optical redshift system has been reduced to the mean 21-cm radio system by a zero-point correction of +30 km s^{-1}, determined from a number of galaxies in common. The distribution of true (external) errors of the present optical data, determined from the same common galaxies, is found to have σ (true)=66 km s^{-1} for plates of quality class E (excellent)+G (good). Widening the quality class to include F (fair) plates increases σ to 83 km s^{-1}. These external (true) errors are ~2.5 times larger than internal errors that are calculated from the spread of individual lines in each galaxy. Comparison of redshifts in common with other observers shows that their true errors are generally also ~2.5 times larger than the quoted errors. Exceptions are noted in the text. The consequence is that the true virial motions of galaxies that occur in pairs, groups, and small clusters may be smaller than generally believed. Galaxies in the sample with high excitation emission lines, inclined emission lines suitable for long slit studies of rotation, and with abnormal intensity ratios of [N II] (6583) to $H\alpha$ are listed. Besides the Shapley–Ames sample, other galaxies in groups, associations, and clusters have been observed, so as to sort out membership. New redshifts are given for 26 galaxies in the Virgo cluster region, 5 in the adjacent background W cloud, and 27 in the complex Ursa Major region (there are 10 in the v_0=285, 595, and 750 km s^{-1} groups that populate the area, 8 in the Ursa Major cluster, and 9 are in the background). Other groups and associations are listed. The distribution of redshifts in the present list, and in the complete Shapley–Ames, shows a sharp cutoff at v_0=100 km s^{-1}, below which no galaxies exist if Virgo Cluster and Local Group galaxies are excluded. This remarkable absence of negative redshifts for field galaxies sets an upper limit on the mean random motion about an ideal Friedmann flow to be σ_r <200 km s^{-1}, but a more accurate calculation using this method depends on details of the actual spatial distribution of very nearby galaxies just beyond the Local Group.

I. INTRODUCTION

Redshifts of galaxies are required for a number of problems of observational cosmology. Common examples include (a) questions of membership in clusters and groups; (b) the velocity dispersion of pairs, groups, and clusters for the mass problem; (c) absolute magnitudes for galaxies of different Hubble types; and (d) the luminosity function of nearby field galaxies. Problems concerned with global properties of the Universe itself include (e) measurement of the mean random motion relative to an ideal Hubble flow for galaxies outside the great clusters, and (f) mapping of the density contrasts in the local neighborhood (distances $\lesssim$40 Mpc; i.e., for velocities smaller than 2000 km s^{-1}) such as the Coma–Virgo complex, and then measuring the local velocity perturbations caused by them. Solutions to the last two problems would determine, in different ways, the ratio of gravitational to kinetic energy (viz., 2 q_0), from which the World model follows directly by standard methods (Sandage, Tammann, and Hardy 1972; Silk 1974; Sandage 1975a; Fall 1975, 1976).

Discussion of most of these questions requires attention to the effects of observational selection, caused by the inevitable incompleteness of existing redshift catalogs. Clearly, it is easiest to correct for these effects if the redshift sample is complete to a given apparent magnitude, for then the principal bias is the Malmquist effect (1920) which is well understood in simple enough cases.

The first systematic observational program that was designed to provide a complete redshift sample to a given apparent magnitude was that of Humason and Mayall, begun in the 1930's and completed in 1956 (Humason, Mayall, and Sandage 1956, hereafter HMS). The resulting Humason–Mayall catalog is complete for Shapley–Ames (1932) galaxies brighter than m_{pg} = 11.7 (on the Shapley–Ames magnitude system) north of δ = $-30°$, but naturally becomes more incomplete toward fainter magnitudes. Its overall completeness is 63% for the Shapley–Ames galaxies north of δ = $-30°$ (HMS, Table VIII).

The program to determine redshifts for the complete Shapley–Ames catalog in both hemispheres was ad-

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vanced during the 1960's by new measurements in the south by Evans (1963, 1967) and his colleagues (Evans and Harding 1961; Evans and Malin 1965; Evans and Wayman 1958), by Shobbrook (1966a), and later by Martin (1976), and others. In the north, new work principally by the de Vaucouleurs (Mayall and de Vaucouleurs 1962; de Vaucouleurs and de Vaucouleurs 1967, 1973, 1976) improved the statistics there.

Then in the late 1960's the development of image tube spectrographs made it feasible to finish the Humason–Mayall redshift program for the faintest Shapley–Ames galaxies. To this end, routine measurements of these faint systems was begun at Mount Stromlo, Australia, in 1968, and at Palomar in 1970. As a result, a new redshifts have now been determined for 719 galaxies, of which 505 are from the Shapley–Ames catalog. The results are the subject of this paper. The data have been combined with all available redshifts from the literature and with new galaxy types to form a *Revised Shapley–Ames Catalog of Bright Galaxies* (Sandage and Tammann 1978, hereafter the *RSA*), to be published and discussed elsewhere.

Included in the present paper are redshifts obtained in other programs during the past 20 years. These comprise (a) velocities of radio galaxies determined during early identification programs, some of which have been published, as noted later in Table V; (b) previously unpublished redshifts of a few identified Bologna radio sources from the lists of Grueff and Vigotti (1968, 1972); and (c) redshifts of faint Sc I galaxies obtained as part of the calibration steps for the Hubble constant (Sandage and Tammann 1975b).

The instrumentation, measuring procedure, and results with notes on individual galaxies are discussed in Sec II. The internal, external, and zero-point errors are determined in Sec. III. Comparison with other observers and a discussion of their external errors is given in Sec. IV. Test for the Roberts' effect of systematic redshift errors with velocity is given in Sec. V. Galaxies with spectra of special interest are listed in Sec. VI, and discussion of the redshift distribution, the mean random motion, and the nature of the Shapley–Ames catalog is given in the final Sec. VII.

II. INSTRUMENTATION, ADOPTED WAVELENGTHS, AND REDSHIFT RESULTS

a) *Instrumentation*

For the southern part of the work, two different grating spectrographs were used at the Cassegrain focus of the 1.9-m Stromlo reflector. The observations were made during three visits to Australia, one in 1968/69 and two in 1972. The first plate series (designated hereafter as Sa) was obtained in the 1968/69 season, using Kent Ford's original image tube spectrograph built at the Department of Terrestrial Magnetism of the Carnegie Institution of Washington. This instrument, then on loan to Mt. Stromlo, uses an f/1 Nikon transfer lens for imaging the spectrum onto an early version of the RCA-Carnegie-type image tube. The nominal dispersion was 185-Å mm^{-1}, with a spectral resolution of ~8 Å.

For technical reasons, the spectral interval for the Sa series was λλ4300–7000 Å. Hence, the blue and near *UV* region is not covered and it should be noted that the presence or absence of λ3727 emission cannot be determined for the Sa series for that reason.

A second series of Stromlo plates (designated Sb) was obtained in 1972 with a new grating spectrograph whose detector was a second generation RCA-Carnegie image tube used at a dispersion ~200 Å mm^{-}. The spectral range was λλ3180–7000 Å, and the resolution was ~6 Å.

The observations at Palomar after 1970 were made with the Cassegrain image tube spectrograph of the Hale 5-m relfector, usually as a standby program. Two gratings and four image tubes were used during the continual experimental development of this equipment. Characteristics of the five Palomar series, denoted as Pa, Pb, Pc, Pd, and Pe, are listed (together with the Stromlo data) in Table I.

Spectra in the Pa series were taken on plates put at the focus of a Bowen all-reflection camera working with a first generation RCA-Carnegie image tube (designated as Carnegie I in the table). Spectra of the Pb–Pd series were obtained by remote operation from the telescope control room using film that was pressed against an

TABLE I. Spectrograph characteristics at Mount Stromlo and at Palomar.

Series	Dates	Image Tube	Dispersion	Range	Resolution
		Stromlo	A mm^{-1}		
Sa	Sept 68–June 69	RCA (Carnegie I)	185	4300–7000 Å	8 Å
Sb	Feb 72–Oct 72	RCA (Carnegie II)	205	3400–7000 Å	6 Å
		Palomar			
N	Before June 1967	Direct Photography	400	3100–5100 Å	5 Å
Pa	June 67–May 72	RCA (Carnegie I)	185	3500–6200 Å	6 Å
Pb	June 72–June 73	Single Stage ITT	250/500	3100–7000 Å	10/15 Å
Pc	July 73–June 74	Two Stage ITT[a]	200	>3800–6000 Å	8 Å
Pd	July 74–present	Two Stage ITT	180	3100–6000 Å	6 Å
Pe	April 1969 (Searle)	RCA (Carnegie I)	50	Balmer series	<1 Å

[a] The two stage ITT image tube used from July 1973 to June 1974 (the Pc series) had poor blue response shortward of λ4000 Å.

TABLE II. Adopted wavelengths for absorption lines either commonly or occasionally seen.

λ_0	Element	Visibility	λ_0	Element	Visibility
3742.0	...	3	5024.6	...	1
3798.6	$H_{10} \equiv H\theta$	3	5103.8	...	1
3835.6	$H_9 \equiv H\eta$	3	5175.4	Mg I	5
3889.1	$H_8 \equiv H\zeta$	2	5168.6 }	Mg I }	...
3933.7	Ca II, K	10	5183.3 }	Mg I }	...
3968.5 }	Ca II, H }	10	5269.0	Ca + Fe	5
3970.1 }	Hϵ }	...	5331.5	...	3
4101.7	Hδ	2	5401.4	...	2
4226.7	Ca I	2	5591.3	...	1
4304.4	G	5	5782.8	...	2
4340.5	Hγ	2	5856.8	...	1
4383.6	Fe	3	5892.5	Na	7
4710	...	1	6025.3	...	1
4863.9	Hβ	2			

output fiber-optic plate of either one- or two-stage ITT image tubes.

Three different image tubes were used in this remote operating mode. A one-stage tube used for the Pb series had poor gain and was used at low dispersion (either 250 or 500 Å mm^{-1} depending on the grating). The spectral resolution was 10 to 15 Å. A two-stage ITT image tube for the Pc series had higher gain in the red but had poor blue response shortward of λ3800 Å. Hence, presence or absence of λ3727 is uncertain on this series. A different two-stage image tube with good blue response was used for the Pd series.

The Palomar series, in order of quality, is Pa, Pd, Pc, and Pb. Most plates taken in the Pb series have been repeated.

Spectra taken at Palomar before 1967 were obtained without image tubes, using the prime-focus grating nebular spectrograph and the solid Schmidt cameras described by Humason (HMS). The dispersion was generally 400 Å mm^{-1} with a resolution of 5 Å. The definition was excellent, although the speed was low. Plates from this series are designated by *N* in Table V. The image tube plates taken by Searle with high dispersion (~50 Å mm^{-1}) for his study of galaxies in the M101 group (Searle 1971) are designated *Pe*. I am grateful to Dr. Searle for the opportunity to include the measurements of these plates.

b) *Measurements: Adopted Wavelengths*

The spectrograms, measured in both the direct and reversed directions with a conventional traveling microscope (least count of 1 μ), where reduced to wavelengths, using a cubic fit to the adopted comparison lines (He + Ne + Ar), listed elsewhere (Sandage 1975b, Table 2). A correction curve to the cubic was applied in the usual way to produce final wavelengths for the unknown galaxy lines.

More than 1000 plates were measured of the program galaxies. The Sa Stromlo series were measured by Sylvia Burd, Louise Lowen, and myself, and reduced by Burd and Lowen. Comparison of duplicate measurements on the same plate shows that the mean measuring error of each of the three measurers is small ($\sigma \approx 40$ km s^{-}) and is generally negligible compared with the plate-to-plate errors and with the true external errors (Sec. III). The same result was found by Humason and by Mayall (HMS, pp. 100 and 117).

The most important absorption lines for redshift determination in the Stromlo Sb and the four Palomar series are the H and K Ca II lines (λλ3933, 3968 Å), followed by the G band (λ4304 Å), the Mg I blend (λλ5168, 5183 Å), and the NaD line blend (λ5982 Å). For the Stromlo Sa series, only lines longward of λ4300 Å are available, the most important of which are NaD (λ5892), the Mg I blend (λ5175 or 5168/83), a blend of Ca and Fe (λ5269), and unknown lines at λ5331 and λ5401.

These, plus other weaker lines that are normally found in galaxies of all types have been summarized by Humason and Mayall in HMS (1956), by the de Vaucouleurs (1967), Sandage (1975b), and others. The lines used in the present work, together with the wavelengths that were initially adopted are listed in Table II. The wavelengths used for the emission lines that have been seen in the program galaxies at least once are listed in Table III.

Due to the composite nature of galaxy spectra, the effective wavelengths of many absorption features differ from their laboratory values. Especially affected are the

TABLE III. Laboratory wavelengths of emission lines seen at least once.

λ_0	Element	λ_0	Element
3425.8	[Ne V]	4685.7	He II
3727.3	[O II]	4861.3	Hβ
3768.9	He II	4958.9	[O III] N1
3797.9	$H_{10} \equiv H\theta$	5006.8	[O III] N2
3833.7 }	He II }	5875.6	He I
3835.4 }	Hη }	5977.0	He II
3868.7	[Ne III]	6300.3	[O I]
3888.9	H_8 + He I	6548.1	[N II]
3967.5	[Ne III]	6562.8	Hα
4101.7	Hδ	6583.4	[N II]
4338.6	He II }	6717.0	[S II]
4340.5	Hγ }	6731.3	[S II]
4363.2	[O III]	7135.8	[A III]
4471.5	He I	7237.3	[A IV]

blends of lines whose relative strengths change with galaxy type. A good example is the blend of hydrogen epsilon (λ3970) with Ca II (H, λ3968.5). The effective wavelength changes by $\sim$1 Å when the Ca II dominance gives way to Hϵ as the galaxy type goes from E to late Sc, which would cause a velocity error of $\sim$100 km s^{-1} from this line alone if the correct $\langle\lambda\rangle$ is not used.

The blending problem can be approached empirically through a study of velocity residuals for each measured line as a function of galaxy type, after the material is partially reduced. We did this in the mean, and found (Sec. IIIb) that our *initial* velocity system, based on Table II, differed from the 21-cm radio system for galaxies in common by $+30 \pm 10$ km s^{-1}. Based on this evidence, the initial system has been corrected to the mean 21-cm system by adding 30 km s^{-1} to the measured velocities, reduced to the sun.

Although a finer analysis of the systematic effects was attempted by inspecting the residuals of each line in those galaxies that had both absorption and emission lines, the data were often contradictory at the level of the corrections, and we have chosen to correct only the *mean* system rather than the individual lines. Therefore, Table II should be understood to produce a velocity system that may differ from the 21-cm system by $\sim$30 km s^{-1} (too small) when spectrographs are used whose spectral resolution is $\sim$5 to 10 Å.

After the measurements were complete, each line was assigned a relative weight by inspection of the spectrogram, and the weighted mean redshift was calculated. The "visibility" listed in Table II is an indication of these relative weights; it is roughly the square of the weight.

The initial redshifts were then reduced to the sun by the heliocentric correction calculated for each plate. The zero-point correction of +30 km s^{-1} was then applied to reduce the results to the mean 21-cm system.

c) *New Redshifts, Types, and Positions*

The finally reduced redshifts and other new data are listed in Tables IV, IVa, and V. The main list (Table IV) contains data for 624 galaxies; the supplementary Table IVa contains similar data for 42 galaxies, obtained after the main table had been prepared. The data on radio sources and their associated galaxies are given in Table V.

The columns of Tables IV and IVa contain the following information.

1. Name: Generally NGC or IC, but standard coordinate notation (as in HMS for clusters) is used here for anonymous objects. Occasional clusters are denoted as *Cl,* or by their Abell (1958) number.

2/3. 1950 coordinates: Most of the coordinate values are new, and were determined as part of the present work by Katem and the writer from computer-generated transparent overlays placed on the National Geographic–Palomar Sky Survey prints, or on the Uppsala Schmidt plates (scale 120″ mm^{-1}) taken for the purpose during the 1968/9 and 1972 Stromlo visits. The accuracy is generally 10″ in each coordinate. The *new* values are listed in seconds of time in RA and tenths of a minute of arc in declination. *Old* coordinates for galaxies not measured here are listed to tenths of a minute of RA and to the whole minute of declination.

4/5. Galactic coordinates: Taken from de Vaucouleurs and de Vaucouleurs (1964).

6. Galaxy types: Determined from new inspection of available plate material. Types for southern galaxies are usually from the Uppsala Schmidt plates previously described. Classes for galaxies north of $\delta \approx -25°$ are generally from large-scale reflector plates obtained at Mount Wilson and Palomar for the purpose. The classification system is that of the Hubble Atlas (Sandage 1961), except that the ellipticity is noted in parenthesis for SO galaxies. The types are generally the same as in the *Revised Shapley–Ames Catalog of Bright Galaxies* (the RSA mentioned earlier).

7. Spectrograms: The number of spectra in each series (S for Stromlo, P for Palomar as described in Sec. IIa).

8. Lines: Number of absorption (a) and emission (e) lines measured for the final redshift. Descriptions of many of the emission lines are given in the notes to this table.

9. Heliocentric velocity v_H: Measured relative to the wavelengths in Tables II and III, reduced to the sun, and *corrected to the mean 21-cm velocity system by adding 30 km s^{-1} to the original raw measurements.* Hence, the listed values differ from those originally published for some of the galaxies (Sandage and Tammann 1975b; Sandage 1975a), and supersede them.

10. Corrected to centroid of the Local Group: The standard correction of $V = 300 \sin l \cos b$ km s^{-1} used by HMS (1956) is used here to reduce v_H of column (9) to v_0. The correction assumes the apex of the solar motion relative to the centroid of the local group to be $l = 90°$, $b = 0°$. The new solution for this apex by Yahil, Tammann, and Sandage (1977) is not used here, but has been used in the *RSA*. Hence, the v_0 listed there will differ from that given in column (10) here.

11. The internal mean error: Calculated from the individual residuals of each line [column (8)] from the mean velocity. These are *not* rms values, but are *average deviations.* For normally distributed errors, the internal σ (i.e., rms values) are $(\pi/2)^{1/2}$ larger. (When true rms values are used elsewhere in this paper, they are noted as σ.) When more than one plate is involved, the listed m.e. is the weighted mean (by the inverse square of the individual mean errors) for all plates. We show in the next section that these listed internal mean errors are smaller than the true 1σ external errors by factors that range from 2 to 4, depending on the listed m.e.

12. Quality class: Each spectrogram was finally inspected to judge the overall quality of the resulting redshift, ranging from excellent (E), through good (G),

TABLE IV. Velocitites of nearby galaxies.

Name (1)	α(1950) (2)	δ(1950) (3)	ℓ^{II} (4)	b^{II} (5)	Type (6)	Plates (7)	Lines a (8)	Lines e (8)	v_H (9)	v_o (10)	m.e. (11)	Q (12)	Remarks (13)
									km s^{-1}	km s^{-1}	km s^{-1}		
NGC 7816.....	00 01 15	+07 11.7	103	-54	(Sc I)	1 Pa	5	-	+5141	+5315	48	E	
0008+0224	00 08 33	+02 24.0	103	-59	(Sc I)	1 Pa	5	-	+12,752	+12,904	59	G	
NGC 36.......	00 08 48	+06 06.4	105	-55	(Sc I)	1 Pa	6	-	+6106	+6271	64	G	
NGC 99.......	00 21 25	+15 29.4	113	-47	(Sc I)	1 Pa	3	2	+5184	+5373	78	F	
NGC 105......	00 22 41	+12 36.1	113	-50	(Sc I)	1 Pa	3	3	+5290	+5469	26	E	
0028+1305	00 27 59	+13 05.4	115	-49	(Sc I)	1 Pa	4	-	+9934	+10,111	77	F	
NGC 148......	00 31 48	-32 03.7	341	-84	SO_1/E6	3 Pd	4	-	+1897	+1887	9	E	
NGC 150......	00 31 49	-28 04.7	22	-86	SBbc(s) I-II	1 Pc	-	3	+1555	+1562	20	E	
0033+1222	00 33 34	+12 21.8	117	-50	(Sc I)	1 Pa	3	1	+10,064	+10,235	85	F	
NGC 173......	00 34 38	+01 40.2	116	-60	(Sc I)	1 Pa	5	-	+4231	+4363	34	E	
NGC 175......	00 34 52	-20 12.3	98	-82	SBab(s) I-II	1 Pd	4	-	+3713	+3754	100	P	
NGC 178......	00 36 37	-14 26.8	109	-76	Sc IV/Sd III	2 Pd	-	4	+1479	+1544	18	E	
NGC 180......	00 35 23	+08 21.8	117	-54	SBc(s) I	1 Pa	4	-	+5251	+5407	29	F	
NGC 182......	00 35 38	+02 27.1	116	-60	(Sc I)	1 Pa	4	-	+5222	+5357	121	E	N 194 group
0037+0235	00 37 01	+02 36.7	117	-59	(Sc I)	1 Pa	4	1	+5140	+5274	39	F	N 194 group
NGC 237......	00 40 55	-00 24.0	118	-62	Sc(s) I.8	2 Pc	4	-	+4139	+4259	27	G	
NGC 245......	00 43 32	-01 59.6	119	-64	Sc II:	2 Pd	3	1	+4114	+4226	20	E	
NGC 254......	00 45 03	-31 41.7	313	-85	?	1 Sa	4	-	+1441	+1424	86	P	
NGC 257......	00 45 26	+08 01.4	121	-54	(Sc I)	1 Pa	4	-	+5302	+5450	40	G	
NGC 268......	00 47 37	-05 28.1	122	-68	SBc(r) I-II	2 Pd	-	2	+5515	+5610	33	F	
Cl A119	00 53 52	-01 31.5	125	-64	E0	1 Pa	5	-	+11,539	+11,645	51	E	Brightest E in cluster
NGC 309	00 54 13	-10 11.3	127	-73	(Sc I)	1 Pd	5	-	+5679	+5750	16	F	
0054-0128	00 54 23	-01 28.7	126	-64	(Sc I)	1 Pa	3	2	+15,048	+15,154	41	E	
NGC 406......	01 05.8	-70 09	300	-47	-	1 Sb	2	3	+1468	+1291	26	E	
NGC 439......	01 11 25	-32 00.9	257	-83	E5	1 Sb	5	-	+5644	+5610	62	G	Brightest in group of ~11
0112-0045	01 12 15	-00 45.6	135	-62	(Sc I)	1 Pa	2	4	+10,143	+10,239	42	E	
NGC 450......	01 12 57	-01 07.6	136	-63	Scd III	1 Pa	2	2	+1914	+2008	53	F	
0115+1107	01 15 31	+11 07.1	133	-50	SBc(sr) I	1 Pa	3	-	+5062	+5200	50	G	
0116+0157	01 16 42	+01 57.3	136	-59	(Sc I)	1 Pa	4	2	+13,339	+13,442	79	F	
0117+0755	01 17 00	+07 54.7	134	-54	(Sc I)	1 Pa	4	1	+9469	+9594	41	F	
NGC 470......	01 17 10	+03 09.0	136	-58	Sbc(s) II.3	2 Pc	2	2	+2362	+2469	38	G	Companion to N 467, N 474
NGC 473......	01 17 15	+16 17.0	132	-45	SBa(s)	2 Pc	4	-	+2252	+2405	36	G	
NGC 491......	01 19 03	-34 19.4	261	-80	-	1 Sb	4	2	+3899	+3850	~30	G	
NGC 497......	01 19 52	-01 08.2	140	-62	(Sc I)	1 Pa	7	-	+8140	+8228	73	G	
NGC 521......	01 22 00	+01 28.2	139	-60	SBc(rs) I	3 Pac	6	-	+4999	+5096	27	G	
NGC 533......	01 22 56	+01 30.3	140	-59	E3	2 Pc	6	-	+5506	+5602	21	G	
IC 1706	01 24 30	+14 31.3	135	-47	(Sc I)	1 Pa	4	1	+6349	+6491	86	E	
NGC 625......	01 32 55	-41 41.4	273	-73	Ir(Sm)	4 Sb	-	15	+405	+318	5	E	
0135+0716	01 35 43	+07 16.9	142	-53	(Sc I)	1 Pa	3	1	+4229	+4337	54	P	
NGC 658......	01 39 30	+12 20.9	142	-48	(Sc I)	1 Pa	3	3	+2985	+3108	42	E	
NGC 664......	01 41 10	+03 58.1	147	-56	(Sc I)	1 Pa	6	1	+5412	+5503	49	G	
NGC 670......	01 44 37	+27 38.1	137	-33	Sa	3 Pbc	3	2	+3788	+3956	18	G	
NGC 673......	01 45 43	+11 16.0	144	-48	(Sc(s) I)	1 Pa	4	2	+5241	+5356	45	E	
0145+1221	01 45 53	+12 22.0	144	-47	SBc(s)I	1 Pa	5	1	+5295	+5413	63	F	
NGC 685......	01 45.9	-53 02	284	-62	SBc(s) II	1 Sb	2	2	+1407	+1272	50	F	
NGC 701......	01 48 36	-09 57.1	164	-67	Sc(s) II.2:	1 Pd	2	2	+1808	+1838	47	G	
NGC 706......	01 49 14	+06 03.0	148	-53	SBc(s) I	1 Pa	3	2	+4911	+5004	54	P	
IC 1743.......	01 50 19	+12 27.9	145	-47	(SBc I)	1 Pa	2	2	+4561	+4676	53	G	
0152+0621	01 52 45	+06 22.0	149	-52	SBc (r) I	1 Pa	1	4	+5190	+5281	12	E	
IC 173........	01 53 23	+01 02.2	154	-57	SBc(s) I	1 Pa	3	1	+13,907	+13,977	77	G	
NGC 777......	01 57 21	+31 11.2	139	-29	E1	4 Pbc	10	1	+5019	+5188	28	G	
NGC 782......	01 56.1	-58 01	286	-57	SBb(r) (I-II)	1 Sb	5	2	+5975	+5819	33	E	[N II] em, no Hα em
0158+0804	01 58 20	+08 04.2	150	-50	(Sc I)?	1 Pa	1	2	+4756	+4849	36	E	
IC 198........	02 03 25	+09 03.4	151	-49	(Sc I)	1 Pa	2	1	+9414	+9506	74	G	
NGC 840......	02 07 37	+07 36.7	154	-50	SBc(r) I	1 Pa	7	-	+7143	+7226	86	G	
IC 1783.......	02 07 57	-33 10.5	236	-72	Sa:	1 Sb	2	3	+3299	+3222	31	E	
IC 211........	02 08 32	+03 36.9	157	-53	Sc(s) I	1 Pa	-	3	+3318	+3385	41	E	
IC 1788	02 13 39	-31 26.0	230	-71	Sc(s)	2 Sb	3	1	+3388	+3313	20	G	
NGC 922	02 22 49	-25 01.1	211	-68	Sc(s) II.2 pec	2 Pd	1	4	+3067	+3010	15	E	
NGC 925......	02 24 18	+33 21.1	144	-25	SBc(s) II-III	1 Pd	-	4	+576	+732	15	G	
NGC 926......	02 23 36	-00 33.0	167	-54	Sc(s) I	2 Pa	4	-	+6515	+6553	29	F	
NGC 941......	02 25 55	-01 22.5	168	-55	Scd III	1 Pd	2	3	+1610	+1643	49	E	
NGC 949......	02 27 39	+36 54.7	144	-21	Sd III	3 Pbc	3	2	+593	+757	31	G	
NGC 955......	02 28 00	-01 19.8	169	-54	Sb	1 Pa	7	-	+1534	+1566	17	E	
0228+0107	02 28 52	+01 07.4	167	-52	(Sc I)	1 Pa	3	4	+7390	+7431	21	E	
0229-0135	02 29 34	-01 35.0	170	-54	Sc(s) I	1 Pa	5	-	+11,269	+11,298	50	F	
NGC 976......	02 31 11	+20 45.4	152	-35	Sbc(r) I-II	2 Pc	5	-	+4362	+4473	23	E	
NGC 991......	02 33 03	-07 22.0	178	-58	Sc(rs) I.3	2 Pad	3	1	+1515	+1518	33	F	Sc(s) III from PSS print
NGC 1019.....	02 35 53	+01 41.7	168	-51	SBc(s) I	1 Pa	2	4	+7251	+7288	43	E	
NGC 1085.....	02 43 50	+03 23.9	169	-48	Sb(r) I	1 Pa	5	-	+6980	+7016	72	G	

TABLE IV. (continued)

