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DOUBLE GALAXIES. I. OBSERVATIONAL DATA ON A WELL-DEFINED SAMPLE

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ABSTRACT

A sample including 279 binary galaxies over a wide range of separations is selected from the Uppsala general catalog using well-defined criteria. The true angular separation distribution of the binary galaxies is reconstructed from the observed distribution and a statistical analysis of the selection criteria. Observational data are compiled on the galaxies using optical as well as radio information. The associated 21 cm neutral-hydrogen studies result in the detection of 149 member galaxies (94 without observed optical redshifts). In addition to accurate radial velocities, H I studies provide global measurements on individual galaxies, including total indicative mass and mass-to-light ratios, to be compared with values obtained from a statistical study of the orbital parameters.

Subject headings: galaxies: clusters of — galaxies: redshifts — galaxies: 21 cm radiation — radio sources: galaxies

I. INTRODUCTION

A determination of mass and the mass-to-light ratio in external galaxies is of basic astronomical interest, and yet it presents the observer with intrinsic and rather severe observational constraints. Mass estimates are based primarily on the analysis of (1) the velocity field in individual galaxies, (2) the orbital parameters in binary systems, or (3) the virial motion in groups and clusters of galaxies (for a review, see Faber and Gallagher 1979). While these mass determinations are independent and subject to differing sets of assumptions, each must rely on observational data in the form of angular separation and radial velocity measurements.

Mass estimates based on internal rotation curve studies are restricted to those nearby spiral systems which exhibit rather large angular diameters. The method is sensitive only to that fraction of the mass interior to the last measured point in the velocity field and thus provides a lower limit to the total mass (Burbidge and Burbidge 1975, and included references). An application of the virial theorem to determine the average galaxian mass in groups and clusters assumes both that the galaxies are physically associated and that the physical associations are stable. If either assumption is incorrect—that is, if the apparent associations are merely chance sky projections (Turner and Sargent 1974), or if the groups and clusters are physical associations expanding with total positive energy (Ambartsumian 1958, 1961; Karachentsev 1966)—then the mass will be overestimated (Neyman, Page, and Scott 1961; Peebles 1971).

An analysis of the orbital parameters in binary galaxies, although beset with projection effects and a possible selection bias, has the potential to yield a reasonably direct measure of the average total mass in galaxies *including* contributions from all material within the orbital dimensions (Turner 1976*a*, *b*, and included references). The method is necessarily statistical in its approach and therefore requires a statistical sample of binary galaxies.

In this paper galaxy pairs are selected in terms of well-defined criteria and the attempt is made to assemble a sample of isolated physical pairs which contains a fair representation of *widely separated doubles* (§ II). The probability that the selection criteria will both exclude physical pairs and include spurious systems is statistically determined as a function of angular separation: the *true* angular separation distribution of the binary galaxies is then derived (§ III).

Observational data are compiled on member galaxies in the binary systems using both *optical and radio information*. The data include angular separations, radial velocities, and corrected magnitudes, as well as additional parameters based on 21 cm line studies (§ IV). The program of 21 cm neutral-hydrogen observations is discussed, with special emphasis on calibration and processing of the spectral line data. The reduced H I profiles are presented (§ V). Derived global properties of the member galaxies, including hydrogen mass content, luminosity, total indicative mass, and ratios of these parameters, are compiled (§ VI). A summary follows (§ VII).

The second part of the investigation (Paper II) will include the statistical analysis of observational data on the binary galaxies and a comparison with the results of earlier studies.

II. SELECTION CRITERIA

Previous investigators (Page 1952, 1961, 1966, 1975; Holmberg 1954; Karachentsev 1974; Turner 1976*a*, *b*) have established criteria for selecting binary galaxies

* Operated by Associated Universities, Inc., under contract with the National Science Foundation.

which uniformly exclude widely separated pairs, stressing the importance of ensuring that prospective doubles be physically associated. In particular, the existing catalogs incorporate an angular separation cutoff (usually from 2′ to 10′) as a means of reducing the number of spurious entries. However, the existence of clustering on all scales of less than 5° ensures that a high percentage of the prospective pairs, including those at rather large separations, will indeed be physically associated, through common membership in either a binary system, a group, or a cluster. The major concern in developing a catalog of isolated physical pairs is thus one of separating the binary galaxies from those physically associated companions in multiple systems.

The isolation of a galaxy pair is usually defined in terms of its apparent (angular) proximity to other galaxies. Unfortunately, the insensitivity of this criterion to the association of physical binaries with faint background galaxies is responsible for creating spurious multiple systems and eliminating isolated pairs, especially at the *wide separations*.

In this investigation the isolation criteria are modified to include a magnitude range based on the magnitudes observed in the prospective pair: only those galaxies within the magnitude range are then involved in the isolation based on angular proximity. Other galaxies which are "faint" in comparison to the prospective members of the double are considered as background objects; if these galaxies are *not* in the background field, then at the very worst they are dwarf companions of the binary and cannot grossly affect the dynamics.

For the purpose of defining the isolation criteria, let g_1 and g_2 (with apparent magnitudes m_1 and m_2) be members of a prospective double with angular separation θ_{12}; and let g_n (with apparent magnitudes m_n) ($n = 3, 4, 5, \ldots$) be neighboring galaxies with angular separations $\theta_{12,n}$ determined from the center of the pair. Then the criteria for isolation can be stated as follows: if

$$m_n > m_o(m_1, m_2) \quad \text{or} \quad \theta_{12,n} \geq x\theta_{12} \quad \text{for each } g_n \ (n = 3, 4, 5, \ldots)\,, \tag{1}$$

then the two galaxies form an isolated galaxy pair. The $m_o(m_1, m_2)$ and x are parameters which characterize the range of the isolation in magnitude and angular separation, respectively, given by

$$x = 2.5$$

$$m_o(m_1, m_2) = 5 \log [\text{dex}\,(m_f/5) + 2.06 \times 10^2]\,, \tag{2}$$

where m_f is the fainter of the two magnitudes. The adopted form of $m_o(m_1, m_2)$ is based on the use of apparent magnitudes as distance indicators, with the magnitude range reflecting a fixed distance scale and corresponding to the radial isolation component (see Appendix A for a derivation). As an example, if the faint component m_f of a prospective double were 13.5, then the pair would have to be isolated with respect to all galaxies having $m_n \leq 14.25$; if, however, $m_f = 14.5$, the isolation criteria would extend to $m_o = 15.0$.

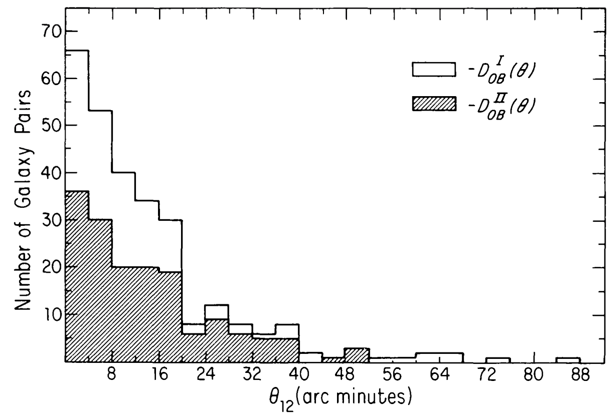

FIG. 1.—Observed distribution of angular separations θ_{12} in the selected catalog of galaxy pairs. $\mathscr{D}_{OB}{}^{I}$ represents the entire sample of 279 double galaxies, while $\mathscr{D}_{OB}{}^{II}$ is restricted to the 160 doubles in the Galactic latitude range $|b| \geq 40°$.

The isolation criteria were applied to the entries in the Uppsala general catalog (Nilson 1973, hereafter UGC), with membership in prospective pairs restricted to those 3271 galaxies with declination $\delta \geq 0°$ and apparent magnitude $12.0 \leq m_z \leq 14.5$. From this analysis, 279 isolated doubles ($\mathscr{D}_{OB}{}^{I}$) were selected with an angular separation distribution displayed in Figure 1.

An identical analysis was performed using the *Catalogue of Galaxies and Clusters of Galaxies* (Zwicky *et al.* 1960–1968), with no significant change in the composition of the binary sample.

The parameters x and $m_o(m_1, m_2)$ were selected to strike a balance between reasonable isolation of the binaries and the selection of the systems in reasonable numbers. An additional criterion restricting the observed radial velocity difference ($\Delta v < 750$ km s^{-1}) eliminates 27 of the 123 pairs for which both velocities are known. The ultimate success of these combined criteria in selecting isolated physical pairs is to be determined by arguments involving a statistical analysis of the sample based on the distribution of observed parameters.

III. DERIVED ANGULAR SEPARATION DISTRIBUTION

The selection of physical pairs on the basis of somewhat arbitrary isolation criteria cannot be expected to produce a pure or complete sample of binary galaxies: the list not only will include a number of spurious pairs but also will exclude a certain portion of the physical doubles. Although it is not possible to state precisely which pairs must be removed and which should be added, a knowledge of the selection criteria permits a statistical determination of the relative numbers involved in each of the two groups as a function of angular separation.

The relative number of physical pairs which have *not* satisfied the isolation criteria, and thus are not included in the catalog, is based on the probability that a physical double will have both a sky position and component magnitudes such that background or foreground galaxies will fall within the prescribed angular separation and magnitude ranges, and the pair will be rejected.

Given a binary system with magnitudes m_1 and m_2, and separation θ_{12},

$$1 - \exp\{-2\pi\rho_{\leq m_0}[1 - \cos(2.5\,\theta_{12})]\} \quad (3)$$

describes the probability that at least one random galaxy will fall within the ranges determined by the isolation criteria (eq. [1]), where $\rho_{\leq m_0}$ is the average angular density of galaxies with magnitudes no greater than m_0.

Let P_{m_f} be the probability that an acceptable member of a pair will have an apparent magnitude m_f, and let $P_{\leq m_f}$ be the probability that its companion will have a magnitude no greater than m_f; then $2P_{m_f}P_{\leq m_f}$ represents the probability that m_f will be the fainter of the two magnitudes in the pair. From these definitions,

$$P_{\rm RJ}(\theta) = 1 - 2\sum_{m_f} P_{m_f}P_{\leq m_f} \times [\![\exp\{-2\pi\rho_{\leq m_0}[1 - \cos(2.5\,\theta)]\}]\!] \quad (4)$$

is the probability, in general, that a *physical pair* with separation θ will be *rejected* under the isolation criteria.

In order to reduce the possible effects of Galactic obscuration, the theoretical analysis is based on the statistics of the 2022 galaxies in the UGC with $12.0 \leq m_z \leq 14.5$, restricted to the sky region defined by $\delta \geq 0°$ and $|b| \geq 40°$. The probability $P_{\rm RJ}(\theta)$ that a physical pair with separation θ will be rejected under the isolation criteria is presented in Figure 2.

$P_{\rm RJ}(\theta)$ is also derived from a numerical simulation (Fig. 2). The numerical analysis is based on the random placement of 10,000 points throughout the restricted sky region, each point representing the possible position of a galaxy pair with component magnitudes reflecting the distribution of magnitudes in the observed binary galaxy sample. The numerical simulation incorporates both the apparent clustering and the observed magnitude distribution in the UGC, and therefore represents a more reasonable approximation of the true probability.

Random or spurious pairs are those entries among the list of binary systems in which the two component galaxies are physically unrelated. The relative number of spurious pairs included in the binary galaxy sample can be *approximated* through a comparison of the degree to which pairing is observed (disregarding the isolation criteria) with the extent to which it is expected at random.

Given a random distribution of galaxies with an average angular density $\hat{\rho}$, the number of galaxies expected at separation θ from a selected galaxy is

$$2\pi\hat{\rho}\sin(\theta)d\theta \quad (5)$$

and is equivalent to the average number of random pairs which involve the membership of that galaxy. Let N_T be the total number of galaxies to be considered in a given sky region, and let $N_{\rm RD}(\theta)$ be the total number of random pairs expected at separation θ; then

$$N_{\rm RD}(\theta)d\theta = \tfrac{1}{2}N_T[2\pi\hat{\rho}\sin(\theta)d\theta] = \pi N_T^2\sin(\theta)d\theta/\Omega_T\,, \quad (6)$$

where Ω_T is the total solid angle of the sky region and $\hat{\rho} = N_T/\Omega_T$. The factor of $\frac{1}{2}$ is included so that each pair is counted only once.

The probability that two galaxies with a separation θ will form a spurious pair is then defined as

$$P_{\rm RD}(\theta) = N_{\rm RD}(\theta)d\theta/N_{\rm OB}(\theta)d\theta\,, \quad (7)$$

with $N_{\rm OB}(\theta)d\theta$ the number of pairs (disregarding the isolation criteria) actually observed within the given region.

If the probability for selecting a spurious pair is to be applied to the list of binary galaxies satisfying the isolation criteria (eq. [1]), then $P_{\rm RD}(\theta)$ should be redefined as the ratio of the number of *isolated* pairs expected at random to the total number of *isolated* pairs observed. However, the actual occurrence of isolated systems is so reduced by the presence of clustering in the observed distribution that this latter ratio is meaningless, having values which often exceed unity. In this study, $P_{\rm RD}(\theta)$ (eq. [7]) is therefore adopted as the probability distribution which best represents the possible inclusion of spurious systems.

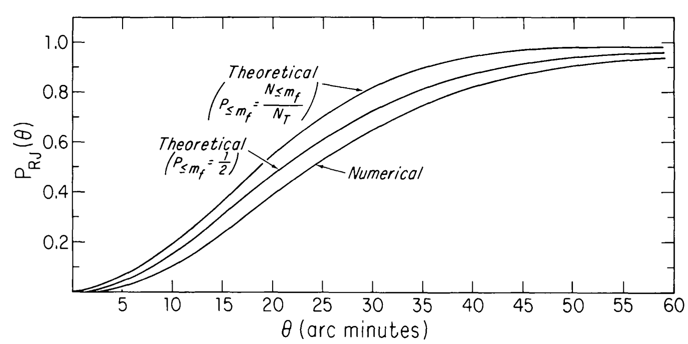

FIG. 2.—Probability $P_{\rm RJ}(\theta)$ that a physical pair with apparent angular separation θ will be rejected under the isolation criteria and thus be excluded from the binary galaxy catalog. The theoretical analysis assumes both a random distribution of sky positions and apparent magnitudes in calculating P_{m_f}, and is based on two possible definitions for $P_{\leq m_f}$. The numerical simulation reflects the observed clustering and the actual magnitude distribution in the UGC.

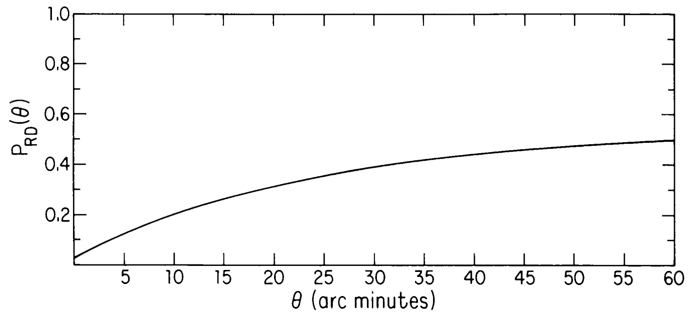

FIG. 3.—Probability $P_{RD}(\theta)$ that a random or spurious pair with angular separation θ will be included in the binary galaxy catalog. The probability is statistically determined from a comparison of the degree to which pairing is observed with the extent to which it is expected at random (disregarding the isolation criteria) as a function of angular separation.

Both the expected number of random pairs $N_{RD}(\theta)$ and the number of pairs observed $N_{OB}(\theta)$ have been determined from an analysis of those galaxies with $12.0 \leq m_z \leq 14.5$, restricted to the sky region defined by $\delta \geq 0°$ and $|b| \geq 40°$; the resulting probability $P_{RD}(\theta)$ is plotted in Figure 3.

An examination of $\mathscr{D}_{OB}{}^{I}$, the primary sample of isolated double galaxies, indicates that 59 (21%) of the 279 pairs could be expected at random, given the probability distribution $P_{RD}(\theta)$. The reliability of this estimate is difficult to judge, although there is evidence to suggest that it is rather good. Of the 123 galaxy pairs in $\mathscr{D}_{OB}{}^{I}$ with redshift information available, 27 systems have radial velocity differences $\Delta v >$ 750 km s^{-1}, indicating that these pairs are probably spurious entries. On the basis of probability $P_{RD}(\theta)$, 26 out of the 123 galaxy pairs could be expected at random. The agreement suggests that, in general, the relative number of spurious pairs can be reasonably predicted and that, in particular, a spurious pair can be eliminated on the basis of radial velocity measurements.

Given the observed distribution $\mathscr{D}_{OB}{}^{II}(\theta)$ in the region $\delta \geq 0°$ and $|b| \geq 40°$,

$$\mathscr{D}_{TR}(\theta) = \mathscr{D}_{OB}{}^{II}(\theta)[1 - P_{RD}(\theta)]/[1 - P_{RJ}(\theta)] \quad (8)$$

represents the *true distribution* of angular separations for the physical doubles.

After grouping the observed pairs ($\mathscr{D}_{OB}{}^{II}$) into overlapping 4′ bins on the basis of angular separation, $\mathscr{D}_{TR}(\theta)$ is plotted as a logarithmic function of the average separation θ within each bin (Fig. 4). A weighted least-squares linear regression on the 23 data points yields

$$\log[\mathscr{D}_{TR}(\theta)] = (1.83 \pm 0.09) - (0.50 \pm 0.08)\log(\theta) \quad (9)$$

and hence

$$\mathscr{D}_{TR}(\theta) \propto \theta^{-(0.50 \pm 0.08)}. \quad (10)$$

A χ^2 estimate for the goodness of fit supports the power-law model. After dividing the data into morphological classes (spiral pairs, elliptical pairs, and mixed systems), a further analysis yields linear regressions which are consistent, given the errors, with a solution (eq. [10]) based on the complete sample.

IV. OBSERVATIONAL DATA

a) Table 1

Observational data on galaxies which form the 279 pairs in $\mathscr{D}_{OB}{}^{I}$ are compiled in Table 1; the tabulated entries are explained and referenced by column number.

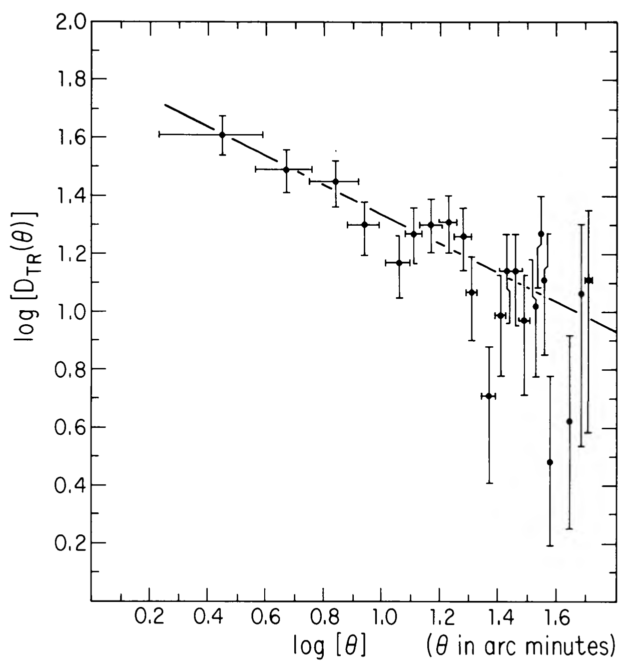

FIG. 4.—True distribution of angular separations θ for physically paired galaxies. $\mathscr{D}_{TR}(\theta)$ is based on the observed distribution, $\mathscr{D}_{OB}{}^{II}(\theta)$, and accounts for the effects of the selection criteria, incorporating both the probability $P_{RJ}(\theta)$ of rejecting a physical double and the probability $P_{RD}(\theta)$ of accepting a spurious system. Standard errors in log (θ) reflect the grouping of the data, while standard errors in log [$\mathscr{D}_{TR}(\theta)$] represent the statistical fluctuations expected in the observed distribution. The latter predominate over the former and are thus used as the basis for weighting the data in the regression.

TABLE 1

Observational Data ($\mathcal{D}_{OB}{}^{I}$)

NAME UGC (1)	NGC *IC (2)	R A (1950.0) (3)	DEC (1950.0) (3)	GLACT LAT (DEG) (4)	HUB TYP (5)	BLUE DIA (MIN) (6)		POS ANG (DEG) (7)	ZWKY MAG (8)	OBSERVED RADIAL VELOCITY OPTL (KM/S) (9)	M.E. (KM/S) (10)	REF (11)	RADIO (KM/S) (12)	M.E. (KM/S) (13)	NOTES (14)	HI PROFILE AREA (JY-KM/S) (15)	HI PROFILE WIDTH (16)	SEP (MIN) (17)
57	1	0 4 41.3	27 25 50	-34.1	S5	1.80	1.20	120	13.4				4548	10	9,2	11.02	367	
80	16	0 6 29.7	27 27 8	-34.2	S1	1.80	1.00	16	12.5	3110	50	B			10,2			24.09
89	23	0 7 19.3	25 38 50	-36.C	S3	2.20	1.60	8	12.5	4568	100	B	4566	15	8,2	8.92	364	
94	26	0 7 51.3	25 33 16	-36.1	S5	2.00	1.10	100	13.9				4583	15	8,1	12.05	354	9.11
183		0 16 55.5	46 57 50	-15.3	S5	1.60	0.70	50	13.8									
196		0 17 54.4	47 9 26	-15.1	S7	1.50	1.10	140	14.2				5136	15	8,1	4.69	280	15.34
286	125	0 26 16.2	2 33 48	-59.5	S1	1.60	1.50		14.2	5289	50	B						
292	128	0 26 40.8	2 35 20	-59.5	S1	3.00	0.90	1	13.2	4243	26	BE						6.33
356	160	0 33.26.0	23 41 0	-38.8	S3	3.00	1.60	45	13.7	5255	50	B			10,1			
365	169	0 34 13.7	23 43 0	-38.8	D	3.50	1.10	88	13.3	4477	220	Z			8,1			11.10
444		0 39 22.5	36 31 53	-26.0	S	1.20	0.80	160	14.0									
480		0 43 48.3	36 3 15	-26.5	S	1.60	1.10		13.6									60.73
491	252	0 45 20.9	27 21 3	-35.2	S1	1.70	1.30	80	13.4									
497	260	0 45 54.0	27 25 6	-35.2	S	0.90	0.90		14.3				5206	25	4,2,1	4.27	217	8.39
592	311	0 54 49.6	30 0 35	-32.6	S1	1.50	0.80	120	14.1									
597	315	0 55 5.8	30 4 58	-32.5	E	3.00	2.50	40	12.5	5010	120	E						5.61
682	380	1 4 32.3	32 13 1	-30.3	E	1.30	1.10		13.9	4341	150	B						
683	379	1 4 30.0	32 15 16	-30.2	S1	1.50	0.80		14.0	5374	65	B						2.30
686	384	1 4 39.7	32 1 33	-30.5	S1	1.10	0.80	135	14.3	4401	100	B						
687	385	1 4 41.9	32 3 15	-30.4	E	1.30	1.00		14.3	4845	150	B						1.76
688	382	1 4 38.7	32 8 13	-30.3	E	0.25	0.25		14.2	5156	50	B						
689	383	1 4 39.4	32 8 46	-30.3	S1	2.00	1.70		13.6	4888	50	B						0.57
690		1 4 43.6	39 7 56	-23.4	S7	2.50	1.90	105	13.8				5869	20	3,2,1	7.55	365	
707	393	1 5 47.7	39 22 40	-23.1	S0	1.70	1.40	20	13.3									19.26
725		1 7 18.8	42 50 37	-19.6	S7	2.20	0.60	43	14.5				5050	10	6,2	8.25	360	
728		1 7 36.3	43 1 23	-19.4	S7	1.50	1.50		14.2				4910	20	10,2	9.09	302	11.23
838		1 16 6.3	14 43 44	-47.4		0.65	0.45		14.2									
861	471	1 17 20.0	14 31 20	-47.5	S1	1.20	0.70	85	14.0									21.72
858	470	1 17 10.5	3 8 53	-58.7	S6	3.30	1.90	155	12.4	2362	38	S	2370	10	8,2	14.40	409	
864	474	1 17 31.7	3 9 17	-58.7	S1	10.00	9.00		12.9	2306	40	B						5.31
956	515	1 21 48.8	33 12 45	-28.9	S1	1.30	1.00		14.3									
960	517	1 21 54.2	33 10 8	-28.9	S1	2.10	1.00	20	13.6									2.85
959		1 21 56.5	31 54 24	-30.2	S3	1.20	1.00	60	14.2									
987		1 22 42.7	31 52 31	-30.2	S3	2.60	0.80	32	14.0									9.99

TABLE 1—*Continued*

NAME UGC (1)	NGC *IC (2)	R A (1950.0) (3)	DEC (1950.0) (3)	GLACT LAT (DEG) (4)	HUB TYP (5)	BLUE DIA (MIN) (6)	BLUE DIA (MIN) (6)	POS ANG (DEG) (7)	ZWKY MAG (8)	OBSERVED RADIAL VELOCITY OPTL (KM/S) (9)	M.E. (KM/S) (10)	REF (11)	RADIO (KM/S) (12)	M.E. (KM/S) (13)	NOTES (14)	HI PROFILE AREA (JY-KM/S) (15)	HI PROFILE WIDTH (16)	SEP (MIN) (17)
986	*1700	1 22 44.7	14 36 13	-47.2	E	2.00	2.00		14.3	5755	192	T						
1027	*1706	1 24 29.2	14 31 1	-47.2	S	1.20	0.80	165	14.2	6319	86	K						25.82
995	529	1 22 50.0	34 27 14	-27.6	S0	2.40	2.10	160	13.1									
1013	536	1 23 31.4	34 26 35	-27.6	S5	3.40	1.70	62	13.2	5160	45	N						8.56
1068		1 26 47.6	45 20 24	-16.8	S7	1.90	1.20	30	13.7				5239	20	7,2,1	6.71	404	
1109	590	1 30 41.5	44 40 21	-17.3	S2	3.60	1.80	150	14.2									57.56
1070		1 27 4.4	40 42 56	-21.3	S7	2.10	1.60	55	14.3				2806	15	7,2	11.45	187	
1078	573	1 27 53.1	41 0 0	-21.0	P	C.45	0.40		13.5				2796	15	6,3	3.89	163	19.39
1089	579	1 28 55.2	33 21 38	-28.5	S7	1.70	1.60		13.6				4981	15	12,2	5.33	239	
1094	582	1 29 7.0	33 13 8	-28.6	S5	2.20	0.60	58	13.7				4354	10	18,4	9.74	502	8.85
1135	608	1 32 37.0	33 24 8	-28.3		0.90	0.60	32	14.0									
1140	614	1 33 0.6	33 25 36	-28.3	S1	1.60	1.50		13.9									5.14
1143	622	1 33 25.6	0 24 35	-60.2	S5	2.10	1.70	45	14.1	5400	200	Z						
1169		1 36 12.7	0 49 6	-59.6	S1	1.40	0.60	74	14.2									48.44
1265		1 46 1.8	20 0 57	-40.6	D	1.10	0.60	170	14.5									
1276	* 163	1 46 30.3	20 27 48	-40.2		2.00	0.90	95	13.8				2735	15	5,2	12.87	277	27.67
1280	678	1 46 39.3	21 44 58	-38.9	S5	5.00	1.10	78	13.3									
1286	680	1 47 1.4	21 43 22	-38.9	E	2.70	2.40		13.0									5.38
1298	687	1 47 37.7	36 7 25	-25.0	S1	1.40	1.40		13.3									
1308		1 47 55.3	36 1 45	-25.1	E	2.30	2.30		14.5									6.69
1310	694	1 48 12.5	21 45 5	-38.8	P	0.50	0.35	160	13.9	2870	43	KZ						
1313	* 167	1 48 22.2	21 40 1	-38.9	S7	3.00	1.70	95	14.0				2928	10	8,2	24.02	213	5.55
1476	777	1 57 21.2	31 11 22	-29.2	E	2.80	2.20	155	12.7	5019	28	S						
1480	778	1 57 25.6	31 4 19	-29.3	S1	1.10	0.50	150	14.2									7.11
1507		1 58 40.3	26 14 28	-33.8	S3	2.10	0.80	70	13.9									
1510		1 58 56.0	26 18 15	-33.7		0.60	0.30	45	14.4				5009	15	2,2,2	3.51	238	5.17
1541	797	2 0 27.9	37 52 41	-22.6	S3	1.90	1.40	65	13.1				5647	20	18,3	12.38	495	
1550	801	2 0 44.9	38 1 11	-22.5	S7	3.30	0.70	150	13.5				5764	10	6,2	14.86	477	9.14
1555	* 155	2 1 2.0	14 28 8	-44.6	S1	1.50	0.80	135	14.3	8610	34	T						
1556	* 196	2 1 7.4	14 30 0	-44.6	S5	3.00	1.50	5	14.2	8573	69	T						2.28
1633	818	2 5 42.7	38 32 22	-21.7	S6	3.50	1.40	113	12.7				4245	10	12,1	14.09	500	
1655	828	2 7 7.0	38 57 23	-21.2	P	3.50	2.70		13.0	5430	120	E	5374	15	11,2	8.53	458	29.93
1672	834	2 8 0.6	37 25 56	-22.6	S	1.20	0.50	20	13.2				4553	25	4,1,1	5.50	307	
1676	841	2 8 16.9	37 15 48	-22.7	S4	2.00	1.00	135	12.8									10.64