Name (1)	α(1950) (2)	δ(1950) (3)	ℓ^{II} (4)	b^{II} (5)	Type (6)	Plates (7)	Lines a (8)	Lines e (8)	v_H (9)	v_o (10)	m.e. (11)	Q (12)	Remarks (13)
									km s^{-1}	km s^{-1}	km s^{-1}		
NGC 1090.....	02 44 01	-00 27.4	173	-51	SBc(s) I-II	4 Pc	4	-	+2729	+2750	37	F	
NGC 1094.....	02 44 54	-00 29.8	173	-51	(Sc I)	1 Pa	6	2	+6294	+6314	58	E	
NGC 1169.....	03 00 10	+46 11.1	145	-10	Sb (II)	4 Pbcd	6	1	+2372	+2539	20	F	
NGC 1172.....	02 59 16	-15 01.8	197	-57	SO$_1$(0) or EO	2 Pc	3	-	+1712	+1663	11	G	N 1209 group
NGC 1175.....	03 01 16	+42 08.7	147	-14	SO$_2$(8)/Sa	4 Pbc	7	-	+5458	+5613	24	G	
NGC 1209.....	03 03 44	-15 48.2	199	-56	E6	2 Pd	6	-	+2720	+2665	23	G	N 1209 group
0305-2308	03 05 59	-23 08.9	212	-59	SB pec	1 Sa	-	6	+10,676	+10,594	15	E	
0305-2306	03 05 59	-23 06.4	212	-59	SO$_1$(3)	1 Sa	3	-	+10,461	+10,379	84	P	
0306-2314	03 06 14	-23 14.3	212	-59	SBab pec	1 Sa	-	2	+3016	+2934	24	G	
N1 of A 419...	03 06 16	-23 48.0	212	-59	E3	1 Sa	5	-	+12,268	+12,186	40	F	Cluster
NGC 1241.....	03 08 49	-09 06.6	190	-52	SBb(rs) I-II	1 Pb	2	1	+3816	+3782	42	F	
NGC 1249.....	03 08.6	-53 32	268	-53	SBc(s) II-III	1 Sb	3	1	+1007	+828	26	G	
NGC 1253.....	03 11 38	-03 00.5	183	-48	Sc(s) II	2 Pa	5	1	+1822	+1809	34	P	
NGC 1288.....	03 15 12	-32 45.3	231	-58	Sab(r) II.3	1 Sb	6	-	+4370	+4246	31	G	
NGC 1292.....	03 16 08	-27 47.8	222	-57	Sc(s) II	1 Pd	-	2	+1430	+1321	15	G	
NGC 1297.....	03 16 59	-19 17.0	207	-55	E2	4 Pabc	8	1	+1599	+1520	32	E	
NGC 1325.....	03 22 13	-21 43.1	282	-40	Sb:	1 Pa	4	-	+1670	+1445	30	E	
NGC 1326.....	03 22 01	-36 38.4	239	-56	RSBO$_1$	1 Sa	3	5	+1332	+1191	23	E	Fornax cluster
IC 1933.......	03 24.3	-52 57	265	-51	SBcd(s) III	1 Sb	2	5	+1063	+877	39	E	
NGC 1337.....	03 25 40	-08 33.7	193	-48	Sc(s) (II)	1 Pd	4	-	+1209	+1163	41	P	
NGC 1339.....	03 26 06	-32 27.3	231	-55	E4	1 Sb	5	-	+1268	+1136	37	E	
NGC 1341.....	03 26 05	-35 19.3	239	-55	SBc(s) II-III	1 Sa	-	6	+1894	+1748	26	E	Fornax cluster
NGC 1344.....	03 26 18	-31 14.4	229	-55	E5/SO$_1$(5)	3 Pd	5	-	+1271	+1143	15	E	
NGC 1353.....	03 29 49	-20 59.3	212	-52	Sb/SBb(s) II	1 Sb	4	-	+1448	+1352	46	G	
IC 1954.......	03 30.2	-52 05	263	-51	Sc(s) II	1 Sb	-	4	+1116	+929	36	E	
NGC 1357.....	03 30 56	-13 50.0	201	-50	Sa:	3 Pbc	5	-	+2095	+2024	25	G	
NGC 1358.....	03 31 11	-05 15.4	303	-39	SBa(s) I	1 Pb	4	3	+4071	+3878	36	G	
IC 1953.......	03 31 29	-21 38.6	213	-52	SBbc(rs) II	1 Pa	3	-	+1962	+1862	76	G	
NGC 1366.....	03 31 53	-31 21.6	229	-54	SO$_1$(8)	1 Sb	4	-	+891	+759	47	G	
NGC 1371.....	03 32 53	-25 06.0	218	-53	SBa(s)	1 Pc	4	-	+1378	+1265	15	F	
NGC 1376.....	03 34 37	-05 12.3	191	-44	Sc(s) II.8	1 Pa	2	-	+4471	+4430	~50	F	
NGC 1386.....	03 34 52	-36 09.9	237	-53	SO$_1$(7)	1 Sa	-	6	+924	+775	14	E	Fornax cluster
NGC 1406.....	03 37 23	-31 29.1	229	-53	SBc(s):	1 Sb	-	5	+1112	+975	12	E	
NGC 1411.....	03 37 04	-44 15.9	251	-52	SO$_1$(4)	1 Sa	6	-	+991	+818	50	F	
NGC 1425.....	03 40 10	-30 03.3	227	-52	Sb(r) II	1 Sb	4	-	+1415	+1281	74	G	
NGC 1437.....	03 41 42	-36 00.4	237	-52	SBa:	1 Sb	4	-	+1134	+981	36	F	Fornax cluster
NGC 1440.....	03 42 48	-18 25.1	209	-49	SO$_1$(5)/SBO$_1$(5)	2 Pc	7	-	+1534	+1436	27	G	
NGC 1441.....	03 43 14	-04 14.8	191	-42	Sa	2 Pd	6	-	+4207	+4162	34	E	
NGC 1448.....	03 42 54	-44 48.1	251	-51	Sc II-III	1 Sb	6	-	+1222	+1045	45	G	
NGC 1449.....	03 43 51	-04 20.5	191	-42	SO	2 Pd	4	-	+4049	+4003	29	F	
NGC 1452.....	03 43 08	-18 47.3	210	-49	SBO$_3$/SBa	2 Pc	6	-	+1904	+1805	17	G	
NGC 1461.....	03 46 11	-16 32.4	207	-47	SO$_1$(8)	2 Pc	5	-	+1450	+1357	36	G	
IC 2006.......	03 52 37	-36 06.9	237	-50	E1	1 Sa	4	-	+1374	+1213	42	F	Fornax cluster?
NGC 1487.....	03 54 03	-42 30.9	247	-49	Late : Hot spots	1 Sa	-	6	+881	+702	16	E	
NGC 1493.....	03 55.9	-46 21	253	-48	SBc(rs) III	1 Sb	2	2	+1022	+833	20	G	
NGC 1494.....	03 56.2	-49 03	257	-48	Sbc(s) II-III	1 Sb	-	3	+1106	+911	83	F	
NGC 1511.....	03 59.3	-67 46	281	-40	Sc pec	1 Sb	-	7	+1349	+1126	22	E	
NGC 1515.....	04 02 51	-54 14.0	264	-45	Sa(s)	1 Sa	3	3	+1131	+923	20	E	Dorado group
NGC 1527.....	04 06 55	-48 01.6	255	-46	SBO$_1$(6)	1 Sa	4	-	+1097	+898	35	G	
IC 2035.......	04 07 29	-45 38.8	251	-46	E4:	1 Sa	3	-	+1458	+1264	40	G	
NGC 1531.....	04 10 04	-32 58.7	233	-46	E pec	1 Sb	4	2	+1141	+976	32	G	Companion to N 1532
NGC 1532.....	04 10 09	-33 00.0	233	-46	Sab I	1 Sb	4	2	+1321	+1156	26	E	Companion to N 1531
NGC 1533.....	04 08 50	-56 15.0	266	-44	E4/SO$_1$(4)	1 Sa	4	-	+812	+598	29	G	Dorado group
NGC 1537.....	04 11 44	-31 46.3	231	-46	E6/SO$_1$(6)	1 Sa	3	-	+1378	+1215	45	F	
NGC 1546.....	04 13 33	-56 11.0	266	-43	SO$_1$(7)	1 Sa	2	2	+1190	+974	37		Dorado group
IC 2056.......	04 15 39	-60 20.0	271	-42	Giant H II?	1 Sa	-	3	+1129	+907	41	G	Dorado group
NGC 1596.....	04 26 35	-55 08.1	264	-42	SO$_1$(8)	1 Sa	6	-	+1526	+1305	36	G	Dorado group
NGC 1617.....	04 30 37	-54 42.5	263	-41	Sa(s):	1 Sa	3	-	+1040	+818	20	G	Dorado group
NGC 1638.....	04 39 05	-01 54.1	198	-29	E2/SO$_1$(2)	3 Pbc	4	-	+3306	+3223	34	F	
NGC 1667.....	04 46 10	-06 24.4	204	-30	Sbc I-II	3 Pbc	3	3	+4578	+4472	24	G	
NGC 1672.....	04 44 58	-59 19.6	268	-38	SBb(rs) II	1 Sa	-	6	+1343	+1110	10	E	Dorado group?
NGC 1688.....	04 47 41	-59 53.3	269	-38	SBc(s) III	1 Sa	-	7	+1266	+1031	15	E	Dorado group?
NGC 1705.....	04 53 07	-53 26.5	261	-38	Giant H II?	6 Sa	-	4	+640	+409	16	E	
NGC 1720.....	04 56 44	-07 56.0	207	-28	SBb(s) I.2	1 Pa	2	1	+4242	+4122	44	G	
NGC 1726.....	04 57 18	-07 49.8	207	-28	SO$_3$(5)	4 Pabc	5	-	+4072	+3952	24	G	
NGC 1796.....	05 02 08	-61 12.4	270	-36	SBc pec	1 Sa	-	3	+987	+719	15	G	
NGC 1800.....	05 04 33	-32 01.2	234	-35	?	1 Sb	1	6	+722	+522	20	E	
A 509	05 09 25	-14 15.1	215	-28	Sc I or Sc I-II	1 Pa	3	-	+2140	+1987	66	F	HA 85, No. 6
NGC 1947.....	05 26 11	-63 48.0	273	-33	SO$_{2/3}$(0)	1 Sa	5	-	+1289	+1039	46	G	
NGC 2082.....	05 41 36	-64 19.2	273	-32	S(Bbc):	1 Sb	3	-	+1374	+1120	30	P	

TABLE IV. (continued)

Name (1)	α(1950) (2)	δ(1950) (3)	ℓ^{II} (4)	b^{II} (5)	Type (6)	Plates (7)	Lines a (8)	Lines e (8)	v_H (9)	v_0 (10)	m.e. (11)	Q (12)	Remarks (13)
									km s^{-1}	km s^{-1}	km s^{-1}		
NGC 2090.....	05 45 15	-34 16.4	239	-27	Sc II	1 Pa	6	-	+949	+720	48	G	
N1 of A548....	05 46 42	-25 29.4	230	-25	E2	1 Sa	3	-	+11,884	+11,676	69	G	
N2 of A548....	05 46 38	-25 29.5	230	-25	EO	1 Sa	4	-	+11,942	+11,734	57	G	
NGC 2179.....	06 05 47	-21 44.3	228	-18	E3 or Sa	1 Pa	3	1	+2761	+2549	42	G	
NGC 2196.....	06 10 04	-21 47.8	228	-18	Sab(r) I	5 Pabcd	5	-	+2351	+2137	14	E	
NGC 2223.....	06 22 31	-22 48.7	230	-15	SBbc(rs) I	1 Pa	2	-	+2608	+2384	~30	G	
NGC 2280.....	06 42 50	-27 35.2	237	-13	Sc(s) I.2	1 Pa	3	-	+2041	+1796	8	G	
NGC 2310.....	06 52 40	-40 48.0	250	-16	$SO_1(8)$	1 Sb	6	-	+1217	+946	50	G	
NGC 2325.....	07 00 42	-28 37.4	240	-10	E4	2 SbPa	5	-	+2248	+1993	33	G	
NGC 2369.....	07 16 05	-62 15.2	273	-21	SBc(s) I	1 Sb	-	4	+3237	+2957	36	F	
NGC 2397.....	07 21 30	-68 54.2	280	-22	SBc(s)	1 Sb	1	1	+1307	+1035	~50	F	
NGC 2434.....	07 35 00	-69 10.4	281	-21	EO	1 Sa	5	-	+1327	+1053	43	G	
NGC 2427.....	07 35.1	-47 30	260	-12	SBcd(s) III	1 Sb	1	4	+31	-257	23	E	Is velocity real? No by 21 cm.
NGC 2442.....	07 36 32	-69 25.0	281	-21	SBbc(rs) II	1 Sa	1	2	+1429	+1155	9	G	
NGC 2545.....	08 11 20	+21 30.4	201	+27	SBc(r) I-II	4 Pbc	6	-	+3531	+3432	19	G	
NGC 2552.....	08 15 42	+50 10.1	169	+34	Sc or Ir IV	1 Pc	-	3	+508	+555	25	E	
NGC 2701.....	08 55 28	+53 58.3	163	+40	Sbc(s) III pec	2 Pc	4	-	+2329	+2392	59	F	Nucleus
NGC 2701.....	08 55 28	+53 58.3	163	+40	Sbc(s) III pec	1 Pc	-	1	+2421	+2484	~30	G	H II knot in arm
NGC 2713.....	08 54 45	+03 06.9	225	+29	Sbc(s) I	1 Pb	5	-	+3969	+3782	85	G	
NGC 2763.....	09 04 29	-15 17.9	224	+20	Sc(rs) II	2 Pc	4	-	+1998	+1803	37	F	
NGC 2764.....	09 05 27	+21 38.7	206	+39	E?; Sa?; Pec?	1 Pb	-	5	+2627	+2523	20	G	Need classification plate
NGC 2781.....	09 09 06	-14 36.7	244	+22	SBa	1 Pa	4	-	+2195	+1945	24	G	
NGC 2815.....	09 14 05	-23 25.5	136	-55	Sb(s) I-II	1 Pa	3	-	+2590	+2706	46	G	
NGC 2844.....	09 18 37	+40 22.0	182	+45	Sa(r)	4 Pcd	6	1	+1485	+1477	10	G	
NGC 2848.....	09 17 49	-16 18.8	247	+22	Sc(s) II.8	1 Pd	2	1	+2255	+2000	92	P	
NGC 2888.....	09 24 09	-27 49.1	257	+16	E2	1 Sa	3	-	+2233	+1952	67	F	
NGC 2889.....	09 24 32	-11 25.3	244	+27	Sbc(rs) I-II	1 Pa	5	-	+3417	+3177	76	E	
NGC 2902.....	09 28 30	-14 31.0	247	+25	$SO_1(0)$	3 Pbc	5	-	+2065	+1816	39	G	
NGC 2907.....	09 29 20	-16 30.9	249	+24	S on edge	1 Pb	4	-	+2065	+1810	33	F	
NGC 2924.....	09 32 49	-16 10.6	249	+25	(E1)	2 Pc	3	-	+4615	+4361	14	F	
NGC 2935.....	09 34 27	-20 54.2	253	+22	SBbc I-II	1 Pb	4	1	+2244	+1978	49	F	
NGC 2942.....	09 36 08	+34 14.0	191	+48	Sc(s) I.3	1 Pc	2	-	+4751	+4712	116	P	
NGC 2955.....	09 38 15	+36 06.6	188	+48	Sc(s) I	3 Pbc	6	2	+7056	+7027	34	G	
NGC 2962.....	09 38 17	+05 23.6	230	+39	$RSBO_2$	1 Pb	2	-	+2039	+1862	47	F	
NGC 2968.....	09 40 15	+32 09.6	194	+49	S(b)	1 Pa	6	-	+1600	+1551	48	E	Paired w N 2964 & 2970
NGC 2970.....	09 40 35	+32 12.5	194	+49	$SO_3(3)$	1 Pa	4	-	+1678	+1629	40	G	Paired w N 2964 & 2968
NGC 2989.....	09 43 04	-18 08.6	253	+26	S(c II)	1 Pa	-	4	+4166	+3908	22	E	
NGC 2990.....	09 43 40	+05 56.6	230	+41	Sc III-IV:	1 Pb	1	5	+3117	+2943	36	G	
NGC 2992.....	09 43 18	-14 05.7	249	+28	S pec	1 Pa	-	5	+2313	+2067	21	E	Interacting w N 2993
NGC 2993.....	09 43 23	-14 08.1	249	+28	S pec	1 Pb	-	7	+2373	+2127	44	G	Interacting w N 2992
NGC 2997.....	09 43 27	-30 57.7	262	+16	Sc(s) I.2	1 Sb	1	3	+1085	+800	44	E	
NGC 2998.....	09 45 34	+44 19.0	175	+49	Sc(rs) I	2 Pc	7	-	+4720	+4734	41	F	
NGC 3001.....	09 44 07	-30 12.4	262	+17	Sbc(rs) I-II	1 Pa	2	-	+2250	+1966	72	PI	
NGC 3021.....	09 47 59	+33 47.1	192	+50	SBc(s) II	1 Pb	4	1	+1495	+1455	63	G	
NGC 3038.....	09 49 05	-32 31.1	264	+16	Sa(r)	1 Pa	5	-	+2660	+2373	53	G	
NGC 3059.....	09 49 41	-73 41.2	291	-15	SBc(rs) III	1 Sb	1	4	+1270	+1000	20	G	
0949+4305....	09 49 48	+43 05.1	176	+50	Sc(s) I	1 Pa	2	-	+4816	+4828	~50	F	
NGC 3041.....	09 50 23	+16 54.8	217	+47	Sc(rs) (II)	3 Pbc	5	-	+1343	+1219	28	F	
NGC 3043.....	09 52 43	+53 32.8	153	+46	S?	1 Pb	-	2	+2935	+3028	51	F	
NGC 3052.....	09 52 07	-18 24.3	254	+27	Sc(r) I.3	1 Pa	4	-	+3616	+3359	45	F	
NGC 3056.....	09 52 18	-28 03.8	262	+20	$SO_1(5)$	1 Sa	4	-	+1047	+768	48	P	
NGC 3081.....	09 57 11	-22 35.1	258	+25	SBa	1 Pd	1	7	+2413	+2146	13	E	
NGC 3087.....	09 56 59	-33 59.0	266	+16	E2	1 Sb	3	-	+2662	+2375	26	G	Plate by N. Stokes
NGC 3089.....	09 57 22	-28 05.1	262	+20	Sab(rs) I-II	1 Pd	2	3	+2653	+2375	23	G	
NGC 3091.....	09 57 53	-19 23.8	256	+27	E3	3 Pbc	6	-	+3882	+3623	37	G	Brightest in group
NGC 3098.....	09 59 27	+24 57.2	206	+52	$SO_1(9)$	4 Pbc	6	-	+1340	+1257	~30	G	
1001+1429....	10 01 16	+14 27.8	222	+49	(Sc I)	1 Pa	3	-	+8991	+8858	59	P	
1001+1352....	10 01 42	+13 51.7	223	+48	(Sc I:)	1 Pa	3	1	+2743	+2607	41	G	
1002+5152....	10 02 01	+51 50.4	163	+50	(Sc I)	1 Pa	2	-	+14,067	+14,122	~50	G	
NGC 3124.....	10 04 17	-18 58.3	257	+28	SBbc(r) I	2 Pb	4	-	+3381	+3124	67	P	
NGC 3136.....	10 04 30	-67 07.8	287	-9	E4	1 Sa	3	-	+1647	+1370	44	G	
NGC 3156.....	10 10 06	+03 22.7	238	+45	E5	1 Pb	4	-	+1174	+994	23	P	
1012+5555....	10 12 26	+55 55.0	156	+50	(Sc I)	1 Pa	6	-	+7254	+7331	32	G	
NGC 3175.....	10 12 24	-28 37.2	266	+22	S(b:)	1 Pd	3	-	+1125	+848	30	PI	
1013+0504....	10 13 45	+05 04.2	236	+47	(Sc(s) I)	1 Pa	4	-	+13,786	+13,616	110	P	
1014+5343....	10 14 02	+53 42.7	159	+51	(SBc I)	1 Pa	4	-	+13,622	+13,688	34	E	
NGC 3191.....	10 16 01	+46 42.3	169	+54	(Sc I)	1 Pa	1	3	+9145	+9176	28	E	
NGC 3200.....	10 16 12	-17 43.9	259	+31	Sb I	4 Pcd	7	-	+3567	+3316	19	G	
NGC 3202.....	10 17 32	+43 16.3	175	+55	(SBc(rs) I)	1 Pa	7	-	+6745	+6759	59	G	
NGC 3203.....	10 17 14	-26 26.9	265	+24	E7 or Sa	2 Pd	8	-	+2424	+2153	15	E	

TABLE IV. (continued)

Name (1)	α(1950) (2)	δ(1950) (3)	ℓ^{II} (4)	b^{II} (5)	Type (6)	Plates (7)	Lines a (8)	Lines e (8)	v_H (9)	v_o (10)	m.e. (11)	Q (12)	Remarks (13)
									km s^{-1}	km s^{-1}	km s^{-1}		
NGC 3223.....	10 19 21	-34 01.0	270	+19	Sb II	1 Sb	4	-	+2911	+2628	55	G	Antlia group?
1022+5546	10 22 11	+55 47.0	155	+51	Sc I	1 Pa	2	2	+7621	+7699	30	G	
NGC 3241.....	10 22 01	-32 13.7	270	+20	Sab	1 Sb	5	1	+2874	+2594	59	G	Antlia group? Plate by Stokes
NGC 3250.....	10 24 21	-39 41.4	274	+14	E3	2 Sa	3	-	+2871	+2582	49	F	Antlia group
NGC 3257.....	10 26 31	-35 24.2	272	+18	E1	1 Sa	4	-	+3063	+2779	67	I	Antlia group
NGC 3258.....	10 26 38	-35 21.0	272	+18	E1	2 Sa	6	-	+2848	+2565	31	G	Antlia group
NGC 3260.....	10 26 51	-35 20.4	272	+18	(E4)	2 Sa	3	-	+2453	+2169	54	F	Antlia group
NGC 3261.....	10 26 54	-44 24.0	277	+11	SBc(rs) I	1 Sb	4	-	+2612	+2321	50	F	Antlia group?
1027-3500	10 27 16	-35 00.2	273	+19	SO_1/E7	1 Sa	4	-	+1892	+1609	50	F	Antlia group?
NGC 3267.....	10 27 34	-35 04.0	272	+19	SO(5)/Sa	1 Sa	4	-	+3749	+3466	45	G	Antlia group?
1027-3507....	10 27 38	-35 07.2	273	+19	E3	1 Sa	4	-	+1781	+1498	32	P	Antlia group?
NGC 3268.....	10 27 46	-35 04.2	272	+19	(E2)	2 Sa	4	-	+2801	+2518	44	G	Antlia group?
NGC 3269.....	10 27 42	-34 58.1	272	+19	(Sa)	1 Sa	3	-	+3794	+3511	44	F	Antlia group
NGC 3271.....	10 28 12	-35 06.2	273	+19	(Sa)	2 Sa	3	-	+3824	+3541	21	G	Antlia group
NGC 3273.....	10 28 14	-35 21.4	273	+19	(SO(6))	1 Sa	4	-	+2459	+2176	70	F	Antlia group
NGC 3274.....	10 29 30	+27 55.6	203	+59	S IV:	1 Pc	1	3	+536	+474	27	G	
NGC 3275.....	10 28 39	-36 29.0	273	+18	SBb(r) I	1 Sa	4	-	+3241	+2957	40	F	Antlia group
NGC 3281.....	10 29 36	-34 36.0	273	+19	Sa(s)	1 Sa	1	5	+3435	+3153	26	E	Antlia group
NGC 3287.....	10 32 04	+21 54.5	215	+58	SBcd(s) III	1 Pc	-	2	+1302	+1211	~50	G	
1033-2715....	10 33 43	-27 15.1	269	+27	(E2)	1 Sa	2	1	+4147	+3880	50	G	Abell 1060
NGC 3300.....	10 33 58	+14 25.8	228	+56	SBO_1	2 Pbd	5	-	+2992	+2867	31	G	
NGC 3308.....	10 34 01	-27 10.8	268	+26	E2	2 Sa	3	-	+3729	+3460	20	G	Abell 1060
NGC 3309.....	10 34 15	-27 15.8	269	+26	E1	2 Sa	4	-	+4086	+3817	38	G	Abell 1060
1034-2718....	10 34 20	-27 18.2	269	+27	(E7)	1 Sa	2	-	+4736	+4469	40	F	Abell 1060
NGC 3311.....	10 34 22	-27 16.2	269	+27	$SO_1(3)$	1 Sa	3	-	+3622	+3355	21	F	Abell 1060
NGC 3312.....	10 34 42	-27 18.3	269	+26	Sab	2 Sa	3	3	+2811	+2542	23	G	Abell 1060
1034-2712....	10 34 57	-27 12.6	269	+27	(SO(6))	1 Sa	6	-	+4835	+4568	13	F	Abell 1060
1035+5414....	10 35 46	+54 14.0	156	+53	(Sc I)	1 Pa	3	-	+21,177	+21,249	87	F	
NGC 3329.....	10 40 32	+77 04.2	131	+38	Sa	1 Pc	4	-	+1948	+2124	25	G	
NGC 3346.....	10 40 59	+15 08.1	228	+57	SBc(rs) II.2	1 Pd	-	1	+1100	+980	~50	G	Hβ alone
NGC 3347.....	10 40 30	-36 05.3	275	+19	Sab(r) II	1 Sa	-	4	+2923	+2642	25	G	Paired w N 3358
NGC 3353.....	10 42 17	+56 13.6	152	+53	-	2 Pc	-	8	+970	+1053	12	E	
NGC 3358.....	10 41 16	-36 08.8	276	+19	Sa(r)	1 Sa	3	-	+2910	+2629	85	F	Companion N 3347
NGC 3390.....	10 45 44	-31 16.2	274	+24	Sbc	1 Sb	4	-	+2850	+2578	40	PF	Plate by N. Stokes
NGC 3408.....	10 49 06	+58 42.1	148	+52	(Sc I)	1 Pa	7	-	+9604	+9700	32	F	
NGC 3415.....	10 48 52	+43 59.0	170	+60	E5	3 Pbc	3	-	+3207	+3231	70	F	
NGC 3423.....	10 48 38	+06 06.3	244	+54	Sc(s) II-III	1 Pc	3	-	+865	+708	55	PI	
1049+5957....	10 49 18	+59 57.1	146	+51	(Sc I)	1 Pa	4	-	+8417	+8519	91	F	
NGC 3433.....	10 49 27	+10 24.7	238	+57	Sc(r) I.3	2 Pc	4	-	+2621	+2483	48	F	
NGC 3435.....	10 51 41	+61 33.3	145	+51	S	1 Pbc	3	-	+5141	+5249	61	F	
NGC 3437.....	10 49 54	+23 12.0	215	+62	Sc(s) III	1 Pb	-	2	+1149	+1070	72	F	
NGC 3449.....	10 50 34	-32 39.7	276	-33	SO_1/Sa:	1 Sb	5	1	+3267	+3019	48	F	Plate by N. Stokes
1051+5613....	10 51 33	+56 13.9	150	+54	(Sc I)	1 Pa	3	1	+14,520	+14,605	~50	F	
NGC 3458.....	10 52 58	+57 23.0	149	+53	SBO_1	2 Pbc	7	-	+1800	+1891	32	G	
NGC 3470.....	10 55 40	+59 46.8	146	+52	(Sc I or Sb I)	1 Pa	5	-	+6669	+6772	43	G	
NGC 3478.....	10 56 35	+46 23.4	164	+60	Sc(s) I	2 Pc	8	-	+6688	+6726	42	F	
NGC 3513.....	11 01 20	-22 58.6	273	+33	SBc(s) II.2	1 Pd	3	2	+1244	+994	20	G	
1103+5758....	11 03 53	+57 57.6	146	+54	(Sc I)	1 Pa	3	2	+9820	+9916	138	F	
1107-3704	11 07 10	-37 04.8	281	+21	(E6)	1 Sa	5	-	+2885	+2611	72	F	
NGC 3547.....	11 07 19	+10 59.5	242	+61	Sc III	2 Pc	2	2	+1543	+1414	28	G	
NGC 3557.....	11 07 36	-37 16.0	281	+21	E2	2 Sa	3	-	+3151	+2877	32	G	N 3557 group
NGC 3549.....	11 08 04	+53 39.4	151	+57	Sbc(s) II	1 Pc	2	-	+2847	+2924	22	G	
NGC 3564.....	11 08 13	-37 16.7	282	+21	$SO_1(7)$	1 Sa	4	-	+2811	+2537	44	G	N 3557 group
NGC 3568.....	11 08 26	-37 10.7	282	+21	(Sb) on edge	2 Sa	-	7	+2476	+2202	6	E	Much dust : N 3557 gr.
NGC 3571.....	11 09 02	-18 01.0	272	+38	Sa?	2 SaPa	5	-	+3777	+3542	24	G	
1111+5704	11 11 16	+57 03.8	146	+55	(Sc I)	1 Pa	4	-	+10,015	+10,109	20	F	
1111+5651	11 11 55	+56 51.1	146	+55	(Sc I)	1 Pa	5	-	+10,369	+10,462	31	G	
NGC 3583.....	11 11 24	+48 35.4	158	+61	Sb(s) II	2 Pc	5	-	+2112	+2165	35	G	
NGC 3596.....	11 12 29	+15 03.5	236	+64	Sc(r) II.2	4 Pbcd	6	1	+1206	+1107	20	F	
NGC 3627.....	11 17 38	+13 15.8	241	+64	Sb(s) II.2	2 Pc	5	-	+808	+694	20	G	
NGC 3629.....	11 17 52	+27 14.4	208	+69	Sc(s) II-III	3 Pcd	2	2	+1588	+1539	25	F	
NGC 3630.....	11 17 42	+03 14.3	256	+57	$SO_1(9)$	2 Pc	6	-	+1514	+1357	22	G	
NGC 3637.....	11 18 08	-09 59.0	269	+46	$RSBO_1$	2 SaPa	5	-	+1855	+1649	36	E	
NGC 3655.....	11 20 17	+16 51.7	235	+66	Sc(s) III	5 Pbcd	6	1	+1492	+1395	27	F	
NGC 3666.....	11 21 50	+11 37.1	246	+64	Sc II-III	4 Pbc	4	1	+1077	+957	31	G	
C11123-3507...	11 23 28	-35 07.3	284	+24	E3	1 Sa	4	-	+9786	+9520	41	G	
NGC 3683.....	11 24 52	+57 09.2	143	+56	Sc (III)	2 Pc	4	2	+1686	+1783	18	G	Nearly edge on
NGC 3687.....	11 25 23	+29 47.0	200	+71	(Sa)	2 Pc	6	-	+2407	+2373	28	G	
NGC 3689.....	11 25 33	+25 56.2	212	+71	Sc(r) II	2 Pc	7	1	+2708	+2716	26	G	
NGC 3705.....	11 27 32	+09 33.2	252	+63	Sab(r) I-II	3 Pc	3	-	+1084	+958	34	G	