TABLE 1—*Continued*

NAME UGC (1)	NGC *IC (2)	R A (1950.0) (3)	DEC (1950.0) (3)	GLACT LAT (DEG) (4)	HUB TYP (5)	BLUE DIA (MIN) (6)		POS ANG (DEG) (7)	ZWKY MAG (8)	OBSERVED RADIAL VELOCITY OPTL (KM/S) (9)	M.E. (10)	REF (11)	RADIO (KM/S) (12)	M.E. (13)	NOTES (14)	HI PROFILE AREA (JY-KM/S) (15)	WIDTH (16)	SEP (MIN) (17)
1759	871	2 14 27.1	14 19 5	-43.4		1.10	0.35	4	13.6	3731	25	CR	3740	10	10,2	13.11	314	
1768	877	2 15 15.3	14 19 1	-43.3	S7	2.30	1.80	140	12.5	4016	68	C	3914	25	8,2	40.07	495	11.68
1767		2 15 2.8	37 50 48	-21.7	S9	1.20	1.20		14.0				5159	25	5,1,1	2.33	170	
1772		2 15 24.5	37 47 40	-21.7		1.10	0.50	143	13.7									5.31
1931	930	2 25 6.1	20 6 32	-37.1	S3	1.80	1.70		13.7									
1947	938	2 25 44.8	20 3 37	-37.1	E	1.60	1.20	100	13.8									9.54
2047	*1815	2 31 20.5	32 12 41	-25.6	S1	1.70	1.60		14.3									
2048	973	2 31 20.5	32 17 13	-25.5	S5	4.00	0.60	48	13.7									4.53
2063	982	2 32 9.1	40 42 29	-17.8	S1	1.70	0.90	110	14.3									
2066	980	2 32 15.1	40 39 6	-17.9	S3	1.80	0.70	132	13.2									3.57
2105		2 34 37.7	34 12 59	-23.5	S3	1.60	1.30		13.9				4915	50	8,2	3.57	291	
2133	1002	2 35 52.3	34 24 33	-23.2	S5	1.60	1.00	140	14.0									19.26
2123	996	2 35 28.4	41 25 56	-16.9	E	1.40	1.40		14.5									
2127	999	2 35 36.2	41 27 19	-16.9	S3	1.10	1.00		14.5									2.01
2152	*1827	2 37 11.8	1 20 40	-51.2	S3	1.20	0.22	154	14.5									
2158	1038	2 37 30.9	1 17 41	-51.2	S3	1.30	0.45	61	14.4				4372	25	4,3,1	3.44	173	5.63
2365	1134	2 50 56.9	12 48 43	-40.1	S	2.50	0.90	148	13.2									
2368	* 267	2 51 6.1	12 38 43	-40.2	S5	2.10	1.40	15	14.1									10.25
2439	1153	2 55 34.4	3 9 43	-46.8		1.40	1.40		13.5									
2446		2 56 4.8	3 14 5	-46.7	P	0.50	0.35	105	14.4				7089	25	4,1,1	4.58	219	8.75
2474	1161	2 57 53.9	44 42 1	-12.1	S1	2.80	2.00	23	12.6									
2475	1160	2 57 53.1	44 45 28	-12.1	S7	1.50	0.70	50	13.0									3.45
2519		3 2 9.8	79 56 25	18.9	S7	1.50	0.90	75	14.3				2377	30	5,2,1	6.56	257	
2583	1184	3 9 6.3	80 36 29	19.6	S2	2.80	0.70	168	13.4									43.75
2783		3 31 1.0	39 11 23	-13.4	E	1.60	1.40		14.2	6103	41	E						
2784		3 31 2.2	39 22 46	-13.3	S1	1.60	1.20	160	14.3									11.39
3063	1587	4 28 5.2	0 33 17	-30.5	E	1.80	1.70		13.3	3890	75	B						
3064	1588	4 28 9.5	0 33 30	-30.5	C	1.50	0.80	175	14.1	3378	105	K						1.10
3223		4 56 30.0	4 54 3	-22.2	S3	1.60	0.80	80	14.0									
3224		4 56 41.2	5 32 35	-21.8	S5	1.70	1.30	15	14.4	4694	10	MR						38.63
3422		6 9 18.8	71 9 5	22.7	S5	2.40	1.80	43	14.5				4053	10	14,2	18.58	449	
3426		6 9 48.8	71 3 10	22.7	S1	1.80	1.60		13.8	4054	10	EMR						6.40
3445		6 17 8.0	59 9 5	19.4	S2	1.50	0.35	101	13.9									
3446		6 17 13.6	59 8 58	19.4	S1	1.40	1.00	150	14.1									0.73

TABLE 1—*Continued*

NAME UGC (1)	NGC *IC (2)	R A (1950.0) (3)	DEC (1950.0) (3)	GLACT LAT (DEG) (4)	HUB TYP (5)	BLUE DIA (MIN) (6)		POS ANG (DEG) (7)	ZWKY MAG (8)	OBSERVED RADIAL VELOCITY OPTL (KM/S) (9)	M.E. (10)	REF (11)	RADIO (KM/S) (12)	M.E. (13)	NOTES (14)	HI PROFILE AREA (JY-KM/S) (15)	WIDTH (16)	SEP (MIN) (17)
3519	2256	6 40 47.5	74 17 22	25.7	E	2.30	2.00		14.0									
3523	2258	6 41 16.2	74 32 9	25.8	S1	2.30	1.50	150	13.2									14.91
3541	2274	6 44 0.0	33 37 19	13.8	E	1.80	1.80		13.6									
3542	2275	6 44 0.6	33 39 13	13.8	S	1.40	1.00	20	14.5									1.90
3549		6 45 35.1	81 1 38	26.9	E	0.60	0.60		14.4									
3604		6 53 4.5	81 1 23	27.2	S	0.80	0.80		14.2									17.53
3596		6 52 8.2	39 49 50	17.7	S1	1.10	1.00		13.5				1340	30	5,2,1	11.25	563	
3601		6 52 21.4	40 3 55	17.8		0.60	0.45	5	14.5									14.31
3642		6 59 34.8	64 5 43	25.6	S1	1.40	1.00	30	13.5				4497	10	6,2	22.77	486	
3660		7 1 49.8	63 55 36	25.8	S3	1.80	1.00	110	13.6									17.92
3685		7 4 33.1	61 40 29	25.7	S5	4.00	4.00		13.1				1800	10	3,2,1	45.34	165	
3704		7 5 57.7	61 52 3	25.9	S3	1.40	0.30	50	14.5									15.29
3695	2329	7 5 21.7	48 41 48	22.8	S0	1.30	1.10	175	13.7	5766	120	K						
3696		7 5 36.9	48 42 58	22.8		1.00	0.70	77	13.8									2.77
3697		7 5 32.5	71 55 1	27.2	I	3.30	0.20	76	13.1	3150	18	ER	3141	20	5,2	19.08	333	
3714		7 6 46.3	71 49 56	27.3	S	2.00	1.70	35	12.7									7.67
3708	2341	7 6 14.2	20 40 58	13.0	P	0.90	0.90		13.7									
3709	2342	7 6 20.7	20 43 3	13.0	S	1.40	1.30		12.6									2.58
3740	2276	7 10 22.0	85 50 58	27.7	S7	2.80	2.50	20	12.3	2369	28	CR	2419	15	7,2	21.18	236	
3798	2300	7 15 45.1	85 48 31	27.8	E	3.20	2.70		12.2	1958	25	BC						6.37
3742		7 10 9.9	35 11 1	19.4		1.50	0.70	73	14.3									
3752		7 10 45.3	35 22 0	19.6		0.45	0.40		14.5									13.15
3750	*2179	7 10 43.1	65 0 46	26.9		0.80	0.80		13.4									
3759	2347	7 11 16.2	64 47 53	26.9	S5	2.00	1.50	175	13.2	4521	62	C	4424	10	8,2	10.08	457	13.35
3816		7 18 57.9	58 9 44	26.9	S1	1.00	0.70	112	13.4									
3828		7 20 21.5	58 4 1	27.0	S5	1.80	0.90		12.7									12.43
3858		7 24 40.1	73 44 1	28.7	S3	1.20	1.00	120	13.8									
3859		7 24 41.3	73 48 33	28.7	S3	1.60	1.10	45	13.3									4.53
3885		7 26 48.5	59 35 16	28.1	S	1.00	0.90		13.9									
3897		7 29 1.6	59 43 58	28.4	S1	1.10	0.90	45	14.2									18.93
3910	*2196	7 30 59.0	31 30 58	22.2	E	1.40	1.10	150	14.0									
3915	*2199	7 31 44.5	31 23 10	22.3	S	1.20	0.60	25	13.6									12.45
3930	2415	7 33 39.7	35 21 18	24.0	P	1.00	1.00		12.5	3798	27	CR	3782	20	17,2	9.50	285	
3937		7 34 18.7	35 43 10	24.2	S	2.10	0.50	151	14.2				3990	10	14,2	11.37	351	23.26

TABLE 1—*Continued*

NAME UGC (1)	NGC *IC (2)	R A (1950.0) (3)	DEC (1950.0) (3)	GLACT LAT (DEG) (4)	HUB TYP (5)	BLUE DIA (MIN) (6)		POS ANG (DEG) (7)	ZWKY MAG (8)	OBSERVED RADIAL VELOCITY OPTL (KM/S) (9)	M.E. (10)	REF (11)	RADIO (KM/S) (12)	M.E. (13)	NOTES (14)	HI PROFILE AREA (JY-KM/S) (15)	WIDTH (16)	SEP (MIN) (17)
3982	* 471	7 39 51.6	49 47 10	28.5	E	0.60	0.60		14.2									
3985	* 472	7 40 5.2	49 44 0	28.6	S5	1.90	1.00	167	14.5									3.85
3993		7 41 49.6	85 3 16	28.4	S1	1.60	1.20	35	14.0				4365	25	9,1	5.83	225	
3994	* 469	7 41 31.7	85 17 11	28.4	S3	2.30	1.20	90	13.6									13.92
4028		7 44 44.3	74 29 0	30.0	S	1.10	0.90	10	12.7	4068	33	KRZ	3943	15	4,2	14.07	277	
4057		7 47 59.3	74 30 59	30.3	S3	2.60	0.70	55	13.4									13.13
4051		7 47 32.7	50 18 27	29.8		0.45	0.30		14.4									
4052		7 47 34.7	50 21 45	29.8	D	0.80	0.40		14.1									3.32
4066		7 49 5.6	78 8 45	29.8	S7	2.10	2.00		14.2				2301	10	16,2	9.32	144	
4151		7 57 17.3	77 57 26	30.3	S8	1.70	1.60		13.1				2286	15	16,2	3.83	174	27.85
4073	2456	7 50 11.0	55 37 30	30.8	E	1.10	0.80	30	14.3									
4079		7 51 6.2	55 50 8	30.9	S	1.00	0.50	3	13.6	6104	43	KZ						14.83
4093	*2209	7 51 58.0	60 26 13	31.3	S	1.10	0.80	145	14.5	1545	95	E						
4097	2460	7 52 35.8	60 29 1	31.4	S5	4.00	2.80	70	12.5	1442	50	B	1450	10	6,2	44.10	384	5.44
4095		7 52 3.8	66 44 38	31.2	P	0.90	0.35	51	14.4				4080	15	12,2	9.24	360	
4098		7 52 32.5	66 34 18	31.3	S	0.90	0.55	105	14.5				4913	10	8,2	9.33	368	10.72
4106	2476	7 53 22.7	40 3 46	29.0	E	1.40	0.80	135	13.4									
4150	2493	7 57 1.5	39 58 5	29.6	S1	2.20	2.20		13.1									42.28
4123	2486	7 54 55.0	25 17 48	25.1	S3	1.90	1.10	100	14.3									
4126	2487	7 55 18.9	25 17 8	25.2	S5	2.50	2.20	115	14.0				4826	15	2,1,2	5.16	327	5.44
4267		8 9 2.8	55 7 13	33.5		1.00	0.50	35	14.2									
4280		8 10 40.3	54 57 12	33.7	S3	1.50	0.30	3	14.4									17.19
4345	2562	8 17 28.6	21 17 27	28.6	S2	1.30	1.00	3	14.0	4963	50	B						
4347	2563	8 17 40.7	21 13 40	28.6	S1	2.00	1.70	80	13.7	4642	39	BX						4.72
4356	*2327	8 18 51.2	3 19 45	21.4	S3	1.50	0.45	168	13.9				2685	10	10,1	11.02	346	
4366	* 503	8 19 33.4	3 25 43	21.6	S3	1.10	1.00		14.0				4131	15	6,2	12.55	342	12.10
4491		8 33 13.1	1 53 41	23.9	S4	2.70	0.90	60	13.9									
4492	2618	8 33 18.8	0 52 52	23.4	S3	3.00	2.50	140	13.9									60.83
4574	2633	8 42 35.7	74 17 0	33.9	S5	2.80	1.70	175	12.4	2141	43	C						
4581	2634	8 42 56.0	74 9 6	33.9	E	2.00	2.00		12.6									8.02
4593		8 44 7.0	70 17 40	35.3	D	0.70	0.45	155	13.4	3594	220	Z	3626	15	10,1	4.66	241	
4603	2650	8 45 4.1	70 29 8	35.3	S5	1.80	1.30	82	14.3				3826	15	20,2	3.87	365	12.43
4670		8 53 10.6	13 25 15	33.5	S1	1.60	1.20		14.2									
4685		8 54 16.6	13 23 28	33.7	S	1.40	0.60	150	14.2									16.15

TABLE 1—*Continued*

NAME UGC (1)	NGC *IC (2)	R A (1950.0) (3)	DEC (1950.0) (3)	GLACT LAT (DEG) (4)	HUB TYP (5)	BLUE DIA (MIN) (6)		POS ANG (DEG) (7)	ZWKY MAG (8)	OBSERVED RADIAL VELOCITY OPTL (KM/S) (9)	M.E. (10)	REF (11)	RADIO (KM/S) (12)	M.E. (13)	NOTES (14)	HI PROFILE AREA (JY-KM/S) (15)	WIDTH (16)	SEP (MIN) (17)
4671		8 53 6.4	52 17 51	40.1	S	1.60	1.40		13.6	3669	14	T						
4675	2692	8 53 22.2	52 15 33	40.1	S4	1.30	0.40	165	14.1	3757	15	T						3.34
4691	2713	8 54 44.3	3 6 57	29.2	S5	4.00	1.40	107	12.9	3875	26	LM						
4692	2716	8 54 59.7	3 17 3	29.3	S1	1.60	1.20	30	13.7	3537	50	B			28,2			10.81
4752	2738	9 1 7.5	22 10 1	38.4	S	1.50	0.70	55	13.8				3102	15	8,2	9.08	307	
4794	2764	9 5 25.6	21 38 46	39.2	S	1.40	0.90	15	13.9	2627	20	S	2714	10	2,1,2	4.21	340	67.53
4757	2744	9 1 49.6	18 39 38	37.4	D	1.60	1.00		13.7	3450	50	B	3431	10	10,1	9.54	284	
4763	2749	9 2 32.4	18 30 53	37.5	E	1.80	1.70		13.3	4236	24	BE						13.39
4840	2778	9 9 19.2	35 14 0	43.0	E	1.40	1.00	40	13.1	2060	21	T						
4843	2780	9 9 39.4	35 7 57	43.1	S	1.00	0.70	150	14.2	2216	22	T						7.32
4883		9 13 21.6	74 31 46	35.7	S	1.40	0.80	27	12.8									
4888	* 529	9 13 27.0	73 58 7	35.9	S7	3.90	1.80	145	12.0				2264	10	5,1,1	28.24	374	33.55
4901	2804	9 13 59.7	20 24 30	40.7	S1	1.50	1.30	60	14.0									
4910	2809	9 14 16.6	20 16 50	40.7	S1	1.60	1.40		13.9									8.53
4905	2798	9 14 9.5	42 12 37	44.3	S3	2.80	0.90	160	12.9	1708	75	B						
4909	2799	9 14 18.1	42 12 15	44.3	S	2.10	0.50	125	14.4	1737	40	R						1.63
4952	2814	9 17 9.2	64 27 50	40.2		1.30	0.25	179	14.0	1663	95	E						
4961	2820	9 17 43.7	64 28 16	40.3	S7	4.40	0.35	59	13.1	1686	18	E						3.74
4995	2854	9 20 39.8	49 25 8	44.8	S5	1.90	0.55	50	13.8									
4997	2856	9 20 53.6	49 27 48	44.8	S	1.10	0.50	134	13.9									3.48
5018	2872	9 23 0.6	11 38 56	39.4	E	1.80	1.70		13.0	2976	95	E						
5021	2874	9 23 5.5	11 38 31	39.4	S7	2.40	0.80	43	13.5	3620	95	E	3775	50	20,2	3.64	435	1.27
5028		9 23 31.2	68 37 44	39.1	P	0.60	0.35	145	13.9	3661	43	KZ						
5029		9 23 42.9	68 38 21	39.1	S7	1.80	1.10	13	14.3									1.23
5092	2911	9 31 5.5	10 22 30	40.6		4.00	3.00	140	13.6	3181	26	BEX						
5096	2914	9 31 22.3	10 19 58	40.6	S3	1.10	0.60	15	13.7	3370	100	B						4.85
5183	2964	9 39 56.4	32 4 35	49.0	S6	3.50	1.90	97	12.0	1310	41	BZ	1319	20	7,2	22.30	346	
5190	2968	9 40 14.5	32 9 26	49.1		2.40	1.70	45	13.1	1613	73	E			2,1,2			6.18
5233	2991	9 44 1.0	22 14 50	47.9	S1	1.40	1.10		14.3									
5239	2994	9 44 27.5	22 19 18	48.1	S1	1.20	0.90	125	14.4									7.58
5251	3003	9 45 37.9	33 39 16	50.3	S7	5.70	1.70	79	12.3	1476	60	B	1482	10	8,1	81.44	315	
5280	3021	9 47 59.5	33 47 20	50.8	S	1.50	0.90	110	12.6	1534	32	E	1541	20	2,1,3	14.32	332	30.53
5264	3009	9 47 1.3	44 31 41	50.0	S	0.80	0.70		14.5									
5273	3010	9 47 26.5	44 33 23	50.1	D	1.90	0.60		14.3									4.80

TABLE 1—*Continued*

NAME UGC (1)	NGC *IC (2)	R A (1950.0) (3)	DEC (1950.0) (3)	GLACT LAT (DEG) (4)	HUB TYP (5)	BLUE DIA (MIN) (6)	(6)	POS ANG (DEG) (7)	ZWKY MAG (8)	OBSERVED RADIAL VELOCITY OPTL (KM/S) (9)	M.E. (10)	REF (11)	RADIO (KM/S) (12)	M.E. (13)	NOTES (14)	HI PROFILE AREA (JY-KM/S) (15)	WIDTH (16)	SEP (MIN) (17)
5265	3018	9 47 7.1	0 51 22	39.0	S	1.30	1.00	27	14.2									
5269	3023	9 47 18.4	0 51 15	39.0	S	3.20	1.60	70	13.5									2.83
5279	3026	9 48 0.8	28 47 1	50.3	S9	2.60	0.70	82	13.8				1492	10	7,2	9.57	234	
5292	3032	9 49 14.1	29 28 20	50.7	S1	2.00	1.70	95	13.0	1568	150	B	1561	20	10,2	5.33	289	44.31
5375	3065	9 57 34.6	72 24 40	39.4	S1	1.80	1.70		12.9	1963	26	CE						
5379	3066	9 57 51.9	72 22 0	39.5	S	1.20	1.20		12.8	2050	31	CE						2.97
5456		10 4 40.0	10 36 25	47.9	P	1.70	0.80	148	13.5									
5468	3130	10 5 33.1	10 13 17	47.9	S2	1.10	0.60	30	14.3									26.56
5520		10 11 21.6	65 23 16	44.8	S7	2.20	1.40	100	14.4				3315	10	8,1	15.99	291	
5576		10 17 8.1	65 25 26	45.2	S	1.50	0.90		14.1				3296	15	8,1	4.35	329	36.12
5584	3209	10 17 51.1	25 45 22	56.3	E	1.30	1.10	80	13.9									
5588		10 18 10.1	25 37 3	56.3	P	0.55	0.35	40	14.0									9.35
5600		10 19 17.0	78 52 4	36.0	S1	1.40	1.10	170	14.4									
5609		10 19 31.9	78 51 48	36.0		1.10	0.70	15	14.5									0.77
5617	3226	10 20 43.5	20 9 7	55.4	E	2.50	2.20	15	13.3	1356	13	BEM						
5620	3227	10 20 47.6	20 7 0	55.4	S5	6.50	4.50	155	12.2	1152	14	BMR	1165	25	8,2	18.10	497	2.33
5643	3212	10 23 13.2	80 4 47	35.2	S	1.70	0.90		14.3									
5659	3215	10 23 38.1	80 4 7	35.2	S	1.10	1.00		14.0									1.26
5717	3259	10 29 6.8	65 17 56	46.2	S5	2.30	1.20	20	12.9	1743	60	C						
5725	3266	10 29 50.3	65 0 26	46.5	S1	1.40	1.20	105	13.5									18.09
5738		10 31 38.9	35 30 58	59.8	S	1.00	0.60	30	14.1				1516	10	8,2	5.25	186	
5763	*2591	10 33 48.4	35 18 43	60.2	S	1.50	0.80	137	14.5									29.09
5742	3287	10 32 4.1	21 54 33	58.5	S9	2.10	1.00	20	12.9	1302	50	S	1307	10	6,2	7.57	233	
5767	3301	10 34 12.1	22 8 33	59.0	S1	3.40	1.10	52	12.2	1333	75	B			24,1			32.80
5761	3299	10 33 44.5	12 57 58	55.3		2.00	1.70	3	14.1									
5774	3306	10 34 31.2	12 54 48	55.4	S7	1.40	0.50	141	13.7				2884	15	4,1,1	8.91	338	11.81
5791		10 36 27.4	48 12 28	57.0		1.60	0.50	43	14.4									
5798		10 36 47.4	48 11 32	57.0		1.00	0.22	45	14.5									3.46
5852	3356	10 41 36.0	7 1 18	53.6	S5	1.80	0.80	102	13.3				6184	10	8,2	10.93	368	
5857	3362	10 42 15.2	6 51 28	53.6	S7	1.40	1.10	90	13.6									13.83
5870		10 43 9.7	35 13 41	62.1	S1	1.10	1.10		14.3									
5909	3381	10 45 36.7	34 58 35	62.7	S	2.30	2.10		12.8									33.64
5931	3395	10 47 2.3	33 14 45	63.1	S7	1.80	1.00	50	12.1	1625	6	CER						
5935	3396	10 47 9.0	33 15 16	63.2	S9	3.70	1.40	100	12.6	1680	16	CEM						1.49

TABLE 1—*Continued*

NAME UGC (1)	NGC *IC (2)	R A (1950.0) (3)	DEC (1950.0) (3)	GLACT LAT (DEG) (4)	HUB TYP (5)	BLUE DIA (MIN) (6)		POS ANG (DEG) (7)	ZWKY MAG (8)	OBSERVED RADIAL VELOCITY OPTL (KM/S) (9)	M.E. (10)	REF (11)	RADIO (KM/S) (12)	M.E. (13)	NOTES (14)	HI PROFILE AREA (JY-KM/S) (15)	WIDTH (16)	SEP (MIN) (17)
5953		10 48 23.9	44 50 10	60.3	P	C.45	0.25	85	13.2	1841	220	Z			6,2			
5969	3415	10 48 49.7	43 58 40	60.8	S2	2.10	1.20	10	13.2	3398	41	S	3303	20	12,2	1.91	167	51.71
5959	3414	10 48 31.8	28 14 28	63.4	S1	3.00	2.60		12.1	1449	100	B			2,1,2			
5963	3418	10 48 39.6	28 22 41	63.5	S2	1.20	1.00	75	14.5									8.39
5981	3433	10 49 26.1	10 24 56	57.2	S7	4.00	3.60	50	13.6	2621	48	S	2719	10	8,1	27.20	298	
5988	3438	10 49 48.6	10 48 46	57.5	S	0.90	0.80		14.3									24.47
6013		10 51 3.3	49 55 37	58.2	SI	0.90	0.70	45	13.9									
6029		10 52 6.7	49 59 33	58.3	P	1.00	0.80	35	14.0	1387	52	EZ	1353	20	5,2	10.82	222	10.93
6025	3435	10 51 39.6	61 33 25	50.6	S5	1.90	1.30	35	14.2	5141	61	S	5158	10	4,2	6.30	393	
6064	3471	10 56 2.2	61 47 56	50.8	S3	1.90	0.90	14	13.0	2076	34	EKZ			6,1			34.36
6028	3455	10 51 51.6	17 33 8	61.3	S5	2.80	1.80	80	13.1	1092	95	E	1102	10	6,2	20.76	248	
6030	3457	10 52 8.8	17 53 18	61.5		1.00	1.00		13.0									20.58
6104		10 59 12.5	16 52 33	62.6	S6	1.50	0.40	50	14.4									
6112		10 59 57.1	17 0 11	62.8	S8	2.30	0.80	123	14.5				1036	10	12,2	14.23	211	13.12
6153	3516	11 3 22.6	72 50 25	42.4	S1	2.10	1.80	55	12.3	2540	23	BCR						
6242	3562	11 9 39.4	73 9 3	42.4	E	1.70	1.30	165	13.2									33.26
6245	* 676	11 10 3.9	9 19 41	60.5	S1	2.20	1.60	10	13.4									
6259	*2637	11 11 13.7	9 51 30	61.1		0.90	0.80	70	13.9									36.17
6313	3615	11 15 27.6	23 40 13	68.6	E	1.40	0.90	40	14.0									
6327	3618	11 15 53.4	23 44 30	68.7	S5	1.00	0.80	175	14.4									7.30
6511	3713	11 29 3.7	28 25 48	72.3	S0	1.20	0.80	125	14.4									
6516	3714	11 29 15.0	28 38 0	72.4	P	2.20	1.00	68	14.3									12.45
6521	3719	11 29 39.6	1 5 48	57.5	S5	2.10	1.50	15	13.8									
6523	3720	11 29 48.2	1 4 51	57.6		1.00	0.90		13.7	5899	40	S						2.35
6528		11 29 55.0	62 6 14	52.9	S7	1.20	1.10		14.1				3251	15	4,1	3.23	79	
6542	3725	11 30 52.4	62 9 50	52.9	S7	1.60	1.20	145	13.6	3182	55	E			8,1			7.61
6541		11 30 45.5	49 30 50	63.3	D	1.30	0.70	133	13.9	215	23	EKR						
6549	* 708	11 31 16.8	49 20 15	63.5	E	1.40	0.90	95	14.2									11.74
6615	3780	11 36 40.1	56 32 52	58.1	S7	3.10	2.50	90	12.2	2768	40	K	2394	10	4,1	19.96	328	
6640	3804	11 38 12.1	56 28 48	58.3	S7	2.50	1.70	120	13.8				1385	10	10,2	17.68	209	13.33
6621	3786	11 37 4.4	32 11 8	73.7	S3	2.20	1.10	77	13.0	2761	95	E						
6623	3788	11 37 6.3	32 12 35	73.7	S	1.80	0.60	178	13.2	2339	95	E						1.50
6630	3799	11 37 33.4	15 36 17	69.7	S	C.70	0.50		14.4	3573	95	E						
6634	3800	11 37 37.5	15 37 11	69.7	S	1.90	0.45	52	13.1	3556	95	E						1.34