TABLE IV. (continued)

Name	α(1950)	δ(1950)	ℓ^{II}	b^{II}	Type	Plates	Lines a	Lines e	v_H	v_o	m.e.	Q	Remarks
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)		(9)	(10)	(11)	(12)	(13)
									km s^{-1}	km s^{-1}	km s^{-1}		
NGC 3706.....	11 27 17	-36 06.7	285	+23	E4	1 Sa	5	-	+3045	+2780	43	G	
NGC 3717.....	11 29 04	-30 01.9	283	+29	Sa or early Sb	1 Pd	3	-	+1778	+1524	42	F	Edge on
NGC 3720.....	11 29 48	+01 04.8	263	+57	(EO or pec) :	2 Pc	5	1	+6016	+5856	28	G	Comp. to N 3719
NGC 3725.....	11 30 53	+62 09.6	138	+52	(Sc I)	1 Pb	5	-	+3284	+3405	44	F	
NGC 3729.....	11 31 04	+53 24.0	146	+60	SB (ring) pec	3 Pcd	3	3	+1035	+1117	11	G	
NGC 3732.....	11 31 41	-09 34.2	273	+48	Sa	2 SaPa	-	7	+1712	+1514	8	E	
NGC 3735.....	11 33 06	+70 48.6	131	+45	Sc (II-III)	1 Pc	3	3	+2627	+2784	42	G	
NGC 3738.....	11 33 04	+54 47.9	144	+59	Ir IV	1 Pd	-	5	+176	+265	29	E	
NGC 3756.....	11 34 05	+54 34.3	144	+59	Sc(s) II	1 Pb	4	1	+1101	+1189	48	P	
NGC 3773.....	11 35 38	+12 23.4	250	+67	E?, S?, Pec?	2 Pc	-	4	+1014	+904	21	E	
NGC 3780.....	11 36 38	+56 33.0	141	+58	Sc(r) II.3	1 Pb	4	2	+2391	+2489	85	F	
NGC 3813.....	11 38 40	+36 49.4	176	+72	Sc(s) II.8	3 Pcd	6	-	+1514	+1520	17	G	
NGC 3865.....	11 42 19	-08 57.5	276	+50	(Sb II-III)	2 Pc	7	-	+5714	+5524	70	P	
NGC 3877.....	11 43 29	+47 46.2	150	+66	Sc II-III	1 Pb	5	2	+868	+928	11	G	
NGC 3885.....	11 44 15	-27 38.7	285	+32	Sa	1 Sa	-	4	+1948	+1706	32	E	
NGC 3888.....	11 44 55	+56 14.9	140	+59	Sbc(rs) I-II	1 Pb	4	-	+2049	+2148	75	P	
NGC 3892.....	11 45 28	-10 41.0	278	+48	SBO	3 SaPc	6	-	+1727	+1532	32	G	
NGC 3912.....	11 47 30	+26 45.3	212	+76	Sa :	2 Pcd	-	3	+1728	+1690	30	G	
NGC 3952.....	11 51 07	-03 43.1	276	+55	S or Ir :	1 Pd	3	4	+1625	+1458	27	E	Not E or SO
NGC 3957.....	11 51 33	-19 17.3	284	+41	$SO_3(9)$	3 SaPc	5	3	+1838	+1620	39	G	
NGC 3963.....	11 52 22	+58 46.3	136	+57	SBc(rs) I-II	1 Pb	2	2	+3234	+3346	67	F	
NGC 3976.....	11 53 23	+07 01.7	267	+67	Sc(s) I-II	2 Pc	4	-	+2521	+2398	18	G	
NGC 3978.....	11 53 35	+60 48.0	134	+55	Sc(s) I	1 Pb	2	1	+9990	+10,111	53	G	In field of N 3945
NGC 3982.....	11 53 53	+55 24.0	138	+60	Sbc(r) II-III	1 Pb	1	5	+975	+1073	25	G	
NGC 4008.....	11 55 43	+28 28.2	204	+78	$SO_1(2)$	1 Pb	6	-	+3550	+3524	49	F	
NGC 4013.....	11 55 58	+44 13.4	151	+70	Sbc :	1 Pd	4	-	+661	+709	42	P	Nearly on edge
NGC 4024.....	11 55 58	-18 04.2	285	+42	E4	1 Sa	3	-	+1694	+1482	56	F	
IC 750	11 56 17	+43 00.1	154	+71	S	1 Pb	2	2	+713	+756	30	G	Nearly on edge. Pair w IC 749
NGC 4033.....	11 58 01	-17 34.0	286	+43	$E6/SO_1(6)$	1 Sa	3	-	+1521	+1312	30	G	
NGC 4037.....	11 58 50	+13 40.7	260	+71	SBc(s) II.3	1 Pd	1	1	+926	+835	87	PI	
NGC 4045.....	12 00 09	+02 15.5	276	+62	Sbc(s)	3 Pbc	4	2	+2001	+1862	41	G	
NGC 4047.....	12 00 18	+48 55.2	143	+66	Sab(s) II-III	1 Pc	5	-	+3355	+3426	17	G	
NGC 4050.....	12 00 20	-16 05.4	286	+44	SBb(rs) I-II	1 Pc	5	-	+1904	+1700	44	F	
NGC 4062.....	12 01 31	+32 10.4	185	+78	Sc(s) II-III	2 Pc	3	-	+670	+665	48	F	
NGC 4073.....	12 01 54	+02 10.6	247	+62	E5	1 Pb	5	-	+5961	+5834	59	G	Brightest in group of ~15 E & SO
NGC 4085.....	12 02 51	+50 38.0	140	+65	Sc III : :	1 Pd	1	3	+714	+794	14	E	Nearly on edge
NGC 4088.....	12 03 02	+50 49.1	140	+65	Sc(s) II.8	1 Pd	4	2	+678	+759	22	G	
NGC 4096.....	12 03 29	+47 45.7	143	+67	Sc(s) II.8	2 Pc	3	-	+479	+546	37	F	
NGC 4100.....	12 03 37	+49 51.4	141	+65	Sc(s) I-II	1 Pb	2	1	+1138	+1215	59	F	
NGC 4123.....	12 05 38	+03 09.3	277	+63	SBbc(rs) II.3	2 Pd	1	3	+1283	+1151	16	G	Very blue continuum
NGC 4124.....	12 05 36	+10 39.5	269	+70	SO_3	2 Pc	5	-	+1652	+1551	29	FG	
NGC 4129.....	12 06 19	-08 45.7	285	+52	Sc III :	1 Pd	5	-	+1210	+1034	69	F	Nearly on edge
NGC 4145.....	12 07 30	+40 09.7	154	+74	SBc(r) II	2 Pcd	5	-	+829	+864	21	F	
NGC 4152.....	12 08 05	+16 18.7	260	+75	Sc(r) I-II	2 Pc	3	1	+2150	+2076	34	F	Virgo cluster 6°
NGC 4156.....	12 08 19	+39 45.0	154	+75	SBab(rs) I	1 Pa	4	2	+6878	+6911	67	E	Near N 4151
NGC 4158.....	12 08 37	+20 27.2	247	+78	E3	1 Pd	3	1	+2536	+2480	17	G	
NGC 4168.....	12 09 44	+13 29.0	267	+73	E2	1 Pb	6	-	+2428	+2342	27	F	Virgo cluster 6°
NGC 4189.....	12 11 14	+13 42.2	268	+73	SBc(rs) II.2	1 Pc	5	-	+2214	+2130	116	FP	Virgo cluster 6°
NGC 4215.....	12 13 22	+06 41.0	279	+67	$SO_2(9)$	2 Pd	6	-	+2093	+1980	17	GE	
NGC 4219.....	12 13 50	-43 02.8	296	+19	Sbc(s) II-III	1 Sb	2	2	+1978	+1724	27	G	
NGC 4224.....	12 14 01	+07 44.4	278	+68	Sa or SO_3	3 Pbc	5	-	+2651	+2543	36	G	
NGC 4233.....	12 14 35	+07 54.1	278	+68	SO	1 Pb	5	-	+2224	+2117	75	F	
NGC 4235.....	12 14 37	+07 28.1	279	+68	Sa	2 Pc	3	1	+2596	+2487	18	F	
NGC 4237.....	12 14 39	+15 36.1	267	+75	Sc III	2 Pbc	4	-	+945	+871	18	FG	Virgo cluster 6°
NGC 4290.....	12 18 23	+58 22.3	130	+58	SBb	3 Pbc	4	2	+2766	+2885	41	F	
NGC 4298.....	12 19 00	+14 53.1	272	+75	Sc III	3 Pbc	1	1	+1173	+1099	27	F	Virgo cluster 6°
NGC 4302.....	12 19 10	+14 52.5	272	+75	Sc (on edge)	1 Pd	-	1	+1339	+1265	~50	I	Is velocity real? VC 6°
NGC 4304.....	12 19 35	-33 12.4	296	+29	SBb(s) II	1 Sb	3	3	+2595	+2359	25	G	
NGC 4307.....	12 19 33	+09 19.1	280	+70	Sa	2 Pbc	3	-	+1305	+1207	81	F	Virgo cluster 6°
NGC 4340.....	12 21 04	+17 00.0	269	+77	SBO	3 Pbc	6	-	+854	+790	23	G	Virgo cluster 6°
NGC 4346.....	12 21 01	+47 16.2	136	+69	$SBO_1(9)$	2 Pc	4	-	+849	+922	38	G	
NGC 4348.....	12 21 20	-03 10.0	289	+58	S on edge	1 Pd	3	-	+2202	+2055	~25	G	
NGC 4369.....	12 22 09	+39 39.7	145	+76	Sc(s) III-IV	2 Pc	2	1	+1081	+1120	20	G	
NGC 4373.....	12 22 40	-39 28.7	297	+22	E4	2 Sa	5	-	+3457	+3212	21	G	N 4373 group
IC 3290.......	12 22 31	-39 29.7	297	+23	SO(5)	1 Sa	3	-	+3380	+3137	60	FG	N 4373 group
NGC 4377.....	12 22 40	+15 02.4	275	+76	SO(3)	3 Pbc	4	-	+1325	+1254	72	F	Virgo cluster 6°
NGC 4378.....	12 22 45	+05 12.1	286	+66	Sa	3 Pbc	7	-	+2510	+2397	14	G	
NGC 4379.....	12 22 43	+15 53.0	273	+76	E4	3 Pbc	6	-	+1039	+972	21	G	Virgo cluster 6°
NGC 4380.....	12 22 50	+10 17.6	282	+71	Sb^-/Sa^+	3 Pbc	5	-	+1000	+908	26	G	Virgo cluster 6°
NGC 4383.....	12 22 54	+16 44.8	272	+77	SO pec?	1 Pb	-	4	+1609	+1545	36	G	Virgo cluster 6°

TABLE IV. (continued)

Name (1)	α(1950) (2)	δ(1950) (3)	ℓ^{II} (4)	b^{II} (5)	Type (6)	Plates (7)	Lines a (8)	Lines e (8)	v_H (9)	v_o (10)	m.e. (11)	Q (12)	Remarks (13)
									km s^{-1}	km s^{-1}	km s^{-1}		
NGC 4385.....	12 23 12	+00 50.9	288	+62	SBa:	2 Pd	2	6	+2203	+2073	14	GE	
NGC 4388.....	12 23 14	+12 56.3	279	+74	Sa/Sb	1 Pb	-	6	+2450	+2370	34	GE	
NGC 4412.....	12 24 02	+04 14.3	287	+66	SBbc(s) II	1 Pd	4	4	+2301	+2185	29	G	
NGC 4413.....	12 24 00	+12 53.3	279	+74	SBb−	1 Pb	1	3	-60	-140	53	F	Virgo cluster 6°
NGC 4417.....	12 24 18	+09 51.7	283	+71	E7	2 Pbc	8	-	+826	+734	25	G	Virgo cluster 6°
NGC 4419.....	12 24 25	+15 19.4	276	+76	SBab:	3 Pbc	7	-	-274	-344	17	GE	Virgo cluster 6°
NGC 4420.....	12 24 25	+02 46.3	288	+64	Sc(s) III	2 Pc	1	3	+1724	+1602	23	E	
NGC 4424.....	12 24 40	+09 41.8	283	+71	Sb: III?	2 Pc	5	1	+462	+369	51	FG	Virgo cluster 6°
NGC 4428.....	12 24 53	-07 53.9	292	+54	Sc(s) II.8	1 Pd	4	1	+3036	+2874	16	G	
IC 3370.......	12 24 59	-39 03.7	297	+23	E1	2 Sa	4	1	+2973	+2730	33	G	N 4373 group
NGC 4433.....	12 25 03	-08 00.3	292	+54	Sbc III	2 Pc	4	4	+3056	+2894	36	G	
NGC 4452.....	12 26 12	+12 02.0	282	+73	SO(9)	2 Pd	6	-	+212	+130	42	G	Virgo cluster 6°
NGC 4454.....	12 26 16	-01 39.7	291	+60	Sa	2 Pc	5	-	+2358	+2220	68	F	
NGC 4455.....	12 26 13	+23 05.5	251	+83	Sc (on edge)	1 Pd	-	2	+631	+598	33	GE	
NGC 4460.....	12 26 19	+45 08.6	135	+71	Sbc (on edge)	3 Pbd	4	3	+558	+624	11	E	
NGC 4462.....	12 26 44	-22 53.6	296	+39	SBab(s) I-II	2 Pd	3	-	+1866	+1658	51	F	
NGC 4469.....	12 26 56	+09 01.5	286	+70	Sa	3 Pbc	6	-	+498	+404	10	G	Virgo cluster 6°
NGC 4470.....	12 27 14	+08 16.7	286	+70	Ring pec.	2 Pb	-	4	+2337:	+2239:	54	G	
NGC 4476.....	12 27 27	+12 37.5	283	+74	E5	2 Pbc	5	-	+1978	+1899	28	F	Virgo cluster 6°
NGC 4483.....	12 28 08	+09 17.1	286	+71	$SBO_1(5)$	2 Pd	6	-	+875	+783		FG	Virgo cluster 6°
NGC 4487.....	12 28 30	-07 46.5	294	+54	SBc(s) II.2	1 Pd	1	2	+1203	+1044	55	F	
NGC 4503.....	12 29 34	+11 27.2	286	+73	$SO_1(6)$	1 Pb	7	-	+1417	+1335	37	FG	Virgo cluster 6°
NGC 4507.....	12 32 55	-39 38.0	299	+22	S(as I):	1 Pd	1	5	+3523	+3283	12	E	
NGC 4522.....	12 31 08	+09 27.0	288	+71	Sc/Sb:	1 Pd	2	1	+2404	+2314	39	F	Virgo cluster 6°
NGC 4561.....	12 33 38	+19 36.1	277	+81	SBc IV or SBm IV	1 Pd	-	4	+1474	+1430	56	G	IC 3569
NGC 4580.....	12 35 16	+05 38.6	293	+67	Sbc(r) II	1 Pd	4	-	+1290	+1187	29	FP	
NGC 4586.....	12 35 55	+04 35.6	294	+66	Sa	2 Pc	3	-	+829	+722	25	F	
NGC 4595.....	12 37 21	+15 34.3	289	+77	Sc(s) III:	1 Pd	4	-	+660	+601	34	F	Virgo cluster 6°
NGC 4596.....	12 37 24	+10 27.0	293	+72	SBO_3	2 Pc	7	-	+ 1950	+1869	46	G	
NGC 4602.....	12 38 03	-04 51.7	297	+57	Sc(r) I.2	1 Pd	3	-	+2575	+2433	63	F	
NGC 4608.....	12 38 42	+10 25.7	294	+72	SBO	2 Pbc	5	-	+1870	+1789	18	G	
NGC 4612.....	12 39 00	+07 35.3	295	+70	SBO_1	3 Pbc	8	-	+1832	+1740	23	G	
NGC 4623.....	12 39 38	+07 57.0	296	+70	SO	3 Pbc	5	-	+1963	+1873	42	G	
NGC 4630.....	12 39 58	+04 13.9	297	+66	S or Ir	1 Pd	3	3	+692	+587	24	G	
NGC 4639.....	12 40 21	+13 31.9	294	+75	Sb I-II	2 Pbc	5	-	+755	+689	32	G	Virgo cluster 6°
NGC 4645.....	12 41 25	-41 28.7	301	+21	E5	1 Sa	4	-	+2651	+2412	39	FG	Centaurus cluster
NGC 4658.....	12 42 02	-09 48.7	300	+52	SBc(s) I-II	1 Pd	1	3	+2407	+2250	17	E	
NGC 4677.....	12 44 14	-41 18.8	302	+21	SO(6)	1 Sa	5	-	+3215	+2978	51	F	Centaurus cluster
NGC 4683.....	12 44 57	-41 15.5	302	+21	SO/E5	1 Sa	3	-	+3627	+3391	24	F	Centaurus cluster
NGC 4684.....	12 44 43	-02 27.1	300	+60	$SO_1(7)$	2 Pc	5	2	+1589	+1461	22	FG	
NGC 4689.....	12 45 15	+14 02.1	299	+76	Sc(s) II.3	1 Pc	4	-	+1776	+1715	59	F	Virgo cluster 6°
NGC 4691.....	12 45 39	-03 03.6	301	+59	SBb pec	2 Pd	-	3	+1125	+995	24	E	
NGC 4694.....	12 45 44	+11 15.4	300	+73	SO pec	3 Pbc	7	-	+1264	+1192	28	G	Virgo cluster 6°
NGC 4696.....	12 46 04	-41 02.3	302	+21	E3	1 Sa	5	-	+2999	+2763	12	G	Centaurus cluster
NGC 4700.....	12 46 32	-11 08.2	302	+51	Sc or Sm	1 Pd	1	4	+1439	+1281	14	E	On edge
1246-4131....	12 46 42	-41 31.1	303	+22	E4	1 Sa	4	-	+4299	+4064	24	F	Centaurus cluster
1246-4107....	12 46 53	-41 07.0	302	+22	SO(7)	1 Sa	2	-	+3782	+3546	~50	F	Centaurus cluster
NGC 4706.....	12 47 09	-41 00.5	302	+21	E3	2 Sa	4	-	+3790	+3555	30	FG	Centaurus cluster
NGC 4709.....	12 47 19	-41 06.7	302	+21	E1	2 Sa	4	-	+4759	+4524	31	F	Centaurus cluster
1247-4114....	12 47 27	-41 14.8	303	+22	E5	1 Sa	5	-	+2684	+2449	70	F	Centaurus cluster
1249-4051....	12 49 00	-40 51.8	303	+21	EO	1 Sa	4	-	+2268	+2026	34	G	Centaurus cluster
1249-4116....	12 49 16	-41 11.6	303	+22	E5	1 Sa	4	-	+3778	+3545	77	P	Centaurus cluster
NGC 4743.....	12 49 30	-41 07.5	303	+22	SO(6)	1 Sa	6	-	+3054	+2821	47	GF	Centaurus cluster
NGC 4744.....	12 49 35	-40 47.4	303	+21	SBO(8)	1 Sa	4	2	+3398	+3165	21	G	Centaurus cluster
NGC 4756.....	12 50 15	-15 08.6	303	+47	E3	3 SaPc	6	-	+4164	+3995	36	FG	In small group of E's
NGC 4760.....	12 50 31	-10 13.3	303	+52	EO	1 Sa	4	-	+4640	+4487	56	F	
NGC 4763.....	12 50 22	-16 44.1	303	+45	S?	3 SaPc	6	-	+4190	+4016	23	FG	
NGC 4767.....	12 51 08	-39 27.0	303	+23	E5	3 SaPc	4	-	+3090	+2860	15	G	Centaurus cluster
NGC 4772.....	12 50 56	+02 26.4	304	+65	Sa:	3 Pbc	6	-	+1087	+982	14	G	
NGC 4786.....	12 51 57	-06 35.3	304	+56	E3	2 Pc	7	-	+4647	+4509	28	FG	
NGC 4790.....	12 52 16	-09 58.6	304	+52	Sd II:	1 Pd	-	2	+1491	+1341	44	G	High SB. Thin arms!
NGC 4793.....	12 52 16	+29 12.5	101	+88	Sc(s) II.2	1 Pd	3	-	+2555	+2565	79	F	
NGC 4795.....	12 52 31	+08 20.2	305	+70	SBa:	1 Pb	3	-	+3199	+3119	71	P	Forced arms by companion?
IC 3896.......	12 53 51	-50 04.6	303	+12	E1	1 Sa	2	-	+2274	+2031	44	F	
NGC 4818.....	12 54 13	-08 15.1	305	+54	Sab:	1 Pc	1	1	+1155	+1012	54	F	
NGC 4825.....	12 54 36	-13 23.9	305	+49	$SO_3(3)$	3 Pd	5	1	+4452	+4291	18	G	
NGC 4835.....	12 55.3	-45 59	304	+16	Sc(r) I:	1 Sb	2	2	+2243	+2005	56	G	Plate by N. Stokes
NGC 4845.....	12 55 28	+01 50.8	306	+64	Sa	1 Pd	2	-	+1228	+1124	80	IP	
NGC 4868.....	12 56 49	+37 34.7	114	+79	Sc	2 Pd	4	2	+4731	+4780	17	G	
NGC 4880.....	12 57 40	+12 45.1	311	+75	$E4/SO_1(4)$	2 Pc	4	-	+1557	+1499	25	GF	

TABLE IV. (continued)