TABLE 1—*Continued*

NAME UGC (1)	NGC *IC (2)	R A (1950.0) (3)	DEC (3)	GLACT LAT (DEG) (4)	HUB TYP (5)	BLUE DIA (MIN) (6)	(6)	POS ANG (DEG) (7)	ZWKY MAG (8)	OBSERVED RADIAL VELOCITY OPTL (KM/S) (9)	M.E. (10)	REF (11)	RADIO (KM/S) (12)	M.E. (13)	NOTES (14)	HI PROFILE AREA (JY-KM/S) (15)	WIDTH (16)	SEP (MIN) (17)
6711		11 41 42.7	7C 0 33	46.3		0.80	0.45	132	13.8				2702	10	8,1	8.04	195	
6752	3879	11 44 4.5	69 39 35	46.7	S8	2.50	0.45	130	13.5				1431	10	4,2	14.08	239	24.27
6738	3872	11 43 14.1	14 2 38	69.7	E	2.30	1.70		12.9	3109	75	B						
6758		11 44 31.6	13 59 5	69.9	S	2.00	1.80		14.4									19.13
6779	3894	11 46 11.4	59 41 41	56.C	S1	2.00	1.40	20	12.9	3223	92	E						
6785	3895	11 46 24.7	59 42 41	56.C	S3	1.30	0.90	125	14.0									1.95
6813	3913	11 48 0.6	55 37 53	59.7	S7	3.00	2.80		14.2	855	105	K	956	10	8,2	12.39	89	
6823	3921	11 48 28.9	55 21 28	60.C		2.20	1.30	20	13.4	5975	32	EZ	5838	25	12,1	5.65	337	16.93
6880	3958	11 51 57.5	58 38 43	57.2	S3	1.40	0.55	28	13.1				3380	50	6,1	11.60	391	
6884	3963	11 52 22.5	58 46 18	57.1	S5	2.9C	2.70		12.2	3204	40	K	3185	20	5,2	22.93	204	8.25
6962	* 749	11 55 59.1	43 0 52	71.1	S7	2.50	2.10	150	13.4									
6973	* 750	11 56 17.3	42 0 2	71.1	S	3.10	1.50	43	12.7	713	30	S						3.43
7012		11 59 28.9	30 7 40	78.8	S7	2.10	1.10	8	14.3									
7017		11 59 49.1	30 8 20	78.9	S5	1.90	0.40	70	14.4									4.42
7021	4045	12 0 8.2	2 15 26	62.3	S3	3.00	2.00	95	13.5	2001	41	S						
7060	4073	12 1 52.8	2 10 30	62.4	E	2.10	1.60	105	13.8	5961	59	S						26.59
7044	4061	12 1 28.1	20 30 38	77.2	E	1.20	0.90		14.4	1603	83	T						
7050	4065	12 1 32.9	20 30 47	77.2	E	1.20	1.10		14.0	1180	152	T						1.13
7048	4C67	12 1 37.3	11 8 0	70.3	S5	1.20	0.90	35	13.2									
7066	4078	12 2 14.2	10 52 27	70.2	S1	1.30	0.40	18	13.9									17.99
7051	4066	12 1 35.9	20 37 36	77.2	E	1.10	1.00		14.4									
7052	4070	12 1 38.4	20 41 21	77.3	E	1.20	1.20		14.3									3.80
7111	4116	12 5 2.7	2 58 15	63.4		3.80	2.50	155	13.0	1323	10	CR	1309	10	4,2	43.48	243	
7116	4123	12 5 37.5	3 9 30	63.6	S7	5.00	4.00	135	13.1	1283	16	S	1328	10	10,2	54.95	240	14.21
7219	4180	12 10 28.9	7 19 1	67.9	S	1.7C	0.50	22	13.2									
7233	4191	12 11 16.8	7 28 42	68.2	S1	1.20	0.90	5	13.9									15.32
7282	4217	12 13 21.7	47 22 12	68.8	S5	5.50	1.60	50	12.4	985	64	R	1032	10	,5	31.04	422	
7297	4226	12 13 57.7	47 18 19	68.9	S	1.10	0.50	127	14.4									7.23
7283	4218	12 13 17.5	48 24 32	67.9		1.00	0.55	142	13.2				725	20	5,2,1	6.89	201	
7290	4220	12 13 42.9	48 9 45	68.1	S3	3.80	1.40	141	12.4	979	50	B			10,2			15.38
7296	4227	12 14 2.9	33 47 56	80.1	S2	1.60	1.00	70	13.8	6515	43	T						
7299	4229	12 14 8.9	33 50 18	80.1	S	1.30	0.90	3	14.3	6662	62	T						2.67
7319	4241	12 14 52.1	6 58 5	68.C	S1	2.50	1.50	128	13.6									
7333	*3115	12 15 26.4	6 55 53	68.C	S7	1.7C	1.30		14.4									8.79

TABLE 1—*Continued*

NAME UGC (1)	NGC *IC (2)	R A (1950.0) (3)	DEC (1950.0) (3)	GLACT LAT (DEG) (4)	HUB TYP (5)	BLUE DIA (MIN) (6)	BLUE DIA (MIN) (6)	POS ANG (DEG) (7)	ZWKY MAG (8)	OBSERVED RADIAL VELOCITY OPTL (KM/S) (9)	M.E. (KM/S) (10)	REF (11)	RADIO (KM/S) (12)	M.E. (KM/S) (13)	NOTES (14)	HI PROFILE AREA (JY-KM/S) (15)	HI PROFILE WIDTH (16)	SEP (MIN) (17)
7360	4261	12 16 49.5	6 6 15	67.4	E	3.50	3.00	160	12.0	2202	75	B						
7364	4264	12 17 2.4	6 7 30	67.4	S1	0.80	0.60		13.9									3.44
7357	4291	12 18 6.0	75 38 59	41.6	E	2.00	1.70	110	12.3	1785	43	BC						
7429	4319	12 19 33.3	75 36 6	41.7	S5	3.10	2.30	160	13.0	1685	73	K			6,2			6.14
7407	4294	12 18 44.8	11 47 18	72.9	D	3.00	1.10	155	12.6	415	79	C	351	15	3,1,2	19.67	240	
7414	4299	12 19 8.0	11 46 53	72.9	S9	1.70	1.70		12.8	212	61	C	228	15	3,1,2	13.52	174	5.69
7412	4298	12 19 0.4	14 53 3	75.7	S7	3.00	1.70	140	12.2	1116	19	M						
7418	4302	12 19 10.2	14 52 43	75.7	S7	5.10	0.90	178	13.4	1339	50	S						2.39
7432	4305	12 19 31.4	13 1 3	74.1	S3	1.90	1.00	32	13.8									
7433	4306	12 19 31.9	13 3 51	74.1	S1	1.30	0.90	140	14.4									2.80
7455	4335	12 20 38.2	58 43 16	58.3	E	1.90	1.50	145	13.7									
7479	4364	12 21 39.1	58 39 43	58.4	S1	1.30	1.20		14.3									8.67
7465	4343	12 21 5.0	7 13 58	68.8	S5	2.60	0.70	133	13.5				1012	10	2,1,2	4.86	361	
7466	4342	12 21 5.8	7 19 56	68.9	S	1.00	0.40	168	13.0	714	50	B			2,1,2			5.97
7511	4391	12 23 0.3	65 12 38	52.0	S1	1.20	1.20		13.8									
7572	4441	12 25 3.5	65 4 36	52.1	P	4.50	3.50		13.5									15.24
7555	* 791	12 24 29.1	22 55 3	82.9	S3	1.10	1.10		14.2									
7603	4455	12 26 14.1	23 6 1	83.3	S8	2.70	1.00	16	13.0	631	33	S						26.53
7610	4458	12 26 25.9	13 31 10	75.2	E	1.50	1.50		13.3	383	250	B						
7613	4461	12 26 31.1	13 27 43	75.1	S1	3.60	1.30	9	12.2	1887	40	B			10,2			3.67
7655	4489	12 28 21.1	17 2 5	78.6	E	1.80	1.70		13.2									
7669	4498	12 29 8.8	17 7 46	78.8	S7	3.50	1.70	133	12.8									12.74
7685		12 29 54.2	0 39 56	62.9		4.70	3.00	30	14.1				1529	10	8,1	41.79	196	
7694	4517	12 30 11.9	0 23 32	62.6	S7	10.80	1.50	83	12.4	1128	10	CR	1129	10	,4	103.00	315	16.99
7706	4521	12 30 33.5	64 12 51	53.1	S2	2.70	0.60	167	13.0				2971	20	9,4	6.86	209	
7747	4545	12 32 20.3	63 48 10	53.5	S7	2.90	1.60	8	13.1				2740	20	11,2	15.18	351	27.32
7721	4527	12 31 35.5	2 55 45	65.2	S5	6.50	2.20	67	12.4	1730	10	BR	1737	10	6,2	98.19	403	
7732	4536	12 31 53.5	2 27 50	64.7	S6	7.00	2.80	130	12.3	1927	10	CR	1807	10	6,2	74.88	362	28.28
7757	4550	12 32 59.3	12 29 48	74.6	S1	3.30	0.90	178	12.5	350	50	B	381	15	4,2	9.03	291	
7759	4551	12 33 6.6	12 32 27	74.7	E	1.70	1.50	70	13.1	978	300	B						3.19
7776	4568	12 34 3.0	11 30 45	73.7	S7	5.10	2.40	23	12.5	2247	24	CE						
7777	4567	12 34 1.1	11 32 1	73.7	S7	3.00	2.50	85	12.5	2199	22	CER						1.35
7828	4596	12 37 24.3	10 27 1	72.8	S1	4.50	4.00	135	12.4	2020	46	S						
7842	4608	12 38 41.9	10 25 50	72.9	S1	3.00	3.00		12.6	1870	18	S						19.12

TABLE 1—*Continued*

NAME UGC (1)	NGC *IC (2)	R A (1950.0) (3)	DEC (1950.0) (3)	GLACT LAT (DEG) (4)	HUB TYP (5)	BLUE DIA (MIN) (6)		POS ANG (DEG) (7)	ZWKY MAG (8)	OBSERVED RADIAL VELOCITY OPTL (KM/S) (9)	M.E. (KM/S) (10)	REF (11)	RADIO (KM/S) (12)	M.E. (KM/S) (13)	NOTES (14)	HI PROFILE AREA (JY-KM/S) (15)	HI PROFILE WIDTH (16)	SEP (MIN) (17)
7851	4614	12 39 3.6	26 19 0	87.5	S2	1.10	0.90	175	14.2									
7852	4615	12 39 9.5	26 20 55	87.6	S7	1.60	1.00	125	13.8									2.33
7892	4646	12 40 35.7	55 7 50	62.2		0.60	0.30	18	13.8									
7905		12 41 33.3	55 10 25	62.2	D	1.90	1.00		14.1									8.62
7930	4670	12 42 49.8	27 23 58	88.6	P	1.60	1.40	90	12.6	1159	42	CPQ						
7933	4673	12 43 7.2	27 20 0	88.7	S1	1.00	0.80	170	13.7	6991	67	C						5.54
7958	4687	12 45 0.0	35 37 32	81.7		0.90	0.70		14.3									
7973	*3804	12 46 22.0	35 36 22	81.8	S	1.40	0.80	40	14.4				4062	25	4,3,1	6.12	349	16.71
8099	4868	12 56 48.3	37 34 45	79.7	S3	1.60	1.50		12.9	4731	17	S						
8125	4914	12 58 22.1	37 35 6	79.6	E	3.50	2.00	155	12.7	4778	23	S						18.59
8175	4952	13 2 35.4	29 23 28	86.4	E	1.30	0.80	23	13.6	5865	71	C						
8194	4966	13 3 54.0	29 19 48	86.2	S	1.00	0.45	143	13.9	7102	70	P						17.51
8178	4957	13 2 48.4	27 50 15	86.9	E	1.10	0.90	100	14.2	7006	70	P						
8185	4961	13 3 23.9	28 0 10	86.8	S7	1.60	1.10	100	13.5	2531	10	CR						12.64
8234		13 6 50.2	62 32 16	54.7	S2	1.20	0.50	137	13.8									
8237		13 6 58.8	62 34 24	54.7	S5	1.00	0.80	130	13.7									2.35
8355	* 875	13 15 8.6	57 48 10	59.3	S1	1.60	1.20	150	13.9	2696	105	K						
8393	5109	13 18 55.3	57 54 16	59.0	S	1.80	0.45	153	13.6				2131	15	5,2	10.46	246	30.77
8396	5107	13 19 9.8	38 48 1	77.0		1.80	0.50	128	13.7				940	15	,5	16.61	205	
8403	5112	13 19 41.5	38 59 55	76.8	S7	4.00	2.80	130	12.5	962	10	R	965	10	,4	41.50	228	13.40
8423	5129	13 21 41.9	14 14 11	74.8	E	1.70	1.40	10	13.3									
8428	5132	13 22 0.7	14 21 8	74.9	S1	1.20	0.80	75	14.3									8.31
8433	5141	13 22 35.5	36 38 16	78.3	S1	1.50	1.10	80	13.9	5223	33	K						
8435	5142	13 22 45.4	36 39 38	78.3	S1	1.00	0.70	5	14.0									2.41
8477	5172	13 26 53.3	17 18 35	76.6	S7	3.30	1.90	103	12.7	4367	90	S	4037	10	8,2	18.28	456	
8479	5180	13 27 0.6	17 4 58	76.5	S1	1.50	1.00	25	14.3									13.73
8507		13 28 33.8	19 41 41	78.1	S9	1.60	0.90	12	14.0				1000	15	10,2	4.63	143	
8516		13 29 28.1	20 15 23	78.3	S7	1.10	0.80	30	13.8				1011	15	10,1	4.04	146	36.03
8528	5216	13 30 24.6	62 57 27	53.8		3.00	2.00		14.0									
8529	5218	13 30 27.8	63 1 27	53.7	S	2.00	1.60	100	13.1									4.02
8641	5257	13 37 19.7	1 5 40	61.3	S	1.80	0.80		13.7	6865	95	E						
8645	5258	13 37 24.7	1 5 10	61.2	S	1.70	1.40		13.8	6689	95	E						1.35
8699	5289	13 43 1.5	41 45 11	71.9	S4	1.90	0.50	100	13.5				2516	15	10,2	8.84	400	
8700	5290	13 43 11.7	41 57 55	71.7	S6	3.60	0.90	95	13.0				2583	15	8,1	10.23	499	12.87

TABLE 1—*Continued*

NAME UGC (1)	NGC *IC (2)	R A (1950.0) (3)	DEC (1950.0) (3)	GLACT LAT (DEG) (4)	HUB TYP (5)	BLUE DIA (MIN) (6)		POS ANG (DEG) (7)	ZWKY MAG (8)	OBSERVED RADIAL VELOCITY OPTL (KM/S) (9)	M.E. (10)	REF (11)	RADIO (KM/S) (12)	M.E. (13)	NOTES (14)	HI PROFILE AREA (JY-KM/S) (15)	WIDTH (16)	SEP (MIN) (17)
8735	5311	13 46 47.6	40 14 0	72.5	S2	2.20	1.70	110	13.7									
8744	5313	13 47 36.6	40 14 1	72.4	S	1.60	0.90	40	12.4	2606	42	S	2537	25	5,2,1	8.29	501	9.35
8751	5318	13 48 23.4	33 57 15	75.7	S1	1.50	0.90	165	13.5									
8805	5347	13 51 5.6	33 44 16	75.2	S4	1.70	1.40	130	13.3	2296	23	S	2386	20	4,2	12.00	144	36.09
8792	5341	13 50 22.0	38 3 43	73.3	S	1.40	0.60	164	14.1				3648	10	10,2	6.18	287	
8809	5351	13 51 18.9	38 9 36	73.1	S5	2.90	1.60	100	13.1				3630	15	8,2	18.42	480	12.64
8834	5368	13 52 40.3	54 34 33	60.4	S3	0.90	0.70	10	13.8									
8837		13 52 55.2	54 8 58	60.8	S9	5.00	1.30	18	14.2	142	10	CR						25.68
8852	5376	13 53 37.6	59 45 11	55.8	S4	1.70	1.10	70	12.9	2064	33	S						
8866	5389	13 54 29.2	59 59 16	55.5	S1	4.50	1.10	3	13.2									15.50
8885	5382	13 55 45.1	6 30 1	63.8	S1	1.50	1.10	25	14.0									
8890	5386	13 55 52.2	6 34 51	63.8	S2	1.10	0.50	51	13.7									5.14
8898	5394	13 56 25.2	37 41 51	72.5	S	1.90	0.80		13.7	3410	21	BK						
8900	5395	13 56 29.7	37 40 5	72.5	S5	3.00	1.30	167	12.6	3542	12	S						1.98
8974	5444	14 1 14.8	35 22 18	72.7	E	2.50	2.00	90	12.8	3954	44	EX						
8976	5445	14 1 21.5	35 15 53	72.7	S1	1.70	0.70	27	14.1									6.56
9026	5480	14 4 30.2	50 57 54	62.4	S7	1.70	1.00		12.6	1791	95	E	1860	20	6,2	5.51	253	
9029	5481	14 4 50.5	50 57 49	62.4	E	1.80	1.30	115	13.5	2102	95	E						3.20
9033	5485	14 5 27.9	55 14 21	58.9	S1	2.70	2.00	170	12.4	1985	50	B						
9036	5486	14 5 42.4	55 20 25	58.8	S8	1.50	0.90	80	14.0	1314	19	KR	1383	10	8,1	13.04	215	6.41
9117		14 12 27.5	14 21 28	66.6	S3	2.00	1.00	7	14.3									
9124	5525	14 13 14.7	14 30 56	66.5	S1	1.20	0.70	23	14.1									14.84
9136	5536	14 14 21.1	39 43 58	68.5	S3	1.00	1.00		14.5	5137	50	T			10,2			
9139	5541	14 14 29.1	39 49 15	68.4	S	0.90	0.70		13.4	7472	41	T			8,2			5.50
9148	5546	14 15 40.4	7 47 35	61.6	E	1.30	1.10		14.1									
9156	5549	14 16 9.9	7 36 22	61.4	S1	1.50	0.70	120	14.2									13.39
9168	* 999	14 17 11.4	18 6 18	67.7	S1	0.80	0.40	142	14.5									
9170	*1000	14 17 18.4	18 5 5	67.7	S1	0.70	0.40	23	14.4									2.06
9172	5560	14 17 33.8	4 13 18	58.6	S5	4.00	0.90	115	13.7				1711	15	2,1,2	5.01	281	
9175	5566	14 17 49.4	4 9 42	58.6	S3	6.20	2.30	35	12.0	1518	68	BC						5.30
9181	5574	14 18 24.8	3 28 3	57.9	S1	1.10	0.80	63	13.4	1716	50	B						
9183	5576	14 18 32.6	3 29 55	57.9	E	3.00	2.30	95	12.3	1528	100	B						2.70
9197	5589	14 19 18.2	35 29 55	69.2	S3	1.30	1.30		14.3									
9200	5590	14 19 31.4	35 25 58	69.1	S1	1.80	1.80		13.6									4.78

TABLE 1—*Continued*

NAME UGC (1)	NGC *IC (2)	R A (1950.0) (3)	DEC (1950.0) (3)	GLACT LAT (DEG) (4)	HUB TYP (5)	BLUE DIA (MIN) (6)		POS ANG (DEG) (7)	ZWKY MAG (8)	OPTL (KM/S) (9)	M.E. (10)	REF (11)	RADIO (KM/S) (12)	M.E. (13)	NOTES (14)	HI PROFILE AREA (JY-KM/S) (15)	WIDTH (16)	SEP (MIN) (17)
9202	5587	14 19 46.9	14 8 46	65.1	S2	2.70	0.80	162	14.0									
9207	5591	14 20 10.1	13 56 46	64.9	D	1.40	0.80		14.5									13.25
9209	5598	14 20 27.4	40 32 53	67.0	S1	1.50	1.00	50	14.3									
9217	5603	14 21 1.2	40 36 16	66.9	S1	1.40	1.40		14.0									7.26
9275	*1014	14 25 54.8	14 0 11	63.8		2.80	1.80	90	14.1									
9288		14 26 34.8	14 5 3	63.7	S1	1.10	1.10		14.4									10.85
9330	5648	14 28 8.7	14 14 36	63.4	S	1.00	0.70	172	14.1									
9333	5649	14 28 27.0	14 11 28	63.4	S7	0.90	0.80		14.0									5.43
9347	5673	14 29 45.9	50 10 48	60.2	S7	2.60	0.50	136	14.0				2082	15	10,1	16.96	306	
9361	*1029	14 30 42.6	50 7 25	60.1	S5	2.80	0.50	152	13.7				2381	10	8,2	14.88	491	9.69
9353	5669	14 30 17.1	10 6 37	60.6	S7	4.50	3.30	50	13.2				1371	10	,4	39.70	220	
9360	5666	14 30 43.3	10 43 47	60.9	C	0.90	0.70	155	13.5				2221	10	10,2	4.62	214	37.72
9369	5674	14 31 22.3	5 40 43	57.4	S6	1.20	1.10		13.7									
9383	5679	14 32 38.7	5 34 40	57.1	D	1.10	0.60	127	14.2				1641	25	4,2,1	3.24	153	19.95
9399	5689	14 33 43.6	48 57 37	60.5	S3	4.00	1.10	85	12.7	2205	50	B			8,2			
9406	5693	14 34 25.7	48 48 12	60.5	S7	1.70	1.70		14.5				2276	15	4,1	7.30	117	11.69
9402	5684	14 33 47.1	36 45 37	66.0	S1	1.90	1.60	105	14.2									
9421	5695	14 35 19.6	36 47 0	65.7	S	1.60	1.10	150	13.9									18.58
9434	5702	14 36 37.2	20 43 22	64.6	S1	1.10	0.80	150	14.5									
9440	5710	14 36 58.4	20 15 28	64.4	E	1.00	0.90		14.5									28.34
9467	5732	14 38 39.8	38 51 10	64.5	S6	1.50	0.80	40	14.4									
9473		14 39 34.2	39 3 56	64.2	S1	1.40	1.20	130	13.8									16.58
9493	5740	14 41 52.1	1 53 25	52.9	S5	3.20	1.80	160	13.2	1802	40	S	1567	10	6,2	30.91	381	
9499	5746	14 42 24.2	2 9 53	53.0	S5	7.40	1.10	170	12.3	1801	33	BC	1724	10	12,2	26.71	678	18.32
9560		14 48 54.4	35 46 38	63.2	P	0.80	0.25	58	14.5	1147	9	CKR						
9562		14 49 13.1	35 44 53	63.2	P	1.10	1.10		14.2	1226	24	KR						4.18
9573	*1066	14 50 31.6	3 29 58	52.4	S	1.40	0.80	70	14.2									
9574	*1067	14 50 34.5	3 32 6	52.4	S5	2.20	1.70	110	13.6									2.25
9576	5774	14 51 12.1	3 47 6	52.5	S7	3.40	2.80	145	13.9	1589	20	ER						
9579	5775	14 51 26.8	3 44 51	52.4	S7	4.20	0.90	146	13.0	1582	95	E						4.30
9592	5784	14 52 24.3	42 45 38	60.7	S1	1.90	1.80		13.7									
9599	5787	14 53 24.0	42 42 30	60.5		1.10	1.00		14.1	5485	105	K			10,2			11.40
9615	5789	14 54 29.1	30 26 3	62.5		1.00	0.90		13.9				1800	15	6,2	7.97	190	
9628	5798	14 55 31.5	30 10 6	62.2	S9	1.40	0.90	42	13.5				1787	10	18,2	6.61	217	20.38