Name (1)	α(1950) (2)	δ(1950) (3)	ℓ^{II} (4)	b^{II} (5)	Type (6)	Plates (7)	Lines a (8)	Lines e (8)	v_H (9) km s^{-1}	v_o (10) km s^{-1}	m.e. (11) km s^{-1}	Q (12)	Remarks (13)
NGC 4914.......	12 58 23	+37 35.0	112	+79	SO$_1$(5)	3 Pbc	6	-	+4775	+4828	23	G	
NGC 4933(NE)...	13 01 20	-11 13.8	307	+51	SO$_3$ pec	2 Pd	5	-	+3188	+3037	27	G	
NGC 4933(SW)...	13 01 20	-11 13.8	307	+51	E3 pec	1 Pd	5	-	+3306	+3155	16	G	
NGC 4936.......	13 01 34	-30 15.4	306	+32	E2	1 Sa	4	-	+3309	+3104	33	G	Brightest in a group
NGC 4947.......	13 02 34	-35 04.2	306	+27	Sb(r) II:	1 Sa	3	1	+2367	+2152	52	F	
NGC 4981.......	13 06 13	-06 30.8	310	+55	SBbc(rs) II	4 Pcd	4	-	+1797	+1669	24	F	
NGC 4984.......	13 06 23	-15 15.0	309	+47	Sa	2 Sa	3	3	+1259	+1109	12	G	
NGC 5011.......	13 10 00	-42 50.1	307	+19	E3	2 Sa	6	-	+3101	+2876	50	F	
NGC 5012.......	13 09 12	+23 10.9	351	+83	Sc(rs) I-II	2 Pbd	3	-	+2815	+2810	26	G	
NGC 5016.......	13 09 42	+24 21.7	0	+84	Sc(r) II	1 Pd	1	3	+2583	+2583	14	G	
NGC 5017.......	13 10 15	-16 30.1	310	+45	E3	2 SaPc	8	-	+2543	+2384	27	G	N 5044 group?
NGC 5026.......	13 11 16	-42 41.8	307	+19	S	1 Sa	4	1	+3664	+3439	36	G	
NGC 5037.......	13 12 22	-16 19.6	311	+45	Sa	2 SaPb	6	-	+1887	+1730	18	G	N 5044 group
NGC 5044.......	13 12 44	-16 07.3	311	+46	EO	2 Sa	4	1	+2704	+2548	33	G	N 5044 group
NGC 5054.......	13 14 19	-16 22.1	311	+45	Sb(r) II	1 Sa	2	3	+1764	+1608	25	E	N 5044 group
NGC 5064.......	13 16 04	-47 38.8	307	+14	SO$_1$	1 Sa	4	-	+2982	+2752	10	F	
NGC 5084.......	13 17 34	-21 33.9	311	+40	SO$_1$(8)	1 Sa	5	-	+1739	+1569	30	E	
NGC 5085.......	13 17 33	-24 10.7	311	+37	Sc(r) I-II	2 Pc	4	-	+2073	+1895	20	F	
NGC 5088.......	13 17 42	-12 18.8	313	+49	Sc III:	1 Pd	-	3	+1464	+1324	16	E	
NGC 5090.......	13 18 17	-43 26.5	308	+18	E2	1 Sa	4	-	+3326	+3104	56	G	Brightest in a group of 6
Cl 1318-2532....	13 18 40	-35 32.2	310	+26	E2	1 Sa	6	-	+15,156	+14,949	78	F	Nice cluster
NGC 5101.......	13 19 01	-27 10.1	311	+34	SBO$_3$/SBa	2 Sa	4	1	+1850	+1665	16	E	
NGC 5121.......	13 21 53	-37 25.3	310	+24	SO$_1$(4)	1 Sa	6	-	+1532	+1324	50	FP	
NGC 5134.......	13 22 36	-20 52.6	313	+41	Sa(r)	1 Pc	5	-	+1696	+1532	50	F	
NGC 5135.......	13 22 56	-29 34.3	311	+32	SBb (I)	2 Pd	1	4	+4157	+3968	14	G	IC 4296 group?
NGC 5140.......	13 23 22	-33 36.4	311	+29	E3	1 Sa	2	-	+3771	+3573	40	FG	IC 4296 group
NGC 5150.......	13 24 50	-29 18.2	312	+32	SBO:	1 Pd	3	-	+4376	+4189	32	F	IC 4296 group?
NGC 5156.......	13 25 43	-48 39.4	309	+13	SBa:(rs)	1 Sa	3	-	+2832	+2606	64	FP	
NGC 5161.......	13 26 25	-32 54.9	311	+29	Sc(s) I	1 Sa	3	2	+2252	+2057	68	F	
NGC 5170.......	13 27 05	-17 42.3	315	+43	Sb:	1 Pd	6	-	+1583	+1432	20	P	
NGC 5188.......	13 28 37	-34 32.0	312	+27	SBO/a? Pec?	1 Sa	1	6	+2366	+2169	17	E	
1329-3258	13 29 00	-32 58.9	312	+28	SO(8)	1 Sa	4	-	+3558	+3366	50	PF	IC 4296 group
NGC 5193.......	13 29 04	-32 58.6	312	+28	EO?, SO?	1 Sa	4	-	+3684	+3491	53	F	IC 4296 group
1332-3338	13 32 27	-33 38.5	314	+28	SO(6)	1 Sa	-	2	+3873	+3682	30	G	IC 4296 group
IC 4296.........	13 33 47	-33 42.4	313	+28	E1	2 Sa	4	-	+3729	+3537	55	FG	Dominant of group
IC 4299.........	13 33 56	-33 48.7	315	+28	SBa	1 Sa	4	-	+4063	+3876	59	F	IC 4296 group
1334-3333	13 34 48	-33 33.4	314	+28	E7/SO	1 Sa	5	-	+3920	+3729	20	G	IC 4296 group
1335-3337	13 35 12	-33 37.3	314	+28	E6	2 Sa	5	-	+3861	+3671	29	F	IC 4296 group
NGC 5247.......	13 35 21	-17 38.1	318	+43	Sc(s) I-II	1 Pc	3	1	+1386	+1241	31	G	
NGC 5266.......	13 39 56	-47 55.0	311	+13	SO$_1$(5)	1 Sa	4	-	+3201	+2983	43	G	
NGC 5291.......	13 44 34	-30 09.0	317	+31	E5	1 Sa	3	-	+4366	+4191	25	FG	IC 4329 cluster
NGC 5292.......	13 44 49	-30 41.6	317	+31	SO(4)	1 Sa	3	-	+4482	+4307	33	G	IC 4329 cluster
1345-3034	13 45 48	-30 34.0	317	+31	SO(7)	1 Sa	4	-	+5275	+5100	32	F	IC 4329 cluster
NGC 5302.......	13 45 58	-30 15.8	317	+30	E5	2 Sa	4	-	+3329	+3154	35	G	IC 4329 cluster
IC 4329.........	13 46 14	-30 02.8	317	+31	SO$_1$(5)/E5	3 Sa	4	-	+4456	+4282	27	G	IC 4329 cluster
IC 4329A	13 46 28	-30 03.7	317	+31	SO$_3$(7)	3 Sa	1	2	+4855	+4681	24	E	Seyfert
NGC 5304	13 47 10	-30 20.0	317	+30	E5	1 Sa	3	-	+3723	+3549	74	F	IC 4329 cluster
NGC 5324.......	13 49 30	-05 48.4	328	+53	Sbc(r) I.3	1 Pc	3	-	+2937	+2846	40	F	
NGC 5328.......	13 50 03	-28 14.7	318	+32	E2	1 Sa	3	-	+4816	+4650	50	F	IC 4329 cluster
NGC 5330.......	13 50 08	-28 13.4	319	+32	E1	1 Sa	4	-	+4911	+4744	51	P	IC 4329 cluster
NGC 5350.......	13 51 14	+40 36.7	82	+71	SBbc(rs) I-II	1 Pd	2	2	+2251	+2345	28	PF	In group w N 5353, 54, 55, 58, 71.
HO IV..........	13 52 55	+54 08.4	103	+60	Ir IV - V	1 Pa	-	4	+126	+268	31	E	M101 group
NGC 5357.......	13 53 06	-30 05.8	319	+30	E3	1 Sa	3	-	+5019	+4846	46	P	IC 4329 cluster
NGC 5365.......	13 54 45	-43 41.3	315	+17	SBO	1 Sa	4	-	+2497	+2296	20	G	
NGC 5376.......	13 53 39	+59 45.0	108	+55	Sb(r)	1 Pd	4	-	+2064	+2224	33	GE	
NGC 5380.......	13 54 49	+37 51.1	74	+72	SO$_1$(1)	2 Pc	7	-	+3156	+3242	38	G	Related w 5394/5?
NGC 5394.......	13 56 25	+37 41.9	73	+72	Sab(s)	3 Pbd	2	1	+3355	+3441	15	E	Pair w N 5395
NGC 5395.......	13 56 30	+37 38.2	73	+72	Sb II	1 Pd	3	-	+3542	+3628	12	F	Pair w N 5394
NGC 5398.......	13 58 27	-32 49.3	319	+27	SBc(s) II	1 Sb	-	9	+1272	+1099	9	E	Plate by N. Stokes
NGC 5406.......	13 58 14	+39 09.2	76	+71	Sc(s) I.2	1 Pd	4	-	+5278	+5371	59	F	
NGC 5419.......	14 00 44	-33 44.5	319	+26	E2	1 Sa	5	-	+4179	+4005	57	FG	
NGC 5422.......	13 58 57	+55 24.3	103	+59	Sa or SO$_3$(8)	2 Pd	8	-	+1837	+1986	17	E	
NGC 5430.......	13 59 09	+59 34.1	107	+55	SBb(r) II	1 Pd	2	1	+3115	+3277	83	F	
NGC 5444.......	14 01 13	+35 22.5	64	+72	E3	2 Pd	5	-	+3994	+4075	18	G	
NGC 5462.......	14 02 07	+54 36.1	102	+60	H II region M101	2 Pe	-	5	+293	+441	2	G	Searle Plates. M101
NGC 5464.......	14 04 11	-29 46.8	321	+30	Giant H II?	1 Sa	-	8	+2686	+2526	15	E	
NGC 5471.......	14 02 42	+54 38.0	102	+60	H II region M101	3 Pe	-	8	+281	+428	3	G	Searle. M101
NGC 5474.......	14 03 15	+53 54.0	100	+60	Scd(s) IV pec	1 Pe	-	3	+234	+380	4	G	Searle. M101 group
NGC 5477.......	14 03 47	+54 41.9	101	+59	Ir IV-V	1 Pa	-	7	+343	+492	15	E	M101 group
NGC 5483.......	14 07 17	-43 05.3	317	+17	SBc(s) I	2 Sb	1	3	+1830	+1634	~25	GE	Plate by N. Stokes

1978AJ.....83..904S

TABLE IV. (continued)

Name (1)	α(1950) (2)	δ(1950) (3)	ℓ^{II} (4)	b^{II} (5)	Type (6)	Plates (7)	Lines a (8)	Lines e (8)	v_H (9)	v_o (10)	m.e. (11)	Q (12)	Remarks (13)
									km s^{-1}	km s^{-1}	km s^{-1}		
NGC 5486.....	14 05 42	+55 20.4	101	+58	Sc(III:)	1 Pa	-	4	+1347	+1499	21	E	
NGC 5595.....	14 21 27	-16 30.0	332	+40	Sc(s) II	2 Pc	3	3	+2672	+2568	18	E	
NGC 5600.....	14 21 26	+14 51.8	7	+65	Sb pec	3 Pd	5	2	+2363	+2379	10	E	
NGC 5612.....	14 28 12	-78 09.8	308	-16	E2	1 Sa	4	-	+2764	+2538	59	F	
NGC 5641.....	14 27 05	+29 02.6	43	+68	SBab I	2 Pd	5	-	+4467	+4543	38	G	
NGC 5643.....	14 29 28	-43 57.2	321	+15	S/SBc(s) II-III	2 Sa	-	9	+1178	+997	8	E	
NGC 5645.....	14 28 10	+07 29.8	357	+59	Sc III	1 Pd	-	3	+1455	+1448	89	G	SE Knot
NGC 5660.....	14 28 04	+49 50.8	89	+60	Sc(s) I.8	1 Pd	2	2	+2342	+2489	78	G	
IC 4444.......	14 28 27	-43 11.9	321	+15	Sc(s) II	1 Sb	-	4	+1979	+1800	14	E	
NGC 5701.....	14 36 41	+05 34.8	357	+56	SBa	2 Pd	6	-	+1586	+1579	22	E	
NGC 5728.....	14 39 37	-17 02.3	337	+38	Sa I-II	2 Sa	-	9	+2970	+2879	16	F	
NGC 5739.....	14 40 34	+42 03.3	73	+62	S	2 Pd	4	1	+5608	+5738	47	G	
NGC 5791.....	14 55 50	-19 03.9	340	+34	SO_1(4)	3 SaPc	4	-	+3339	+3254	29	FG	
NGC 5793.....	14 56 37	-16 29.9	341	+36	Sb: on edge	1 Pc	2	-	+3521	+3446	72	F	
NGC 5796.....	14 56 36	-16 25.4	342	+36	EO	3 SaPc	5	-	+2946	+2871	12	F	
NGC 5861.....	15 06 33	-11 07.9	348	+39	Sc(s) II	2 Sa	-	1	+1814	+1768	~50	G	If the one em is Hα. Correct by 21 cm
NGC 5861.....	15 06 33	-11 07.9	348	+39	Sc(s) II	2 Sa	-	1	+862	+816	~50	G	If the one em is [N II]
NGC 5898.....	15 15 17	-23 55.0	340	+27	EO	2 Sa	4	-	+2251	+2164	53	G	Related to N 5903 and 1515-2356
NGC 5903.....	15 15 40	-23 53.1	341	+27	E2	2 Sa	3	-	+2499	+2413	51	G	
NGC 5905.....	15 14 02	+55 42.1	90	+51	SBb(rs) I	2 Pb	2	3	+3386	+3572	20	G	
1515-2356	15 15 39	-23 56.4	341	+28	E5	1 Sa	4	-	+2380	+2294	66	G	
NGC 5908.....	15 15 24	+55 35.4	90	+51	Sa or Sb on edge	2 Pb	7	-	+3433	+3620	40	F	
NGC 5949.....	15 27 19	+64 56.0	100	+44	Sc IV	1 Pd	4	1	+601	+810	50	F	
NGC 5967.....	15 42 10	-75 31.2	313	-16	SBc(s) II:	1 Sb	3	2	+2904	+2695	36	G	Plate by N. Stokes
NGC 6052.....	16 03 01	+20 40.5	35	+45	Ir or S pec	1 Pb	-	6	+4760	+4882	14	G	
NGC 6300.....	17 12 18	-62 45.8	328	-14	SBc(rs) II pec	1 Sa	2	3	+1053	+901	23	F	
NGC 6684.....	18 44 02	-65 13.8	330	-24	SBO(5)	2 Sa	3	-	+901	+766	28	G	
NGC 6699.....	18 47 48	-57 22.7	338	-22	Sbc(r) I-II	1 Sa	-	2	+3411	+3311	20	G	
NGC 6707.....	18 51 20	-53 53.0	342	-22	S	1 Sa	-	3	+2759	+2676	31	E	IC 4797 group
NGC 6708.....	18 51 35	-53 47.0	342	-22	E3/SO_1(3)	1 Sa	-	4	+2622	+2536	17	E	IC 4797 group
IC 4796.......	18 52 26	-54 16.8	342	-22	E5:	2 Sa	5	-	+3076	+2991	28	G	IC 4797 group
IC 4797.......	18 52 28	-54 22.3	342	-22	E6/SO_1(6)	2 Sa	4	-	+2620	+2535	34	G	IC 4797 group
A 1853	18 52 53	-54 36.9	341	-22	E3	2 Sa	7	-	+2761	+2675	45	GE	IC 4797 group
NGC 6721.....	18 56 34	-57 49.6	338	-23	EO	2 Sa	4	-	+4416	+4316	50	G	
IC 4721.......	18 30 03	-58 32.0	336	-20	SBc(s) II	1 Sb	3	-	+5954	+5844	37	PF	Plate by N. Stokes
NGC 6739.....	19 03 18	-61 29.5	335	-26	SO_1(5)	1 Sa	4	-	+4272	+4158	48	G	N 6769 group
NGC 6753.....	19 07 13	-57 07.7	339	-25	Sa I	2 Sa	5	-	+3145	+3051	39	F	Related to N 6758?
NGC 6754.....	19 07 34	-50 43.4	346	-23	Sb(rs) II:	1 Sb	-	2	+3282	+3218	46	G	Plate by N. Stokes
IC 4827.......	19 08 54	-60 57.2	336	-26	SO(8)/Sa?	1 Sa	3	-	+4349	+4239	53	G	N 6769 group
NGC 6758.....	19 09 44	-56 23.7	340	-25	E2	1 Sa	3	-	+3367	+3277	43	F	Related to N 6753?
IC 4831.......	19 10 14	-62 22.8	334	-26	Sbc(s) I-II	1 Sa	4	-	+4312	+4194	84	F	N 6769 group
IC 4837.......	19 11 12	-54 45.1	342	-25	Sc(s) (III-IV:)	1 Sb	-	6	+2708	+2626	24	E	
NGC 6769.....	19 13 57	-60 36.2	336	-26	Sbc(s) I-II	1 Sa	2	-	+3943	+3834	85	F	N6769 group
NGC 6770.....	19 14 14	-60 36.2	336	-26	Sbc pec	1 Sa	3	1	+3863	+3754	16	FG	em [N II]; not Hα
NGC 6771.....	19 14 18	-60 38.0	336	-26	SO_1(8)	2 Sa	5	-	+4273	+4164	28	G	N 6769 group
IC 4842.......	19 15 01	-60 44.4	335	-26	SO_1(5)	2 Sa	5	-	+4089	+3980	23	G	N 6769 group
IC 4845.......	19 16 01	-60 28.6	336	-26	EO?	2 Sa	6	-	+3863	+3755	38	G	N 6769 group
NGC 6776.....	19 20 43	-63 57.9	332	-27	E1	1 Sa	2	-	+5736	+5613	50	G	
NGC 6780.....	19 18 46	-55 52.4	341	-26	Sbc(r) I-II	1 Sb	1	2	+3516	+3430	32	F	
NGC 6782.....	19 19 38	-60 01.1	336	-27	SO_1(6)/(Sa)	1 Sa	5	-	+3876	+3771	50	G	N 6769 group
NGC 6808.....	19 38 30	-70 45.2	324	-29	(Sa)	1 Sa	1	2	+3468	+3318	21	GE	
Cygnus Cl	19 40 27	+50 28.6	83	+13	E2	1 Pd	3	-	+7565	+7855	60	FG	
IC 4889.......	19 41 19	-54 27.6	343	-29	E5	2 Sa	5	-	+2531	+2457	27	FG	
NGC 6835.....	19 51 47	-12 42.0	28	-19	S(a or b)	1 Pd	3	1	+1790	+1925	34	G	
Cygnus Cl	19 57 20	+49 53.9	84	+11	E3	2 Pd	9	-	+7366	+7659	26	F	
NGC 6851	19 59 55	-48 25.0	350	-31	E4	1 Sa	6	-	+3117	+3077	48	G	Telescopium group
Cygnus Cl	20 01 25	+49 10.6	84	+10	E1	2 Pd	5	-	+7071	+7365	49	F	
NGC 6854.....	20 01 46	-54 31.0	343	-32	E2	1 Sa	3	-	+5680	+5609	50	FP	
NGC 6861.....	20 03 42	-48 30.8	350	-32	E6	1 Sa	6	-	+2859	+2819	32	G	Telescopium group
NGC 6861D ...	20 04 43	-48 21.2	351	-32	$S0_1$(7)	1 Sa	6	-	+2534	+2494	44	G	Telescopium group
NGC 6870.....	20 06 34	-48 26.2	351	-32	SO_1(7)	1 Sa	4	-	+2660	+2621	~75	F	Telescopium group
IC 4960.......	20 10 05	-70 41.6	324	-32	SO_1(8)	1 Sa	5	-	+3519	+3372	41	FG	Pavo group
NGC 6878.....	20 10 25	-44 40.4	355	-32	Sc(r) I	1 Sa	4	-	+5870	+5850	48	PI	Telescopium group
IC 4967.......	20 11 07	-70 43.0	325	-33	E5	1 Sa	4	-	+4153	+4005	7	P	Pavo group
2011-4544	20 11 14	-45 44.6	354	-33	E1	1 Sa	3	-	+5071	+5045	85	FP	Telescopium group
NGC 6872.....	20 11 41	-70 55.5	324	-32	SBb(s) I	1 Sa	3	-	+4737	+4589	58	G	Pavo group
IC 4970.......	20 11 42	-70 54.4	324	-32	E6	1 Sa	2	3	+4755	+4607	59	G	Pavo group
NGC 6876.....	20 13 05	-71 01.0	324	-32	E3	1 Sa	5	-	+3999	+3851	83	FG	Pavo group
NGC 6877.....	20 13 21	-71 00.6	324	-32	E5	1 Sa	4	-	+4172	+4024	39	F	Pavo group
NGC 6880.....	20 14 17	-71 01.0	324	-32	SO_1(8)	1 Sa	4	-	+3969	+3821	30	FG	Pavo group

TABLE IV. (continued)

Name (1)	α(1950) (2)	δ(1950) (3)	ℓ^{II} (4)	b^{II} (5)	Type (6)	Plates (7)	Lines a (8)	Lines e (8)	v_H (9)	v_o (10)	m.e. (11)	Q (12)	Remarks (13)
									km s^{-1}	km s^{-1}	km s^{-1}		
NGC 6890.....	20 14 50	-44 57.4	355	-33	Sb(s) II-III	1 Sa	-	4	+2459	+2439	34	G	Telescopium group
NGC 6893.....	20 17 14	-48 23.7	351	-34	E3/SO_1(3)	1 Sa	7	-	+3175	+3137	38	G	Telescopium group
A 2021	20 20 33	-44 09.4	356	-34	SO_1(6)/E6	1 Sa	4	2	+2942	+2927	25	E	Telescopium group = New 5
NGC 6907.....	20 22 07	-24 58.3	18	-30	SBbc(rs) II	3 Pb	-	3	+3155	+3238	32	G	
NGC 6909.....	20 24 09	-47 11.6	352	-35	E5	1 Sa	4	-	+2680	+2649	80	FP	Telescopium group
NGC 6935.....	20 34 41	-52 17.2	346	-37	Sa	1 Sa	4	-	+4794	+4738	80	P	
NGC 6942.....	20 36 53	-54 28.8	343	-37	SBO_1(3)	1 Sa	3	-	+3964	+3897	~100	PI	
NGC 6943.....	20 39 52	-68 55.6	325	-35	Sc(s) I	1 Sb	3	-	+3114	+2977	99	PI	Plate by N. Stokes
IC 5052.......	20 47 26	-69 23.6	325	-35	Sd	1 Sb	-	5	+423	+284	40	E	
IC 5063.......	20 48 12	-57 15.2	339	-38	E4	2 Sa	-	8	+3402	+3322	6	E	
NGC 6970.....	20 48 40	-48 57.8	350	-39	S[c(s)]:	1 Sa	4	1	+5187	+5149	38	PI	
NGC 6984.....	20 54 19	-52 03.8	346	-40	Sbc(r) II	1 Sb	-	3	+4522	+4469	45	GE	
2100-4825	21 00 08	-48 25.0	351	-42	E4	1 Sa	3	-	+5300	+5265	63	FG	N 7014 Indus group
2101-4824	21 01 20	-48 24.0	352	-42	E1	1 Sa	4	-	+4848	+4817	49	F	N 7014 Indus group
NGC 7007.....	21 01.9	-52 45	345	-41	SBO_1(4)	1 Sa	5	1	+2954	+2897	24	G	
2102-4714.....	21 02 06	-47 14.8	352	-42	SO/Sa?	1 Sa	3	-	+4985	+4954	37	P	N 7014 Indus group
2103-4723.....	21 03 24	-47 23.6	352	-42	E5	1 Sa	3	-	+5204	+5173	41	G	N 7014 Indus group
NGC 7014.....	21 04 29	-47 22.8	352	-42	E5	1 Sa	4	-	+4790	+4761	25	FG	N 7014 Indus group
NGC 7020.....	21 07 16	-64 14.0	330	-39	RSO_1(6)	1 Sa	3	-	+3029	+2915	64	G	
NGC 7029.....	21 08 27	-49 29.6	349	-42	E5	1 Sa	2	-	+2857	+2817	33	F	
NGC 7038.....	21 11 48	-47 25.4	352	-43	SBc(rs) I.3	1 Sb	6	-	+4844	+4813	67	P	N 7014 Indus group
NGC 7041.....	21 13 09	-48 34.2	350	-43	SO_1(7)/E7	1 Sa	4	-	+1915	+1880	42	G	
NGC 7049.....	21 15 38	-48 46.4	350	-44	E3	1 Sa	6	-	+2198	+2162	43	G	
IC 5105.......	21 21 12	-40 45.1	1	-45	E5	1 Sa	4	-	+5363	+5368	64	G	
NGC 7059.....	21 23 34	-60 14.0	334	-42	Sbc(s) II-III	1 Sb	4	2	+1797	+1702	33	FG	
NGC 7064.....	21 25 34	-52 59.0	344	-44	Sc	1 Sb	-	5	+797	+739	3	E	
NGC 7083.....	21 31 52	-64 07.6	329	-41	Sc(s) I.3	1 Sb	2	-	+3089	+2975	~50	FG	
NGC 7096.....	21 37 28	-64 08.2	329	-42	Sa(r) I	1 Sb	6	-	+2958	+2844	14	G	
NGC 7097.....	21 37 04	-42 46.1	358	-48	E4	1 Sa	3	-	+2404	+2398	32	G	
NGC 7124.....	21 44 48	-50 48.0	346	-48	SBc(s) I	1 Sb	8	-	+5027	+4979	61	F	
IC 5135.......	21 45 21	-35 11.2	9	-50	HiSB: Filaments	1 Pb	-	3	+4812	+4845	40	G	
NGC 7125.....	21 45 38	-60 56.8	332	-44	Sc(r) I	1 Sb	-	4	+3031	+2932	20	E	
NGC 7126.....	21 45 41	-60 50.4	332	-44	Sab:	1 Sb	6	2	+3009	+2910	26	E	
NGC 7145.....	21 50 08	-48 07.1	349	-49	EO	1 Sa	4	-	+1918	+1883	24	G	N 7144 triplet
NGC 7155.....	21 52 56	-49 45.8	347	-49	E2	1 Sa	3	-	+1893	+1850	44	G	N 7144 triplet
NGC 7166.....	21 57 27	-43 37.7	356	-52	SO_1(7)	1 Sa	4	-	+2407	+2395	29	G	
NGC 7168.....	21 58 53	-51 59.0	343	-49	E3/SO_1:	1 Sa	4	-	+2783	+2727	42	P	N 7196 group
IC 5156.......	22 00 20	-34 05.0	11	-53	SB(s)b:	1 Pb	4	-	+2584	+2621	77	PI	
NGC 7192.....	22 03 08	-64 33.4	326	-44	EO	1 Sa	5	-	+2879	+2761	17	FG	
NGC 7200.....	22 03 58	-50 14.6	345	-51	E5	1 Sa	4	-	+2937	+2890	18	F	N 7196 group
2207-4620	22 07 50	-46 20.4	355	-43	Spiral?	1 Sa	3	-	+2723	+2704	46	F	
IC 5181.......	22 10 18	-46 16.4	351	-53	SO_1(8)	1 Sa	5	-	+2110	+2082	47	G	N 7213 group
NGC 7232.....	22 12 35	-46 06.0	351	-54	SO_1(9)	1 Sa	3	-	+2051	+2024	82	G	N 7213 group
NGC 7233.....	22 12 46	-46 06.0	351	-54	SBa(s) or SBO	1 Sa	-	8	+1881	+1854	9	E	N 7213 group
IC 5186.......	22 13 14	-37 05.7	6	-56	Sc(rs) II-III	2 SbPb	2	4	+3447	+3466	10	E	Plate by N. Stokes
IC 5201.......	22 17 55	-46 17.0	350	-54	SBc(s) I-II	1 Sb	-	5	+952	+923	43	F	
NGC 7300.....	22 28 21	-14 15.7	47	-54	Sa I-II	1 Pa	-	2	+3324	+3452	~100	I	Are any lines real?
NGC 7307.....	22 30 59	-41 11.7	357	-58	SBc(s) II	1 Sb	-	5	+1880	+1875	24	G	
NGC 7329.....	22 36 56	-66 44.6	320	-45	SBab(r)[I-II]:	1 Sb	6	-	+3189	+3057	25	FG	
IC 5240.......	22 38 53	-45 02.0	349	-58	SBa(s)	1 Sa	4	-	+1834	+1807	55	F	
NGC 7418.....	22 53 49	-37 17.6	3	-63	Sc/SBc(rs) I	1 Pb	-	3	+1469	+1477	27	F	
NGC 7424.....	22 54 28	-41 20.4	354	-62	Sc(s) II.3	1 Sb	-	2	+904	+892	17	FG	IC 1459 Grus group?
NGC 7428.....	22 54 46	-01 19.2	71	-52	SBa(r)	1 Pa	5	-	+3050	+3225	29	GE	
IC 5269.......	22 54 57	-36 17.7	5	-64	SO_1(7)	1 Sa	4	-	+2162	+2174	15	F	IC 1459 Grus group?
2255+0202	22 55 48	+02 01.4	76	-49	Sc I	1 Pa	4	1	+4797	+4985	45	G	
IC 5273.......	22 56 40	-37 58.4	1	-64	Sc/SBc(s) II-III	1 Pa	-	2	+1262	+1266	37	G	
NGC 7460.....	22 59 10	+01 59.7	76	-50	Sc I	1 Pa	2	2	+3326	+3512	28	GE	
NGC 7599.....	23 16 36	-42 31.8	348	-65	SBc(s) II	1 Sb	-	4	+1730	+1705	30	F	IC 1459 Grus group
IC 5325.......	23 26 02	-41 36.7	347	-67	Sbc(r) I	2 Sb	4	2	+1464	+1440	10	G	Plate by N. Stokes
NGC 7689.....	23 30 34	-54 22.4	325	-59	Sc(rs) II-III	1 Sb	2	2	+1963	+1877	65	F	
NGC 7690.....	23 30 20	-51 58.6	328	-61	SO_1(6)	1 Sb	6	5	+1317	+1242	35	GE	
IC 5328.......	23 30 36	-45 17.4	338	-66	E3	1 Sa	5	-	+3049	+3005	48	FG	
NGC 7702.....	23 32 46	-56 17.4	323	-58	Sa:	1 Sa	4	-	+3152	+3057	34	G	
NGC 7744.....	23 42 26	-43 11.4	339	-69	SO_1(3)	1 Sa	4	-	+2990	+2952	51	G	
2342+0646	23 42 38	+06 45.7	95	-52	Sc(s) I	1 Pa	5	2	+5354	+5537	42	G	
NGC 7750.....	23 44 04	+03 31.2	93	-55	Sc(s) II	1 Pa	3	1	+2913	+3083	59	G	
NGC 7756.....	23 46 12	+03 53.6	94	-55	Sc(s) I	2 Pa	3	2	+3148	+3319	23	F	
2346+0552	23 46 24	+05 51.6	96	-53	Sc	1 Pa	-	4	+3848	+4026	30	E	
2348+0046	23 48 32	+00 46.4	93	-58	Sc(s) I	1 Pa	1	2	+8244	+8401	21	G	
NGC 7780.....	23 50 59	+07 50.6	99	-52	Sc I	1 Pa	5	-	+5155	+5337	58	F	
NGC 7782.....	23 51 21	+07 41.5	99	-52	Sb(r) I	1 Pa	4	-	+5368	+5549	20	G	
IC 1515.......	23 53 30	-01 15.8	93	-60	SB(s)	1 Pa	4	5	+6739	+6886	34	E	
IC 1516.....	23 53 33	-01 11.7	93	-60	Sc(s) I	1 Pa	4	-	+7390	+7537	43	FG	
NGC 7796.....	23 56 27	-55 44.4	317	-60	E1	1 Sa	3	-	+3411	+3311	~100	P	

Notes to Table IV

NGC *IC	
99	3727 in center and in two symmetrical parts of the disk.
105	Weak 3727. Strong N2, more intense than Hβ. 3727 across most of decker, but patchy. Hβ, N1, N2 confined to center.
150	Hβ, N1, N2 confined to central regions. Hβ and N2 nearly same intensity.
175	Very poor plate. Velocity may not be real. Velocity of 1694 ± 60 km s^{-1} given by de Vaucouleurs and de Vaucouleurs (1976) is an alternative.
178	Intense 3727, Hβ, N1, N2 in central region, extending with diminished intensity into the disk on one side. Hβ $\gtrsim$ N1. N2 more intense than Hβ by factor of 3.
180	Very blue *UV* continuum. Shallow hydrogen absorption.
0037 + 0235	Strong *UV* continuum. 3727 confined to central region.
245	Strong *UV* continuum. Weak Hβ emission. Shallow hydrogen lines in absorption plus Fe (4383).
268	3727 and Hβ across decker. More intense in central region.
406	Extended 3727 but with gradient from center. Very weak Hβ. Hα present.
0112 − 0045	3727 and Hβ in patches across decker. N1 and N2 in center. N2 > Hβ.
470	3727, Hβ, N2 confined to central region. Hβ > N2.
491	Weak Hα and [N II]. Hα $\gtrsim$ [N II].
*1706	3727 extended into the disk across the central region.
625	Peculiar galaxy with bright blue object displaced from center. Intense emission lines begin sharply at the blue object and extend in one direction across the galaxy face. Emission lines include 3727, He II, [Ne III], He I, H, N1, N2, [N II], [S II], [A III], [A IV].
0135 + 0716	3727 across decker. Galaxy has low SB, hence contrast with night sky spectrum is only moderate.
658	3727 across decker, but patchy.
664	Extended and tilted Hβ well into the disk.
670	Partially extended 3727 into inner disk. Velocity good and preferred over 3200: $\pm$ 240 km s^{-1} from de Vaucouleurs and de Vaucouleurs (1976).
673	Extended 3727 and Hβ across decker, but very patchy.
685	Extended 3727, Hα, [N II].
701	Thin, uniform 3727 and Hβ across decker. Tilted. Galaxy has low SB and hence low contrast with the sky.
*1743	Uniform intensity 3727 and Hβ entirely across decker. Slightly tilted.
0152 + 0621	Intense N2. Pronounced 3727, [Ne III], N2, and weak Hβ. Intensity of N2 ≫ Hβ. The emission confined to central region.
782	3727 and [N II] but no Hα! Emission confined to nuclear region.
0158 + 0804	Extended and tilted 3727 and Hβ. Galaxy is of low SB.
*1783	Extended and highly tilted 3727, Hα, [N II].
* 211	Strong 3727, slightly extended over central region. Hβ and N2 also present. Hβ ≈ N2.
922	Strong 3727, Hβ, N2. N1 also present. Intensity Hβ ≈ N2. Emission lines extend across decker. Not tilted with slit EW.
925	Strong 3727, moderate Hβ and N_2, weak N_1. Highly tilted, extended lines over decker.
941	Extended and tilted 3727, Hβ, N2. Emission lines across decker. Hβ and N2 weak and of equal intensity. N1 very weak. 3727 fairly strong. Low SB galaxy.
949	Extended and tilted 3727, Hβ, and Hα. Low SB galaxy. Patchy.
0228 + 0107	3727, Hβ, N1, N2 in a knot away from central region. 3727 extends over decker. Little or no tilt, hence measured velocity is close to systemic.
991	Very low SB galaxy. 3727 across decker.
1019	Intense N2 ≫ Hβ. 3727 and N1 present. Emission line at $\lambda_0 \approx 3424$ Å may be [Ne V]. Lines confined to bright central nuclear region.
1090	Spectra have low SB relative to sky.
1094	Very weak extended and tilted 3727 and Hβ.
0305 − 2308	In a group north of Abell 419. Intense N2: moderate strength Hβ, N1, Hα, [N II]. Excitation conditions in central region differ from those in knot away from center. In center N2 ≫ Hβ, and [N II] ≈ Hα: in knot N2 ≈ Hβ and [N II] ≪ Hα or is absent.
N1 of A 419	Brightest galaxy (E) in cluster of galaxies.
1241	Hα, [N II], and weak 3727 confined to central region. Velocity of 2168 ± 65 km s^{-1} by de Vaucouleurs and de Vaucouleurs (1976) evidently incorrect.
1249	Low SB galaxy. Tilted 3727 extends across decker.
1292	Low SB galaxy. 3727 and Hβ extend across decker.
1297	3727 confined to central region.
1326	Hβ, Hα, [N II], [S II] across central region. Hα > [N II] by factor of ~2.
*1933	3727, N2 and Hα across entire decker. 3727 strong. N2 > Hβ by factor of ~3. Disk emission not peaked at center. Separate central emission regime. Moderately low SB galaxy.
1337	Very low SB galaxy. Optical redshift, based on 4 poor lines, confirmed by 21 cm value of $v_H = 1238 \pm 15$ km s^{-1} by Fisher and Tully (1976) and $v_H = 1238 \pm 9$ km s^{-1} by Shostak (1975).
1341	Moderately low SB galaxy. Emission lines extended across central disk. Hβ, Hα, [N II], [S II], and weak N2. Hβ ≫ N2.
*1954	Weak 3727, Hβ, Hα, [N II] confined to central region. Hα ≫ [N II].
1358	3727, N2, Hα, [N II], [S II] confined to central region. N2 ≫ Hβ. [N II] > Hα. Strong 3727.
1386	N1, N2, Hα, [N II], [S II] confined to central region and tilted. N2 ≫ Hβ.
1406	3727, Hβ, Hα, [N II] extended across decker and highly tilted. Galaxy is nearly on edge.
1487	Hot spots across direct image. Emission lines in the two hot spots on the slit. Hβ, N1, N2, Hα, [N II], [S II]. N2 $\gtrsim$ Hβ. Hα ≫ [N II].
1493	Weak 3727, Hβ, Hα slightly extended beyond central region.
1494	Very low contrast between galaxy spectrum and night sky. Moderately strong 3727 extended 3/4 across the decker. Very weak Hβ and Hα, also extended.
1511	Strong but normal emission lines across decker and in hot spots on the slit. 3727, Hβ, N1, N2, Hα, [N II], [S II]. Well defined hydrogen absorption lines across the decker, visible to Hθ.
1515	Highly inclined and partly extended Hβ, Hα, [N II].
*2035	Very compact optical image. Galaxy type uncertain. High surface brightness. Looks like an E4 on Uppsala Schmidt plates but has no soft edges. Need short exposure classification plate.
1531	Weak 3727, Hα confined to central region. Good hydrogen absorption lines shortward of Hγ.
1532	3727 across slit. Very weak Hα in center. Deep absorption lines, especially Na D. Velocities by Carranza (1967) and Welch, Chincarini, and Rood (1975) evidently incorrect. Fisher and Tully's (1976) 21 cm value $v_H = 1207 \pm 15$ km s^{-1} clearly preferred.
1546	Highly inclined Hα, [N II] lines. Have lost original plate so no indication of extension of lines across the decker.
*2056	Extended and highly inclined Hβ, Hα, [N II].
1667	Emission confined to central region; but nevertheless inclined. 3727, N1, N2, Hα, [N II], [S II]. Hβ and Hα weak. N2 ≫ Hβ. [N II] > Hα.
1672	Rotationally inclined emission lines confined near the central region. Hβ, Hα, [N II], [S II] extend slightly further into the disk than N1 and N2. Intensity Hβ $\gtrsim$ N2.
1688	Extended emission lines across decker. Hβ, N1, N2, Hα, [N II], [S II]. Hβ ≈ N2. Hα ≫ [N II]. Only a slight rotational inclination if any. Slit along major axis.
1705	The listed velocity is for the emission lines that arise

Notes to Table IV

NGC *IC	
	from the *disk,* Hβ, N1, N2, Hα. The galaxy is peculiar with an intense blue object displaced from center by $\sim$1/3 disk length. The blue object has a hydrogen absorption spectrum that gives nearly same velocity as the disk emission. Disk is lumpy on direct plates. Many of these data, especially higher dispersion plates are from K. C. Freeman. Absolute magnitude of the bright blue compact object must be brighter than $M_B \simeq -13$, and hence quite unusual.
1720	Strong 3727 in nucleus, and weaker 3727 line from the disk extends across decker. No obvious rotational inclination with slit in EW direction.
1796	Low SB spectrum relative to night sky. Hβ, Hα, [N II] of uniform intensity (emission) across decker. No obvious rotational inclination, although slit was along major axis.
1800	Moderately strong 3727, Hβ, N1, N2, Hα, [N II] across most of decker. N2 > Hβ. H$\alpha \gg$ [N II]. Hydrogen line absorption spectrum in disk.
A509 = HA 85	Fairly low surface brightness for this faint Shalpey–Ames catalog galaxy.
1947	Good absorption lines. Deep Na D. Page's (1967) velocity of 547 km s^{-1} is evidently incorrect.
2090	Radio 21-cm velocity by Balkowski *et al.* (1973) of $v_H{}^{21}$ = 1805 ± 20 to 50 km s^{-1} is evidently wrong. Optical absorption lines are excellent (H, K, Ca I, Fe, Hβ, and Mg I) and give consistent values. Later 21-cm velocity by Fisher and Tully (1976) of 928 ± 15 km s^{-1} confirms the optical result.
2179	3727 fairly strong, confined to central region of high surface brightness.
2369	Weak Hβ, Hα, [N II] confined to central region.
2397	Moderate Hα confined to small central region. Suggestion of inclined thin Hα line extending into disk with rotational inclination, but must be confirmed.
2427	Excellent Stromlo plate shows Hβ, Hα, [N II], [S II] across decker, and a single absorption line. All lines consistent with $v_H = +31 \pm 23$ km s^{-1}. Radio 21-cm velocity is 1000 ± 50 km s^{-1} by van Woerden *et al.* (1977), and confirmed by Whiteoak and Gardner (1977) as $v_H = 967 \pm 15$ km s^{-1}. Optical spectrum must be from H I diffuse emission *in our Galaxy* at latitude $b = -12°$. The one apparent optical absorption line must be night sky K, since H appears to be present also but was not measured. (See note to NGC 2888.)
2442	Velocity beyond doubt. Good Na D in absorption and weak Hα and [S II] definitely present. Carranza's (1967) velocity of 712 km s^{-1} evidently incorrect.
2552	Intense 3727, Hβ, N1, N2. Strongest in center. Extends slightly into the disk. N2 $\gtrsim$ Hβ.
2701	Hβ emission alone in a bright knot of an arm on a third special spectrogram gives $v_H = 2421$ km s^{-1} confirming the general order of the nuclear value listed in the table.
2764	Good emission lines of 3727, Hβ, Hα, [N II], [S II] confined to central region.
2844	3727 in central region.
2848	Poor H and K but real. Probable 3727 across 1/2 the decker. But velocity is of poor quality. (It would have been of quality I if 3727 were absent or not real.) 21 cm velocity by Fisher and Tully (1976) gives 2030 ± 15 km s^{-1} which confirms the identification of the optical lines, but clearly supercedes the optical value.
2888	Hβ, Hα, and [N II] are present across decker at zero redshift, evidently due to our own Galaxy at $b = +16$. Similar case to NGC 2427 at $b = -12$. Absorption lines in NGC 2888 are unusually broad, indicating large velocity dispersion.
2889	Weak 3727 confined to central region.
2942	The general order of the velocity is not in question, but the plate is poor. The H and K break is clear, and the H and K lines are visible but difficult to measure.

NGC *IC	
	Rubin *et al.* (1976) 21 cm value of $v_H = 4412 \pm 20$ km s^{-1} is clearly to be preferred.
2955	Very weak 3727 and Hα. Good H and K Ca II absorption. Velocity beyond doubt. An uncertain velocity of 1750 ± 190 km s^{-1} is given by de Vaucouleurs and de Vaucouleurs (1976).
2968 2970	A bright SN (1970 l) discovered October 1970 by P. Wild on luminous bridge between NGC 2968 and NGC 2970. The pair have closely the same redshift, but differ from that of NGC 2964 which forms an apparent triplet. Photograph in Tammann (1973).
2989	3727 and Hβ across entire decker. N1 and N2 confined to central region. N2 $\gg$ Hβ.
2990	Low SB galaxy with patchy disk. 3727, Hβ, N1, N2, Hα, and [N II] strong and extend across the decker. Hβ > N2. Hα > [N II]. 3727 is strong.
2992	Intense emission lines from central region and from a displaced hot spot. Hydrogen absorption spectrum in underlying disk. 3727, Hβ, N1, N2, Hα. N2 $\gg$ Hβ. High excitation [Ne III] λ 3868 also weakly present. Paired with NGC 2993 with tidal plumes.
2993	Intense emission lines but with different excitation level than in NGC 2992 shown from the ratio Hβ/N2. Emission confined to central high SB region. 3727, Hβ, N1, N2, Hα, [N II], [S II]. H$\beta \gtrsim$ N2. Paired with NGC 2992 with tidal plumes.
2997	Highly inclined Hβ, Hα, [N II] confined to central region.
3001	Radio 21-cm velocity of 2454 ± 15 km s^{-1} by Fisher and Tully (1976) is preferred.
3021	Rotationally inclined (but only slightly) Hα across decker.
0949 + 4305	Very strong *UV* continuum and shallow H and K absorption.
3043	Very low SB. 3727, Hα extend across decker. Possibly hydrogen absorption spectrum in underlying disk.
3059	3727, Hβ, Hα, [N II], [S II] confined to central region. No obvious rotational inclination, although slit is along major axis.
3081	3727, Hβ, N1, N2 in central region. N2 $\gg$ Hβ. The high excitation nature of spectrum is indicated by presence of [Ne II] 3868, and [Ne V] 3425.
3089	Hβ, N1, N2 confined to central region. H$\beta \approx$ N2.
3175	Very low SB spectrum fills decker. Lines may not be real. Velocity in some doubt.
3191	3727, Hβ, N2 across decker but patchy. 3727 strong.
3241	Very weak Hα confined to central region.
3274	Emission lines across decker. 3727, Hβ, N1, N2. Strong 3727. N2 > Hβ. No obvious rotational inclination with slit EW.
3281	Hβ, N1, N2, Hα, [N II] confined to central region. (This early Stromlo plate does not go shortward of λ 4300, hence nothing known of 3727.) High excitation. N2 $\gg$ Hβ. Strong Na D in absorption.
3287	3727, Hβ across decker. 3727 is shortward of the last comparison line on this spectrogram, and hence velocity depends only on Hβ.
1033 − 2715	Member of Hydra I cluster (A 1060). Weak Hα confined to central region.
3312	Weak Hβ, Hα confined to central region. Member Hydra I cluster (A 1060).
3346	Inclined Hβ over half the decker. 21-cm velocity v_H = 1256 ± 15 km s^{-1} by Fisher and Tully (1976) preferred.
3347	Highly inclined Hβ, N1, N2, and Hα across decker. Low SB galaxy. H$\beta \approx$ N2.
3353	Intense high excitation lines. 3727, [Ne III] (3868, 3967), H8, Hϵ, Hδ, Hβ, N1, N2. He I (5875). N2 $\gtrsim$ Hβ.
3437	Hβ and Hα extend across decker in only one direction within the disk from the nuclear region. Higher intensity in center, uniform in disk. Slight rotational inclination with slit EW. 21-cm value $v_H = 1285 \pm 15$ km s^{-1} by Fisher and Tully (1976) preferred.
3513	Inclined 3727 and Hβ across most of decker, but strongest in central region. 21-cm velocity of v_H =

Notes to Table IV

NGC *IC	
	1105 ± 15 km s^{-1} (Fisher and Tully 1976) preferred.
1103 + 5758	Strong *UV* continuum. Inclined 3727 and Hβ across slit. Shallow hydrogen absorption lines in disk.
3547	3727, Hβ, N2 across most of decker and slightly rotationally inclined with slit EW.
3557	Very broad but good absorption lines in these early Stromlo spectra (Sa) that only extend redward of λ 4300. Na D particularly good.
3568	Observing note at telescope says Sb with very much dust. Spectrum of the geometric center slows only emission at far north end of slit. Second spectrum north of center shows continuum and Hβ, N1, N2, Hα, [N II], [S II]. Inclined Hα extends beyond continuum into disk. H$\alpha \gg$ [N II[. H$\beta \approx$ N2.
3629	Low SB galaxy. Inclined 3727 and Hβ across decker. Hydrogen absorption in the underlying disk.
3655	Weak Hβ and Hα inclined across decker. There is a second object (star?, knot?) on the slit. Either the galaxy's nucleus or this object has a very strong *UV* continuum. More detailed study needed of this interesting geometry.
3666	Low SB lumpy disk. Very faint, extended Hβ and Hα across decker.
3683	Hβ across decker, not obviously inclined with slit EW.
3705	3727 confined to central region, but could not measure on the Pc plates due to lack of He comparison lines: poor tube response shortward of λ 3819.
3732	Rotationally inclined lines 3727, Hβ, N1, N2, Hα, [N II], [S II]. H$\beta >$ N2. Lines extended across 3/4 of the decker.
3735	Very weak Hβ, N1, N2 across decker, and perhaps 3727 is present, but the Pc plate sensitivity is too low in the *UV* to be certain.
3729	Strong emission lines. 3727, Hβ, N1, N2. 3727 and N2 extended across most of the decker. Hβ more confined to central region. N2 $\approx$ Hβ.
3738	Very low SB galaxy. Intense 3727, Hβ, N1, N2 across decker. N2 $\gg$ Hβ. Hydrogen absorption spectrum in underlying disk.
3773	Strong *UV* continuum. Intense 3727, Hβ, N1 and N2 confined to central high surface brightness region. High surface brightness continuum.
3885	Weak Hβ but strong Hα and moderate [N II], confined to central bright region, nevertheless highly inclined.
3888	21-cm value $v_H = 2369 \pm 15$ km s^{-1} clearly correct and supercedes listed value of $v_H = 2049 \pm 75$ (P) km s^{-1} in Table IV based on a poor Palomar Pb plate. Hence, Sargent's (1972) value $v_H = 1966 \pm 45$ km s^{-1} also suspect.
3912	3727, and weak Hβ, N2 across most of the decker. N2 = Hβ. Weak hydrogen line absorption spectrum in the disk. Some rotational inclination with slit EW.
3952	Low SB galaxy. Strong 3727, Hβ, N1, N2 across decker, but patchy. N2 > Hβ. Probable hydrogen line spectrum in underlying disk.
3957	Very weak Hβ, Hα, [N II] confined to central region.
3963	Weak Hα and [N II] confined to central region.
3978	Rotationally inclined Hα in disk over about 1/2 the decker in this distant Sc I.
3982	3727, [Ne III] (3868), N1, N2, Hα, [N II], [S II] confined to central region. N2 $\gg$ Hβ.
4013	Low SB galaxy with very well developed narrow hydrogen absorption lines across disk and entire decker.
*750	Ordinary Hα extends slightly beyond central region.
4037	Very poor plate. 3727 present in central region. Optical velocity confirmed by 21-cm value (Fisher and Tully 1976) of $v_H = +933 \pm 15$ km s^{-1}.
4045	Hα and [N II] confined to central region.
4047	Hydrogen absorption spectrum across underlying disk.
4085	Low SB galaxy. 3727, Hβ, N2 extend across decker with uniform intensity. Hβ > N2. Strong 3727.
4088	Low SB galaxy. Weak Hβ confined to central region.
4100	Moderately strong Hα confined to central region. Strong *UV* continuum.
4123	Very blue *UV* continuum. 3727, Hβ, N2 confined to central region. Hβ > N2. N1 present but very faint.
4156	5′ NE of the Seyfert galaxy NGC 4151 but NGC 4156 is clearly a high luminosity background system. It is a well-developed SBab luminosity class I galaxy, entirely consistent with its large redshift of $v_H = 6878$ km s^{-1}. 3727 and Hβ confined to central region.
4158	Very weak 3727 confined to central region.
4219	Weak to moderate Hα and [N II] confined to central region, but highly inclined nevertheless with slit along major axis.
4290	Hα, [N II], and Hβ confined to central region, but the spectrograms are poor to fair, hence the velocity is only of moderate quality.
4298	Weak 3727 confined to central region of this moderately low SB galaxy.
4302	The listed velocity depends on a marginal identification of 3727 on a very poor plate which should not have been measured. Later 21 cm velocity by Fisher and Tully (1976) is $v_H = 1112 \pm 15$ km s^{-1}. A still later optical velocity by Eastmond (1977) is $v_H = 1120 \pm 100$ km s^{-1}.
4304	Hβ, Hα, [N II] confined to central region.
4369	Quite high SB for galaxy of this late luminosity class. Moderately strong continuum extension into *UV*. Moderately strong 3727 extended across decker. Good Hβ, Hα, [N II]. Hydrogen absorption spectrum in nucleus.
4383	Strong 3727 and Hα extended into disk. Hβ, N1, N2 with N2 $\gtrsim$ Hβ. Very strong extension of the continuum into *UV*. Need a better direct plate for morphological classification.
4385	Strong emission lines confined to central regions of the galaxy. 3727, Hδ, Hα, Hβ, N1, N2. H$\beta \approx$ N2.
4388	Intense emission lines, some of high excitation. 3727, [Ne III] (3868), [Ne III] (3967), either He II (4338) or Hγ (4340), He II (4685), Hβ, N1, N2, [O I] (6300), Hα, [N II], [S II]. The lines are most intense in the center *but have an appreciable extension into the disk.*
4412	Weak 3727, Hβ. Stronger N1 and N2. Lines confined to central region. N2 > Hβ.
4413	Narrow 3727, Hα, [N II] rotationally inclined, extending 1/2 across decker. The negative velocity is beyond doubt, but is given only a F quality class because the plate is from the *Pb* series.
4420	Low SB galaxy. Narrow 3727 and Hβ of uniform intensity across entire decker. Possibly N2 as well. Hydrogen absorption spectrum in underlying disk.
4424	Moderately low SB galaxy. 3727 of uniform intensity across entire decker. Hydrogen absorption spectrum in underlying disk.
4428	Fairly low SB disk that is patchy. Narrow 3727 and Hβ that extend over the entire decker. Small but definite rotational inclination with slit EW. Hydrogen absorption spectrum in underlying disk.
4433	3727, Hβ, N1, N2 extended over decker. H$\beta \approx$ N2 and of only moderate intensity.
4455	Very low SB galaxy. 3727 and N2 of nearly uniform intensity across entire decker. Hβ and N1 not visible. Hydrogen absorption spectrum in underlying disk.
4460	Extended 3727 and Hα, slightly rotationally inclined with slit EW. Also present and extended are Hβ, N1, and N2. N2 $\approx$ Hβ. Good hydrogen absorption spectrum in disk.
4470	Peculiar ring galaxy of moderately high SB, 10′S of NGC 4472 (the brightest member of the Virgo Cluster). Thin 3727, Hβ, N1, N2 and Hα are present, extending across entire decker. H$\beta \approx$ N2. Velocity marked uncertain in the listing because the plate-to-plate difference is 150 km s^{-1}; the plates are from the *Pb* series, but there is no question about the ve-

Notes to Table IV

NGC *IC	
	locity to within $\sim \pm 200$ km s^{-1}. The galaxy is evidently background, or at the limit of the velocity dispersion of the Virgo Cluster itself.
4487	3727 and Hβ extend across decker with good intensity into the disk. No obvious rotational inclination with slit EW.
4507	High excitation emission line spectrum, confined to the central region. 3727, [Ne III] (3868), Hγ, [O III] (4363), Hβ, N1, and very intense N2. N2 $\gg$ Hβ.
4522	Weak Hβ confined to central region.
4561	3727, Hβ, N1, N2 extend across decker with fairly uniform intensity. 3727 strong. N2 > Hβ but fairly weak.
4630	3727, Hβ, N1, N2 confined to center. Strong 3727 and Hβ. H$\beta \gg$ N2.
4658	Low SB disk with bright center. Strong 3727 extends across decker, brighter in center, but disk intensity uniform. Hβ, N1, and N2 also extended. Hβ > N2.
4684	Intense 3727 and N2, neither of which were measured; 3727 because blue response of the *Pc* plates permitted no comparison lines shortward of 3819 on these plates; N2 because intense overexposed continuum made measurement difficult. Lines confined to central region.
4691	Extended emission across decker. Mean intensity fairly uniform across the disk, except for the slight patchiness due to a partly lumpy disk. Strong 3727. Good Hβ, Hγ, and N2. Weak N1. Hβ > N2.
4694	Strong UV continuum. *Pronounced* hydrogen absorption spectrum in central region. Weak Hα confined to center.
4696	Brightest galaxy in Centaurus Cluster. Weak, rotationally inclined Hα in central region. Good Na D absorption.
4700	Extended 3727, Hβ, N1, N2 across the decker. Strong 3727. N2 > Hβ. H$\beta \approx$ N1. Hydrogen absorption spectrum in disk.
4744	Weak but highly rotationally inclined Hα and [N II] confined to central region on this lightly exposed plate.
4790	3727 and Hβ extended across decker, but brighter in high SB center. Possibly rotationally inclined. Unusual features of direct image. The arms are thin as in a high luminosity galaxy of earlier type, but there is no regular spiral pattern—hence the unusual classification as Sd II.
4818	Inclined Hβ confined to central region but extended enough to show the rotational inclination. Hydrogen absorption in disk.
4825	Highly inclined 3727 and the Ca II (H and K) absorption lines. 3727 strongest in center.
4835	Very weak, narrow but extended Hβ, Hα, [N II] across lumpy disk. Highly inclined lines (emission as well as H and K of Ca II). A good candidate for long slit technique.
4868	Highly inclined, but weak, Hβ across decker. Very lumpy disk intensity distribution. Good H and K, also highly inclined with slit EW.
4984	Rotationally inclined Hα and [N II], confined to central region.
5016	3727, Hβ, N1, N2 confined to central region. H$\beta \approx$ N2.
5026	Weak emission confined to central region. A good absorption line spectrum (deep Na D plus 3 other lines) shows, from the velocity, that the emission is [N II] not Hα. No trace of Hα on this moderate exposure plate.
5037	Very broad absorption lines indicating high internal velocity dispersion.
5054	Weak Hβ, Hα, [N II] highly inclined. Slit along major axis. Emission lines confined to central region, hence rotation curve cannot be measured from the lines. Hα > [N II].
5084	Weak Hα confined to central region. Very strong Na D in absorption.
5088	3727, N1, N2 confined to central region. Only faintest suggestion of Hβ on this plate.
5101	The weak emission line in the red is [N II], not Hα.
5121	Very shallow absorption lines. The general order of the listed redshift is beyond doubt, but the error is high due to the poor absorption lines.
5135	3727, Hβ, N1, N2 confined to central region. N2 $\gg$ Hβ.
5140	Bright E3 (or S0$_3$ by inspection of image at the telescope) that should be in the Shapley-Ames catalog but is not. In the IC 4296 group.
5161	Weak Hα, [N II] confined to central region.
5188	Hβ, Hα, [N II], [S II]. Intense Hα > [N II] (6583).
1332–3338	Weak Hβ and Hα confined to central region.
*4296	Brightest member of a group. Excellent absorption lines in red. Na D especially good, although wide, indicating a high velocity dispersion.
5247	Hβ extended across decker. No obvious inclination with slit EW.
*4329A	Extreme Seyfert galaxy with *very* broad Hβ and Hα and narrow N1, N2, [N II], [S II]. Discussed by Disney (1973) following discovery from the present plates. The galaxy is of early type with dust lane in center; therefore, type is S0$_3$. Small scale direct plates (Uppsala Schmidt) suggest only S0. The galaxy is on edge.
Ho IV	Member M101 group. Strong 3727, Hβ and N2. N1 also present. N2 > Hβ. Some extension beyond bright central knot.
5394	NW member of a pair with NGC 5395. Exceedingly weak 3727. Weak Hβ, moderately strong Hα and [N II], all confined to central region. This is the fainter component of the pair, and has a beautiful set of arms "that appear to be tidally forced by NGC 5395."
5395	Humason (HMS 1956) lists either NGC 5394 or NGC 5395. His entry is named NGC 5394 but his spectrum is probably of the brighter component which is NGC 5395. He gives $v_H = 3558 \pm 100$ km s^{-} to be compared with the table IV value of $v_H = 3542 \pm 12$ km s^{-} for NGC 5395, and $v_H = 3355$ km s^{-1} for NGC 5394. Our listed internal m.e. for both NGC 5394 and NGC 5395 is realistically too small by about a factor 3.
5398	High-excitation emission spectrum, brightest in central region but extending well into disk for the brightest lines. Intense 3727, Hβ, N1, N2, and Hα. N2 > Hβ. Weaker lines of He II (3833), He I (3888, 4471, 5875), and [Ne III] (3868, 3967). Hδ also present.
5430	Weak Hβ and Hα confined to central region. Only Hβ measured on one plate for the redshift.
5464	Hβ, N1, N2, Hα, [N II], [S II] extend across decker and are rotationally inclined. N2 > Hβ. All lines are intense relative to fairly low SB continuum of the galaxy. Nothing known of lines shortward of 4300 Å on this *Sa* series plate.
5477	High excitation emission spectrum in this Ir IV-V member of the M101 group. Lines are only slightly extended beyond central region which gives the optical continuum. Strong 3727, Hβ, N1 and N2 with N2 > N1 > Hβ. Weaker lines of [Ne III] (3868), He I (3888), Hϵ (3970), Hδ (4101), Hγ (4340). Probably blend of Hϵ + [Ne III] for the 3970 line.
5483	Extended very weak Hβ, Hα, [N II], rotationally inclined.
5486	3727 extended across decker but patchy with greatest intensity in a region away from center of continuum light. Hβ, N1, N2 also extended but not across entire decker. N2 > Hβ.
5595	3727, Hβ, N1, N2 extended across decker. Hβ > N2. No obvious rotational inclination with slit EW.
5600	Weak 3727 and Hβ extended across decker on longer exposures, but more intense on one side of the disk than the other. Strong hydrogen absorption spectrum on this same side of the disk.
5643	Strong emission spectrum on these Stromlo *Sa* plates