TABLE 1—*Continued*

NAME UGC	NGC *IC	R A (1950.0)	DEC	GLACT LAT (DEG)	HUB TYP	BLUE DIA (MIN)		POS ANG (DEG)	ZWKY MAG	OBSERVED RADIAL VELOCITY OPTL (KM/S)	M.E.	REF	RADIO (KM/S)	M.E.	NOTES	HI PROFILE AREA (JY-KM/S)	WIDTH	SEP (MIN)
(1)	(2)	(3)		(4)	(5)	(6)		(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
9645	5806	14 57 28.4	2 5 20	50.2	S5	3.00	1.50	170	12.9	1301	65	B	1353	10	18,2	9.07	365	
9655	5813	14 58 38.9	1 53 57	49.8	E	3.40	2.70	145	12.5	1882	65	B						20.97
9650		14 58 13.7	83 47 26	32.6	S3	1.60	0.25	6	14.1									
9668		15 0 27.9	83 43 18	32.6		1.50	0.80	85	13.8									5.51
9724	5857	15 5 11.1	19 47 27	58.0	S3	1.30	0.60	137	13.6	4706	57	BC						
9728	5859	15 5 19.0	19 46 25	58.0	S5	2.90	0.70	136	13.1	4664	150	B						2.13
9741		15 7 3.2	52 29 8	54.1	P	0.45	0.40		14.1									
9745	5875	15 7 43.0	52 43 8	53.9	S5	2.60	1.30	145	13.4				3527	20	4,2,1	18.64	472	15.25
9774	5893	15 11 45.5	42 8 40	57.5	S5	1.40	1.30		14.1				5381	15	14,2	5.76	332	
9789	5899	15 13 14.9	42 14 1	57.2	S7	2.80	1.20	18	12.6	2549	50	B	2554	15	6,3	16.47	569	17.40
9797	5905	15 14 2.6	55 42 6	51.6	S5	4.70	3.60	135	13.6	3386	20	S	3393	10	4,2	46.78	387	
9805	5908	15 15 23.0	55 35 37	51.5	S5	3.00	1.30	154	13.5	3433	40	S	3309	10	12,2	18.25	693	13.06
9906	5963	15 32 16.0	56 43 31	48.5	S	4.00	3.00	55	13.0				655	10	8,2	43.44	237	
9914	5965	15 32 50.1	56 51 8	48.8	S5	6.00	0.90	53	13.4				3416	10	10,2	36.03	632	8.93
9908	5956	15 32 35.9	11 55 0	48.7	S7	1.70	1.70		13.3				1899	10	12,1	7.67	187	
9915	5957	15 33 0.9	12 12 51	48.8	S5	2.80	2.80		13.3				1828	15	,5	22.59	106	18.87
9961	5982	15 37 38.5	59 31 3	46.9	E	3.00	2.10	110	12.4	2879	28	BC						
9969	5985	15 38 36.3	59 29 35	46.8	S5	5.80	3.10	13	12.0	2467	40	B	2521	10	,5	30.37	555	7.48
10003	5992	15 42 36.3	41 15 0	52.0	S	1.00	0.80	130	14.2	9594	122	Z						
10007	5993	15 42 42.8	41 16 33	52.0	S5	1.20	0.90	140	13.9	9390	58	T						1.97
10091	6014	15 53 29.4	6 4 40	41.3	S1	2.00	1.60		13.8									
10098	6017	15 54 47.6	6 8 30	41.1		0.80	0.80	140	13.8									19.81
10116	6027	15 57 2.9	20 54 28	46.9	D	1.90	1.00		13.4									
10127		15 58 12.7	20 59 25	46.6	S5	1.40	0.80	70	14.2									17.03
10345	6127	16 18 14.9	58 6 11	42.6	E	1.40	1.40		13.0									
10347	6130	16 18 34.6	57 43 56	42.7	S6	1.10	0.70	25	14.2									22.40
10497		16 37 30.3	72 30 6	35.7	S	1.20	0.45	96	14.4									
10502		16 38 21.0	72 28 16	35.7	S7	2.60	2.20	130	13.1									4.23
10500		16 38 5.5	57 49 21	40.2	S2	1.60	1.50		14.1									
10516	6211	16 40 34.4	57 52 43	39.8	S1	1.70	1.20	105	13.8									20.09
10628	6267	16 56 2.0	23 3 37	34.5	S7	1.40	1.10	35	14.0				2974	15	8,2	6.13	272	
10656	6278	16 58 43.8	23 5 1	33.9	S1	2.10	1.20	130	13.8				2776	15	18,1	1.72	173	37.24
10724	6306	17 7 0.0	60 47 37	36.0	S	1.00	0.30	166	14.3	2973	28	E						
10727	6307	17 7 3.2	60 48 55	36.0	S2	1.40	1.10	145	14.0	3057	31	E						1.36

TABLE 1—*Continued*

NAME UGC (1)	NGC *IC (2)	R A (1950.0) (3)	DEC (1950.0) (3)	GLACT LAT (DEG) (4)	HUB TYP (5)	BLUE DIA (MIN) (6)	BLUE DIA (MIN) (6)	POS ANG (DEG) (7)	ZWKY MAG (8)	OBSERVED RADIAL VELOCITY OPTL (KM/S) (9)	M.E. (10)	REF (11)	RADIO (KM/S) (12)	M.E. (13)	NOTES (14)	HI PROFILE AREA (JY-KM/S) (15)	WIDTH (16)	SEP (MIN) (17)
10747	6308	17 9 54.0	23 26 23	31.6	S7	1.30	1.00	150	14.4									
10752	6314	17 10 33.1	23 19 45	31.5	S3	1.80	0.80	175	14.3	6748	77	C						11.16
10848	*4660	17 23 33.2	75 53 33	31.7	S	1.40	0.35	170	14.3				1225	15	8,3	2.47	108	
10897	6412	17 31 22.9	75 44 26	31.2	S7	2.30	2.30		12.4	1406	62	C	1320	10	6,1	23.34	160	30.18
10867	*1258	17 26 31.3	58 31 32	33.8	S2	1.00	0.80	65	14.4									
10869	*1259	17 26 40.1	58 33 22	33.7	D	1.20	1.20		14.0									2.15
11009	6482	17 49 43.6	23 5 0	22.9	E	2.10	1.80	70	12.8	3922	60	B						
11010	6484	17 49 43.1	24 29 38	23.4	S5	2.00	1.90		13.5				3112	10	8,1	28.63	418	84.53
11048	6500	17 53 47.3	18 20 48	20.2	S3	2.50	2.00	50	13.4									
11049	6501	17 53 52.2	18 22 48	20.2	S2	1.70	1.50		13.4									2.31
11055		17 54 45.6	12 14 41	17.5	S	1.00	0.80	105	14.4									
11057		17 54 55.2	12 11 3	17.5	S7	2.00	0.80	90	13.8									4.32
11137	6570	18 8 50.5	14 4 51	15.2	S8	1.80	1.00	30	13.2				2283	10	10,2	11.89	259	
11144	6574	18 9 34.7	14 58 3	15.4	S	1.30	0.90	160	12.5	2315	21	BC	2261	20	30,1	4.77	341	54.26
11200	6619	18 16 50.5	23 38 5	17.4	E	1.20	1.10		14.3									
11203	6623	18 17 38.4	23 41 13	17.2	E	1.40	1.10	155	14.4									11.41
11256	*1288	18 27 43.8	39 40 43	20.9	S3	1.30	0.70	2	14.3									
11258	6646	18 28 0.3	39 49 46	20.9	S3	1.30	1.30		13.7									9.59
11265		18 29 45.8	33 54 3	18.6	C	0.80	0.80		13.9				6122	25	5,2,1	10.13	651	
11271	6657	18 31 12.9	34 1 22	18.3	S	0.80	0.40	138	14.2									19.49
11288	6677	18 33 34.4	67 6 7	26.6	D	0.60	0.20		13.6									
11290	*4763	18 33 39.4	67 4 13	26.5	S	0.90	0.35	103	13.9									1.96
11354	6702	18 45 30.9	45 39 3	19.8	E	1.90	1.50	65	13.8	4725	43	BC						
11356	6703	18 45 51.8	45 29 41	19.7	S1	2.30	2.30		12.4	2318	35	BC						10.06
11405	6762	19 5 14.8	63 51 19	22.7	S2	1.60	0.40	119	14.2									
11425	6789	19 16 17.0	63 52 54	21.5	S9	1.80	1.80		13.7									72.93
11429	6792	19 19 22.1	43 2 15	13.2	S5	2.40	1.30	25	13.4				4628	10	10,1	14.85	536	
11430		19 19 34.2	43 13 51	13.2	S7	1.10	1.10		14.4				5478	10	9,2	2.85	147	11.81
11459		19 35 41.7	40 35 31	9.4	S7	2.40	1.50	12	14.4				3128	20	6,6	24.93	404	
11460		19 36 11.1	40 53 40	9.4	S0	1.40	0.80	120	14.0									18.99
11589	6928	20 30 25.0	9 45 30	-17.3	S4	2.20	0.60	106	13.7	4754	75	B						
11590	6930	20 30 34.4	9 42 25	-17.3	D	1.20	0.50	8	14.3	4182	75	B						3.86
11628	6962	20 44 45.4	0 8 13	-25.4	S3	3.00	2.30	75	13.5	4183	75	B	4219	15	20,2	14.33	545	
11629	6964	20 44 50.3	0 6 58	-25.4	E	1.60	1.10	168	14.2	3832	100	B						1.75

TABLE 1—*Continued*

NAME UGC (1)	NGC *IC (2)	R A (1950.0) (3)	DEC (1950.0) (3)	GLACT LAT (DEG) (4)	HUB TYP (5)	BLUE DIA (MIN) (6)		POS ANG (DEG) (7)	ZWKY MAG (8)	OBSERVED RADIAL VELOCITY OPTL (KM/S) (9)	M.E. (10)	REF (11)	RADIO (KM/S) (12)	M.E. (13)	NOTES (14)	HI PROFILE AREA (JY-KM/S) (15)	WIDTH (16)	SEP (MIN) (17)
11772	*1392	21 33 26.4	35 10 26	-12.2	S0	1.60	1.30	75	13.0									
11781		21 34 33.4	35 28 8	-12.2	S1	1.40	1.00	75	13.7									22.36
11972	7248	22 14 43.7	40 15 20	-13.4	S1	1.80	0.90	133	13.6									
11980	7250	22 16 8.5	40 18 48	-13.5	S	1.30	0.60	157	13.1									16.54
12035	7280	22 24 1.6	15 53 40	-34.2	S2	1.90	1.30	78	13.6	1817	80	E	1903	20	18,2	2.69	155	
12045	7290	22 26 0.8	16 53 35	-33.8	S5	1.70	1.00	161	13.8				2896	20	6,2	10.05	292	66.39
12080	7311	22 31 34.6	5 18 46	-43.4	S4	1.80	0.90	10	13.4									
12083	7312	22 32 3.6	5 33 30	-43.3	S5	1.70	1.00	83	14.5									16.41
12115	7332	22 35 1.2	23 32 16	-29.7	S1	3.60	0.90	155	12.0	1191	11	BKM			8,1			
12122	7339	22 35 23.5	23 31 38	-29.7	S6	2.80	0.80	93	13.1	1276	27	E	1339	15	8,1	9.18	366	5.15
12309	7458	22 58 55.0	1 29 5	-50.8	E	1.10	0.90	15	13.9									
12312	7460	22 59 9.6	1 59 41	-50.5	S5	1.10	1.00		14.2	3296	28	K						30.82
12365	*5285	23 4 31.5	22 40 0	-33.9	C	1.70	1.30	100	14.4	6245	105	K						
12378	7489	23 5 5.3	22 43 35	-33.9	S7	2.20	1.10	170	14.3				6239	15	6,4	12.54	384	8.58
12442	7537	23 12 1.9	4 13 33	-50.7	S5	2.10	0.50	49	13.8	2602	46	T						
12447	7541	23 12 10.3	4 15 43	-50.7	S7	3.40	1.10	102	12.7	2393	83	T						3.01
12456	7550	23 12 46.8	18 41 25	-38.4	S0	1.40	1.40		13.9	4987	150	P						
12457	7549	23 12 47.5	18 46 13	-38.3	S	2.80	0.70	8	14.1	4806	150	P						4.80
12464	7562	23 13 25.1	6 24 53	-49.0	E	2.10	1.60	83	13.0	3806	63	C						
12486	7591	23 15 43.7	6 18 45	-49.4	S5	1.90	0.80	145	13.8				4964	15	18,2	14.61	469	34.98
12507		23 16 58.4	43 42 0	-15.8	S3	1.20	0.20	152	14.2									
12517		23 17 32.2	43 41 0	-15.9	E	1.40	1.30		14.5									6.19
12607	7673	23 25 11.8	23 18 51	-35.4	C	1.70	1.60		12.7	3409	12	KRZ	3407	20	16,2	8.17	202	
12610	7677	23 25 36.2	23 15 18	-35.5	S5	1.70	1.10	35	13.9	3542	29	R	3544	20	41,2	9.02	302	6.63
12618	7679	23 26 12.8	3 14 11	-53.4	S1	1.70	1.10	93	13.2	5205	44	T						
12622	7682	23 26 30.2	3 15 28	-53.5	S3	1.10	0.90		14.3	5170	33	T						4.53
12737	7731	23 38 55.7	3 27 43	-54.8	S3	1.50	1.00	95	14.3	2802	100	T						
12738	7732	23 39 0.0	3 26 50	-54.8	S8	1.90	0.70	96	14.5	2875	65	T						1.39
12759	7743	23 41 48.6	9 39 25	-49.5	S2	2.50	2.10	80	12.9	1802	65	B			16,1			
12760	7742	23 41 43.1	10 29 25	-48.7	S1	2.00	1.80		12.5	1622	30	BC						50.02
12776		23 43 41.3	33 5 26	-27.6	S5	2.80	2.20	90	14.2				4929	15	8,2	13.80	262	
12781	*5355	23 44 44.1	32 30 21	-28.2	S7	1.10	0.60	10	14.4									37.48
12779	7752	23 44 27.0	29 10 57	-31.3		0.45	0.20	113	14.3	4880	20	CK						
12780	7753	23 44 33.2	29 12 22	-31.3	S5	3.50	1.80	50	13.2	5083	62	CK						1.96

TABLE 1—*Continued*

NAME UGC (1)	NGC *IC (2)	R A (1950.0) (3)	DEC (1950.0) (3)	GLACT LAT (DEG) (4)	HUB TYP (5)	BLUE DIA (MIN) (6)		POS ANG (DEG) (7)	ZWKY MAG (8)	OBSERVED RADIAL VELOCITY OPTL (KM/S) (9)	M.E. (KM/S) (10)	REF (11)	RADIO (KM/S) (12)	M.E. (KM/S) (13)	NOTES (14)	HI PROFILE AREA (JY-KM/S) (15)	HI PROFILE WIDTH (16)	SEP (MIN) (17)
12805	7767	23 48 24.5	26 48 35	-33.9	S2	1.10	0.20	142	14.2									
12806	7768	23 48 26.2	26 52 9	-33.8	E	1.60	1.30	60	14.0	7955	120	K						3.59
12808	7769	23 48 31.5	19 52 25	-40.5	S4	1.80	1.80		12.9	4349	74	C						
12815	7771	23 48 52.3	19 50 8	-40.6	S3	2.50	1.20	68	13.1	4290	53	C						5.40
12827	7778	23 50 46.6	7 35 33	-52.3	E	1.10	1.00		13.8									
12831	7779	23 50 52.6	7 35 51	-52.3	S2	1.40	1.00	10	13.6									1.52
12883	*1525	23 56 42.6	46 36 45	-15.0	S5	1.90	1.30	20	13.3				5018	10	6,1	10.99	345	
12889		23 57 28.4	46 59 46	-14.7	S5	2.30	1.80	165	14.0				5017	10	10,2	7.36	486	24.31
12906	7803	23 58 46.0	12 50 0	-48.0	S2	1.00	0.70	85	13.8				5401	25	3,2,1	4.13	205	
12919	7810	23 59 45.5	12 41 37	-48.2	S1	1.00	0.70	80	14.3									16.76
12908	7805	23 58 52.7	31 9 23	-30.2		1.00	0.70		14.3									
12911	7806	23 58 56.4	31 9 51	-30.2	S	1.10	0.80	20	14.4									0.92
12914		23 59 4.0	23 12 23	-38.0	S	2.70	1.30	160	13.2	4536	56	E						
12915		23 59 8.6	23 12 59	-38.0		1.60	0.50	137	13.9	4530	56	E						1.22

Column (*1*).—Source number of the galaxy taken from the UGC.

Column (*2*).—NGC or IC designation.

Column (*3*).—1950.0 position taken from Dressel and Condon (1976).

Column (*4*).—Galactic latitude (b), in decimal degrees.

Column (*5*).—Structural type based on the Hubble system (Hubble 1926) and taken from the UGC: E = elliptical; S = spiral (S0 = E to S0, S1 = S0, S2 = S0 to Sa, S3 = Sa, S4 = Sa to Sb, S5 = Sb, S6 = Sb to Sc, S7 = Sc, S8 = Sc to Irr, S9 = Irr); D = close double; C = compact; P = peculiar; I = integral.

Column (*6*).—Major and minor blue diameters, in decimal arcminutes, adopted from the UGC.

Column (*7*).—Position angle, in degrees, defined as the orientation of the major axis and measured from the north eastward (UGC).

Column (*8*).—Apparent photographic magnitude measured by Zwicky *et al.* (1960–1968) and adopted from the UGC.

Column (*9*).—Radial velocity (km s^{-1}) based on optical measurements and taken from either de Vaucouleurs, de Vaucouleurs, and Corwin (1976), Sandage (1978), or Turner (1976*a*). The velocity is heliocentric.

Column (*10*).—Mean error (km s^{-1}) quoted from the original source and representing a 1 standard deviation uncertainty.

Column (*11*).—Reference for the optical velocity based on the de Vaucouleurs *et al.* compilation (a weighted average is quoted when more than one reference is listed): B = Mount Wilson, C = Lick, E = McDonald, K = Palomar, L = Mount Stromlo, M = Department of Terrestrial Magnetism, N = Asiago, P = Kitt Peak, Q = Kyoto, R = Radio data included, X = Steward, Z = Russian data, S = Sandage (1978), T = Turner (1976*a*).

Column (*12*).—Radial velocity (km s^{-1}) based on 21 cm hydrogen line observations using the optical convention ($v = c\Delta\lambda/\lambda_0$), and defined as the mid-range or midpoint of the line profile. The velocity is heliocentric.

Column (*13*).—Mean error (km s^{-1}) representing a 1 standard deviation uncertainty in the mid-range determination.

Column (*14*).—Notes on the quoted radio velocity (see § V for further explanation).

The first entry indicates the number of individual observations (each observation equivalent to a scan on one receiver) averaged to produce the composite line profile upon which the various radio parameters are based.

The second entry indicates the order of the baseline removed from the composite profile (1 = linear; 2 = quadratic; 3 = third order).

The third entry references the following notes: (1) The composite spectrum is based on a 96-channel receiver (search mode). (2) The spectrum is based on Arecibo observations (Peterson and Terzian 1979). (3) Both Arecibo and NRAO data are combined to produce the composite spectrum. (4) The radio parameters are based on a profile taken from Shostak (1975). (5) The parameters are based on observations by M. S. Roberts (unpublished data).

If the third entry is blank, then the composite spectrum is based on observations made at the NRAO in a full 192-channel receiver mode.

Column (*15*).—H I profile area (Jy-km s^{-1}) defined as the area under the entire 21 cm line using a maximum profile width. A mean error of 10% is estimated from the flux calibration (see § V) and the profile width measurement.

Column (*16*).—H I profile width (km s^{-1}) defined as the observed velocity difference across the hydrogen profile measured at a level of 25% of the mean flux. The definition assumes a steep slope (rapid rise in flux) at the edges of the line but is reasonably independent of the signal-to-noise ratio. The mean error is roughly twice that quoted for the mid-range determination.

Column (*17*).—Separation of the member galaxies in the pair (decimal arcminutes) determined from 1950.0 positions and hence measured from the galaxy centers. Errors quoted for the listed positions indicate that the standard error in the derived separation is fairly uniform at approximately 0'.1.

b) *Table 2*

Additional parameters on those galaxies included among the 123 pairs in $\mathscr{D}_{\rm OB}{}^{\rm I}$ with redshift information available on each component are compiled in Table 2; the tabulated entries are explained and referenced by column number.

Column (*1*).—Source number of the galaxy taken from the UGC.

Column (*2*).—NGC or IC designation.

Column (*3*).—Structural type based on the Hubble system (Hubble 1926) and taken from the UGC (see Table 1, col. [5]).

Column (*4*).—Galactic latitude (b), in decimal degrees.

Column (*5*).—Major blue diameter, in decimal arcminutes (UGC).

Column (*6*).—Inclination, in decimal degrees, defined as the angle between the plane of the sky and the principal plane of the galaxy. From Roberts (1969),

$$\cos^2(i) = 1.042(b/a)^2 - 0.042\,, \qquad (11)$$

where b/a is the ratio of minor blue diameter to major blue diameter. The equation is based on the assumption that a galaxy's shape approximates an oblate spheroid with a ratio of small axis to large axis p = 0.20 (Holmberg 1958). Only spiral systems (type S; S2–S9) are included in this entry, and any galaxy with $b/a < 0.20$ is assigned an inclination $i = 90°$.

Column (*7*).—Apparent photographic magnitude measured by Zwicky *et al.* (1960–1968) and adopted from the UGC.

Column (*8*).—Zwicky magnitude corrected for Galactic extinction (Holmberg 1958):

$$(m_z)_G = m_z - 0.25 \csc|b|\,, \qquad (12)$$

TABLE 2

ADDITIONAL PARAMETERS ($\mathscr{D}_{OB}{}^{I}$, subset with complete redshift data)

NAME UGC	NAME NGC *IC	HUB TYP	GLACT LAT (DEG)	MAJ DIA (MIN)	INCL (DEG)	ZWICKY MAG m_Z	ZWICKY MAG $(m_Z)_G$	ZWICKY MAG $(m_Z)_{GI}$	HOLMBERG MAG (CALC) m_H^*	HOLMBERG MAG (CALC) $(m_H^*)_G$	HOLMBERG MAG (CALC) $(m_H^*)_{GI}$	RADIAL VELOCITY (KM/S) V_S	RADIAL VELOCITY (KM/S) V_{LG}	RADIAL VELOCITY (KM/S) V_{CF}	M.E.	REF	SEP (MIN)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
57	1	S5	-34.1	1.80	49.5	13.4	12.95	12.74	13.13	12.69	12.48	4548	4780	5053	10	R	
80	16	S1	-34.2	1.80		12.5	12.06		12.40	11.96		3110	3341	3617	50	O	24.09
89	23	S3	-36.0	2.20	44.5	12.5	12.07	11.90	12.33	11.91	11.74	4566	4792	5064	15	R	
94	26	S5	-36.1	2.00	58.5	13.9	13.48	13.12	13.50	13.08	12.72	4583	4808	5081	15	R	9.11
286	125	S1	-59.5	1.60		14.2	13.91		13.70	13.41		5289	5430	5644	50	O	
292	128	S1	-59.5	3.00		13.2	12.91		12.67	12.38		4243	4384	4599	26	O	6.33
356	160	S3	-38.8	3.00	59.7	13.7	13.30	12.88	13.18	12.78	12.35	5255	5461	5760	50	O	
365	169	D	-38.8	3.50		13.3	12.90		12.77	12.38		4477	4682	4982	220	O	11.10
682	380	E	-30.3	1.30		13.9	13.40		13.64	13.14		4341	4548	4900	150	O	
683	379	S1	-30.2	1.50		14.0	13.50		13.69	13.19		5374	5582	5933	65	O	2.30
686	384	S1	-30.5	1.10		14.3	13.81		13.99	13.50		4401	4608	4959	100	O	
687	385	E	-30.4	1.30		14.3	13.81		13.96	13.47		4845	5052	5403	150	O	1.76
688	382	E	-30.3	0.25		14.2	13.70		14.04	13.55		5156	5363	5714	50	O	
689	383	S1	-30.3	2.00		13.6	13.10		13.29	12.79		4888	5095	5446	50	O	0.57
725		S7	-19.6	2.20	79.1	14.5	13.75	12.72	14.04	13.29	12.26	5050	5277	5641	10	R	
728		S7	-19.4	1.50	0.0	14.2	13.45	13.45	13.90	13.15	13.15	4910	5137	5501	20	R	11.23
858	470	S6	-58.7	3.30	56.6	12.4	12.11	11.85	11.98	11.69	11.43	2370	2477	2756	10	R	
864	474	S1	-58.7	10.00		12.9	12.61		12.17	11.88		2306	2413	2692	40	O	5.31
986	*1700	E	-47.2	2.00		14.3	13.96		13.77	13.43		5755	5899	6227	192	O	
1027	*1706	S	-47.2	1.20	49.5	14.2	13.86	13.67	13.82	13.48	13.28	6319	6461	6791	86	O	25.82
1070		S7	-21.3	2.10	41.4	14.3	13.61	13.52	13.88	13.19	13.10	2806	3018	3397	15	R	
1078	573	P	-21.0	0.45		13.5	12.80		13.49	12.79		2796	3008	3388	15	R	19.39
1089	579	S7	-28.5	1.70	20.2	13.6	13.08	13.06	13.34	12.82	12.80	4981	5175	5551	15	R	
1094	582	S5	-28.6	2.20	79.1	13.7	13.18	11.93	13.34	12.82	11.57	4354	4548	4923	10	R	8.85
1310	694	P	-38.8	0.50		13.9	13.50		13.71	13.32		2870	3018	3390	43	O	
1313	* 167	S7	-38.9	3.00	57.3	14.0	13.60	13.36	13.41	13.01	12.77	2928	3076	3448	10	R	5.55
1541	797	S3	-22.6	1.90	43.6	13.1	12.45	12.29	12.92	12.27	12.11	5647	5832	6235	20	R	
1550	801	S7	-22.5	3.30	86.0	13.5	12.85	11.82	13.03	12.38	11.35	5764	5949	6352	10	R	9.14
1555	* 195	S1	-44.6	1.50		14.3	13.94		13.85	13.50		8610	8724	9087	34	O	
1556	* 196	S5	-44.6	3.00	62.1	14.2	13.84	13.40	13.54	13.18	12.74	8573	8687	9051	69	O	2.28
1633	818	S6	-21.7	3.50	69.3	12.7	12.02	11.44	12.36	11.68	11.09	4245	4428	4835	10	R	
1655	828	P	-21.2	3.50		13.0	12.31		12.60	11.91		5374	5557	5965	15	R	29.93
1759	871		-43.4	1.10		13.6	13.24		13.34	12.98		3740	3842	4216	10	R	
1768	877	S7	-43.3	2.30	39.5	12.5	12.14	12.05	12.27	11.90	11.82	3914	4015	4390	25	R	11.68

where b is the Galactic latitude. The corrected magnitude is given a formal accuracy of 2 decimal places.

Column (9).—Zwicky magnitude corrected for both Galactic extinction and internal absorption. The internal absorption correction is taken from Holmberg (1958):

$$(m_z)_{GI} = (m_z)_G - \alpha[\sec(i) - 1] \quad (i < 75°)$$
$$= (m_z)_G - (A_I)_{\rm MAX} \quad (i \geq 75°) \quad (13)$$

($\alpha = 0.43$, $(A_I)_{\rm MAX} = 1.33$ for S2–S5; $\alpha = 0.28$, $(A_I)_{\rm MAX} = 1.03$ for S6–S9), where i is the inclination; α and $(A_I)_{\rm MAX}$ are given as a function of morphological type. The correction is made only for those galaxies with an inclination estimate available.

Column (10).—Apparent photographic magnitude statistically corrected from a Zwicky magnitude to the Holmberg system (Holmberg 1958):

$$m_H{}^* = 8.11 \times 10^{-1}(m_z) + 4.57 \times 10^{-3}(\delta) - 1.54 \times 10^{-1}(a) + 2.42 \quad (a \leq 6'.0)$$
$$= 9.48 \times 10^{-1}(m_z) + 7.79 \times 10^{-3}(\delta) - 7.37 \times 10^{-2} \quad (a > 6'.0), \quad (14)$$

where a is the major blue diameter in arcminutes and δ is the declination in degrees. The conversion is an attempt to correct for systematic declination and angular diameter effects present in the Zwicky catalog (see Appendix B).

TABLE 2—*Continued*

NAME UGC (1)	NAME NGC *IC (2)	HUB TYP (3)	GLACT LAT (DEG) (4)	MAJ DIA (MIN) (5)	INCL (DEG) (6)	ZWICKY MAG m_Z (7)	ZWICKY MAG $(m_Z)_G$ (8)	ZWICKY MAG $(m_Z)_{GI}$ (9)	HOLMBERG MAG (CALC) m_H^* (10)	HOLMBERG MAG (CALC) $(m_H^*)_G$ (11)	HOLMBERG MAG (CALC) $(m_H^*)_{GI}$ (12)	RADIAL VELOCITY V_S (KM/S) (13)	RADIAL VELOCITY V_{LG} (KM/S) (14)	RADIAL VELOCITY V_{CF} (KM/S) (15)	M.E. (16)	REF (17)	SEP (MIN) (18)
3063	1587	E	-30.5	1.80		13.3	12.81		12.93	12.44		3890	3825	4194	75	O	
3064	1588	C	-30.5	1.50		14.1	13.61		13.63	13.13		3378	3313	3682	105	O	1.10
3422		S5	22.7	2.40	42.5	14.5	13.85	13.71	14.13	13.49	13.35	4053	4219	4569	10	R	
3426		S1	22.7	1.80		13.8	13.15		13.66	13.01		4054	4219	4570	10	O	6.40
3740	2276	S7	27.7	2.80	27.4	12.3	11.76	11.73	12.36	11.82	11.78	2369	2579	2858	28	O	
3798	2300	E	27.8	3.20		12.2	11.66		12.21	11.68		1958	2168	2447	25	O	6.37
3930	2415	P	24.0	1.00		12.5	11.89		12.56	11.95		3782	3762	4104	20	R	
3937		S	24.2	2.10	82.5	14.2	13.59	12.41	13.77	13.17	11.99	3990	3972	4313	10	R	23.26
4066		S7	29.8	2.10	18.1	14.2	13.70	13.68	13.97	13.47	13.45	2301	2481	2780	10	R	
4151		S8	30.3	1.70	20.2	13.1	12.60	12.59	13.14	12.64	12.62	2286	2465	2762	15	R	27.85
4093	*2209	S	31.3	1.10	44.5	14.5	14.02	13.88	14.29	13.80	13.66	1545	1646	1977	95	O	
4097	2460	S5	31.4	4.00	46.8	12.5	12.02	11.84	12.22	11.74	11.56	1450	1551	1882	10	R	5.44
4095		P	31.2	0.90		14.4	13.92		14.26	13.78		4080	4211	4533	15	R	
4098		S	31.3	0.90	53.9	14.5	14.02	13.77	14.34	13.86	13.62	4913	5043	5366	10	R	10.72
4345	2562	S2	28.6	1.30	40.7	14.0	13.48	13.34	13.67	13.15	13.01	4963	4862	5121	50	O	
4347	2563	S1	28.6	2.00		13.7	13.18		13.32	12.80		4642	4541	4799	39	O	4.72
4356	*2327	S3	21.4	1.50	76.8	13.9	13.21	11.88	13.48	12.79	11.46	2685	2503	2692	10	R	
4366	* 503	S3	21.6	1.10	25.2	14.0	13.32	13.28	13.62	12.94	12.90	4131	3949	4137	15	R	12.10
4593		D	35.3	0.70		13.4	12.97		13.50	13.07		3626	3769	4061	15	R	
4603	2650	S5	35.3	1.80	44.9	14.3	13.87	13.71	14.06	13.63	13.47	3826	3970	4261	15	R	12.43
4671		S	40.1	1.60	29.6	13.6	13.21	13.16	13.44	13.05	13.00	3669	3724	4006	14	O	
4675	2692	S4	40.1	1.30	76.2	14.1	13.71	12.38	13.89	13.50	12.17	3757	3811	4093	15	O	3.34
4691	2713	S5	29.2	4.00	73.0	12.9	12.39	11.44	12.28	11.77	10.82	3875	3688	3823	26	O	
4692	2716	S1	29.3	1.60		13.7	13.19		13.30	12.79		3537	3350	3486	50	O	10.81
4752	2738	S	38.4	1.50	64.5	13.8	13.40	12.93	13.48	13.08	12.61	3102	3001	3203	15	R	
4794	2764	S	39.2	1.40	51.4	13.9	13.50	13.29	13.58	13.18	12.97	2714	2610	2804	10	R	67.53
4757	2744	D	37.4	1.60		13.7	13.29		13.37	12.96		3431	3313	3501	10	R	
4763	2749	E	37.5	1.80		13.3	12.89		13.01	12.60		4236	4117	4304	24	O	13.39
4840	2778	E	43.0	1.40		13.1	12.73		12.99	12.62		2060	2025	2257	21	O	
4843	2780	S	43.1	1.00	46.8	14.2	13.83	13.67	13.94	13.58	13.41	2216	2181	2411	22	O	7.32
4905	2798	S3	44.3	2.80	75.2	12.9	12.54	11.21	12.64	12.28	10.95	1708	1710	1953	75	O	
4909	2799	S	44.3	2.10	82.5	14.4	14.04	12.86	13.97	13.61	12.43	1737	1739	1982	40	O	1.63
4952	2814		40.2	1.30		14.0	13.61		13.87	13.48		1663	1778	2051	95	O	
4961	2820	S7	40.3	4.40	90.0	13.1	12.71	11.68	12.66	12.27	11.24	1686	1801	2074	18	O	3.74

Column (*11*).—Derived Holmberg magnitude corrected for Galactic extinction (see col. [8]).

Column (*12*).—Derived Holmberg magnitude corrected for both Galactic extinction and internal absorption (see col. [9]).

Column (*13*).—Heliocentric radial velocity (km s^{-1}) based on the radio data when available.

Column (*14*).—Radial velocity (km s^{-1}) corrected to the rest frame of the Local Group (de Vaucouleurs *et al.*):

$$v_{LG} = v_S + 300 \sin(l) \cos(b) . \qquad (15)$$

Column (*15*).—Radial velocity (km s^{-1}) corrected to the comoving frame (Rubin *et al.* 1976):

$$v_{CF} = v_{LG} + 450 \cos(A) , \qquad (16)$$

where A is the angle between the galaxy position and $l = 163°, b = -11°$.

Column (*16*).—Mean error (km s^{-1}) quoted from the original source and representing a 1 standard deviation uncertainty.

Column (*17*).—Reference indicating whether the radial velocity is based on optical measurements (O) or radio observations (R).

Column (*18*).—Separation of the member galaxies in the pair (decimal arcminutes) determined from 1950.0 positions and hence measured from the galaxy centers.

c) Table 3

The supplementary Table 3 appears in the same format as Table 2, and lists those 34 galaxy pairs in

TABLE 2—*Continued*

NAME UGC (1)	NGC *IC (2)	HUB TYP (3)	GLACT LAT (DEG) (4)	MAJ DIA (MIN) (5)	INCL (DEG) (6)	ZWICKY MAG m_Z (7)	$(m_Z)_G$ (8)	$(m_Z)_{GI}$ (9)	HOLMBERG MAG (CALC) m_H^* (10)	$(m_H^*)_G$ (11)	$(m_H^*)_{GI}$ (12)	RADIAL VELOCITY (KM/S) V_S (13)	V_{LG} (14)	V_{CF} (15)	M.E. (16)	REF (17)	SEP (MIN) (18)
5018	2872	E	39.4	1.80		13.0	12.61		12.74	12.34		2976	2825	2954	95	O	
5021	2874	S7	39.4	2.40	74.2	13.5	13.11	12.36	13.05	12.66	11.91	3620	3469	3598	95	O	1.27
5092	2911		40.6	4.00		13.6	13.22		12.88	12.50		3181	3025	3136	26	O	
5096	2914	S3	40.6	1.10	58.8	13.7	13.32	12.92	13.41	13.02	12.62	3370	3214	3324	100	O	4.85
5183	2964	S6	49.0	3.50	59.0	12.0	11.67	11.37	11.76	11.43	11.13	1319	1269	1451	20	R	
5190	2968		49.1	2.40		13.1	12.77		12.82	12.49		1613	1564	1746	73	O	6.18
5251	3003	S7	50.3	5.70	77.0	12.3	11.98	10.95	11.67	11.34	10.31	1482	1441	1621	10	R	
5280	3021	S	50.8	1.50	54.7	12.6	12.28	12.02	12.56	12.24	11.98	1541	1501	1678	20	R	30.53
5279	3026	S9	50.3	2.60	79.4	13.8	13.48	12.45	13.34	13.02	11.99	1492	1426	1586	10	R	
5292	3032	S1	50.7	2.00		13.0	12.68		12.79	12.47		1561	1499	1659	20	R	44.31
5375	3065	S1	39.4	1.80		12.9	12.51		12.93	12.54		1963	2117	2372	26	O	
5379	3066	S	39.5	1.20	0.0	12.8	12.41	12.41	12.95	12.55	12.55	2050	2204	2459	31	O	2.97
5520		S7	44.8	2.20	51.9	14.4	14.05	13.87	14.06	13.70	13.53	3315	3438	3675	10	R	
5576		S	45.2	1.50	54.7	14.1	13.75	13.49	13.92	13.57	13.31	3296	3419	3653	15	R	36.12
5617	3226	E	55.4	2.50		13.3	13.00		12.91	12.61		1356	1254	1331	13	O	
5620	3227	S5	55.4	6.50	47.4	12.2	11.90	11.71	11.64	11.34	11.15	1165	1063	1139	25	R	2.33
5742	3287	S9	58.5	2.10	63.8	12.9	12.61	12.25	12.66	12.36	12.01	1307	1216	1284	10	R	
5767	3301	S1	59.0	3.40		12.2	11.91		11.89	11.60		1333	1244	1309	75	O	32.80
5931	3395	S7	63.1	1.80	58.1	12.1	11.82	11.57	12.11	11.83	11.58	1625	1595	1691	6	O	
5935	3396	S9	63.2	3.70	70.9	12.6	12.32	11.74	12.22	11.94	11.36	1680	1650	1746	16	O	1.49
5953		P	60.3	0.45		13.2	12.91		13.26	12.97		1841	1869	2012	220	O	
5969	3415	S2	60.8	2.10	56.9	13.2	12.91	12.56	13.00	12.72	12.36	3303	3327	3466	20	R	51.71
6025	3435	S5	50.6	1.90	48.1	14.2	13.88	13.68	13.92	13.60	13.41	5158	5268	5468	10	R	
6064	3471	S3	50.8	1.90	64.0	13.0	12.68	12.13	12.95	12.63	12.08	2076	2188	2385	34	O	34.36
6528		S7	52.9	1.20	24.1	14.1	13.79	13.76	13.95	13.64	13.61	3251	3372	3545	15	R	
6542	3725	S7	52.9	1.60	42.5	13.6	13.29	13.19	13.49	13.17	13.07	3182	3303	3476	55	O	7.61
6615	3780	S7	58.1	3.10	37.1	12.2	11.91	11.83	12.09	11.80	11.73	2394	2492	2636	10	R	
6640	3804	S7	58.3	2.50	48.5	13.8	13.51	13.36	13.48	13.19	13.05	1385	1483	1626	10	R	13.33
6621	3786	S3	73.7	2.20	62.1	13.0	12.74	12.25	12.77	12.51	12.02	2761	2744	2771	95	O	
6623	3788	S	73.7	1.80	74.2	13.2	12.94	11.99	12.99	12.73	11.78	2339	2322	2349	95	O	1.50
6630	3799	S	69.7	0.70	45.6	14.4	14.13	13.98	14.06	13.79	13.64	3573	3479	3420	95	O	
6634	3800	S	69.7	1.90	82.6	13.1	12.83	11.65	12.82	12.56	11.38	3556	3462	3403	95	O	1.34
6711			46.3	0.80		13.8	13.45		13.81	13.46		2702	2858	3055	10	R	
6752	3879	S8	46.7	2.50	90.0	13.5	13.16	12.13	13.30	12.96	11.93	1431	1586	1781	10	R	24.27

Turner's (1976*a*) sample which satisfy the isolation criteria (eq. [1]) but include component magnitudes *outside* the original selection range (i.e., $m_z < 12.5$ or $m_z > 14.5$).

V. 21 CENTIMETER H I OBSERVATIONS

The 21 cm observations of galaxies in $\mathscr{D}_{OB}{}^{I}$ were performed over a $1\frac{1}{2}$ year period (1975 January–1976 June) and required approximately 1200 hours of telescope time on the 91 m (300 foot) transit telescope of the National Radio Astronomy Observatory. The peripheral hardware included a dual-polarization, cryogenic 21 cm parametric amplifier (paramp) with system temperatures of approximately 50 K, and a 384-channel model III autocorrelation receiver. When observing those sources without available redshift data, the autocorrelator was divided into four 10 MHz (96-channel) sections, each section offset by 7 MHz; the search mode provided a radial velocity coverage of 6500 km s^{-1} and a spectral resolution of 21 km s^{-1}. Sources detected in the search mode or having known optical redshifts were observed with two 10 MHz (192-channel) receivers of opposite polarization, resulting in a spectral resolution of 11 km s^{-1}.

A movable feed allowed the tracking of each source for 4 csc δ minutes as the galaxy crossed the meridian. A scan of the same duration was made in a source-free field either before or after the galaxy observation, with the off-source scan subtracted from the on-source scan to remove instrumental variations in the spectrum. A galaxy was usually observed on three to eight scans in the two-receiver autocorrelation mode; these scans were then averaged and the two polarizations

TABLE 2—*Continued*

NAME UGC	NGC *IC	HUB TYP	GLACT LAT (DEG)	MAJ. DIA (MIN)	INCL (DEG)	ZWICKY MAG m_Z	$(m_Z)_G$	$(m_Z)_{GI}$	HOLMBERG MAG (CALC) m_H^*	$(m_H^*)_G$	$(m_H^*)_{GI}$	RADIAL VELOCITY V_S (KM/S)	V_{LG}	V_{CF}	M.E.	REF	SEP (MIN)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
6813	3913	S7	59.7	3.00	21.5	14.2	13.91	13.89	13.73	13.44	13.42	956	1053	1184	10	R	
6823	3921		60.0	2.20		13.4	13.11		13.20	12.91		5838	5934	6063	25	R	16.90
6880	3958	S3	57.2	1.40	69.8	13.1	12.80	11.99	13.10	12.80	11.98	3380	3491	3634	50	R	
6884	3963	S5	57.1	2.90	21.9	12.2	11.90	11.87	12.13	11.84	11.81	3185	3297	3440	20	R	8.25
7021	4045	S3	62.3	3.00	49.5	13.5	13.22	12.99	12.92	12.63	12.40	2001	1862	1706	41	0	
7060	4073	E	62.4	2.10		13.8	13.52		13.30	13.01		5961	5823	5664	59	0	26.59
7044	4061	E	77.2	1.20		14.4	14.14		14.01	13.75		1603	1544	1477	83	0	
7050	4065	E	77.2	1.20		14.0	13.74		13.68	13.43		1180	1121	1054	152	0	1.13
7111	4116		63.4	3.80		13.0	12.72		12.39	12.11		1309	1176	1016	10	R	
7116	4123	S7	63.6	5.00	37.8	13.1	12.82	12.75	12.29	12.01	11.93	1328	1196	1036	10	R	14.21
7283	4218		67.9	1.00		13.2	12.93		13.19	12.92		725	799	872	20	R	
7290	4220	S3	68.1	3.80	71.6	12.4	12.13	11.20	12.11	11.84	10.91	979	1052	1123	50	0	15.38
7296	4227	S2	80.1	1.60	52.8	13.8	13.55	13.26	13.52	13.27	12.98	6515	6524	6514	43	0	
7299	4229	S	80.1	1.30	47.4	14.3	14.05	13.88	13.97	13.72	13.55	6662	6671	6661	62	0	2.67
7397	4291	E	41.6	2.00		12.3	11.92		12.43	12.06		1785	1968	2173	43	0	
7429	4319	S5	41.7	3.10	43.2	13.0	12.62	12.48	12.83	12.45	12.31	1685	1868	2072	73	0	6.14
7407	4294	D	72.9	3.00		12.6	12.34		12.23	11.97		351	263	128	15	R	
7414	4299	S9	72.9	1.70	0.0	12.8	12.54	12.54	12.59	12.33	12.33	228	140	5	15	R	5.69
7412	4298	S7	75.7	3.00	57.3	12.2	11.94	11.70	11.92	11.66	11.42	1116	1042	922	19	0	
7418	4302	S7	75.7	5.10	90.0	13.4	13.14	12.11	12.57	12.31	11.28	1339	1265	1145	50	0	2.39
7465	4343	S5	68.8	2.60	79.4	13.5	13.23	11.98	13.00	12.73	11.48	1012	906	745	10	R	
7466	4342	S	68.9	1.00	69.3	13.0	12.73	12.08	12.84	12.57	11.92	714	609	448	50	0	5.97
7610	4458	E	75.2	1.50		13.3	13.04		13.04	12.78		383	308	171	250	0	
7613	4461	S1	75.1	3.60		12.2	11.94		11.82	11.56		1887	1811	1675	40	0	3.67
7685			62.9	4.70		14.1	13.82		13.13	12.85		1529	1403	1198	10	R	
7694	4517	S7	62.6	10.80	90.0	12.4	12.12	11.09	11.68	11.40	10.37	1129	1002	796	10	R	16.99
7706	4521	S2	53.1	2.70	84.4	13.0	12.69	11.36	12.84	12.53	11.20	2971	3116	3261	20	R	
7747	4545	S7	53.5	2.90	58.4	13.1	12.79	12.54	12.89	12.58	12.32	2740	2884	3025	20	R	27.32
7721	4527	S5	65.2	6.50	73.9	12.4	12.12	11.11	11.70	11.42	10.41	1737	1621	1425	10	R	
7732	4536	S6	64.7	7.00	69.3	12.3	12.02	11.44	11.60	11.32	10.74	1807	1689	1490	10	R	28.28
7757	4550	S1	74.6	3.30		12.5	12.24		12.10	11.85		381	305	155	15	R	
7759	4551	E	74.7	1.70		13.1	12.64		12.84	12.58		978	903	753	300	0	3.19
7776	4568	S7	73.7	5.10	64.2	12.5	12.24	11.88	11.82	11.56	11.20	2247	2168	2011	24	0	
7777	4567	S7	73.7	3.00	34.4	12.5	12.24	12.18	12.15	11.89	11.83	2199	2120	1964	22	0	1.35

combined in producing a composite spectrum. The line profiles are shown in Figures 5 and 6.

The calibration of the data was accomplished through a comparison with noise tubes switched into the receiver circuits every 10 s. Using drift scans, the noise tubes were then compared with small continuum sources of known flux; fluxes were taken from Bridle *et al.* (1972) and Fomalont and Moffet (1971). A detailed summary of the corrections applied to account for gain variation as a function of hour angle and declination, as well as corrections for the telescope pointing, can be found in Fisher and Tully (1975). Calibration uncertainty is estimated at 6%.

Supplementary observations were made in 1976 March using the 305 m (1000 foot) Arecibo telescope (Peterson and Terzian 1979). The observations employed an uncooled 21 cm paramp with system temperature of approximately 70 K, and a 12 m (40 foot) linear feed illuminating an area 213 m (700 feet) in diameter. The spectral processing was performed over a 10 MHz bandwidth using 252 channels of the 1008-channel autocorrelator. In this configuration, the Arecibo telescope has a maximum sensitivity of 8.5 K Jy^{-1} and a half-power beamwidth of 3'.2, compared with 1.0 K Jy^{-1} and 10'.8, respectively, for the 91 m instrument. The Arecibo observations were performed to confirm marginal 91 m detections and to eliminate spatial confusion in those galaxy pairs which were unresolved in the 10'.8 beam.

The H I observations on both the 91 m and 305 m telescopes resulted in a detection ratio of 55%: out of the 271 galaxies observed, 94 galaxies without redshift information and 55 galaxies with optical redshifts were detected at 21 cm. The 149 galaxies may be

TABLE 2—*Continued*

NAME UGC	NGC *IC	HUB TYP	GLACT LAT (DEG)	MAJ DIA (MIN)	INCL (DEG)	ZWICKY MAG m_Z	$(m_Z)_G$	$(m_Z)_{GI}$	HOLMBERG MAG (CALC) m^*_H	$(m^*_H)_G$	$(m^*_H)_{GI}$	RADIAL VELOCITY (KM/S) V_S	V_{LG}	V_{CF}	M.E.	REF	SEP (MIN)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
7828	4596	S1	72.8	4.50		12.4	12.14		11.83	11.57		2020	1939	1772	46	O	
7842	4608	S1	72.9	3.00		12.6	12.34		12.22	11.96		1870	1789	1621	18	O	19.12
7930	4670	P	88.6	1.60		12.6	12.35		12.52	12.27		1159	1155	1076	42	O	
7933	4673	S1	88.7	1.00		13.7	13.45		13.50	13.25		6991	6987	6907	67	O	5.54
8099	4868	S3	79.7	1.60	20.8	12.9	12.65	12.62	12.81	12.55	12.52	4731	4780	4748	17	O	
8125	4914	E	79.6	3.50		12.7	12.45		12.35	12.10		4778	4828	4794	23	O	18.59
8175	4952	E	86.4	1.30		13.6	13.35		13.38	13.13		5865	5882	5794	71	O	
8194	4966	S	86.2	1.00	65.7	13.9	13.65	13.14	13.67	13.42	12.91	7102	7120	7030	70	O	17.51
8178	4957	E	86.9	1.10		14.2	13.95		13.89	13.64		7006	7017	6919	70	O	
8185	4961	S7	86.8	1.60	47.8	13.5	13.25	13.11	13.25	13.00	12.86	2531	2543	2445	10	O	12.64
8355	* 875	S1	59.3	1.60		13.9	13.61		13.71	13.42		2696	2834	2914	105	O	
8393	5109	S	59.0	1.80	81.3	13.6	13.31	12.13	13.44	13.14	11.96	2131	2271	2350	15	R	30.77
8396	5107		77.0	1.80		13.7	13.44		13.43	13.17		940	1007	962	15	R	
8403	5112	S7	76.8	4.00	46.8	12.5	12.24	12.11	12.12	11.86	11.73	965	1033	989	10	R	13.40
8507		S9	78.1	1.60	57.6	14.0	13.74	13.50	13.62	13.36	13.12	1000	994	821	15	R	
8516		S7	78.3	1.10	44.5	13.8	13.54	13.43	13.53	13.28	13.17	1011	1008	838	15	R	36.03
8641	5257	S	61.3	1.80	66.1	13.7	13.41	12.89	13.26	12.97	12.45	6865	6790	6509	95	O	
8645	5258	S	61.2	1.70	35.4	13.8	13.51	13.43	13.35	13.07	12.99	6689	6614	6333	95	O	1.35
8699	5289	S4	71.9	1.90	80.0	13.5	13.24	11.91	13.27	13.00	11.67	2516	2609	2565	15	R	
8700	5290	S6	71.7	3.60	81.3	13.0	12.74	11.63	12.60	12.34	11.23	2583	2677	2634	15	R	12.87
8792	5341	S	73.3	1.40	67.3	14.1	13.84	13.28	13.81	13.55	12.99	3648	3732	3657	10	R	
8809	5351	S5	73.1	2.90	58.4	13.1	12.84	12.49	12.77	12.51	12.16	3630	3715	3640	15	R	12.64
8898	5394	S	72.5	1.90	67.8	13.7	13.44	12.85	13.41	13.15	12.56	3410	3496	3415	21	O	
8900	5395	S5	72.5	3.00	66.9	12.6	12.34	11.73	12.35	12.09	11.48	3542	3628	3547	12	O	1.98
9026	5480	S7	62.4	1.70	55.6	12.6	12.32	12.10	12.61	12.33	12.11	1791	1929	1935	95	O	
9029	5481	E	62.4	1.80		13.5	13.22		13.32	13.04		2102	2240	2246	95	O	3.20
9033	5485	S1	58.9	2.70		12.4	12.11		12.31	12.02		1985	2137	2173	50	O	
9036	5486	S8	58.8	1.50	54.7	14.0	13.71	13.50	13.80	13.50	13.30	1383	1535	1572	10	R	6.41
9136	5536	S3	68.5	1.00	0.0	14.5	14.23	14.23	14.21	13.94	13.94	5137	5243	5164	50	O	
9139	5541	S	68.4	0.90	39.9	13.4	13.13	13.02	13.33	13.06	12.95	7472	7578	7500	41	O	5.50
9172	5560	S5	58.6	4.00	84.0	13.7	13.41	12.16	12.93	12.64	11.39	1711	1682	1380	15	R	
9175	5566	S3	58.6	6.20	71.4	12.0	11.71	10.79	11.33	11.04	10.12	1518	1489	1187	68	O	5.30
9181	5574	S1	57.9	1.10		13.4	13.10		13.13	12.84		1716	1685	1379	50	O	
9183	5576	E	57.9	3.00		12.3	12.00		11.95	11.65		1528	1497	1191	100	O	2.70

placed in one of three categories: (1) 44 galaxy pairs with H I data on each member, (2) 29 galaxy pairs with a 21 cm profile on one component and an optical redshift for the other, and (3) 38 systems with a 21 cm profile on one member but no redshift information on its companion (six H I observations have been included from Shostak 1975 and Roberts [unpublished data]).

VI. DERIVED GLOBAL PROPERTIES

The optical and radio data compiled on member galaxies in $\mathscr{D}_{OB}{}^{I}$ are combined in the derivation of global properties, including hydrogen mass content, luminosity, total indicative mass, and the ratios of these parameters. The integral properties provide the means for a comparison of galaxies in double systems with individual field galaxies. In addition, the total indicative mass and total mass-to-light ratio based on global H I profiles provide independent measurements to be compared with values obtained from a statistical study of orbital parameters in the observed sample of galaxy pairs.

Table 4 catalogs the integral properties of those galaxies in double systems with radio data available on each member, while the supplementary Table 5 includes the individual components of systems having an observed optical redshift for the companion. A cutoff in the radial velocity difference, $\Delta v < 750\ \mathrm{km\ s^{-1}}$, is incorporated to increase the probability that only physically paired galaxies are included in an analysis of the global properties. Tabulated entries are explained and referenced by column number.