Notes to Table IV

NGC *IC	
	that record only longward of 4300 Å. Line intensity very high in region of the central continuum, but extends with greatly reduced intensity into the nearby disk. N2 ≫ Hβ. N1 > Hβ. Hα, [N II], [S II] also present, but [N II] (6583) ≳ Hα. [O I] (6300) also present in strength about equal to that of [S II] (6717, 6731).
5645	Spectrum is of the SE knot. 3727, Hβ, N2 slightly extended beyond central continuum.
5660	Very weak 3727 and Hβ, confined to region of the central continuum.
*4444	Intense continuum with moderately strong extension into *UV*. 3727, Hβ, Hα, [N II] extend across entire decker with uniform intensity. But the curious aspect of the spectrogram is deep H and K absorption that appear to be in the galaxy continuum, but at zero redshift. There was slight moon, but spectrum does not appear to be contaminated. The simplest interpretation is that the zero velocity absorption lines *are* due to contamination. The absorption lines that show zero redshift are H and K, Hδ (4104), Ca I (4226), G (4304), Hβ (4863), and Na D (5892), all expected in a moonlit spectrum. Confirmation needed since the H and K lines are deep and cut into a very strong galaxy continuum.
5728	Intense N2 in central region. Also strong N1, Hα, and [N II]. Hβ, [S II], and the high excitation [O I] (6300) also present. Overexposed lines in center are flared longward (N1, N2, [N II]) as if they were double. Effect may or may not be present in Hβ and Hα. Higher dispersion needed to investigate this possible multiple velocity structure.
5739	3727 confined to central region.
5861	Very low SB spectrum. Single emission line entirely across decker with uniform intensity. 21-cm velocity of $v_H = 1855 \pm 15$ km s^{-1} (Roberts 1977, Fisher and Tully 1976) shows the line to be Hα. The best plate here gives an optical velocity of $v_H = 1855 \pm 30$ km s^{-1}. The weaker plate gives $v_H = 1774 \pm \sim 50$ km s^{-1}, from which the straight mean is listed in Table IV.
5905	Plate taken in *Pb* series but with higher dispersion using a grating that gives 250 A/mm. Weak Hβ, Hα, [N II] confined to central region.
5949	Weak 3727 of uniform intensity across decker.
5967	Weak extended Hα and [N II], slightly inclined due to rotation.
6052	Extended lines across much of the continuum disk. Strong 3727, Hβ, N2, Hα. N1 and Hγ also present. N2 ≳ Hβ. It is rare to see Hγ in such strength: here Hγ ≈ Hβ. The Hδ line is only marginally visible.
6300	N1, N2, Hα, [N II] confined to central region. N2 ≫ Hβ. Hβ is only marginally visible. [N II] > Hα.
6699	Rotationally inclined Hα and [N II] extending slightly beyond central continuum.
6707	Highly inclined but weak lines of Hβ, Hα, [N II] that extend over entire decker with slit along major axis.
6708	Moderately strong highly inclined Hβ, Hα, [N II] halfway across the decker.
6754	Weak Hα and [N II]. Hα > [N II]. Extension of very weak Hα across entire disk, well inclined by rotation. The decker on this spectrogram was set exceptionally wide, so there may be a small zero point error due to slit curvature at Hα, not taken into account. However, no curvature is evident by measurement of the nearby night sky 6300 [O I] line that extends across the entire slit.
*4837	Moderately strong emission lines extended across central disk and slightly inclined. 3727, Hβ, N2, Hα, [N II]. Hβ > N2. N1 only marginally visible.
6770	Single weak emission line on this *Sa* spectrogram (λ > 4300 Å) is [N II] (6583), not Hα. Confined to central continuum.
6780	Weak Hα and [N II] confined to central continuum.
6808	Moderate Hα and [N II] across decker and highly inclined. Hα > [N II]. Good Na D in absorption.
Cygnus Cluster	The three galaxies listed in the table are, in order of RA, numbers 7, 17, and 23 from the listing given by Sandage (1976). The cluster contains the radio source 3C 402, and velocities from other spectra are given in Table V. 3C 403G3 in that table is the same as number 7 here. The listed velocities in each table are from independent plates.
6835	3727 confined to central continuum.
6854	Faint companion in envelope of primary. Nuclei of both galaxies on slit. Listed velocity refers to primary, although there is no large (<200 km s^{-1}) velocity difference between the two nuclei.
6861	Excellent Na D absorption line in this E6 galaxy. Slit was along major axis. Very pronounced rotational inclination of Na D. Sharpest inclination in center region with break in the angle of inclination in the envelope immediately outside central continuum. This is a Stromlo *Sa* plate (λ > 4300). Nothing known about presence of 3727.
*4970	Weak Hβ, Hα confined to central continuum.
6890	N1, N2, Hα, [N II] confined to central continuum. Hα extended and slightly inclined over entire decker. [N II] > Hα. No trace of Hβ on this plate, hence N2 ≫ Hβ. Nothing known of emission lines shortward of 4300 Å.
A2021 = New 5	Extraordinarily strong, well defined Na D absorption. Also well defined (narrow) absorption lines of 5175, 5268, and 5331. The Na D lines appear actually to be resolved (Δλ = 6 Å, which is just within the capability of this plate as judged from the resolution of the 5331 and 5341 Ne comparison lines); hence, the velocity dispersion of the galaxy must be small. Inclined Hα and [N II] extend over central continuum but not into the disk. Hα > [N II].
6907	Hβ, Hα, [N II] confined to central continuum.
*5052	Very long slit. Extended emission lines over entire disk, significantly inclined. Excellent for rotational velocity study. 3727, Hβ, N1, N2, Hα, slightly patchy across disk. Hydrogen absorption spectrum in disk (Hγ particularly strong, plus H and K with Hε, and λ 3835 of Hη).
*5063	Intense and moderately broad emission lines (∼5 Å) as in low excitation Seyfert galaxies. Lines are confined to narrow central continuum region, but are very highly inclined over this small radial distance. Hβ, N1, N2, [O I] (6300), Hα, [N II], [S II]. On longer of the two exposures, lines are extended into the disk, especially N2, hence rotational velocity studies are possible. N2 ≫ Hβ. The Keplerian reversal in the N2 velocity curve may be visible on the heavily exposed plate.
6970	Very poor lines on this plate. Possible Hα, but marginal. Carranza (1967) gives $v_H = 5155$ km s^{-1} which agrees with the present value: Evans and Malin (1965) give $v_H = 5543 \pm 110$ km s^{-1} which does not.
6984	Weak but greatly extended 3727, Hα, [N II]. [N II] > Hα. Slightly rotationally inclined.
7007	The very weak emission confined to the central region in [N II], not Hα, but since [N II] (6583) is so weak in itself, all that can be concluded from this plate is that [N II] > Hα.
7059	3727 and Hα extend beyond the central continuum and are rotationally inclined.
7064	Very long-slit spectrogram. Thin, well-defined emission lines across entire disk. 3727, Hβ, N1, N2, Hα slightly rotationally inclined. Hydrogen (plus H and K of Ca II) absorption line spectrum in underlying disk of low SB.
*5135	Poor plate of Palomar *Pb* series. 3727, and intense N2. Hβ, and N1 also present. N2 ≫ Hβ. Velocity beyond doubt. Lines are confined to central bright continuum region.
7125	3727, Hβ, Hα, [N II] extends over central region which is broad. The emission lines are weak. Velocity beyond doubt.

Notes to Table IV

NGC *IC	
7126	Companion to NGC 7125. Extended weak Hβ and Hα, slightly rotationally inclined.
7192	Member of a group with NGC 7179, 7191, 7199, and 7219.
*5181	The absorption lines are excellent on this plate. Na D is nearly resolved (Δλ = 6 Å), as is 5175 (5168, 5183). The 5331 and 5268 lines are sharp, indicating small velocity dispersion in this $S0_1(8)$ galaxy.
7233	This Stromlo Sa series plate shows emission lines that are longward of λ 4300 Å. Hβ, N1, N2, Hα, [N II], and [S II] are present with only a moderate extension into the galactic disk. N2 ≈ Hβ. Hα > [N II] > [S II]. Lines are all strong to quite strong.
*5186	Very long slit plate. Inclined lines, with change of slope between center and disk value, over part of slit. Very weak 3727. Strong Hβ, Hα, [N II]. Hα > [N II]. Good Na D in absorption. Hydrogen absorption spectrum in the disk.
*5201	Hβ, N1, N2, Hα, [N II] confined to very central region. N2 ≫ Hβ.
7300	Marginal suggestion of Hγ and Hβ, but velocity could be totally wrong.
7307	Emission lines generally confined to central region, except Hα which has a slight extension into the disk. 3727, Hβ, N2, Hα, and very weak [N II] (6583). Hβ ≈ N2. N1 only marginally visible on this plate.
7418	Very weak Hβ, Hα, [N II] confined to central continuum region.
7428	Weak Hα, [N II] extended partly across decker and slightly inclined.
2255 + 0202	Rotationally inclined Hβ half way across the decker.
*5273	Weak Hβ and Hα confined close to the central region.
7460	Extended 3727 and Hβ far into disk with small but definite rotational inclination with slit EW.
7599	3727, Hβ, Hα, [N II] extended across entire decker. Very low SB galaxy. The emission lines are of nearly uniform intensity over the slit. Slight rotational inclination. Hα > [N II].
*5325	Weak narrow Hα extends across entire decker, slightly rotationally inclined. [N II] also present with Hα > [N II].
7689	Very long slit. Hα and [N II] across much of the disk but exceedingly weak. Slight rotational inclination.
7690	3727, Hβ, N2, Hα, [N II] extends well beyond the high surface brightness central region. The emission lines are of moderately high intensity. N2 ≈ Hβ. Continuum extends well into the *UV*.
2342 + 0646	3727 confined to central region.
7750	3727 confined close to central region.
7756	Extended but very weak 3727 and Hβ across entire decker.
2346 + 0552	Strong 3727 and weaker Hβ, N1, and N2 extended across half the decker. N2 ≳ Hβ.
2348 + 0046	Weak 3727 and very weak Hβ extended across most of decker. Extension of the continuum into the *UV*.
*1515	3727, [Ne III] (3868), N1, N2 well confined to central continuum region. Hβ marginally visible. N2 ≫ Hβ.

fair (*F*), poor (*P*), to impossible (*I*). The quality refers not only to the technical aspects of the plate (focus, correct exposure, etc.) but also the quality of the lines (intrinsically strong or weak), and hence reflects the quality of the redshift. In general, *E* means an exceptional plate, good lines, good focus and exposure, etc.; *G* is a really good plate with no question of the velocity; *F* means that the velocity is not in question, but either the lines are poor or the technical quality of the plates is poor; *P* means the velocity may be questionable. Velocities on plates of quality *I*, which means "impossible but measured anyway," may not be real, but are included as guides to future remeasurement. The error analysis (Sec. III) shows that the true *external* 1 σ errors vary from ≈40 km s^{-1} to 120 km s^{-1} for quality classes *E* to *F*.

13. Comments: Group or cluster membership, companions, types, or spectral features are mentioned where appropriate.

A series of notes on the spectra follow Table IVa. These are generally concerned with emission lines, their intensity, and their spatial distribution across the face of the galaxy.

A listing of redshifts for radio galaxies and for galaxies associated with them is given in Table V. Some have been published previously, as noted in column (14); most of the others are new. Many of the new redshifts are for the Bologna sources (designated as B2) from identifications due to Grueff and Vigotti (1968, 1972) and were obtained at the request of Grueff for his statistical studies. The coordinates for the B2 sources are from the listed references.

Finally, redshift data for members of *clusters* of galaxies observed during the present work, taken from Tables IV, IVa, and V are summarized in Table VI. The mean redshift, corrected to the centroid of the Local Group, is listed in column (2), *obtained only from the galaxies observed here.* More correct mean values for the Fornax, Centaurus, and Virgo clusters, for example, can be obtained by combining these new data with redshifts already in the literature for additional cluster members. The 26 new redshifts in Virgo obtained here have been used in a recent discussion of the kinematics of that cluster (Sandage and Tammann 1976).

III. INTERNAL, EXTERNAL, AND SYSTEMATIC ERRORS OF THE REDSHIFTS

The factors that contribute to errors in galaxy redshifts from low-dispersion plates, discussed by Humason (HMS, p. 100), and by Mayall (MHS, pp. 117, 134) apply here as well. We can generally distinguish and determine the internal, the external, and the systematic errors from the following tests.

a) Internal Errors

These are of two kinds: (1) measuring errors and (2) plate errors. The *measuring errors* were determined by

TABLE IVa. Supplemental list of velocities for nearby galaxies.

Name (1)	α(1950) (2)	δ(1950) (3)	ℓ^{II} (4)	b^{II} (5)	Type (6)	Plates (7)	Lines a (8)	Lines e (8)	v_H (9)	v_o (10)	m. e. (11)	Q (12)	Remarks (13)
									km s^{-1}	km s^{-1}	km s^{-1}		
NGC 3464.....	10 52 15	-20 48.1	270	+34	Sc(s) II	1 Pd	3	-	+3836	+3588	66	F	Isolated
NGC 3485.....	10 57 24	+15 06.6	233	+61	SB(s)bc II	2 Pd	6	1	+1513	+1404	37	G	Isolated
NGC 3506.....	11 00 35	+11 20.3	240	+60	Sb(s) I-II	2 Pd	2	2	+6489	+6359	21	E	Isolated
NGC 3614.....	11 15 34	+46 01.2	162	+64	Sc(r) I	1 Pd	3	-	+2293	+2335	34	F	
NGC 3659.....	11 21 08	+18 05.4	233	+68	Sc(s) III	1 Pd	3	2	+1354	+1263	54	G	N 3607 Group? Leo
NGC 3673.....	11 22 44	-26 27.8	280	+32	SBb(rs) II	1 Pd	3	-	+2396	+2146	50	PI	Isolated
NGC 3981.....	11 53 35	-19 36.9	286	+41	Sb: (I)	1 Pd	3	-	+1809	+1591	91	F	N 4038/39 Group
NGC 3985.....	11 54 06	+48 36.9	146	+66	S	2 Pd	2	4	+ 958	+1026	17	E	UMa cluster
NGC 4094.....	12 03 18	-14 15.9	287	+47	Sbc(s) II	1 Pd	-	2	+1363	+1167	37	G	
NGC 4157.....	12 08 35	+50 45.8	138	+65	Sbc	1 Pd	5	-	+ 681	+ 704	34	G	UMa 750 km s^{-1} Group?
NGC 4389.....	12 23 10	+45 57.7	137	+71	SB pec	2 Pd	3	2	+ 752	+ 820	21	E	UMa 750 km s^{-1} Group?
NGC 4462.....	12 26 44	-22 53.6	296	+39	SBab(s) I-II	2 Pd	3	-	+1866	+1658	51	F	Isolated
NGC 4592.....	12 36 45	-00 15.4	296	+62	Sc III-IV	1 Pd	-	2	+1281	+1156	78	F	Associated w N 4517?
NGC 4635.....	12 40 09	+20 13.2	287	+83	Sc II-III	1 Pd	1	1	+1022	+ 985	42	G	Virgo Region
NGC 4653.....	12 41 17	-00 17.2	299	+62	SBb(s) I.3	1 Pd	3	-	+2577	+2455	36	G	
NGC 4668.....	12 42 58	-00 15.7	300	+62	SBm III	1 Pd	1	1	+1701	+1580	50	F	Companion N 4666
NGC 4765.....	12 50 42	+04 44.1	304	+67	Sd III	1 Pd	-	4	+ 772	+ 676	19	E	N 4636, 4665, 4688, 4701 etc.
NGC 4891.....	12 58 15	-13 10.9	306	+49	Sab(r) I	2 Pd	2	1	+2632	+2475	34	G	N 4899, 4902
NGC 4899.....	12 58 19	-13 40.6	306	+49	Sc(s) II.8	1 Pd	2	-	+2653	+2494	53	F	N 4891, 4902
NGC 4904.....	12 58 25	+00 14.5	308	+63	SBbc(rs) II-III	2 Pd	2	2	+1470	+1362	33	F	
NGC 4928.....	13 00 26	-07 49.0	308	+55	Sbc(s) III.3	2 Pd	1	1	+1759	+1622	71	F	
NGC 4951.....	13 02 31	-06 13.7	309	+56	Sc(s) II:	1 Pd	3	-	+1195	+1065	66	F	
NGC 4999.....	13 07 00	+01 56.4	313	+64	SB(r) b	1 Pd	2	-	+3105	+3010	96	P	Isolated
Anon.........	13 20 46	+39 00	96	+77	E	1 Pd	5	-	+26,287	+26,355	71	G	1^m W of N 5112
NGC 5172.....	13 26 53	+17 18.6	346	+77	Sb I	2 Pd	2	-	+4367	+4350	91	F	Isolated
NGC 5230.....	13 33 05	+13 55.8	342	+73	Sc(s) I	2 Pd	4	-	+6893	+6867	45	F	N 5222, 5226?
NGC 5313.....	13 47 37	+40 14.0	83	+72	(Sb II)	1 Pd	4	-	+2606	+2696	42	G	N 5311, 5326 etc.
NGC 5326.....	13 48 42	+39 49.2	82	+72	(Sb- II)	2 Pd	6	-	+2554	+2643	22	G	N 5311, 5313 etc.
NGC 5347.....	13 51 04	+33 44.2	62	+75	(SBb^+ III)	1 Pd	4	3	+2296	+2364	23	G	
NGC 5351.....	13 51 18	+38 08.5	76	+73	SBb(rs) I	1 Pd	3	-	+3875	+3960	90	F	
NGC 5362.....	13 52 48	+41 33.7	84	+71	(Sbn)	1 Pd	5	-	+2262	+2360	57	F	N 5350, 53, 54, 55, 58, 71
IC 4351.......	13 55 03	-29 04.3	320	+31	Sb	1 Pd	2	-	+2587	+2422	15	F	Isolated?
NGC 5534.....	14 15 01	-07 11.2	337	+50	SBa?	3 Pd	-	2	+2600	+2522	42	F	Isolated
NGC 5592.....	14 21 02	-28 27.9	326	+30	Sbc(s:) I	2 Pd	2	1	+13,511	+13,368	80	F	
NGC 5597.....	14 21 42	-16 32.2	333	+41	SBc(s) II	2 Pd	-	4	+2677	+2573	39	G	Pair with N 5595
NGC 5691.....	14 35 20	-00 10.9	350	+52	S(B)b pec III:	2 Pd	1	5	+1876	+1845	20	G	N 5713
NGC 5740.....	14 41 52	+01 53.4	355	+53	Sb(r) I	1 Pd	2	1	+1802	+1785	40	F	N 5746
NGC 5750.....	14 43 37	-00 00.8	353	+51	SBab(s) I pec	1 Pd	4	-	+2023	+2000	69	F	
NGC 5756.....	14 44 48	-14 38.4	340	+39	(Sc pec)	2 Pd	3	1	+2183	+2105	30	G	
NGC 5757.....	14 44 57	-18 52.1	337	+36	SB(r)a	3 Pd	2	2	+2771	+2678	23	G	
NGC 5936.....	15 27 39	+13 09.6	20	+50	Sc(r) I-II	1 Pd	-	2	+4138	+4204	32	FG	
NGC 6902.....	20 21 04	-43 49.0	356	-34	SBa?	1 Sa	4	-	+2723	+2708	34	F	

Notes to Table IVa

NGC

3448 A spectrogram by Humason was, for some reason, not included in the HMS (1956) catalog. Nonimage tube plate of excellent quality. Intense 3727 across half of decker. Probable [Ne III] (3868), and weak Hβ. Several 21-cm velocities from the literature give $\langle v_H \rangle = 1357 \pm 9$ km s^{-1}.

3485 Just a smell of 3727, confined to central region.

3506 Good 3727 across decker, but patchy. Very weak Hβ in one of the patches away from central region. No obvious rotational component with slit EW.

3659 Extended Hβ across decker. Good intensity in the disk.

3673 Optical value listed clearly in error as determined from poor plate (quality PI). 21 cm by Fisher and Tully (private communication) gives $v_H = 1933 \pm 15$ km s^{-1}.

3985 Intense 3727, Hβ, N2 but patchy across decker. N1 also present. N2 $\gtrsim$ Hβ. Hydrogen absorption spectrum in central region.

4094 3727 extended across decker. Weak Hβ also present. Fairly low SB galaxy.

4389 Intense 3727 across most of decker, but patchy. Hydrogen absorption spectrum in fairly low SB disk. Hδ, Hγ, Hβ across most of decker. No obvious rotational inclination with slit EW.

4592 Extraordinarily intense 3727 across entire decker. Low SB galaxy. Hβ also extended across slit. Spectrum overexposed on night sky continuum, but order of the redshift not in doubt.

4635 3727 extended across decker. Slight rotational component with slit EW.

4668 Strong 3727 across decker. Hε in absorption across disk of this moderate to low SB galaxy.

4765 Intense 3727, N2 across decker. Less intense Hβ and N1, also extended across entire slit. N2 > Hβ. Emission lines brigher in higher SB central region.

4904 Strong 3727 and Hβ. Also N1 and N2. Hβ > N2. Lines confined to central region of galaxy, although weak 3727 extends across decker, and is rotationally inclined.

4928 Moderately strong 3727 across decker.

5347 3727, N1, N2 confined to central region. N2 ≫ Hβ which is just marginally visible.

5534 Moderately strong 3727 and Hβ in central region. Plates out of focus, so velocity has higher error than would otherwise apply for a spectrum of this nature.

5597 Very blue *UV* continuum. Strong 3727, Hβ, N2 confined to central region.

5691 Intense 3727 across decker. Also strong Hβ and N2, similarly extended. Weaker Hγ and N1 present. Hβ ≈ N2.

5756 Weak Hβ emission confined to central region.

5757 Moderately strong *UV* continuum. Weak 3727 and moderately strong Hβ confined to central region.

5936 3727 and Hβ across decker.

TABLE V. Redshifts for radio sources or associated galaxies.

Name (1)	Other (2)	α (1950) (3)	δ (1950) (4)	l^{II} (5)	b^{II} (6)	I.D. (7)	Plates (8)	Lines a (9)	Lines e (9)	Type (10)	v_H km s^{-1} (11)	v_0 km s^{-1} (12)	m.e. km s^{-1} (13)	Remarks (14)
3C 29	...	00 55 01.4	-01 39 51	127	-64	1,3	1 N	3	-	EO	13,414	13,519	127	Ap. J. 150, L145
3C 76.1	...	03 00 27.2	+16 14 37	163	-36	1,3	1 N	2	-	E2	9,778	9,849	150	Ap. J. 150, L145
3C 135	...	05 11 33.8	+00 53 08	200	-21	1,3	1 N	2	-	E	38,189	38,093	60	Ap. J. 150, L145
3C 192	...	08 02 35.5	+24 18 28	198	+26	1,3	1 N	-	2	EO	17,947	17,864	39	Ap. J. 145, 1
B2 0828+32	4C 32.25	08 28 21	+32 29 36	190	+34	5	1 Pa	4	-	(EO)	15,373	15,330	69	
B2 0836+29B....	4C 29.30	08 36 58	+29 59 28	194	+35	5	1 Pa	4	-	(E2)	19,302	19,243	35	
B2 0838+32A ...	4C 32.26	08 38 06	+32 35 47	192	+36	5	1 Pa	2	1	E2/SO	20,800	20,750	179	North component: Brightest
B2 0838+32A ...	4C 32.26	08 38 06	+32 35 47	192	+36	5	1 Pa	3	1	EO	20,893	20,843	69	Southwest component
B2 0844+31B ...	4C 31.32	08 44 54	+31 58 22	192	+37	5	1 Pa	3	-	(E1)	20,217	20,167	77	
GV 49	...	09 16 12.5	+34 13 17	191	+44	4	1 Pa	6	-	SO	5,065	5,021	31	Outskirts of Abell 779
NGC 2832......	...	09 16.8	+33 59	191	+44	-	2 Pa	7	-	-	6,964	6,923	25	Central galaxy in Abell 779
B2 0923+33.....	4C 32.29	09 23 12	+33 00 30	193	+46	5	1 Pa	2	-	EO	41,884	41,837	~ 50	Velocity either right or dead wrong
3C 223		09 36 50.9	+36 07 35	188	+49	1,3	1 N	-	7	E2	41,050	41,023	30	Ap. J. 145, 1
3C 223.1		09 38 17.4	+39 58 15	183	+49	3	1 N	-	3	E5	32,244	32,234	64	Ap. J. 145, 1
3C 227		09 45 06.6	+07 39 17	228	+42	1,3	1 N	-	4	N	25,830	25,664	30	Ap. J. 150, L145
3C 236		10 03 05.4	+35 08 49	190	+54	1,3	2 N	-	1	E3	29,667	29,636	35	Ap. J. 150, L145
B2 1037+30.....	4C 30.19	10 37 42.9	+30 13 38	200	+61	5	1 Pa	5	1	(E)	27,314	27,264	40	
B2 1040+31A ...	...	10 40 31.4	+31 46 42	196	+62	5	2 Pa	4	-	(E)	10,541	10,502	50	
B2 1113+29.....	4C 29.41	10 13 54.2	+29 31 40	202	+69	5	1 Pa	5	-	E2	15,023	14,983	34	In a cluster. South galaxy
B2 1113+29.....	4C 29.41	10 13 54.2	+29 31 40	202	+69	5	1 Pa	4	-	E3	14,610	14,570	68	In a cluster. North galaxy
B2 1205+34A ...	...	12 05 00	+34 09 19	174	+79	5	1 Pa	1	4	EO	23,720	23,726	50	
B2 1316+29.....	4C 29.47	13 16 43.4	+29 54 18	58	+84	5	1 Pa	4	-	E1	21,573	21,600	85	
3C 285		13 19 5.1	+42 50 57	102	+74	1,3	1 N	-	1	E5 or S	23,811	23,892	~ 50	Only λ 3727. Ap. J. 150, L145
B2 1321+31AB...	NGC 5127	13 21 28	+31 49 00	69	+82	5	1 Pa	5	-	E2	4,876	4,915	62	NGC 5127 between the double radio source
3C 287.1		13 30 20.5	+02 16 09	326	+63	1,3	1 N	-	5	N	64,758	64,682	30	Ap. J. 145, 1
B2 1332+35.....		13 32 04.2	+35 08 35	75	+78	5	1 Pa	4	-	(E3)	7,154	7,214	47	
3C 293		13 50 03.4	+31 41 32	56	+76	1,2	1 N	-	1	E5	13,493	13,553	~ 40	Only λ 3727, Ap. J. 145, 1
3C 296	NGC 5532	14 14 26.0	+11 02 15	357	+64	1,3	1 N	2	-	E4	7,117	7,110	39	Ap. J. 145, 1
3C 303		14 41 22.9	+52 14 15	90	+58	3	1 Pa	-	5	N	42,319	42,478	30	
3C 305		14 48 17.6	+63 28 36	103	+49	1,3	1 N	2	4	Sa	12,373	12,565	53	Ap. J. 145, 1
3C 318.1 G1 ...		15 19 25.5	+70 53 07	12	+49	-	1 Pa	5	-	E3/SO	13,176	13,217	61	
3C 318.1 G2 ...		15 19 24.3	+07 54 46	12	+49	-	1 Pa	5	-	E2	14,235	14,276	49	
3C 318.1 G3 ...		15 19 10.9	+07 53 44	12	+49	-	1 Pa	4	-	EO	13,643	13,684	45	
3C 318.1 G4 ...		15 19 05.7	+07 55 01	12	+49	-	1 Pa	2	-	E2	12,984	13,025	~ 60	
T on 256.......		16 12 00	+26 13	43	+45	6	1 N	-	10	N	39,213	39,358	60	Ap. J. 141, 1560
3C 357.........		17 26 27.4	+31 48 24	56	+30	1,3	1 Pa	4	-	E1	50,103	50,318	160	
3C 371		18 07 20	+69 49	100	+29	3	1 N	-	1	N	15,000	15,258	~ 30	Only λ 3727. Ap. J. 145, 1
3C 381		18 32 24.3	+47 24 39	76	+22	1,3	1 N	-	5	EO	48,149	48,419	30	Ap. J. 150, L145
3C 390.3		18 45 37.8	+79 43 03	112	+27	1,3	1 N			N	16,829	17,077	45	Ap. J. 145, 1
3C 402 G1		19 40 21.1	+50 30 53	83	+13	7	1 Pa	2	-	E3	7,902	8,192	~ 40	
3C 402 G3		19 40 25.7	+50 28 39	83	+13	7	1 Pa	4	-	E1	7,642	7,932	37	
3C 449		22 29 07.7	+39 06 04	95	-16	1,3	1 N	3	-	E2	5,122	5,409	106	Ap. J. 150, L145
3C 455		22 52 33.8	+12 57 14	84	-41	1,2	1 N	3	-	E4	9,706	9,931	127	Ap. J. 150, L145

Sources for the Identifications:

1. Veron (1966).
2. Wyndham (1965).
3. Wyndham (1966).
4. Grueff and Vigotti (1968).
5. Grueff and Vigotti (1972).
6. Iriarte and Chavira (1957).
7. Sandage (1976).

comparing duplicate measurements of the same plate, measured either by the same person, or by various combinations of the three measures (Burd, Lowen, Sandage on the Sa series). As there was no detectable difference between the three people, all duplicate measurements have been treated alike.

A total of 60 plates were measured twice; an additional seven plates were measured three or more times. The individual redshift differences from the mean (i.e., $v_i - \langle v \rangle$) of the *same* plate measured several times clearly depends only on the measuring error. The distribution of these residuals for *E* and *G* plates show σ (measuring) = 41 km s^{-1}, which corresponds to a random error per plate of ~0.7 Å. This result is nearly identical with that obtained from Humason's material (HMS, Fig. 1) where σ (measuring) = 39 km s^{-1} for good quality plates.

Plates of quality class *F* to *P* were often remeasured in an attempt to improve the first measurement for some specific reason—hence, it is not proper to include the statics for these in evaluating the measurement error *per se.* Nevertheless, including them increases σ (measuring) only to 51 km s^{-1}, again a result nearly identical with Humason's (HMS p. 101).

Almost all the remeasured plates had only absorption lines. The measuring errors for emission-line galaxies are undoubtedly much smaller, but have not been determined.

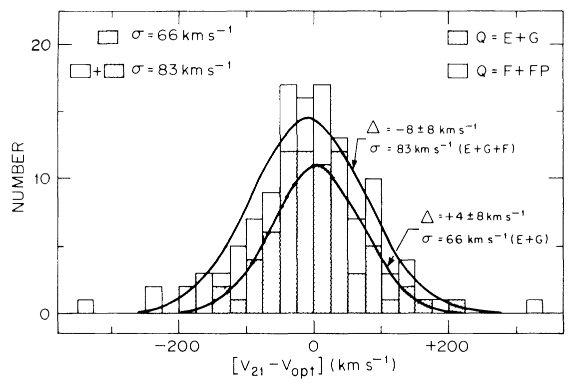

FIG. 1. Distribution of true (external) errors for quality class $E + G$ (hatched) and for $F + FP$ (open bars) plates. The combined quality classes ($E + G + F + FP$) have σ (external) = 83 km s^{-1}. Quality class $E + G$ alone has σ (external) = 66 km s^{-1}. Mean differences between 21-cm and optical values are $\Delta_{21-\text{opt}} = +4 \pm 8$ km s^{-1} for quality class $E + G$; $\Delta_{21-\text{opt}} = -8 \pm 8$ km s^{-1} for combined classes $E + G + F + FP$. The optical values are from Tables IV and IVa, and the summary of external errors is from Table X.

The *plate errors* can be evaluated in two ways. (a) *internal* errors can be determined on a given plate from the residuals of individual lines from the mean [these are the m.e. listed in column (11) of Tables IV and IVa], and (b) plate-to-plate differences of a given galaxy follow directly from the comparison of duplicate plates of the same galaxy. Both errors are a combination of the measuring error and the plate error (emulsion creep, definition of line centers when the signal-to-noise is marginally small, etc.).

(a) *The internal mean errors,* determined from line residuals, have been described in Sec. IIc. The distribution of these errors among the program galaxies is shown in Table VII (together with the distribution of quality classes). Evidently, most galaxies have internal mean errors in the range $20 \lesssim$ m.e. $\lesssim 60$ km s^{-1}. (It will be shown later that the true 1 σ external errors average 2.5 times these formal internal mean errors.)

(b) *The distribution of plate-to-plate redshift differences* determined from duplicate plates is set out in Table VIII. The error of plate i is taken as $(v_i - \langle v \rangle)$, relative to the mean redshift $\langle v \rangle$ determined from all available plates. Column (2) gives the number of such differences (for repeats there are generally only two plates of each galaxy, hence the number of galaxies in these comparisons is of order $n/2$). Column (3) is the 1 σ value of the redshift differences from the mean. The data are separated into quality classes, with the Palomar Pb series treated alone. As expected, σ_P^I (the plate-to-plate internal sigma) increases toward poorer quality classes and especially for the Pb series. Because generally $\sigma_P^I > \sigma$ (measuring), these plate-to-plate differences are due to plate errors as well as errors of measurement.

The true external error for each quality class, determined from the 21-cm overlap described next, is listed in column (4) of Table VIII. This true external error is larger than σ_P^I by the ratio shown in the last column.

TABLE VI. Clusters of galaxies in the sample.

Name	v_0 km s^{-1}	Number observed
A119	11645	Brightest E
A419	12268	Brighest E
Fornax	⟨1181⟩	Five new values
A548	⟨11705⟩	Two galaxies
A779	6923	Central cD
4C29.41	⟨14776⟩	Two brightest
A1060	⟨3727⟩	Seven new values
1123-3507	9520	Single E3 galaxy
Virgo	⟨1075⟩	26 new values
Centaurus	⟨3150⟩	14 new values
1318-2532	14949	Brightest E
IC4329	⟨4350⟩	10 new values
Cygnus	⟨7800⟩	5 new values

TABLE VII. Distribution by listed mean errors and by quality class.

m.e. km s^{-1}	n	Q	n
0–19	106	E	126
20–39	278	G	314
40–59	194	F	177
60–79	59	P	43
80–99	29	$PI + I$	14
100–119	7		
120–139	2		
TOTAL	675		674

b) External and Systematic Zero-Point Errors

Many of the late-type galaxies of classes Sb to Sm in the present list have known 21-cm radio redshifts, from which the external errors and a test of the zero-point error of the optical system follow in the manner studied by Lewis (1975, 1976).

In addition to the literature radio redshifts used in the present comparisons (references to the relevant radio data are listed in the *RSA;* there are 22 literature sources of 21-cm that overlap with the present work), both B. Tully and M. Roberts generously made their many unpublished 21-cm values available for galaxies in common with the present list (Fisher and Tully 1976; Roberts and Peterson 1978).

An early comparison with a short list, again supplied by Tully in 1975, showed a systematic zero-point correction of $\sim +30$ km s^{-1} to be applied to the optical

TABLE VIII. Distribution of internal plate-to-plate error compared to external error.

Q	n	σ_P^I km s^{-1}	$\sigma_{21\,\text{cm}}^E$ km s^{-1}	σ^E/σ^I
E	87	37	42	1.1
G+GE	249	60	73	1.2
F	103	71	120	1.7
E+G+GE	336	50	92	1.8
Pb	65	151	…	…

TABLE IX. External errors binned by tabulated mean errors.

m.e. km s^{-1} (1)	$\langle\Delta\rangle_{21\text{-S}}$ km s^{-1} (2)	n (3)	σ km s^{-1} (4)	$\langle$m.e.$\rangle$ km s^{-1} (5)	σ/m.e. (6)	Inclusion (7)
0–19	−11.6 ± 12.6	19	53	13.4	4.0	all
20–39	−5.2 ± 11.7	54	85	27.8	3.1	all
40–59	−20.6 ± 26.8	37	146	47.8	3.0	all
40–59	−5.6 ± 20.3	35	115	47.4	2.4	excludes 2
≥60	−8.8 ± 40	19	170	77.4	2.2	all
all	−7.9 ± 10.2	129	116	38.7	3.0	all
all	+1.6 ± 7.4	117	80	39	2.0	exclude > |200|
all	−4.2 ± 8.5	124	94	39	2.4	exclude > |300|

values to put them on the 21-cm system. This was applied to all measured redshifts to produce the listed values in Tables IV, IVa, V, and VI. More recently, nearly double the number of 21-cm comparisons known in 1975 have become available, and we make the complete comparison here.

Comparison of the two systems was very greatly facilitated by use of the card catalog of all known redshifts for Shapley–Ames galaxies prepared by Tammann as part of the construction of the *RSA*. From that source, all 21-cm values were identified, and the velocity differences could be binned according to the mean error of the optical listing, with the results set out in Tables IX and X.

In Table IX, the differences (21-cm minus Tables IV and V) are averaged in column (2), which is then the mean systematic difference between the 21-cm system and our final optical system. (Note again that +30 km s^{-1} has already been applied to the raw redshift values that were tied to Table II.) The remaining columns of Table IX contain the following:

(3) the number of galaxies in the comparison;

(4) the 1 σ values of the distribution;

(5) the average mean error of the galaxies in the overlap sample;

(6) the ratio of the true external error [column (4)] to the average mean error [column (5)]. We assume here that the errors of the 21-cm values ($\sigma \approx 5$ to 10 km s^{-1} typically) can be neglected, and hence that the column (4) values refer solely to the optical data.

The conclusions to be drawn from Table IX are the following: (1) The true external errors are larger than the internal mean errors [columns (11) of Tables IV and IVa] by factors of between 2 and 4. (2) Nevertheless, the mean errors are a relative indicator of reliability because the true 1 σ values generally do increase with increasing m.e. (3) As set out in column (2), the systematic zero point of the presently adopted optical system (Tables IV and IVa) is correct (after the correction of 30 km s^{-1} to the original system) to within the errors of the determination (i.e., at the level of about ±15 km s^{-1}).

The same general conclusions follow from Table X where the errors are binned by quality class. The table is further divided into galaxies with absorption and (if present) emission lines, and with emission lines only. The columns contain the following:

(2) the mean difference between the 21-cm and our final velocity system [as in Table IX, a negligible systematic difference exists between the systems (relative to the error) for comparisons with the highest weight (*E* and *G* plates)];

(3) the number of galaxies in the comparison;

(4) the true external σ found from the distribution of 21 cm minus optical velocities;

(5) the average mean error of the galaxies in the comparison sample;

(6) the ratio of the true external 1 σ error to the listed mean error.

Again the principal result is that the *true 1 σ (external) error increases monotonically with listed m.e., and*

TABLE X. External errors binned by quality class.

Q (1)	$\langle\Delta\rangle_{21\text{-S}}$ (2)	n (3)	σ (external) (4)	$\langle$m.e.$\rangle$ (internal) (5)	σ/m.e. (6)
		Emission plus absorption line galaxies			
E+GE	−16.7 ± 8.4	26	42	22	1.9
G+FG	+15.1 ± 10.8	47	73	34	2.2
F	−24.5 ± 17.1	50	120	45	2.7
P+PI+I	−24.1 ± 73.8	12	245	62	3.9
E+GE+G+FG	+3.8 ± 7.7	73	66	30	2.2
E+G+F	−7.7 ± 8.3	123	83	36	2.3
		Only galaxies with emission lines			
E+GE	−11.3 ± 8.2	24	39	22	1.8
G+FG	+29.3 ± 11.4	29	60	34	1.8
F	−43.2 ± 21.7	22	100	42	2.4
E+G+GE+FG	+10.9 ± 7.7	53	55	29	1.9

TABLE XI. Galaxies in 21cm overlap with $|\Delta| > 150$ km s^{-1}.

Binned by mean error (km s^{-1})

0–19	20–39		40–59		≤60	
	Name	Δ	Name	Δ	Name	Δ
	N4145	+188	N450	−159	N2848	−225
	N4639	+216	N1376	+316	N2942	−339
	(N6835	−232)[a]	N3346	+156	N3001	+204
	N7756	−195	N3673	−463	N3124	+176
			N3756	+187	N3888	+320
			N4013	+172	N4592	−184
			N4302	−219	N5172	−330
			(N4462	−5114)[a]		
			N4487	−170		
			N4689	−226		
			N4949	−166		
			N5740	−235		

Binned by quality class

G+GF		*F*		*FP+P*		*PI+I*	
Name	Δ	Name	Δ	Name	Δ	Name	Δ
N3346	+156	N450	−159	N2848	−225	N3001	+204
N4639	+216	N1376	+316	N2942	−339	N3673	−463
(N6835	−232)[a]	N4145	+188	N3124	+176	N4302	−219
		(N4462	−5114)[a]	N3756	+187		
		N4487	−170	N3888	+320		
		N4592	−184	N4013	+172		
		N4689	−226				
		N5172	−330				
		N5740	−235				
		N5949	−166				
		N7756	−195				

[a] The 21-cm velocity for NGC 6835 and NGC 4462 may be in error.

has a value that is ~2.5 times the internal error. The factor is somewhat less for pure emission line galaxies. The true 1 σ errors range from ~40 km s^{-1} to >200 km s^{-1}. Interestingly enough, they are very similar to Humason's "estimated" errors (MHS, Tables I and II), which he arrived at by instinct based on a long experience with low-dispersion plates. The distributions of errors for quality class $E + G$ and for $E + G + F +$ FP are shown by the histograms in Fig. 1.

c) Galaxies With Large Differences Between Their Radio and Optical Redshifts

Most of the differences between 21 cm and optical velocities are smaller than ±100 km s^{-1}, but a few are larger, as noted in Table XI, binned both by mean error and quality class. As expected, the largest and most frequent differences occur for the galaxies with the largest m.e. and poorest quality classes.

Clearly the 21-cm results are to be preferred, and, although there is generally little question of their validity, occasionally the 21-cm literature values are, in fact, wrong. There are at least seven such cases in the present material:

(1) NGC 2090: The 21-cm value by Balkowski *et al.* (1973) of 1805 ± 30 km s^{-1} is not confirmed by Fisher and Tully's radio redshift of 928 ± 25 kms^{-1}, which agrees with the optical value.

(2) NGC 3963: Fisher and Tully's (1976) 21-cm value is v_H = 1050 ± 15 km s^{-1}. The optical value from Table IV is v_H = 3234 ± 67 km s^{-1} on a fair plate with two absorption lines and two emission lines and seems beyond doubt. The optical value has been confirmed recently by a new 21-cm value of v_H = 3185 ± 15 km s^{-1} by Peterson (1977).

(3) NGC 4522: Optical value of v_H = 2404 ± 39 km s^{-1} from Table IV differs from Fisher and Tully's (1976) 21-cm velocity of v_H = 262 ± 10 km s^{-1}, but is confirmed by the 21-cm value by Huchtmeier, Tammann, and Wenkler (1976) of v_H =2316 ± 10 km s^{-1}, and Eastmond's (1977) optical value of v_H = 2504 ± ~100 km s^{-1}.

(4) NGC 4612: Bieging and Biermann (1977) give v_H = 1207 ± 20 km s^{-1}. However, the Table IV value of v_H = 1832 ± 23 km s^{-1} from eight absorption lines is confirmed by Eastmond's (1977) value of v_H = 1838 ± ~100 km s^{-1}.

(5) NGC 5247: The 21-cm velocity of v_H = 1655 ± 20 km s^{-1} by Balkowski *et al.* (1973) differs from the optical value of 1386 ± 31 km s^{-1} and from other 21-cm values of 1352 ± 15 from Fisher and Tully, and 1354 ± ~10 by Shostak (quoted by Roberts 1977).

(6) NGC 6835: The 21-cm velocity of 1546 ± 20 km s^{-1} by Bottinelli and Gougenheim (1976), which is perhaps the same measurement as 1568 ± 10 km s^{-1} by Bottinelli *et al.* (1970), differs from our optical value of

v_H = 1790 ± 34 km s^{-1}, which seems to be confirmed by the value of v_H = 1720 ± 23 km s^{-1} by de Vaucouleurs and de Vaucouleurs (1967).

(7) NGC 7796: The 21-cm value of 205 ± 100 km s^{-1} by Bottinelli *et al.* (1968) differs from our optical value of 3411 ± 100 km s^{-1}, which is confirmed by Evans (1963) with 3511 ± ~50 km s^{-1} and by Martin (1976) with 3300 ± ~70 km s^{-1}.

In view of these examples, it may be that *all* of the large differences in Table XI may not be due only to errors in the optical values, although most of them must be.

An example is NGC 2427, where the listed velocity in Table IV is $v_{\rm opt}$ = +31 km s^{-1}. The later 21-cm value of 967 km s^{-1} by Whiteoak and Gardner (1977) is confirmed by van Woerden *et al.* (1977, private communication) as ~1000 ± 50 km s^{-1}. This case is discussed in the notes. The optical velocity must refer to diffuse Hα emission from our Galaxy at b = 12° superposed on the spectrum of NGC 2427.

Another not quite so certain example is NGC 4462 (Table IVa), where we obtain $v_{\rm opt}$ = 1866 ± 127 km s^{-1} from two very poor plates, where Rubin *et al.* (1976) give 6980 ± 50 km s^{-1}, which is probably correct for this faint Sab I–II galaxy.

These examples emphasize that the present catalog should be considered principally as a working list, to be combined with other values, properly weighted, into summary catalogs such as the *Reference Catalog of Bright Galaxies* (de Vaucouleurs and de Vaucouleurs 1964; de Vaucouleurs, de Vaucouleurs, and Corwin 1977), and the *RSA* (Sandage and Tammann 1978). Only in this way can a definitive system of redshifts eventually be obtained.

As an aid to working with the present list, we show in Table XIa those galaxies from Tables IV and IVa whose v_H values differ by more than 200 km s^{-1} from the values listed in the *Second Reference Catalog*. Differences from the *RSA* are also shown. Zero difference with the *RSA* means that only the value from this paper was used there.

TABLE XIa. Galaxies in the present sample with velocity differences > 200 km s^{-1} relative to the *Second Reference Catalog*.

NGC	$V_S - V_{\rm dV^2C}$ km s$^-$	$V_S - V_{\rm RSA}$ km s^{-1}
148	+411	0
245	−236	0
470	−200	−114
533	+498	0
1353	−252	−97
1366	−364	0
1406	+231	+40
1425	−213	−95
1511	−478	0
1947	+387	0
2082	+270	+101
2090[a]	−856	+21
2442	+772	0
2545	+339	+170
2942	+339	+337
2992	+253	+113
2993	+313	+275
3329	+259	+38
3888	−394	−309
4639	−208	−215
4760	+242	−18
5247[a]	−269	+33
5949	+221	+180
6835[a]	+209	+60
IC5052	−488	0
IC5240	+331	+113
7702	−3319	0

[a] Noted in the text.

IV. EXTERNAL ERRORS OF OTHER OBSERVERS

Many optical redshifts of the program galaxies have been measured by others during the decade that the present work has been in progress; hence a number of comparisons can be made between observers to determine external errors and zero-point differences. As in Sec. III, most of the overlaps with Tables IV and IVa studied here are for Shapley–Ames galaxies only.

The comparisons are set out in Table XII for other observers where four or more galaxies are common with the present data. The columns contain the following information:

(2) The number of galaxies in the comparison.

(3) The mean zero-point difference, together with the 1 σ error of this mean. The sense is $\Delta \equiv$ Sandage minus others.

(4) The 1 σ value of the distribution of the redshift differences, denoted σ_{SO} to indicate a combination of the present errors (S) with those of the others (O).

(5) The *external* 1 σ_S errors in the data in this paper for the *particular* galaxies that make up the overlap as determined from their listed m.e. and Q values in Tables IV and IVa, using the σ/m.e. ratios derived in the last section [column (6) of Tables IX and X].

(6) The σ value for the other observers (σ_O), found by deconvolving (i.e., $\sigma_O^2 \equiv \sigma_{SO}^2 - \sigma_S^2$) columns (4) and (5). The σ_O values should then represent the mean *external* (true) 1 σ error of the listed observer. Note that the procedure is ultimately tied to the 21-cm comparison via the σ_S/m.e. ratios described in the last section.

(7) The number of exclusions in the literature lists before the comparison was made. The exclusions usually represent large Δ values that are probably either mistakes or values obtained from unrepresentative plate material.

The conclusion to be drawn from this table is that the most accurate optical redshifts in the literature are evidently due to Humason, Mayall, Ford, and Rubin where $\langle \sigma_{\rm true} \rangle \approx$ 80 km s^{-1}. (The Rubin–Ford redshifts at their high dispersion are clearly the best optical redshifts available.) Martin (1976), where the overlap is substantial (n = 37), and de Vaucouleurs and de Vaucouleurs (1967, 1973) are also reliable. However, the scanner redshifts (de Vaucouleurs and de Vaucouleurs 1976) are evidently not competitive with conventional spectrographic values.

Comparison of these external σ_O values of others with the (generally internal) errors quoted in the original papers leads to a principal conclusion that *the quoted errors in the literature for optical redshifts are generally too small by factors that range between 2 and 4.* This is true for all cases studied here (including our own values) except for Humason, and probably also Mayall. Humason's "estimated errors" *are* realistic, and although Mayall's average deviations are internal errors, they are only slightly smaller than the column (6) values of Table XII.

The clear implication of these much larger true errors for problems of virial masses in binary galaxies and in small groups have been repeatedly emphasized by Materne (1974), Sandage and Tammann (1974), Materne and Tammann (1974, 1976), Tammann (1977), Tammann and Kraan (1978), and others, where it has been shown that group after group becomes stable with conventional masses (low M/L ratios) as soon as redshifts with small and well-determined errors are used. The same conclusion of normal masses in very compact groups has been reached by Rose (1977). It has also been shown from the dynamics of the Local Group that there is no need for abnormal masses of our Galaxy and M31 to explain the observed radial velocity of M31 (Yahil, Tammann, and Sandage 1977). Hence, the need for substantial "missing mass" in binaries and in loose and also in compact groups (i.e., in *small* clusters) is yet to be established.

V. SYSTEMATIC ERRORS WITH REDSHIFT

Using the comparison of the optical and 21-cm values, we have searched for systematic errors that vary with redshift (the Roberts effect in the HMS catalog) in our present data.

A small effect was found in the same sense, but with about half the amplitude found by Roberts (1972) and studied again by Lewis (1975, 1976), and Botinelli and Gouguenheim (1976). The comparison is shown in Fig. 2. The more detailed difference-plot is shown in Fig. 3, and is set out in Table XIII, where the mean differences between the 21 cm and the optical values are taken in each 500 km s^{-1} redshift interval for all quality classes, and for the $E + G + F$ combined classes. There is no significant effect other than in the 1500–2000 km s^{-1} interval, where Table XIII and Figs. 2 and 3 show the systematic difference to be 51 ± 19 km s^{-1}.

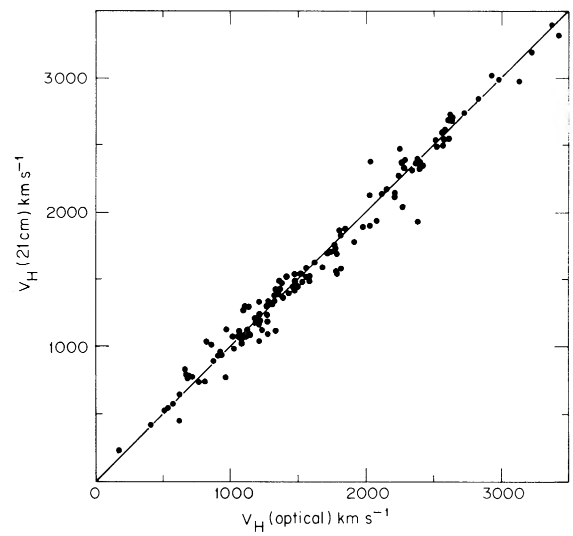

FIG. 2. Comparison of the 21-cm and the optical redshifts for Shapley–Ames galaxies in the present sample. The 45° correlation line is shown. Note the slight systematic difference, in the sense of negative $\Delta_{21-\mathrm{opt}}$, in the interval $1300 < v < 2300$ km s^{-1}.

The most reasonable interpretation is that advanced by Roberts (1972). He supposes that the H and K night sky absorption lines interfere with the H and K lines of the galaxies in the indicated redshift interval and that

TABLE XII. Comparison with other observers.

Observer (1)	n (2)	$\langle\Delta\rangle_{S-O}$ km s^{-1} (3)	σ_{SO} km s^{-1} (4)	σ_S km s^{-1} (5)	σ_O km s^{-1} (6)	Remarks (7)
Carranza (1967)	8	+25 ± 99	259	70	249	excludes 2
Chincarini and Rood (1972)	6	+44 ± 65	146	80	122	
{(de Vaucouleurs)² (1967) (de Vaucouleurs)² (1973)}	12	+14 ± 37	122	65	103	excludes 2
(de Vaucouleurs)² (1976)	16	+130 ± 78	313	80	300	excludes 3
Eastmond (1977)	42	+91 ± 25	159	90	130	
{Catchpole *et al.* (1969) Evans (1963, 1967) Evans and Harding (1961) Evans and Malin (1965) Evans and Wayman (1958)}	17	−63 ± 50	200	95	175	excl. N7702
{Ford and Rubin (1968) Ford and Rubin (1969) Ford, Rubin, Roberts (1971) Rubin *et al.* (1976)}	14	0 ± 41	152	125	85	
Humason (1956, HMS)	9	−21 ± 44	124	85	90	
Kirshner (1977)	6	+107 ± 69	169	130	108	
Martin (1976	37	+38 ± 21	129	70	108	
Mayall (1956, HMS)	4	+44 ± 71	123	90	83	
Page (1967)	8	+208 ± 76	202	70	190	excludes 2
Welsh, Chincarini, Rood (1975)	23	−28 ± 13	175	65	162	

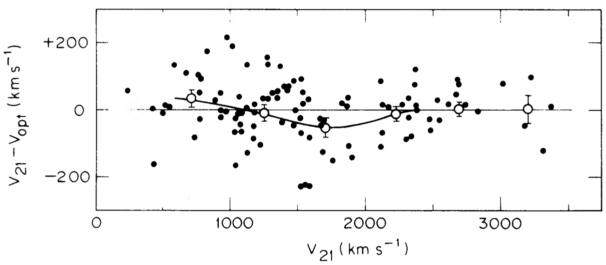

FIG. 3. The differences $\Delta \equiv v_{21} - v_{\rm opt}$ as a function of 21-cm redshift. A Roberts' effect of amplitude $\sim$50 km s^{-1} may be present in the interval $1300 \leq v \leq 2300$ km s^{-1}.

the blend is improperly allowed for by the measurer. Although a detailed inspection of our spectrograms has failed to make a convincing case, and the cause is still to be adequately explained, nonetheless some color to Roberts' suggestion is given by noting that galaxies in our sample that have emission lines do show a smaller systematic difference in the interval $1500 < v < 2000$ km s^{-1} than those with only absorption lines. The differences are $\Delta_{21-0} = -33 + 22$ km s^{-1} for *e* line galaxies and $\Delta_{21-0} = -103 + 37$ km s^{-1} for galaxies with only absorption lines.

Furthermore, the case seems reasonable on other grounds. Lewis (1975, 1976) concludes that the Lick redshifts show a larger effect than the Mount Wilson–Palomar values in HMS. Humason concentrated on the early-type galaxies (high surface brightness *E*, *S0*, *Sa*, and *Sb* types), while Mayall generally observed the more difficult low surface brightness, late-type spirals where the sky contamination problems are generally more severe. Many galaxies in the present work are also of low surface brightness, and can be expected to have night-sky contamination.

No corrections have been applied to the listed data in Tables IV, IVa, and V to remove the small Roberts' effect shown in Figs. 2 and 3.

VI. GALAXIES OF SPECIAL INTEREST

a) *High-excitation Spectra*

Among the galaxies with emission lines, some are of high excitation showing He I (λλ3888, 4471, 5875), He II (λλ3768, 4686, 5977), and forbidden lines of [Ne V] (λ3425), [Ne III] (λλ3868, 3967), and [O I] (λ6300). The most noteworthy high-excitation galaxies in our sample are listed in Table XIV. Details of the spectra are usually given in the notes to Tables IV and IVa.

Most of the high-excitation lines are confined to the central regions, but in a few galaxies they extend well into the disk (NGC 625, 4388, 5398, 5643) or are associated with discrete objects such as hot spots (NGC 625, 2992).

b) *Galaxies With Inclined Emission Lines*

Many emission-line galaxies have inclined lines that extend across an appreciable part of the disk. The slit at both Stromlo and at Palomar was short (only ~30″), so very extended emission lines across entire disks could not be observed, but candidate galaxies for long-slit studies of rotation will be among this sample. It should also be noted that the spectrograph for the Stromlo plates was generally rotated so that the slit was along the major axis of the galaxy. However, the slit for all Palomar plates was east–west.

Galaxies in our sample with inclined lines are listed in Table XV, together with the galaxy type and the declination for easy reference in the organization of new observing programs. Details of most of these spectra are given in notes to Tables IV and IVa.