TABLE 2—*Continued*

NAME UGC	NGC *IC	HUB TYP	GLACT LAT (DEG)	MAJ DIA (MIN)	INCL (DEG)	ZWICKY MAG m_Z	$(m_Z)_G$	$(m_Z)_{GI}$	HOLMBERG MAG (CALC) m_H^*	$(m_H^*)_G$	$(m_H^*)_{GI}$	RADIAL VELOCITY V_S (KM/S)	V_{LG}	V_{CF}	M.E.	REF	SEP (MIN)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
9347	5673	S7	60.2	2.60	90.0	14.0	13.71	12.68	13.60	13.31	12.28	2082	2231	2220	15	R	
9361	*1029	S5	60.1	2.80	90.0	13.7	13.41	12.16	13.33	13.04	11.79	2381	2530	2518	10	R	9.69
9353	5669	S7	60.6	4.50	43.9	13.2	12.91	12.80	12.48	12.19	12.08	1371	1376	1096	10	R	
9360	5666	C	60.9	0.90		13.5	13.21		13.28	12.99		2221	2229	1952	10	R	37.72
9399	5689	S3	60.5	4.00	78.9	12.7	12.41	11.08	12.33	12.04	10.71	2205	2353	2330	50	O	
9406	5693	S7	60.5	1.70	0.0	14.5	14.21	14.21	14.14	13.85	13.85	2276	2424	2400	15	R	11.69
9493	5740	S5	52.9	3.20	57.6	13.2	12.89	12.55	12.64	12.33	11.99	1567	1550	1220	10	R	
9499	5746	S5	53.0	7.40	90.0	12.3	11.99	10.74	11.60	11.29	10.04	1724	1708	1379	10	R	18.32
9560		P	63.2	0.80		14.5	14.22		14.22	13.94		1147	1262	1137	9	O	
9562		P	63.2	1.10		14.2	13.92		13.93	13.65		1226	1342	1216	24	O	4.18
9576	5774	S7	52.5	3.40	35.4	13.9	13.58	13.52	13.18	12.87	12.81	1589	1587	1261	20	O	
9579	5775	S7	52.4	4.20	85.6	13.0	12.68	11.65	12.33	12.02	10.99	1582	1580	1254	95	O	4.30
9615	5789		62.5	1.00		13.9	13.62		13.68	13.40		1800	1901	1735	15	R	
9628	5798	S9	62.2	1.40	51.4	13.5	13.22	13.05	13.29	13.01	12.84	1787	1888	1720	10	R	20.88
9645	5806	S5	50.2	3.00	62.1	12.9	12.57	12.13	12.43	12.10	11.66	1301	1298	960	65	O	
9655	5813	E	49.8	3.40		12.5	12.17		12.04	11.71		1882	1879	1540	65	O	20.97
9724	5857	S3	58.0	1.30	64.9	13.6	13.31	12.72	13.34	13.04	12.46	4706	4777	4535	57	O	
9728	5859	S5	58.0	2.90	82.1	13.1	12.81	11.56	12.69	12.39	11.14	4664	4735	4493	150	O	2.13
9774	5893	S5	57.5	1.40	22.3	14.1	13.80	13.77	13.83	13.53	13.50	5381	5532	5444	15	R	
9789	5899	S7	57.2	2.80	67.3	12.6	12.30	11.86	12.40	12.10	11.66	2554	2706	2619	15	R	17.40
9797	5905	S5	51.6	4.70	41.0	13.6	13.28	13.15	12.98	12.66	12.53	3393	3579	3595	10	R	
9805	5908	S5	51.5	3.00	66.9	13.5	13.18	12.58	13.16	12.84	12.23	3309	3496	3510	10	R	13.06
9906	5963	S	48.9	4.00	42.5	13.0	12.67	12.54	12.60	12.27	12.15	655	852	872	10	R	
9914	5965	S5	48.8	6.00	90.0	13.4	13.07	11.82	12.62	12.29	11.04	3416	3614	3635	10	R	8.93
9908	5956	S7	48.7	1.70	0.0	13.3	12.97	12.97	13.00	12.67	12.67	1899	1964	1665	10	R	
9915	5957	S5	48.8	2.80	0.0	13.3	12.97	12.97	12.83	12.50	12.50	1828	1895	1597	15	R	18.87
9961	5982	E	46.9	3.00		12.4	12.06		12.28	11.94		2879	3084	3125	28	O	
9969	5985	S5	46.8	5.80	59.6	12.0	11.66	11.28	11.53	11.19	10.80	2521	2726	2767	10	R	7.48
10003	5992	S	52.0	1.00	37.8	14.2	13.88	13.79	13.97	13.65	13.56	9594	9762	9661	122	O	
10007	5993	S5	52.0	1.20	42.5	13.9	13.58	13.44	13.70	13.38	13.24	9390	9559	9457	58	O	1.97
10628	6267	S7	34.5	1.40	39.2	14.0	13.56	13.48	13.66	13.22	13.14	2974	3144	2915	15	R	
10656	6278	S1	33.9	2.10		13.8	13.35		13.39	12.94		2776	2948	2720	15	R	37.24
10724	6306	S	36.0	1.00	76.8	14.3	13.87	12.69	14.14	13.72	12.54	2973	3216	3270	28	O	
10727	6307	S2	36.0	1.40	39.2	14.0	13.57	13.45	13.84	13.41	13.29	3057	3300	3354	31	O	1.36

Column (1).—Source number of the galaxy taken from the UGC.

Column (2).—Structural type based on the Hubble system (Hubble 1926) and taken from the UGC (see Table 1, col. [5]).

Column (3).—Major diameter, in decimal arcminutes, statistically corrected from the UGC blue diameter to the Holmberg system (Holmberg 1958):

$$\theta_H{}^* = 2.0(a)^{0.75}(b/a)^{0.2}\,, \qquad (17)$$

where a is the major blue diameter in arcminutes and b/a is the ratio of minor blue diameter to major blue diameter. The primary conversion is based on a least-squares analysis of the 206 galaxies in the Holmberg catalog with $a \leq 15'$. The axial ratio dependence is taken from Shostak (1975) and corrects for the observed dependence of measured photometric diameter on inclination (Heidmann, Heidmann, and de Vaucouleurs 1972).

Column (4).—H I profile area (Jy-km s^{-1}) corrected to account for the effects of a finite source size on the observed flux (the correction assumes a Gaussian shape for both the distribution of neutral hydrogen in the source and the telescope beam pattern; the major diameter determines a scale size for each galaxy, with the assumption that 70% of the hydrogen is confined within that dimension):

$$S = S_{OB}(1 + \beta^2)^{1/2}[1 + \beta^2 \cos^2(i)]^{1/2}\,, \qquad (18)$$

where S_{OB} is the observed profile area and $\beta = 0.76\,\theta_H{}^*/\theta_{HPBW}$. The half-power beamwidth of the 91 m telescope $\theta_{HPBW} = 10'.8$ at 21 cm, while $\theta_{HPBW} = 3'.2$ for the Arecibo observations. Although this is only

TABLE 2—*Continued*

NAME UGC (1)	NGC *IC (2)	HUB TYP (3)	GLACT LAT (DEG) (4)	MAJ DIA (MIN) (5)	INCL (DEG) (6)	ZWICKY MAG m_Z (7)	$(m_Z)_G$ (8)	$(m_Z)_{GI}$ (9)	HOLMBERG MAG (CALC) m^*_H (10)	$(m^*_H)_G$ (11)	$(m^*_H)_{GI}$ (12)	RADIAL VELOCITY (KM/S) V_S (13)	V_{LG} (14)	V_{CF} (15)	M.E. (16)	REF (17)	SEP (MIN) (18)
10848	*4660	S	31.7	1.40	81.3	14.3	13.82	12.64	14.15	13.67	12.49	1225	1468	1636	15	R	
10897	6412	S7	31.2	2.30	0.0	12.4	11.92	11.92	12.47	11.98	11.98	1320	1565	1733	10	R	30.18
11009	6482	E	22.9	2.10		12.8	12.16		12.58	11.94		3922	4128	3923	60	O	
11010	6484	S5	23.4	2.00	18.6	13.5	12.87	12.85	13.17	12.54	12.52	3112	3321	3126	10	R	84.63
11137	6570	S8	15.2	1.80	58.1	13.2	12.25	12.00	12.91	11.96	11.71	2283	2474	2227	10	R	
11144	6574	S	15.4	1.30	47.4	12.5	11.56	11.39	12.42	11.48	11.31	2261	2455	2214	20	R	54.26
11354	6702	E	19.8	1.90		13.8	13.06		13.53	12.79		4725	4998	4983	43	O	
11356	6703	S1	19.7	2.30		12.4	11.66		12.33	11.59		2318	2591	2576	35	O	10.06
11429	6792	S5	13.2	2.40	59.1	13.4	12.31	11.94	13.11	12.02	11.65	4628	4910	4905	10	R	
11430		S7	13.2	1.10	0.0	14.4	13.31	13.31	14.13	13.03	13.03	5478	5760	5756	10	R	11.81
11589	6928	S4	-17.3	2.20	79.1	13.7	12.86	11.53	13.24	12.39	11.06	4754	4986	4876	75	O	
11590	6930	D	-17.3	1.20		14.3	13.46		13.88	13.04		4182	4414	4303	75	O	3.86
11628	6962	S3	-25.4	3.00	40.9	13.5	12.92	12.78	12.91	12.32	12.18	4219	4419	4283	15	R	
11629	6964	E	-25.4	1.60		14.2	13.62		13.69	13.11		3832	4031	3896	100	O	1.75
12035	7280	S2	-34.2	1.90	48.1	13.6	13.16	12.94	13.23	12.78	12.57	1903	2147	2237	20	R	
12045	7290	S5	-33.8	1.70	55.6	13.8	13.35	13.05	13.43	12.98	12.68	2896	3142	3239	20	R	66.39
12115	7332	S1	-29.7	3.60		12.0	11.50		11.70	11.20		1191	1451	1589	11	O	
12122	7339	S6	-29.7	2.80	78.0	13.1	12.60	11.49	12.72	12.21	11.10	1339	1599	1738	15	R	5.15
12365	*5285	C	-33.9	1.70		14.4	13.95		13.94	13.49		6245	6493	6671	105	O	
12378	7489	S7	-33.9	2.20	62.1	14.3	13.85	13.53	13.78	13.33	13.01	6239	6487	6666	15	R	8.58
12442	7537	S5	-50.7	2.10	82.5	13.8	13.48	12.23	13.31	12.98	11.73	2602	2791	2905	46	O	
12447	7541	S7	-50.7	3.40	75.0	12.7	12.38	11.58	12.21	11.89	11.09	2393	2582	2696	83	O	3.01
12456	7550	S0	-38.4	1.40		13.9	13.50		13.56	13.16		4987	5222	5396	150	O	
12457	7549	S	-38.3	2.80	81.3	14.1	13.70	12.52	13.51	13.10	11.92	4806	5041	5216	150	O	4.80
12464	7562	E	-49.0	2.10		13.0	12.67		12.67	12.34		3806	4002	4128	63	O	
12486	7591	S5	-49.4	1.90	67.8	13.8	13.47	12.83	13.35	13.02	12.38	4964	5159	5287	15	R	34.98
12607	7673	C	-35.4	1.70		12.7	12.27		12.56	12.13		3407	3648	3857	20	R	
12610	7677	S5	-35.5	1.70	51.1	13.9	13.47	13.24	13.54	13.11	12.87	3544	3785	3994	20	R	6.63
12618	7679	S1	-53.4	1.70		13.2	12.89		12.88	12.57		5205	5383	5515	44	O	
12622	7682	S3	-53.5	1.10	35.9	14.3	13.99	13.89	13.86	13.55	13.45	5170	5348	5480	33	O	4.53
12737	7731	S3	-54.8	1.50	49.5	14.3	13.99	13.76	13.80	13.50	13.26	2802	2975	3126	100	O	
12738	7732	S8	-54.8	1.90	71.6	14.5	14.19	13.59	13.90	13.60	12.99	2875	3048	3199	65	O	1.39
12759	7743	S2	-49.5	2.50	33.6	12.9	12.57	12.48	12.54	12.21	12.12	1802	1995	2177	65	O	
12760	7742	S1	-48.7	2.00		12.5	12.17		12.30	11.96		1622	1818	2003	30	O	50.02

the first approximation of a complicated geometry, it should be stressed that even a rather rough correction is justified because the errors are systematic. The average 91 m correction applied is 5% and in no case exceeds 18%; the several Arecibo corrections are somewhat larger.

Column (5).—H I profile width (km s^{-1}) corrected to the plane of the galaxy:

$$\Delta v_{TR} = \Delta v / \sin(i) , \qquad (19)$$

where i is the inclination. A minimum inclination of $i = 15°$ is adopted in this correction, and a dagger (†) denotes those Δv_{TR} based on $i \leq 20°$.

Column (6).—Distance to the galaxy pair, in Mpc, based on the radial velocity of the center of mass, assuming a constant mass-to-light ratio for the double system:

$$hD = \hat{v}_{LG}/100 ,$$

$$\hat{v}_{LG} = [v_1 \operatorname{dex}(-0.4m_1) + v_2 \operatorname{dex}(-0.4m_2)] \times [\operatorname{dex}(-0.4m_1) + \operatorname{dex}(-0.4m_2)]^{-1} , \qquad (20)$$

where the Hubble constant $H_0 = h \times 10^2$ km s^{-1} Mpc^{-1} and the velocities are corrected to the rest frame of the Local Group (eq. [15]).

Column (7).—Neutral hydrogen mass, in solar units, determined from the relation

$$h^2 M_{HI}/M_\odot = 2.36 \times 10^5 (hD)^2 S , \qquad (21)$$

TABLE 2—*Continued*

NAME UGC (1)	NGC *IC (2)	HUB TYP (3)	GLACT LAT (DEG) (4)	MAJ DIA (MIN) (5)	INCL (DEG) (6)	ZWICKY MAG m_Z (7)	$(m_Z)_G$ (8)	$(m_Z)_{GI}$ (9)	HOLMBERG MAG (CALC) m_H^* (10)	$(m_H^*)_G$ (11)	$(m_H^*)_{GI}$ (12)	RADIAL VELOCITY (KM/S) V_S (13)	V_{LG} (14)	V_{CF} (15)	M.E. (16)	REF (17)	SEP (MIN) (18)
12779	7752		-31.3	0.45		14.3	13.82		14.08	13.60		4880	5126	5379	20	O	
12780	7753	S5	-31.3	3.50	61.1	13.2	12.72	12.30	12.72	12.24	11.82	5083	5329	5582	62	O	1.96
12808	7769	S4	-40.5	1.80	0.0	12.9	12.52	12.52	12.69	12.31	12.31	4349	4570	4800	74	O	
12815	7771	S3	-40.6	2.50	63.6	13.1	12.72	12.18	12.75	12.36	11.83	4290	4511	4741	53	O	5.40
12883	*1525	S5	-15.0	1.90	48.1	13.3	12.33	12.14	13.13	12.16	11.97	5018	5283	5584	10	R	
12889		S5	-14.7	2.30	39.5	14.0	13.01	12.90	13.63	12.65	12.53	5017	5282	5584	10	R	24.31
12914		S	-38.0	2.70	63.5	13.2	12.79	12.35	12.81	12.41	11.97	4536	4760	5015	56	O	
12915			-38.0	1.60		13.9	13.49		13.55	13.15		4530	4754	5009	56	O	1.22

TABLE 3

ADDITIONAL PARAMETERS (Turner 1976*a* supplement)

NAME UGC (1)	NGC *IC (2)	HUB TYP (3)	GLACT LAT (DEG) (4)	MAJ DIA (MIN) (5)	INCL (DEG) (6)	ZWICKY MAG m_Z (7)	$(m_Z)_G$ (8)	$(m_Z)_{GI}$ (9)	HOLMBERG MAG (CALC) m_H^* (10)	$(m_H^*)_G$ (11)	$(m_H^*)_{GI}$ (12)	RADIAL VELOCITY (KM/S) V_S (13)	V_{LG} (14)	V_{CF} (15)	M.E. (16)	REF (17)	SEP (MIN) (18)
34	7824	S4	-54.2	1.90	48.1	14.5	14.19	13.98	13.92	13.61	13.39	3126	3297	3495	86	O	
36		S3	-54.3	1.70	64.2	14.7	14.39	13.83	14.11	13.80	13.24	3071	3242	3440	56	O	9.20
		E	-54.1			15.0	14.69		14.47	14.16		4761	4921	5162	184	O	
312		S	-54.1	1.70	64.2	14.6	14.29	13.83	14.04	13.73	13.26	4349	4509	4750	34	O	1.40
983	*1698	S1	-47.2	1.70		14.9	14.56		14.31	13.97		5376	5520	5848	110	O	
986	*1700	E	-47.2	2.00		14.3	13.96		13.77	13.43		5758	5902	6230	192	O	1.70
1153	631	E	-55.3	1.70		15.0	14.70		14.35	14.04		4021	4124	4431	52	O	
1157	632	S1	-55.2	1.70		13.5	13.20		13.13	12.83		3321	3424	3731	36	O	8.10
1266	* 162	S	-49.9	1.00	46.8	14.2	13.87	13.71	13.83	13.50	13.34	5031	5141	5478	83	O	
1267		S1	-49.9	1.70		14.8	14.47		14.21	13.88		4823	4933	5270	40	O	2.50
1325		E	-51.8	1.80		14.2	13.88		13.69	13.38		5158	5258	5589	105	O	
1326		E	-51.7	1.10		15.0	14.68		14.45	14.13		5004	5104	5435	82	O	2.90
1463	770	S	-41.1	1.10	44.5	14.2	13.82	13.68	13.85	13.47	13.33	2489	2621	2993	124	O	
1466	772	S5	-41.0	8.00	52.8	11.3	10.92	10.66	10.78	10.40	10.14	2470	2602	2974	87	O	3.60
1678	* 211	S7	-53.5	2.60	37.0	14.5	14.19	14.12	13.79	13.48	13.41	3088	3155	3485	115	O	
1680	851	S1	-53.6	1.30		14.7	14.39		14.16	13.85		3211	3278	3608	84	O	4.50
2142	1024	S5	-43.9	4.80	72.7	13.8	13.44	12.52	12.92	12.56	11.64	3587	3656	4034	81	O	
2149	1029	S2	-43.9	1.60	75.9	14.9	14.54	13.21	14.30	13.94	12.61	3527	3596	3974	103	O	7.00
4986	2852	C	45.4	1.10		14.0	13.65		13.79	13.44		1896	1888	2120	40	O	
4987	2853	S3	45.4	1.90	64.0	14.6	14.25	13.70	14.15	13.80	13.25	1808	1800	2032	39	O	2.30
5134	2939	S6	41.2	2.60	73.3	13.5	13.12	12.33	13.01	12.63	11.84	3372	3214	3315	66	O	
	2940	S0	41.2			14.8	14.42		14.31	13.93		2987	2829	2930	65	O	5.80
5536	3168	E	47.8	1.00		14.6	14.26		14.38	14.04		9288	9387	9613	37	O	
5542		E	47.8	1.00		14.9	14.56		14.63	14.29		9024	9123	9349	43	O	4.80
	* 601	S8	48.5			15.0	14.67		14.46	14.13		3644	3482	3509	36	O	
5561	* 602	S9	48.5	0.90	53.9	13.4	13.07	12.87	13.18	12.85	12.65	3810	3648	3675	31	O	1.30
	3286	E	50.8			14.6	14.28		14.37	14.05		7588	7683	7889	61	O	
5752	3288	S5	50.8	1.10	51.9	15.0	14.68	14.43	14.68	14.36	14.12	7592	7687	7893	52	O	4.00
6204		S	67.0	1.00	62.1	14.5	14.23	13.82	14.14	13.87	13.46	6173	6107	6136	61	O	
6207		S	67.0	1.50	90.0	14.6	14.33	13.15	14.14	13.87	12.69	6149	6083	6112	46	O	0.76
6310	3609	S4	69.2	1.20	34.4	14.1	13.83	13.74	13.79	13.52	13.43	5673	5622	5651	90	O	
6321	3612	S8	69.3	1.00	37.8	15.0	14.73	14.66	14.55	14.29	14.21	5521	5470	5499	150	O	5.40
6938	3990	S1	60.1	1.40		13.6	13.31		13.49	13.20		720	820	945	43	O	
6946	3998	S1	60.1	3.00		11.2	10.91		11.29	11.01		1138	1238	1363	16	O	3.00

TABLE 3—*Continued*

NAME UGC	NAME NGC *IC	HUB TYP	GLACT LAT (DEG)	MAJ DIA (MIN)	INCL (DEG)	ZWICKY MAG m_Z	$(m_Z)_G$	$(m_Z)_{GI}$	HOLMBERG MAG (CALC) m_H^*	$(m_H^*)_G$	$(m_H^*)_{GI}$	RADIAL VELOCITY (KM/S) V_S	V_{LG}	V_{CF}	M.E.	REF	SEP (MIN)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
		S	74.6			14.6	14.34		14.18	13.92		3507	3430	3345	150	0	
7032		S2	74.6	0.60	34.4	14.0	13.74	13.65	13.76	13.50	13.41	3907	3830	3745	19	0	2.20
	*2989	S	62.3			14.8	14.52		14.28	14.00		5858	5719	5559	104	0	
7063	4077	S0	62.3	1.00		14.5	14.22		14.03	13.75		6916	6777	6617	140	0	1.30
7073		S7	75.9	1.10	44.5	14.1	13.84	13.73	13.77	13.51	13.40	4488	4419	4338	56	0	
7074		S	75.9	1.00	81.3	14.6	14.34	13.16	14.19	13.93	12.75	4695	4626	4545	68	0	2.10
		S8	68.9			15.0	14.73		14.47	14.20		6325	6217	6090	47	0	
7085		S	68.9	1.90	75.6	14.8	14.53	13.35	14.17	13.90	12.72	6161	6053	5926	54	0	1.50
7166	4151	S4	75.1	7.00	31.7	11.2	10.94	10.87	10.85	10.59	10.51	873	906	936	61	0	
7173	4156	S5	75.0	1.40	22.3	14.3	14.04	14.01	13.98	13.72	13.69	724	757	787	63	0	5.20
7508	4382	S1	79.2	7.40		10.2	9.95		9.74	9.48		773	717	612	30	0	
7523	4394	S5	79.3	3.60	19.6	11.9	11.65	11.62	11.60	11.34	11.32	772	716	611	150	0	7.80
7648	4485	S9	74.8	3.00	34.4	12.4	12.14	12.08	12.20	11.95	11.89	765	817	839	95	0	
7651	4490	S	74.9	7.00	62.1	10.1	9.84	9.44	9.82	9.56	9.16	577	629	651	5	0	4.00
7896	4647	S7	74.4	2.90	35.0	12.5	12.24	12.18	12.16	11.90	11.84	1358	1285	1121	64	0	
7898	4649	E	74.3	7.00		10.3	10.04		9.78	9.52		1200	1127	963	26	0	2.80
8375	* 881	S3	76.9	1.70	87.3	14.8	14.54	13.21	14.23	13.98	12.65	6835	6807	6624	34	0	
	* 882	S2	76.9			15.0	14.74		14.50	14.25		6774	6746	6563	47	0	3.80
8493	5194	S7	68.6	9.00	34.4	8.8	8.53	8.47	8.63	8.37	8.31	460	566	572	4	0	
8494	5195	S9	68.5	7.00	45.6	10.6	10.33	10.21	10.34	10.07	9.95	552	658	664	16	0	4.60
8675	5273	S1	76.3	2.80		12.7	12.44		12.45	12.19		1014	1083	1002	22	0	
8680	5276	S3	76.2	1.10	51.9	14.6	14.34	14.07	14.25	14.00	13.73	5271	5340	5259	44	0	3.30
	5296	S	69.9			15.0	14.73		14.63	14.37		2216	2319	2290	107	0	
8709	5297	S7	69.9	5.80	90.0	12.3	12.03	11.00	11.70	11.44	10.41	2576	2679	2650	44	0	1.50
		S2	48.0			15.0	14.66		14.62	14.28		2030	2213	2111	25	0	
10200		S2	48.0	0.80	42.5	13.6	13.26	13.11	13.52	13.18	13.03	1938	2121	2019	43	0	1.60
12422	7518	S3	-49.0	1.50	21.5	14.5	14.17	14.14	13.98	13.64	13.61	645	841	961	190	0	
12423		S7	-48.9	3.60	90.0	14.8	14.47	13.44	13.89	13.56	12.53	888	1084	1204	78	0	6.70
	7557	S0	-49.1			15.0	14.67		14.46	14.13		3615	3811	3937	55	0	
12464	7562	E	-49.1	2.10		13.0	12.67		12.67	12.34		3525	3721	3847	51	0	4.70
12602	7671	S1	-45.5	1.40		14.3	13.95		13.86	13.51		4222	4432	4599	94	0	
	7672	S	-45.5			14.8	14.45		14.32	13.97		4398	4608	4775	93	0	6.00
	7681	S2	-41.3			15.0	14.62		14.51	14.13		7485	7709	7897	47	0	
12620		S1	-41.3	1.40		14.2	13.82		13.80	13.42		6997	7221	7409	68	0	6.30

where hD is the distance in Mpc and S is the corrected profile area in Jy-km s^{-1}. The equation is derived under the assumption that the H I is optically thin, and no optical depth corrections have been applied at high inclinations.

Column (*8*).—Total indicative mass, in solar units, estimated from the hydrogen line profile using

$$hM_T/M_\odot = K_o(hD)\theta_H^*(\Delta v_{TR})^2 \,,$$

$$K_o = 4.25 \times 10^3 \,, \qquad (22)$$

with hD in Mpc, θ_H^* in arcminutes, and Δv_{TR} in km s^{-1}. A dagger (†) denotes $hM_T/M_\odot$ based on $i \leq 20°$ and indicates that the entry is not included in the subsequent analysis. The derivation of $hM_T/M_\odot$ is discussed in detail by Roberts (1968), and is based on the Brandt (1960) formulation assuming a shape parameter $n = 3$ and turnover radius $0.17\,\theta_H^*$ for the rotation curve. Any change in the shape or scaling parameter will rescale the mass estimate while preserving the functional form. Rogstad and Shostak (1972) have found rotation curves in late-type galaxies with $n = 1$ and turnover radius $0.30\,\theta_H^*$. These systems are characterized by a large turnover radius with flat rotation in the outer regions; the derived mass constant $K = 1.72 \times 10^4$, and the total mass estimates are thus 4 times those listed in column (8).

Column (*9*).—Luminosity, in solar units, based on derived Homberg magnitudes corrected for Galactic extinction (Table 2, col. [11]):

$$h^2L/L_\odot = 10^{10}(hD)^2 \,\text{dex}\,(0.4M_\odot) \times \text{dex}\,[-0.4(m_H^*)_G] \,, \qquad (23)$$

1979ApJS...40..527P

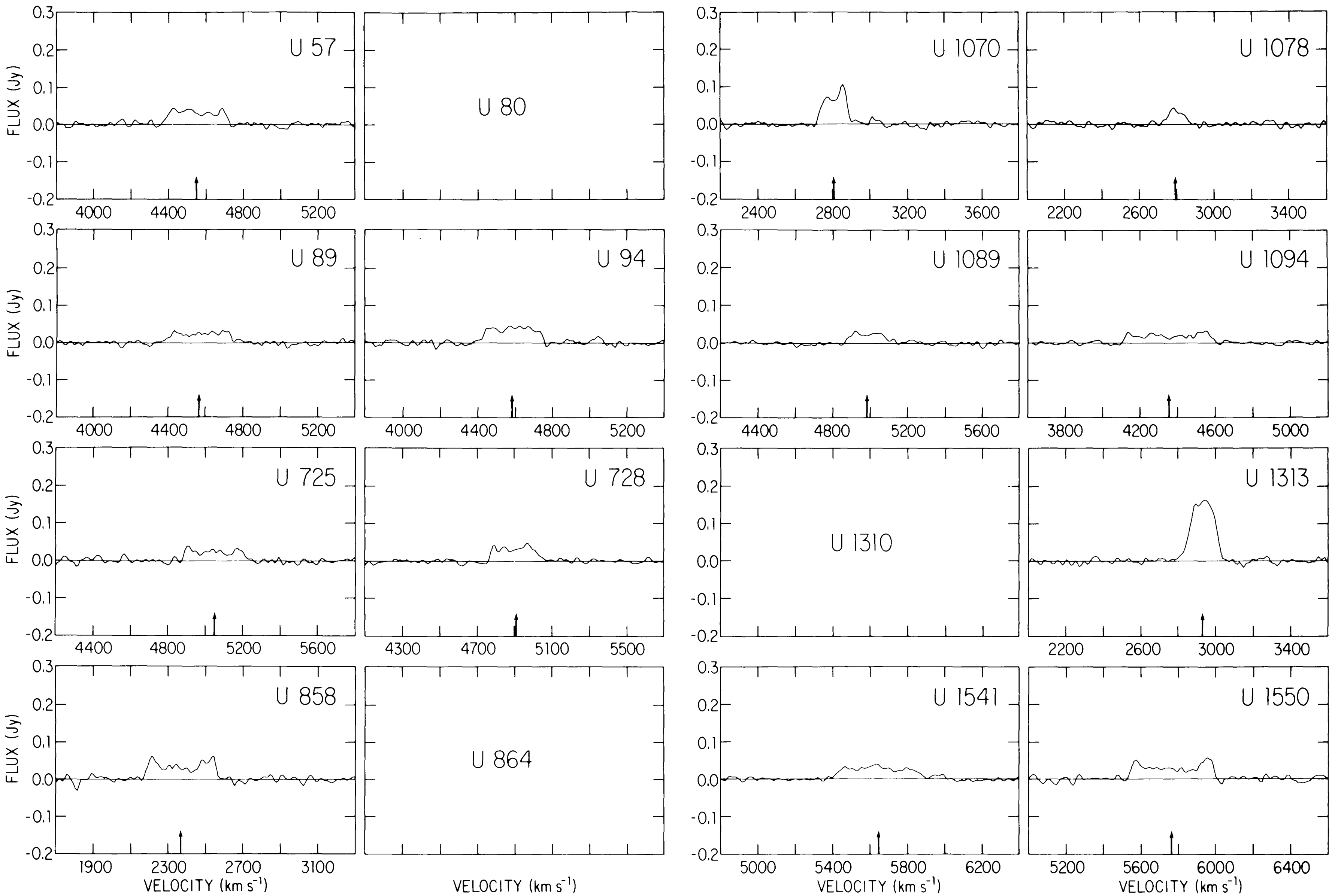

FIG. 5.—Neutral-hydrogen, 21 cm line profiles of member galaxies in binary systems with redshift information (radio or optical) available on both components. The spectra have been processed through a Hanning smoothing and the removal of a low-order polynomial from the baseline; calibration is in Jy. The small arrow appearing in each spectrum indicates the quoted radial velocity, defined as the mid-range of the line profile. When only the optical redshift is available, a blank spectrum is included. Note the presence of Galactic hydrogen in the spectra of U7407, U7414, U7465, U7757, and U9906; note the presence of interference in the spectra of U5292, U7685, U10897, and U12610. (For numerical information on the individual profiles, see Table 1, Cols. [12]–[16].)