The emission lines that extend across the disks of spiral galaxies are generally not associated with individual H II regions, but rather are due to the diffuse emission from the entire disks, similar to that discovered in our Galaxy by Struve and Elvy (1939a,b,c,) from their very long-slit studies.

c) *Galaxies With Zero-Velocity Emission Lines*

Two galaxies in the sample have smooth, narrow, nearly zero-velocity emission lines across the entire decker. These lines are evidently due to the diffuse emission *in our Galaxy*. NGC 2427 at galactic latitude $b = -12°$ has zero-velocity Hβ, Hα, [N II], and [S II] lines across the decker. NGC 2888 at $b = +16°$ also has

TABLE XIII. 21-cm minus optical redshifts as a function of redshift (test for the Roberts' effect).

	v_{21} (km s^{-1}) 0–1000	1000–1500	1500–2000	2000–2500	2500–3000	3000–3500
			All quality classes			
n	23	43	23	19	14	5
$\langle \Delta_{21\text{-}o} \rangle$ (km s^{-1})	+29 ± 19	−4 ± 15	−71 ± 26	+10 ± 28	+1 ± 20	+1 ± 45
σ(km s^{-1})	87	96	120	121	73	91
			Excluding $Q = P, PI, I$			
n	23	39	21	16	14	5
$\langle \Delta_{21\text{-}o} \rangle$ (km s^{-1})	+29 ± 19	−8 ± 14	−51 ± 19	−7 ± 17	+1 ± 20	+1 ± 45
σ(km s^{-1})	87	86	87	67	73	91

TABLE XIV. Galaxies with emission lines of high excitation in the sample.

NGC IC*	Type	Dec	Lines
625	Irr (Sm)	−41	He II (3768, 4686, 5977); [Ne III] (3868, 3967), He I (3888, 4471); [AIII] (7135); [AIV] (7237).
2992	S pec	−14	[Ne III] (3868).
3081	SBa (s)	−22	[Ne III] (3868); [Ne V] (3425).
3353	?	+56	[Ne III] (3868, 3967); He I (5875).
3448	Irr	+54	[Ne III] (3868).
3982	Sbc (r) II-III	+55	[Ne III] (3868).
4388	Sa/Sb	+12	[Ne III] (3868, 3967); He II (4338, 4685), [O I] (6300).
4507	S (al):	−39	[Ne III] (3868); [O III] (4363).
5398	Sbc (s) II	−32	He I (3888, 4471, 5875); [Ne III] (3868, 3967); probably He II (3833).
5477	Irr IV-V	+54	He I (3888); [Ne III] (3868, 3967).
5643	Sc/SBc (s) I-III	−43	[O I] (6300). No data for λ < 4800 Å.
5728	Sa I-II	−17	[O I] (6300).
1515*	SB (s)	−1	[Ne III] (3868).
5063*	E4	−57	[O I] (6300).

smooth Hβ, Hα, and [N II] across the decker. Details are in the Notes to Table IV.

d) *Emission-Line Galaxies With No Or Weak Hα But With [N II]*

Five emission-line galaxies in the present sample show [N II] (λ6583) to be much stronger than Hα, which on our spectra is below the plate threshold. The five galaxies were observed with the Stromlo equipment where the wavelength coverage at Hα was excellent. As only the *Pb* Palomar series spectra covers the Hα region, many more galaxies in our sample undoubtedly show this phenomenon, which was discovered by Burbidge and Burbidge (1962), and subsequently discussed in the literature (Burbidge, Gould, and Pottasch 1963; Morgan and Osterbrock 1969; Spinrad and Peimbert 1968; Rubin, Thonnard, and Ford 1978).

In each of the five galaxies here, the absorption lines make secure the identification of the single emission line as [N II]. The galaxies in our sample with [N II] present and Hα not visible are NGC 782 [λ3727 plus 5 absorption lines (a)], NGC 5026 (4 a), NGC 5101 (4 a), NGC 6770 (3 a), and NGC 7007 (5 a). Others in the sample where both lines are present, but where I[N II] > I(Hα) include 0305–2308, NGC 1358, NGC 6300, NGC 6890, and NGC 6984.

Of the several mechanisms proposed by Burbidge and Burbidge (1962) to explain the intensity reversal, the one favored by Peimbert (1968) to explain his data in M51 and M81 is an increase in the N/H abundance ratio in the central regions where the [N II] line dominates. The mechanism of high electron temperature ($T_e \gtrsim$ 20 000/K) favored by Burbidge, Gould, and Pottasch (1963), while giving a large [N II]/Hα intensity ratio, fails to explain the observed intensity of [O II] 3727 Å.

Recently, Rubin, Thonnard, and Ford (1978) report new observations of the phenomenon were I(N) > I(Hα) in those galaxies where the nuclear continuum (the old bulge population) is red. They also report that the normal I(Hα) > I(N) ratio applies in the centers of galaxies where the central colors are blue.

TABLE XV. Galaxies suitable for long-slit studies with extended emission lines that are sometimes inclined.

NGC IC*	Type	Dec.	NGC IC*	Type	Dec.
664	(Sc I)	+3	4790	Sd II:	−9
673	(Sc (s) I)	+11	4835	Sc (r) I:	−45
685	SBc (s) II	−53	4904	SBbc (rs) II-III	+0
701	Sc (s) II.2:	−9	5247	Sc (s) I-II	−17
1743*	(SBc I)	+12	5464	Giant H II?	−29
1783*	Sa:	−33	5483	SBc (s) I	−43
925	SBc (s) II-III	+33	5595	Sc (s) II	−16
941	Scd III	−1	5600	Sb pec	+14
949	Sd III	+36	5691	S(B)b pec III:	−0
1249	SBc (s) II-III	−53	5967	SBc (s) II:	−75
1406	SBc (s):	−31	6052	Irr or S pec	+20
1511	Sc pec	−67	6707	S	−53
1515	Sa (s)	−54	6708	E3/S0$_1$(3)	−53
1546	S0$_1$ (7)	−56	6754	Sb (rs) II:	−50
2056*	Giant H II?	−60	4837*	Sc (s) (III-IV)	−54
1688	SBc (s) III	−59	6808	(Sa)	−70
1720	SBb (s) I.2	−7	5052*	Sd	−69
1796	SBc pec	−61	5063*	E4	−57
3021	SBc (s) II	+33	6984	Sbc (r) II	−52
3506	Sb (s) I-II	+11	7059	Sbc (s) II-III	−60
3513	SBc (s) II.2	−22	7064	Sc	−52
3738	Irr IV	+54	7460	Sc I	+1
3885	Sa	−27	7599	SBc (s) II	−42
3912	Sa:	+26	5325*	Sbc (r) I	−41
3952	S or Irr:	−3	7689	Sc (rs) II-III	−54
4428	Sc (s) II.8	−7	7756	Sc (s) I	+3

TABLE XVI. Some possible binary and related galaxies in the present sample.

Name (1)	Type (2)	v_0 (RSA) (3)	r (min) (4)	r (Kpc) (Ho = 50) (5)	Description (6)
NGC 470	Sbc II.3	2643 ± (50)	5.6	84	Probable pair. NGC 467 at 12 min SW of N470 had redshift of v_0 = 5680 km s^{-1}, and is clearly background.
NGC 474	E0/RS0$_2$	2548 ± 9			
NGC 1531	E	1379 ± 76	1.7	12	Clear companions.
NGC 1532	Sab I	1107 ± 14			
NGC 2964	Sc II	1294 ± 45			NGC 2964 may be foreground. Bridge between N 2968/70. SN1970I on bridge.
NGC 2968	S (b)	1576 ± 93	4.9	46	
NGC 2970	S0$_3$ (3)	1629 ± 100			
NGC 2992	S pec	1963 ± 36	2.8	31	Tidal plumes and extended arms. Clearly interacting.
NGC 2993	S pec	1861 ± 46			
NGC 3347	Sab II	2626 ± 63	9.5	144	Distant pair separated by 7 diameters. No visible tidal interaction.
NGC 3358	Sa	2613 ± 212			
NGC 4085	Sc III	825 ± 14	11.2	54	Part of UMa complex, tentatively put in the 750 km s^{-1} group (N3949 is the dominant member).
NGC 4088	Sc II.8	825 ± 14			
IC 749	Sc III	827 ± 15	3.5	16	Part of UMa complex, in same group as NGC 4085/88.
IC 750	S	742 ± 75			
NGC 4373	E4	3155 ± 47	1.9	35	Close pair. No visible interaction.
IC 3290	S0 (5)	3177 ± 150			
NGC 4933 (NE)	S0$_3$ pec	3037 ± 68	0.8	14	Clear interaction. Bridge
NGC 4933 (SW)	E3 pec	3155 ± 40			
NGC 5394	Sab	3397 ± 38	1.9	39	Beautiful arms on each galaxy. No obvious bridges or diffuse matter. Nevertheless, probable pair.
NGC 5395	Sb II	3584 ± 42			
NGC 6769	Sbc I-II	3703 ± 81			Interacting. VV 304. Cape Atlas #21.
NGC 6770	Sbc pec	3708 ± 40			
NGC 7125	Sc I	2910 ± 50	5.8	98	Possible pair.
NGC 7126	Sab:	2888 ± 65			

e) New Redshifts For Pairs, Groups, and Clusters

Special emphasis was placed in the present work on redshifts for pairs, associations, groups and clusters so as to sort out dynamical units. As noted by de Vaucouleurs (1975), most groups or associations now widely listed in the literature are undoubtedly unbound. Although the galaxies in such groups may, in fact, be neighbors, their motions are controlled more by the general Friedmann expansion than by gravitational interaction with traveling companions (cf. Gott, Wrixon, and Wannier 1973).

That adjacent galaxies could continue to move together without being bound follows if the mean random motion about the ideal Friedmann model-flow is small. A random motion of σ_r = 50 km s^{-1} (Sandage and Tammann 1975a; note that Tammann and Kraan 1978 place an even lower limit of σ_r = 25 km s^{-1}) over 10^{10} yr leads to a separation of only 0.5 Mpc even if the summed energy of the neighborhood ($T + \Omega$) is positive (i.e., if there is no reversal in the orbital directions with time).

Examples of loose associations (also often called groups in the literature) that are almost certainly unbound are those in Telescopium, Grus, Dorado, and Pavo (de Vaucouleurs 1956; Shobbrook 1966b; Sandage 1975a), among others. The galaxies there are still spatially adjacent only because they were initially close at their formation and because of the low value of σ_r (cf. Turner and Sargent 1974; Jackson 1975; Turner and Gott 1976).

However, there *are* clear cases of bound systems such as the close binary pairs [Holmberg 1937; Page 1960, 1975 and references therein to earlier works; Turner 1976; and certain cases of interacted systems (Vorontsov-Velyaminov 1959)]. Other clear cases of negative energy are the very nearby groups such as the Local Group and those surrounding M81 and M101 (Holmberg 1950), together with the Sculptor group (NGC 300, etc., de Vaucouleurs 1959). Membership of the individual galaxies can usually be established by criteria of distance rather than velocity (i.e., resolved stars, H II regions, etc.) Calculations show these groups to be bound, using conventional masses (Materne 1974; Tammann and Kraan 1968; with earlier references); their internal velocity dispersions are so small.

Going up the scale of density contrast one finds the more compact groups such as those in Leo (Materne 1978) and the very compact interacting quartets, quintets, and higher multiplicities such as those found by Stephan, Seyfert, Keenan, and Shakhbazian (cf. Robinson and Wampler 1973; Arp, Burbidge, and Jones 1973), many of which are also bound, using conventional masses (Rose 1977). Then come the small clusters (Fornax, Centaurus, IC 4329, and many of the HMS groups such as NGC 507), and finally the great clusters which, although presumably bound, are, in fact, *the only systems where the problem of the missing mass has been established.*

TABLE XVII. Candidates for groups that may form dynamical units.

Name	Type	v_0 km s^{-1}	BM	Description and other members
NGC 439	E5	5610	I	Brightest in group of ~11.
NGC 1441 }	Sa	4162	I	Small group of 4. One large Sa plus 3 satellites.
NGC 1449 }	S0	4003		NGC 1449 clear member.
NGC 3091	E3	3623	I	Brightest in a group of ~5.
NGC 3258 } Antilia Gr. }	E1	~2850		Small group of ~15. Details in Table 2 of Sandage (1975a).
NGC 3557	E3	2530	I	Small group of ~4. NGC 3557 dominates and has considerably fainter satellites.
NGC 4073	E5	5834	I	Brightest group of ~15 E and S0.
NGC 4373	E4	~3150	III	Group of ~7 of which NGC 4373 and IC 3370 are about equally bright.
NGC 4756	E3	~4000	I	Central cD with many satellites of large Δmag difference.
NGC 4936	E2	3100	I	Central cD. May or may not have associated galaxies. Group reality is least certain in this table.
NGC 5044	E0	2548	I	Central E0 with many small satellites. Velocities show that NGC 5037 and NGC 5054 are not members.
IC 4296	E1	~3650	I	Dominated by large isolated E1 IC 4296. Details in Table 2 of Sandage (1975a).
IC 4329	S0/E5	4320	II–III	Sparce cluster. Details in Table 2 of Sandage (1975a). Dominated by IC 4329 (mislabeled as IC 4327 in Sandage 1975a) and NGC 5302.
NGC 5090	E2	~3100	I	Brightest in a group of 6. Not really a good case, but if real, NGC 5090 is a cD.
M101	Sc	402	I	Dynamically stable group discussed in Sandage and Tammann (1974). Have 5 new velocities here.
NGC 6769 }	Sbc I–II	~3950		Interacting double spiral with satellites, some of which may be dynamically connected. Details of other possible members in Table 2 of Sandage (1975a). But many of the galaxies in this region are clearly not associated.
NGC 6970 }	Sbc pec			

The present redshift catalog has examples of each type of aggregate, and we summarize in this subsection the clearest of these cases.

(*a*) *Close pairs:* There are only a few very close pairs in Tables IV and IVa, and the most evident are summarized in Table XVI. The velocities in column 3 are from the *RSA;* the projected distances are listed in columns 4 and 5 (H_0 = 50 km s^{-1} Mpc).

The velocity differences are small [often hardly more than the errors, listed here as σ (external)], as expected for Keplerian orbits with conventional masses at the separations listed [i.e., $\Delta v(\max)$ = 270 km s^{-1} for $r(\max)$ = 25 kpc with equal masses of $2 \times 10^{11}\mathfrak{M}_\odot$], and from the extensive observational material for other pairs (Page 1960; Turner 1976).

Four interacting cases show bridges or plumes. The bridge between NGC 2968 and NGC 2970 contained the supernova 1970 l (Tammann 1973). The adjacent Sc II galaxy NGC 2964 may be in the foreground: the velocity difference is large for the separation and there is no evident optical connection. Tidal plumes and other signs of interaction exist in the pairs NGC 2992/3, NGC 4933, and NGC 6769/70.

(*b*) *Loose groups that may form dynamical units:* Candidates for density contrasts that may form dynamical units are listed in Table XVII. The supposition of dynamical association is based on visual inspection alone. Usually the field is dominated by a single large galaxy near the center of a swarm of smaller, generally E and S0 satellites. The listed systems resemble the aggregates discussed by Morgan, Kayser, and White (1975). Most are of Bautz–Morgan contrast Type I. Redshifts exist for a few of the companions (listed in detail elsewhere: Sandage 1975a, Table 2), but for most systems set out in Table XVII dynamical connection is yet to be shown by detailed redshift measurements.

(*c*) *Loose groups probably not dynamically connected:* Many apparent associations of galaxies at about the same distance are evident on the National Geographic–Palomar Sky Survey fields, but very few form dynamical units. A summary of such southern groups has been given elsewhere, based on an early version of Tables IV and IVa. From the detailed listing there (Sandage 1975a, Table 2), it is evident from the large velocity spread that most of these aggregates are not bound. As mentioned earlier, the most conservative interpretation is that the observed range in velocities is due to a spread in distance (combined with a very regular expansion velocity field), rather than to virial motion.

A listing of the groups and associations for program galaxies here is given in the final column of Tables IV and IVa. A summary of some of these associations is given in Table XVIII, based on previous work by de Vaucouleurs (1956), Shobbrook (1966b), Sandage (1975a, Table 2), and others. It is again to be emphasized that these groupings are probably not dynamical units.

(*d*) *Clusters:* An aim of this work was to obtain redshifts for all Shapley–Ames galaxies in the regions of the Virgo cluster and the Ursa Major complex so as to help determine memberships.

Twenty-six galaxies in the central area of radius 6°

TABLE XVIII. Associations that are probably not dynamically connected.

Name	Neighbors
NGC 1209	NGC 1172, 1199 plus ~8 other E galaxies. BM II–III.
Dorado	NGC 1515, 1533, 1536, 1543, 1546, 1549, 1553, IC 2056, NGC 1566, 1574, 1596, 1617.
NGC 5899	NGC 5903 plus a few other fainter neighbors.
IC 4797	Chain of 5 galaxies, 4 of which have closely the same velocity of ~2600 km s^{-1}. Details in Table 2 of Sandage (1975a).
Telescopium	An association of ~10 galaxies of nearly the same velocity near $v_0 \approx 2700$ km s^{-1}. Details in Table 2 (Sandage 1975a).
Pavo	5 galaxies with $v_0 \approx 3780$ km s^{-1}.
NGC 7014	Indus: $v_0 \approx 4930$ km s^{-1} for 6 neighbor galaxies.
NGC 7196	$v_0 \approx 2850$ km s^{-1}.
NGC 7213	4 neighbor galaxies with $v_0 \approx 1900$ km s^{-1}.
Grus	Very loose mixed group of wide extent studied by Shobbrook (1966b). A few new velocities are added here [membership list in Sandage (1975a, Table 2)].

of the Virgo Cluster are listed in Table IV. With the inclusion of these systems, all Shapley–Ames galaxies in this region now have known redshifts. This material has been included in the recent discussion of the equality of $\langle v_0 \rangle$ for E and S galaxies in the Virgo Cluster, where no evidence was found for a variation of $\langle v_0 \rangle$ with galaxy type for probable Virgo Cluster members (Sandage and Tammann 1976).

Also included in Table IV are additional redshifts for a loose association of galaxies, called the *W* cloud by de Vaucouleurs (1961), on the southwest edge of the Virgo cluster 6° circle. This field of predominantly S0 galaxies has a large redshift of ~2200 km s^{-1}; all the galaxies have smaller angular diameters than galaxies assigned to the Virgo cluster, and are clearly in the background. The *W* cloud members in Table IV are NGC 4224 (v_0 = 2543), NGC 4233 (2117), NGC 4235 (2487), NGC 4215 (1980), and NGC 4378 (2397).

A number of new redshifts in Tables IV and IVa are for galaxies in the complex Ursa Major region, which can be divided into many associations, groups, and other aggregates (cf. de Vaucouleurs 1975) whose projected areas overlap in the line of sight. Tammann (private communication) has shown that the galaxies in the Ursa Major complex can reasonably be divided into at least three groups, together with the great Ursa Major cluster where spirals predominate (cf. Tully and Fisher 1977 for a listing). The lowest redshift group contains the highly resolved, late-type spirals of NGC 4144, 4214, 4244, 4449, 4736, and IC 4182, where $\langle v_0 \rangle$ = 285 km s^{-1} with a low internal random motion of $\sigma_r \approx 35$ km s^{-1}. Now to be added to this group from Table IV is NGC 3738 with v_0 = 265 km s^{-1}. Being so highly resolved, this group should provide an important new opportunity to study the resolution of late-type galaxies into stars and H II regions.

A second aggregate, called the M51 group by Tammann, has $\langle v_0 \rangle$ = 595 km s^{-1} and contains NGC 4258, 4490, 4618, and others. New possible members from Table IV are NGC 4096 (v_0 = 546), and NGC 4460 (624).

A group near $\langle v_0 \rangle$ = 750 km s^{-1} contains NGC 3675, 4051, 4242. Six additional galaxies can now be added from Tables IV and IVa (IC 750, NGC 4013, 4085, 4088, 4157, and 4389).

The Ursa Major cluster, with $\langle v_0 \rangle \simeq 980$ km s^{-1} and $\sigma_r \approx 100$ km s^{-1} is less well defined at present. Eight new possible members from Table IV are NGC 3353, 3729, 3756, 3877, 3982, 3985, 4100, and 4346.

Clear background galaxies in this region include NGC 3458, 3549, 3683, 3725, 3780, 3888, 3965, 4047, and 4290 from Table IV.

Other clusters observed in the present work, summarized in Table VI, include Fornax (5 new values), Centaurus (n = 14), IC 4329 (n = 10), and a new cluster in Cygnus associated with the radio source 3C 402 (Sandage 1976).

VII. DISTRIBUTION OF REDSHIFTS IN THE PRESENT SAMPLE COMPARED WITH THE COMPLETE SHAPLEY–AMES

Figure 4(a) shows the distribution of redshifts for the Shapley–Ames galaxies. Hatched bars are from the present list (Tables IV and IVa), while the open symbols show the nearly complete Shapley–Ames catalog, taken from the *RSA*. The velocities are corrected to the centroid of the Local Group using the solution by Yahil *et al.* (1977) and are binned in 200 km s^{-1} intervals in Fig. 4(a). All galaxies in the Shapley–Ames are shown except those assigned to the Virgo cluster (within a 6° radius centered at RA $12^h 25^m$, Dec +13° 06′) and to the Local Group.

A detail of the low velocity part of the distribution is shown in Fig. 4(b), binned in 100 km s^{-1} intervals, and again separated into the present data (hatched), and the complete Shapley–Ames. The line is the $N(v)dv \propto v^2 dv$ distribution expected for a uniform density model with a linear velocity–distance relation, normalized to the observed total of 102 galaxies with $v \geq 700$ km s^{-1} as if no selection effects (luminosity function and apparent magnitude cutoff in the catalog) exist.

The distribution of Virgo cluster galaxies within $r \leq$ 6° radius from the center, and in the Virgo region (6° $< r \leq$ 8°) is shown in Fig. 4(c), again divided into the present catalog, and the complete Shapley–Ames.

The most striking feature of Figs. 4(a) and 4(b) is the absence of negative velocities in the Shapley–Ames catalog that excludes Virgo and the Local Group. The *entire* Shapley–Ames contains only eight negative velocities—six are within the 6° circle centered on the Virgo cluster (NGC 4192, 4216, 4406, 4419, 4438, and 4569), and two are members of the Local Group (M31 with $v_0 = -10$ km s^{-1}, and SMC with $v_0 = -19$ km s^{-1}).

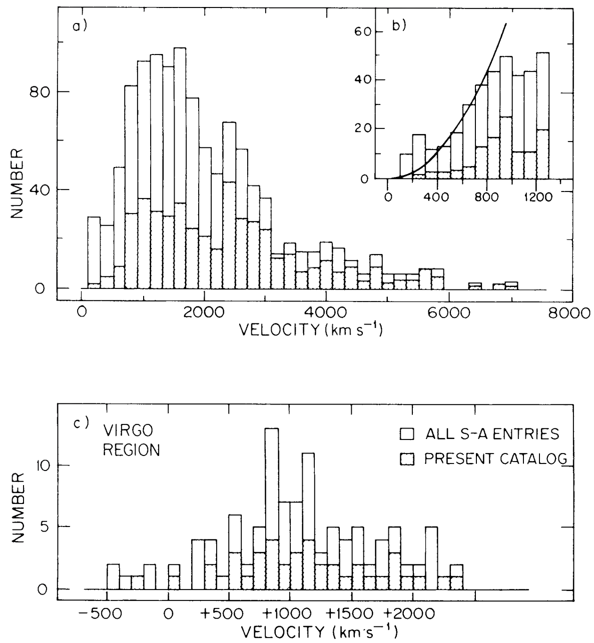

FIG. 4(a). Distribution of redshifts (corrected to the centroid of the Local Group) in the complete Shapley-Ames catalogue (*RSA:* Sandage and Tammann 1978) shown as open bars, compared with the distribution of Shapley-Ames galaxies in the present catalog (Tables IV and IVa) shown as hatched areas. Galaxies in the Local Group and in the Virgo Cluster are excluded.

FIG. 4(b). Details of the low-velocity tail of Fig. 4(a), binned in 100 km s^{-1} intervals. The hypothetical spatially uniform $N(v) \propto v^2$ distribution is shown, normalized to $N(700)$ = 102 galaxies. Again, galaxies in the Local Group and in the Virgo Cluster are excluded.

FIG. 4(c). Distribution of velocities for Virgo cluster candidates in the entire Revised Shapley-Ames (RSA) catalog (open bars), and in the present sample (hatched). Except for two negative velocities for Local Group members, corrected as in Yahil *et al.* (1977), the only negative velocities in the *RSA* are for galaxies within $r < 6°$ of the center of the Virgo Cluster.

Furthermore, in Figs. 4(a) and 4(b) there are no galaxies with velocities smaller than 100 km s^{-1}.

The same sharp cutoff at positive velocities is shown by other samples of nearby galaxies such as those of Fisher and Tully (1975) and of Tammann and Krann (1978, Fig. 4). From this remarkable result it has been concluded (e.g., previous two references; Yahil *et al.* 1977) that, if the nearby galaxies are distributed uniformly, then the mean random motion of these nearby galaxies must be small, for if this were not so, the tail of the distribution would extend to negative velocities.

However, the problem is rather more complex, for two reasons: (1) the number of nearby galaxies is so small that, even if the distribution is extended by convolution to $v_0 < 0$, the numbers of negative values would still be only of the order of a few, and hence the test is weak; and (2) it is known that the distribution of nearby galaxies is not uniform but is clumped into many discrete groups (cf. Tammann 1976; Tammann and Kraan 1978).

Both these effects are illustrated in Fig. 5, which is Fig. 4(b), but with the $N(v) \propto v^2$ curve numerically smeared by two Gaussian point-spread-functions with dispersions of σ_r = 200 km s^{-1} and σ_r = 400 km s^{-1} for the rms random motion. Out of a total of 102 galaxies under the ideal $N(v) \alpha v^2$ curve in the interval $0 < v \leq 700$ km s^{-1}, the number of negative velocities that will appear from these convolutions are 1.5 for σ_r = 200 km s^{-1} and 7.6 for σ_r = 400 km s^{-1}. These numbers are small enough so as to make difficult a good determination of σ_r in this direct way from the observations.

But even more serious is the effect of the true nonuniform spatial distribution. Most of the very nearby galaxies appear in the few well-defined aggregates such as the South Polar group (i.e., NGC 300, etc.) M101 group, M81 group, IC 342 group, NGC 4214 group, and the NGC 5128 group. The distances to these groups start at about 2 Mpc (not closer); hence, there appears to be a trough of low density surrounding the Local Group. This is, of course, expected if the Local Group, with negative energy, formed by collapse from an otherwise expanding neighborhood that has since moved away. Hence, although the absence of velocities smaller than v_0 = 100 km s^{-1} is expected, the evident nonuniformity of the local distribution makes difficult a precise determination of σ_r because its calculation depends on details of the true distribution that are still only sketchily known. In this regard, note that the excess of the histogram over the smooth v^2 distribution in the interval $100 \leq v_0 \leq 300$ km s^{-1} in Figs. 4(a), 4(b), and 5 is undoubtedly due to these nearby groups.

One final comment should be made. Figures 4(a) and 4(b) show how quickly the Shapley-Ames sample becomes incomplete for $v_0 \gtrsim 700$ km s^{-1}. The list is clearly a catalog of intrinsically bright galaxies. And just as the

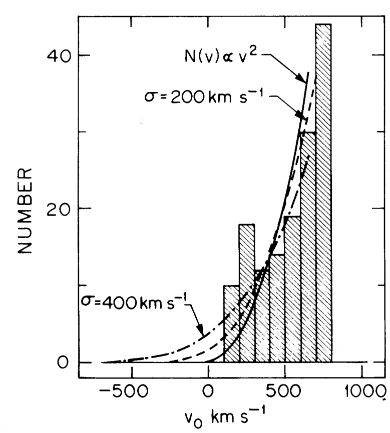

FIG. 5. Enlarged version of Fig. 4b, with the ideal $N(v)$ distribution convolved with Gaussian point-spread functions whose dispersions are σ_r = 200 and 400 km s^{-1}. All distributions are normalized to Σ_0^{700} $N(v)\Delta v$ = 102 galaxies.

Yale Bright Star Catalog contains mostly giant and supergiant stars with no M dwarfs (there are none near enough to appear brighter than $V = 6$ mag), the *SA* contains only a few dwarf galaxies. Determination of the galaxian luminosity function from this sample that is necessarily so grossly incomplete per unit volume (due to the effects of observational bias) is hardly justified with any confidence, as the answer depends entirely on the corrections for completeness, and these themselves depend not only on the purely geometrical volume factors but on the *inhomogeneous spatial distribution within the shells at vastly different distances* (i.e., over distances corresponding to $0 < v \lesssim 6000$ km s^{-1}). Nevertheless, most of what is said to be known about the luminosity function for field galaxies comes from study of even a smaller subsample of the galaxies that make up Fig. 4(a). Clearly, more redshifts of a fainter complete sample are needed as the next step in the study of the distribution of absolute luminosities so as to determine the crucial density function that is needed toward and away from the Virgo–Coma complex before the field galaxy luminosity function can be found.

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