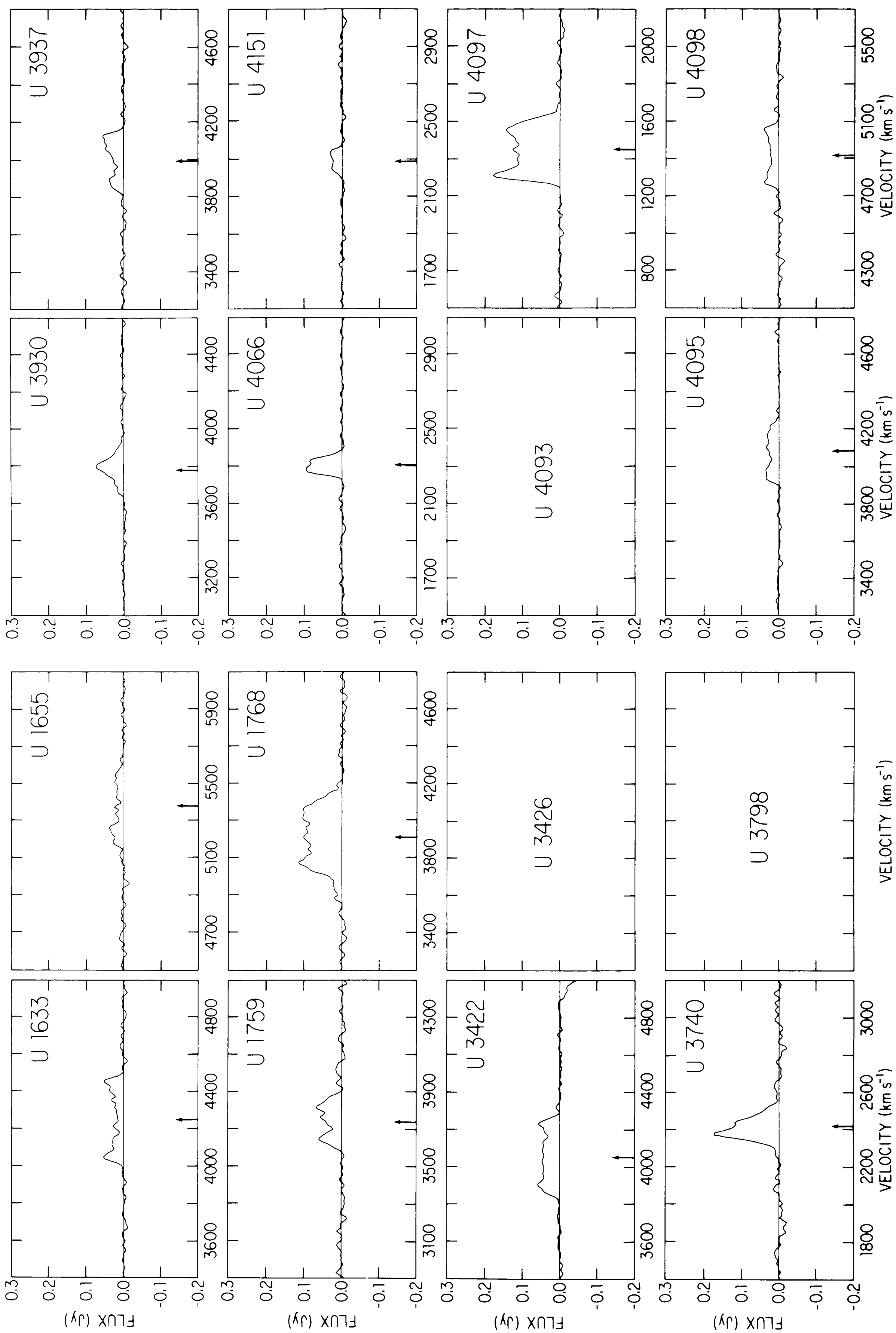

FIG. 5—*Continued*

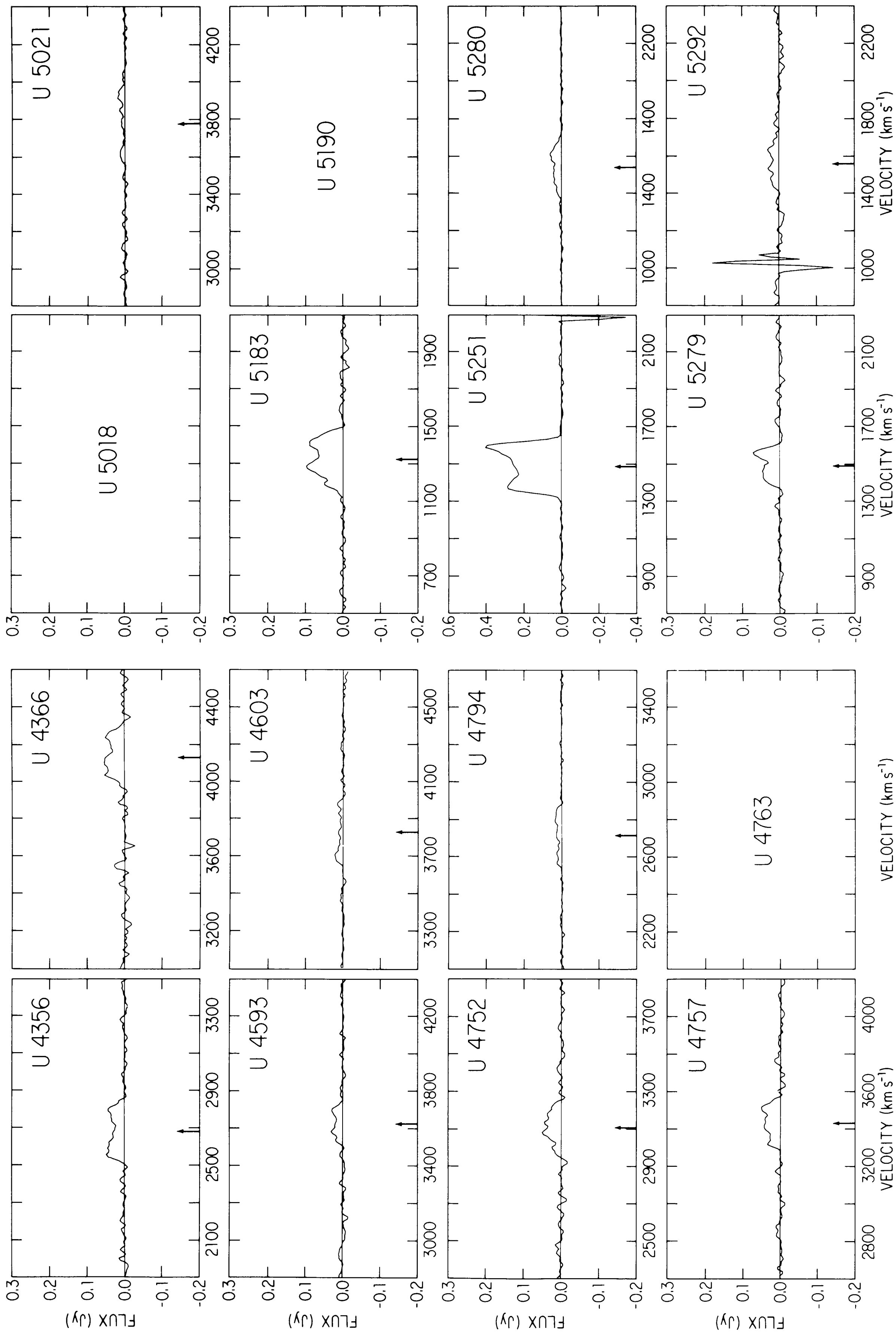

FIG. 5—*Continued*

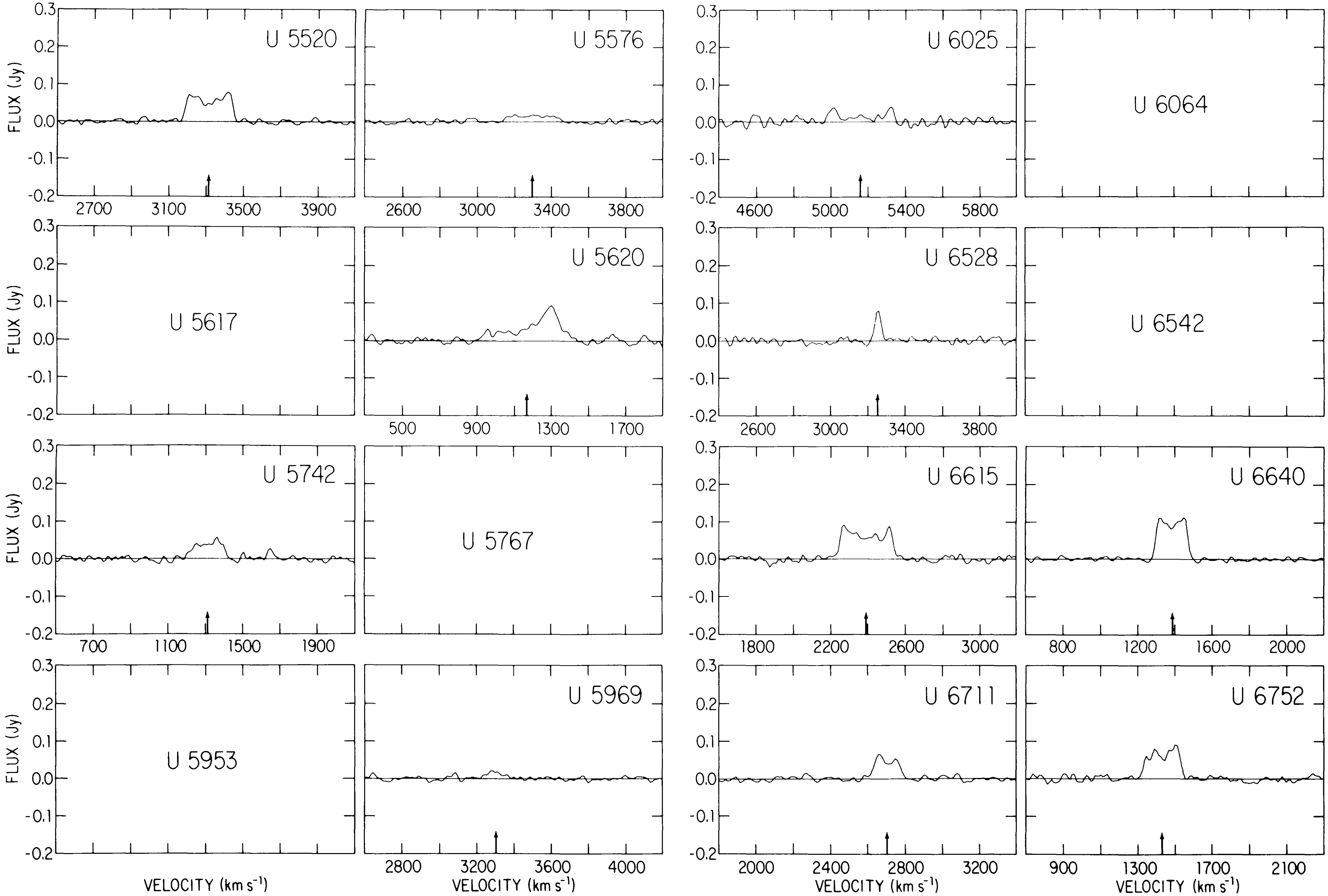

FIG. 5—*Continued*

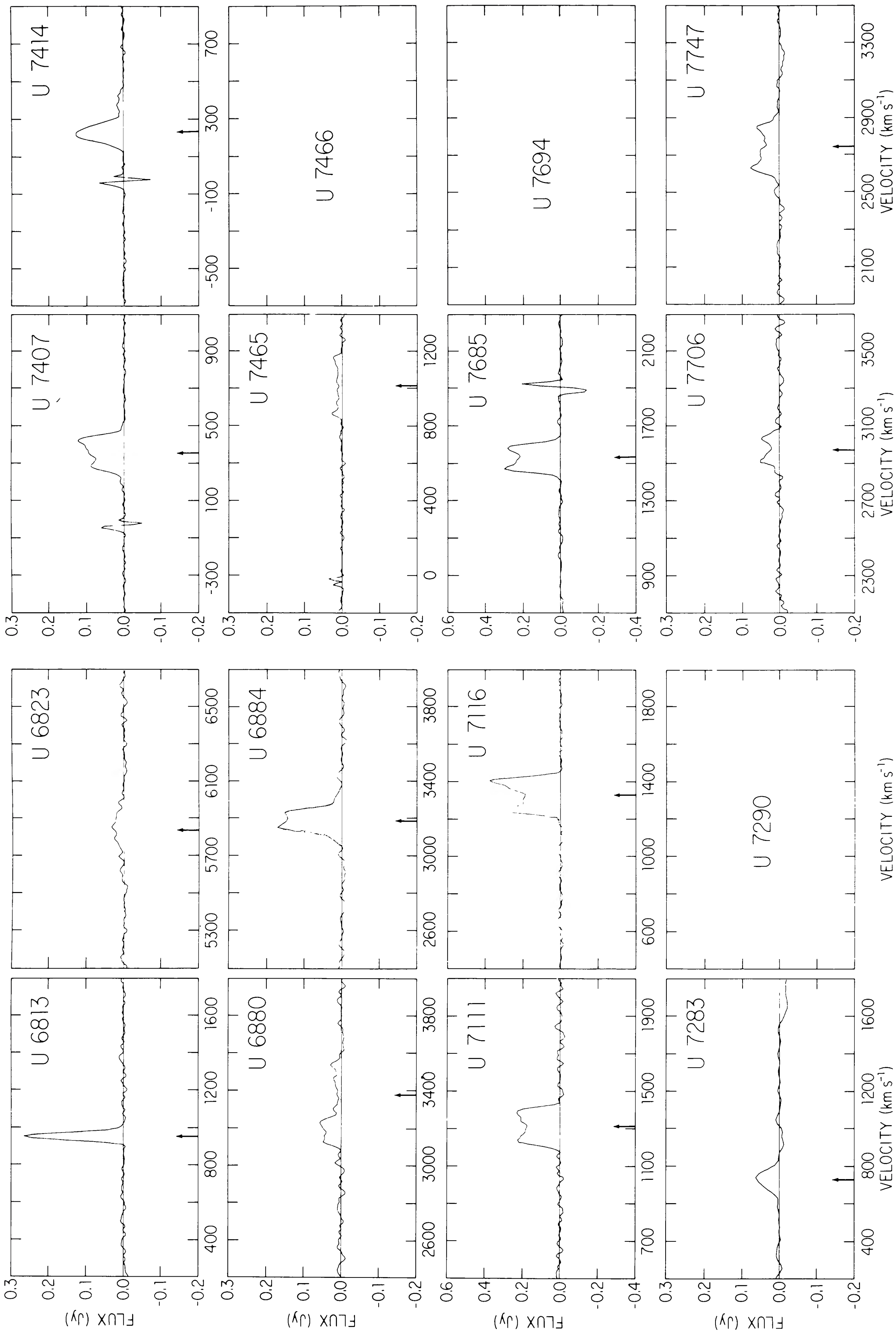

FIG. 5—*Continued*

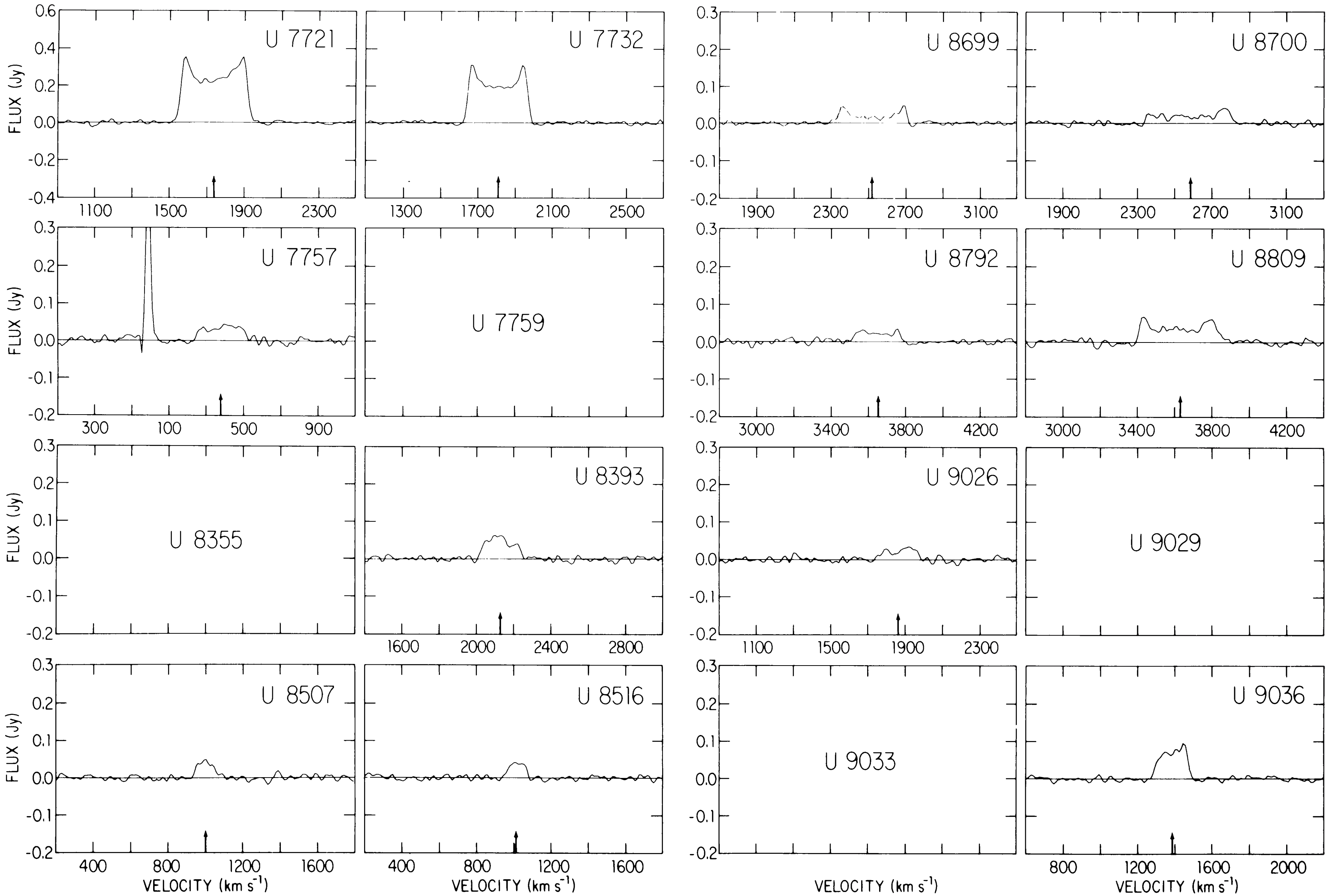

FIG. 5—*Continued*

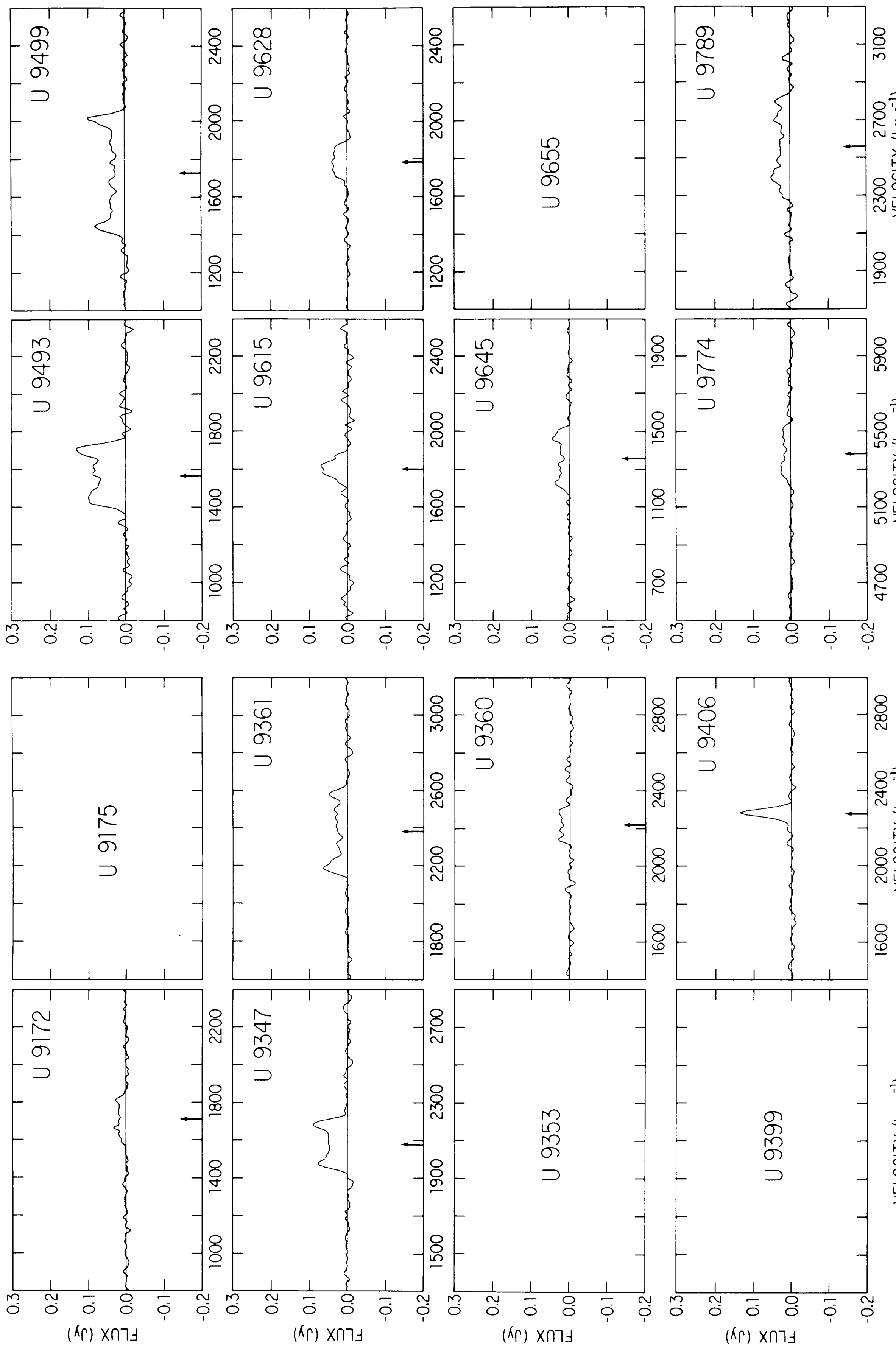

Fig. 5—*Continued*

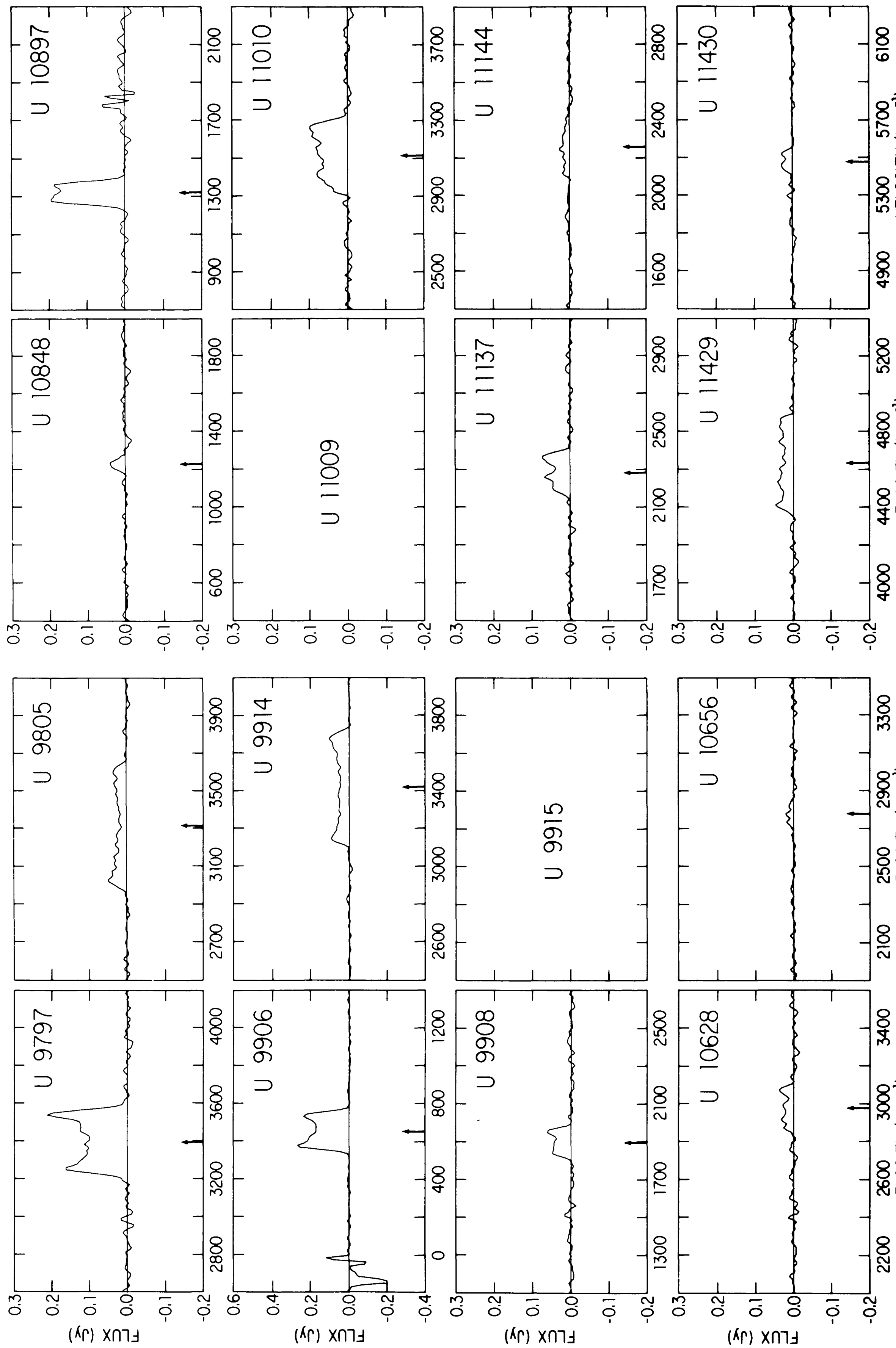

FIG. 5—*Continued*

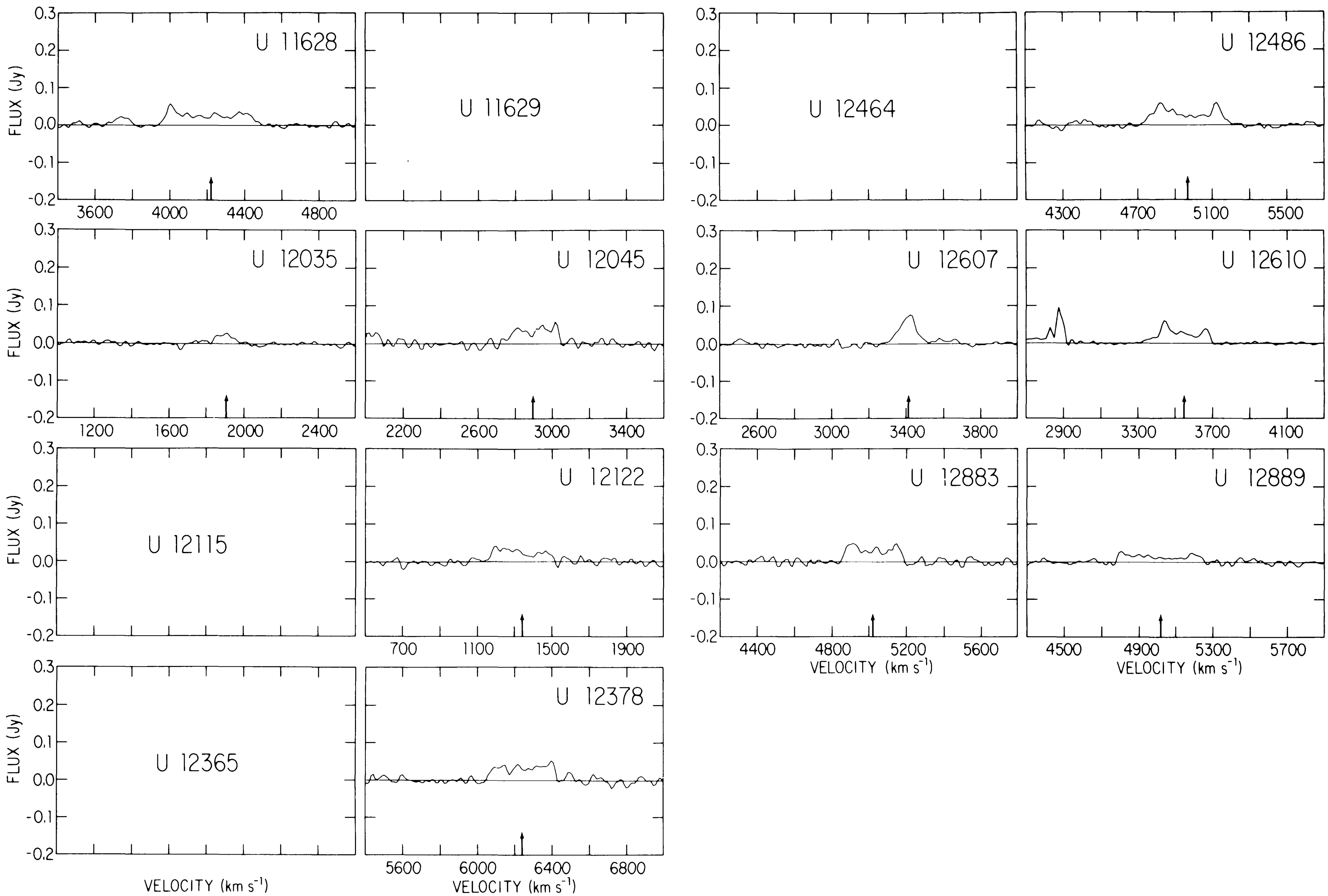

FIG. 5—*Continued*

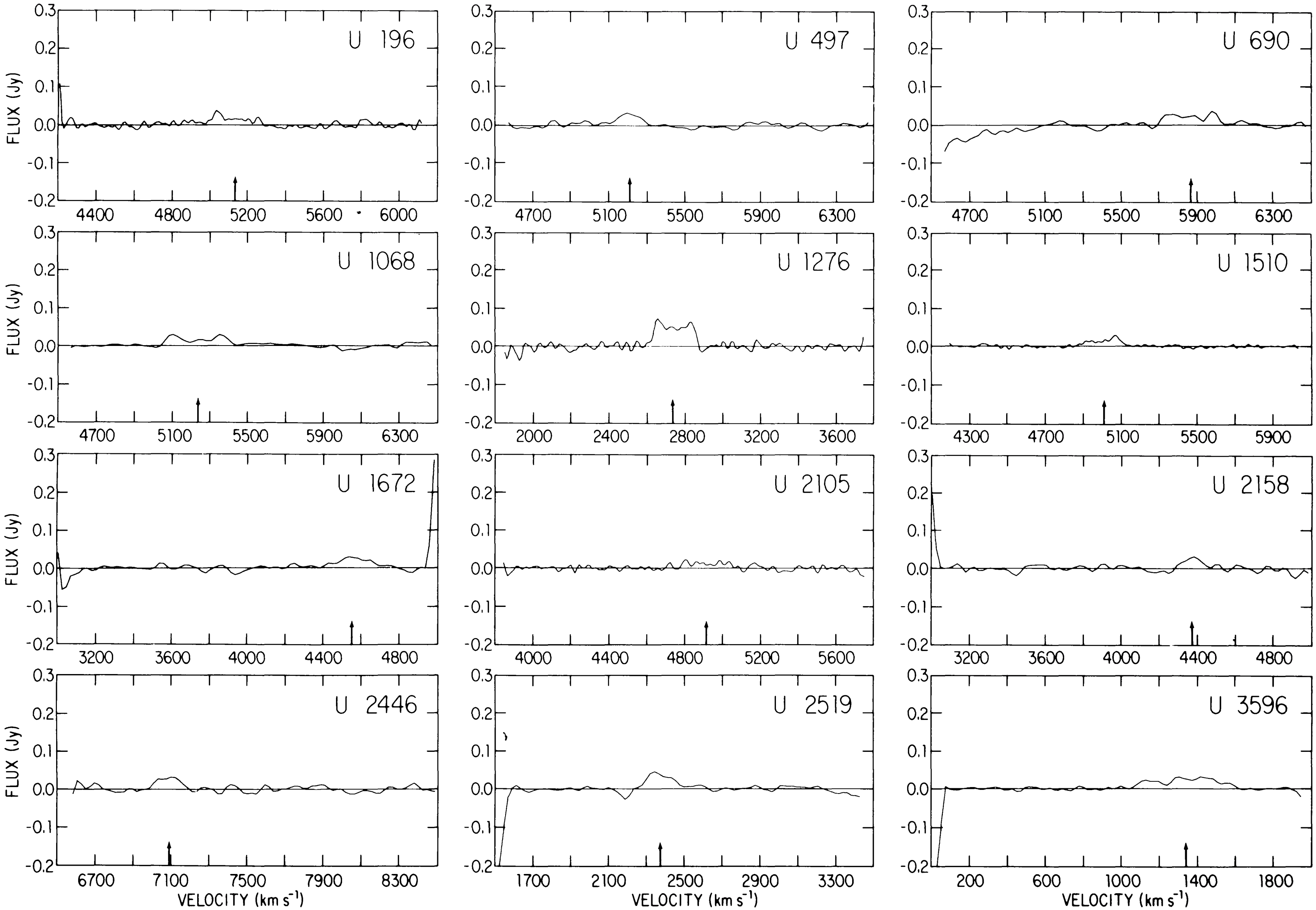

FIG. 6.—Neutral-hydrogen, 21 cm line profiles of component galaxies in binary systems with only the one known redshift. The spectra have been processed through a Hanning smoothing and the removal of a low-order polynomial from the baseline; calibration is in Jy. The small arrow appearing in each spectrum indicates the quoted radial velocity, defined as the mid-range of the line profile. Note the presence of interference in the spectrum of U5738. (For numerical information on the individual profiles, see Table 1, Cols. [12]–[16].)

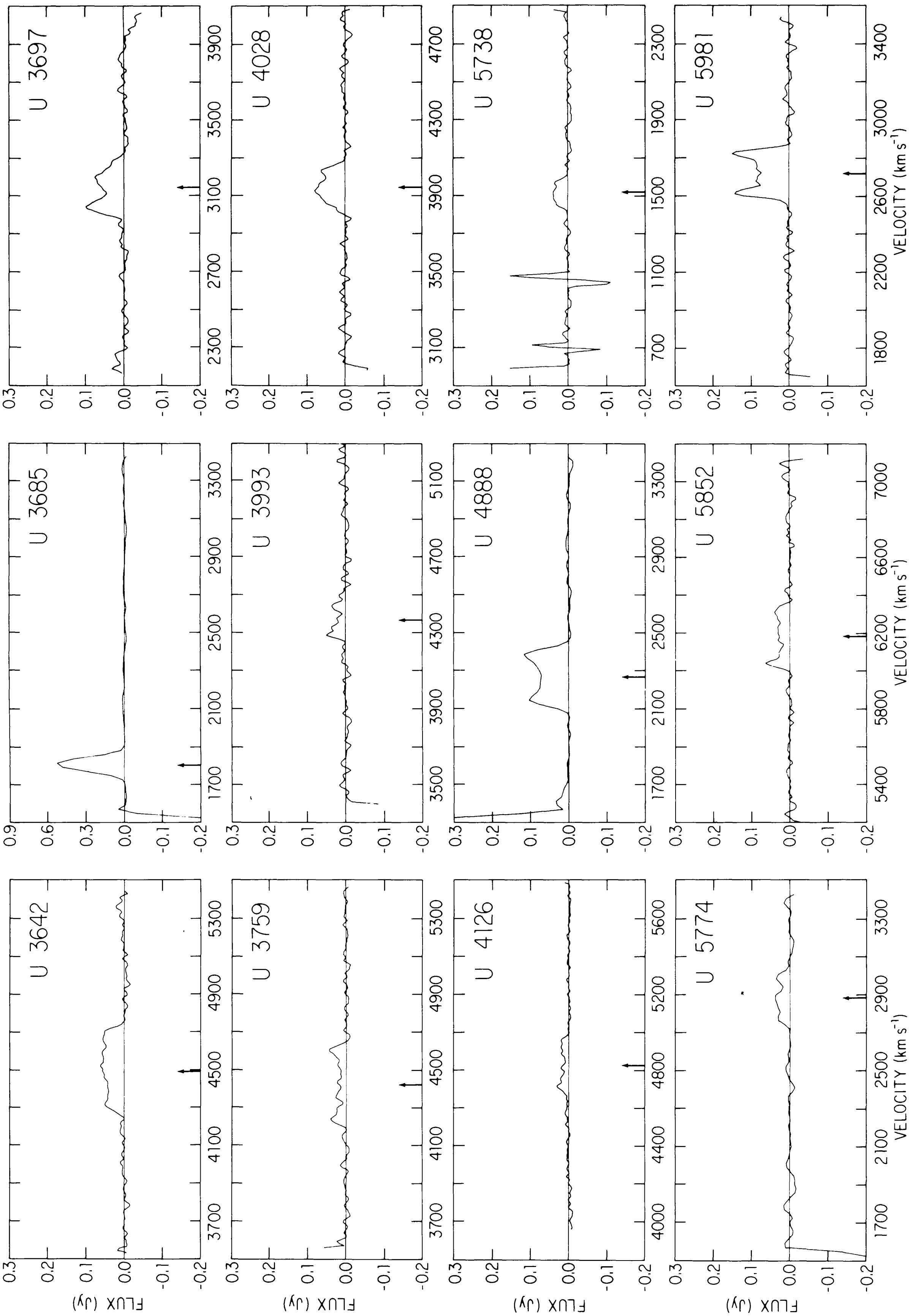

FIG. 6—*Continued*

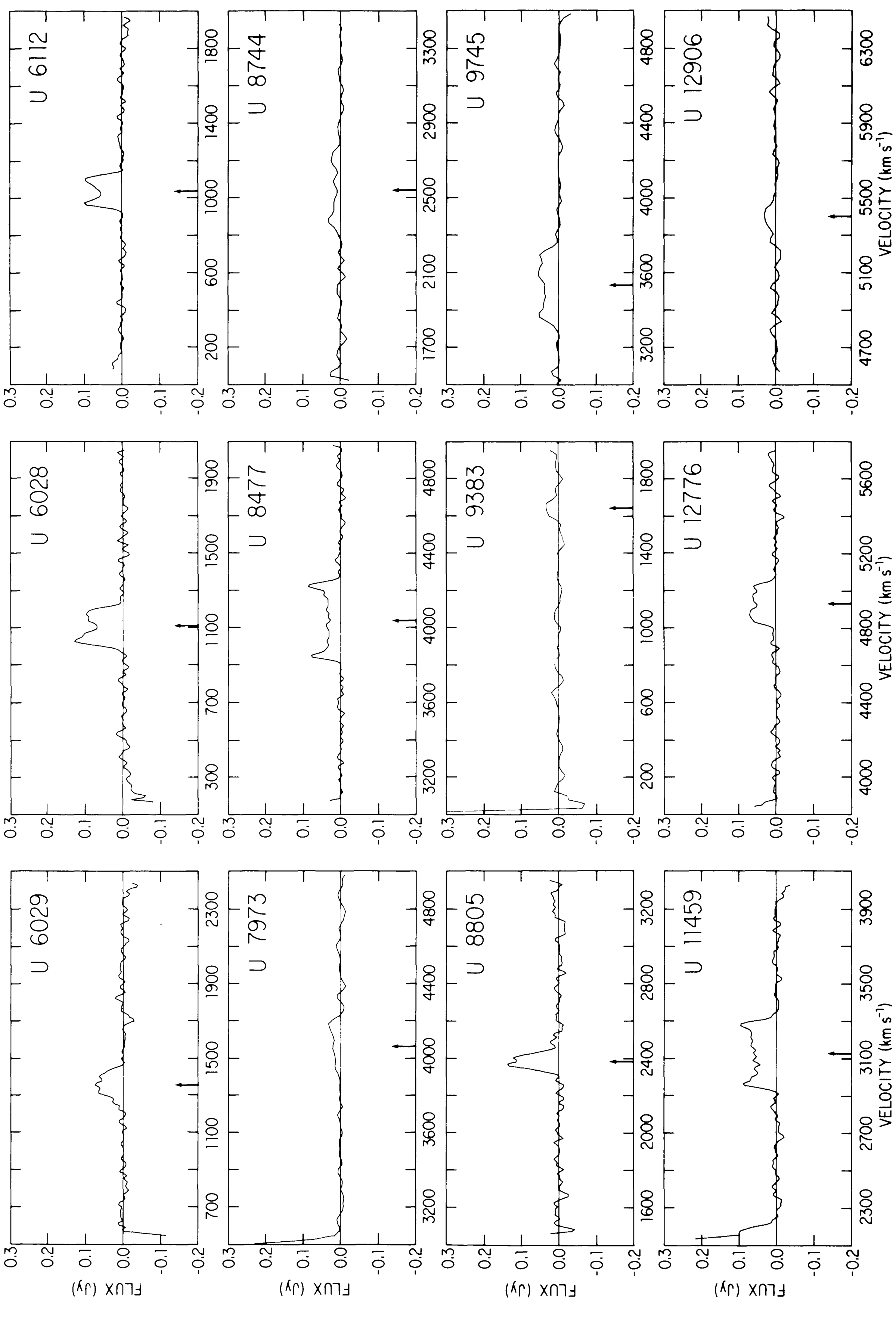

FIG. 6—*Continued*

TABLE 4

Global Properties ($\mathscr{D}_{OB}{}^{I}$, subset with complete H I data)

UGC NAME (1)	HUB TYP (2)	HOLMBERG DIA (CALC) (MIN) (3)	CORRECTED HI AREA (JY-KM/S) (4)	CORRECTED HI WIDTH (KM/S) (5)	DISTANCE hD (MPC) (6)	HI MASS $h^2 M_{HI}$ ($10^9 M_\odot$) (7)	TOTAL MASS hM_T ($10^9 M_\odot$) (8)	LUMINOSITY $h^2 L$ ($10^9 L_\odot$) (9)	M_{HI}/L ($10^{-1} M_\odot/L_\odot$) (10)	hM_{HI}/M_T (10^{-2}) (11)	M_T/hL ($M_\odot/L_\odot$) (12)
89	S3	3.39	9.30	519.5	47.96	5.05	186.	55.7	.907	2.72	3.34
94	S5	2.98	12.4	415.2	47.96	6.72	105.	19.0	3.54	6.40	5.53
725	S7	2.78	8.41	366.6†	52.02	5.37	82.6†	18.4	2.92	6.50	4.49
728	S7	2.69	9.40	1167.†	52.02	6.00	810.†	20.9	2.87	.741	38.8
1070	S7	3.31	11.9	282.8	30.12	2.55	33.9	6.76	3.77	7.52	5.01
1078	P	1.07	3.91	348.6	30.12	.837	16.6	9.77	.857	5.04	1.70
1089	S7	2.94	5.54	692.9†	48.62	3.09	292.†	24.8	1.25	1.06	11.8
1094	S5	2.78	9.93	511.2	48.62	5.54	150.	24.8	2.23	3.69	6.05
1541	S3	3.05	12.8	717.3	58.88	10.5	393.	60.2	1.74	2.67	6.53
1550	S7	3.59	15.3	478.2	58.88	12.5	205.	54.4	2.30	6.10	3.77
1759		1.71	13.2	324.5	39.68	4.91	30.4	14.2	3.46	16.2	2.14
1766	S7	3.56	42.1	779.0	39.68	15.6	364.	38.5	4.05	4.29	9.45
3930	P	1.99	9.68	1101.†	38.14	3.32	391.†	33.9	.979	.849	11.5
3937	S	2.62	11.6	354.0	38.14	3.97	53.2	11.0	3.61	7.46	4.84
4066	S7	3.46	9.84	462.7†	24.70	1.42	77.8†	3.51	4.05	1.83	22.2
4151	S8	2.94	3.98	504.4†	24.70	.573	78.5†	7.54	.760	.730	10.4
4593	D	1.40	4.69	308.2	38.44	1.64	21.7	12.3	1.33	7.56	1.76
4603	S5	2.91	3.99	517.0	38.44	1.39	127.	7.34	1.89	1.09	17.3
4752	S	2.33	9.22	340.0	28.14	1.72	32.2	6.53	2.63	5.34	4.93
4794	S	2.35	5.10	434.8	28.14	.953	53.1	5.95	1.60	1.80	8.92
5251	S7	5.79	88.3	323.3	14.59	4.43	37.5	8.71	5.09	11.8	4.31
5380	S	2.45	14.6	406.6	14.59	.733	25.1	2.56	2.86	2.92	9.80
5279	S9	3.15	9.81	238.0	14.72	.502	11.2	1.89	2.66	4.48	5.93
5292	S1	3.25	5.57	537.4	14.72	.285	58.7	3.13	.911	.486	18.8
5520	S7	3.30	16.6	369.6	34.28	4.60	65.7	5.47	8.41	7.00	12.0
5576	S	2.45	4.44	402.9	34.28	1.23	57.9	6.17	1.99	2.12	9.38
6880	S3	2.13	11.7	416.5	33.54	3.12	52.7	12.0	2.60	5.92	4.39
6884	S5	4.38	24.9	547.6	33.54	6.62	187.	29.0	2.28	3.54	6.45
7111		5.00	47.2	316.1	11.86	1.57	25.2	2.83	5.55	6.23	8.90
7116	S7	6.40	63.9	391.9	11.86	2.12	49.5	3.11	6.82	4.28	15.9
7407	D	3.73	27.2	252.7†	2.12	.029	2.15†	.103	2.82	1.35	20.9
7414	S9	2.96	19.9	672.3†	2.12	.021	12.1†	.074	2.84	.174	163.
7685		5.83	46.6	249.4	10.86	1.30	16.7	1.20	10.8	7.78	13.9
7694	S7	8.65	121.	315.0	10.86	3.35	39.6	4.57	7.33	8.46	8.67
7706	S2	3.12	7.02	210.0	30.03	1.49	17.6	12.3	1.21	8.47	1.43
7747	S7	3.94	15.9	412.3	30.03	3.39	85.5	11.8	2.87	3.96	7.25
7721	S5	6.55	109.	419.6	16.57	7.06	81.2	10.4	6.79	8.69	7.81
7732	S6	7.17	85.1	386.9	16.57	5.52	75.6	11.4	4.84	7.30	6.63
8396		2.41	16.9	209.1	10.27	.420	4.60	.800	5.25	9.13	5.75
8403	S7	5.27	45.6	312.8	10.27	1.14	22.5	2.67	4.27	5.07	8.43
8507	S9	2.54	4.72	169.4	10.01	.112	3.10	.638	1.76	3.61	4.86
8516	S7	2.02	4.10	208.4	10.01	.097	3.73	.687	1.41	2.60	5.43
8699	S4	2.48	8.98	406.2	26.53	1.49	46.1	6.24	2.39	3.23	7.39
8700	S6	3.96	10.6	504.9	26.53	1.77	114.	11.5	1.54	1.55	9.91
8792	S	2.17	6.26	311.2	37.20	2.04	33.2	7.40	2.76	6.14	4.49
8809	S5	3.94	19.3	563.8	37.20	6.31	198.	19.3	3.27	3.19	10.3
9347	S7	2.97	17.3	306.0	23.99	2.35	28.4	3.84	6.12	8.27	7.40
9361	S5	3.14	15.2	491.0	23.99	2.07	77.2	4.92	4.21	2.68	15.7
9493	S5	4.27	32.7	451.4	16.64	2.14	61.5	4.55	4.70	3.48	13.5
9499	S5	6.51	29.4	678.0	16.64	1.92	212.	11.9	1.61	.906	17.8
9615		1.96	8.11	427.0	18.93	.686	28.8	2.20	3.12	2.38	13.1
9628	S9	2.35	6.73	277.5	18.93	.569	14.6	3.15	1.81	3.90	4.63
9797	S5	6.05	53.4	589.7	35.41	15.8	317.	15.2	10.4	4.98	20.9
9805	S5	3.86	19.0	753.3	35.41	5.63	330.	12.9	4.36	1.71	25.6
9908	S7	2.96	7.99	722.5†	19.27	.700	127.†	4.46	1.57	.551	28.5
9915	S5	4.30	24.6	409.6†	19.27	2.15	59.1†	5.22	4.12	3.64	11.3
10628	S7	2.45	6.27	430.8	30.33	1.36	58.6	6.66	2.04	2.32	8.80
10656	S1	3.12	1.77	206.5	30.33	.384	17.1	8.62	.445	2.26	1.97
10848	S	1.95	2.49	109.3†	15.48	.141	1.53†	1.15	1.23	9.22	1.33
10897	S7	3.72	24.9	618.2†	15.48	1.41	93.5†	5.44	2.59	1.51	17.2
11137	S8	2.76	12.2	305.2	24.62	1.74	26.9	14.0	1.24	6.47	1.92
11144	S	2.26	4.86	462.9	24.62	.695	50.7	21.8	.319	1.37	2.33
12607	C	2.94	8.50	585.6	36.88	2.73	158.	26.9	1.01	1.73	5.87
12610	S5	2.73	9.25	388.0	36.88	2.97	64.4	10.9	2.72	4.61	5.91
12883	S5	3.00	11.3	463.4	52.83	7.47	145.	53.7	1.39	5.15	2.70
12889	S5	3.56	7.73	764.8	52.83	5.09	468.	34.2	1.49	1.09	13.7

TABLE 5

GLOBAL PROPERTIES ($\mathscr{D}_{OB}{}^{I}$, subset with complete redshift data and H I data on one component)

UGC NAME (1)	HUB TYP (2)	HOLMBERG DIA (CALC) (MIN) (3)	CORRECTED HI AREA (JY-KM/S) (4)	CORRECTED HI WIDTH (KM/S) (5)	DISTANCE hD (MPC) (6)	HI MASS h^2M_{HI} ($10^9 M_\odot$) (7)	TOTAL MASS hM_T ($10^9 M_\odot$) (8)	LUMINOSITY h^2L ($10^9 L_\odot$) (9)	M_{HI}/L ($10^{-1} M_\odot/L_\odot$) (10)	hM_{HI}/M_T (10^{-2}) (11)	M_T/hL ($M_\odot/L_\odot$) (12)
858	S6	4.39	15.3	490.0	24.48	2.16	110.	17.8	1.21	1.96	6.18
1313	S7	4.07	25.3	253.2	30.51	5.55	33.8	8.18	6.78	16.4	4.13
3422	S5	3.64	19.5	665.0	42.19	8.20	289.	10.1	8.12	2.84	28.6
3740	S7	4.23	22.9	513.4	23.60	3.00	112.	14.6	2.05	2.68	7.67
4097	S5	5.27	48.5	526.8	15.63	2.80	97.2	6.92	4.05	2.88	14.1
5021	S7	3.10	3.73	452.0	31.00	.846	83.4	11.7	.723	1.01	7.13
5183	S6	4.53	23.7	403.6	13.50	1.02	42.3	6.87	1.48	2.41	6.16
5620	S5	7.56	21.8	674.7	11.08	.631	162.	5.02	1.26	.390	32.3
5742	S9	3.01	7.77	259.6	12.35	.280	10.6	2.44	1.15	2.64	4.34
6528	S7	2.25	3.30	193.6	33.30	.864	11.9	5.46	1.58	7.26	2.18
7283		1.77	6.96	235.8	9.84	.159	4.12	.925	1.72	3.86	4.45
7465	S5	3.15	6.12	367.2	7.47	.081	13.5	.635	1.28	.600	21.3
7757	S1	3.78	9.35	296.3	5.07	.057	7.15	.658	.866	.797	10.9
8393	S	2.36	10.6	248.9	25.16	1.59	15.6	4.94	3.22	10.2	3.16
9026	S7	2.68	5.64	306.5	20.35	.551	21.8	6.81	.809	2.53	3.20
9036	S8	2.45	13.3	263.3	20.14	1.27	14.5	2.27	5.59	8.76	6.39
9172	S5	4.20	7.11	282.5	15.25	.390	21.7	2.87	1.36	1.80	7.56
9406	S7	2.96	7.60	452.1†	23.64	1.00	60.8†	2.27	4.41	1.64	26.8
9645	S5	3.97	9.50	412.9	16.40	.603	47.2	5.47	1.10	1.28	8.63
9969	S5	6.59	34.4	643.3	28.46	6.57	330.	38.1	1.72	1.99	8.66
11628	S3	4.32	15.4	831.6	42.93	6.68	545.	30.6	2.18	1.23	17.8
12122	S6	3.37	9.44	374.1	14.93	.497	29.9	4.09	1.22	1.66	7.31
12378	S7	3.14	12.9	434.4	64.90	12.8	163.	27.6	4.64	7.85	5.91

assuming $(M_\odot)_{pg} = 5.37$ (Stebbins and Kron 1957). Given a Holmberg diameter corrected for observed axial ratio effects, the resulting surface brightness is independent of inclination.

Column (*10*).—Hydrogen mass-to-light ratio M_{HI}/L, in solar units. Note that this parameter is independent of distance.

Column (*11*).—Ratio of hydrogen mass to total mass hM_{HI}/M_T.

Column (*12*).—Total mass-to-light ratio M_T/hL, in solar units.

VII. SUMMARY

Average mass and mass-to-light ratios which are based on an analysis of the orbital parameters in binary systems require a well-defined statistical sample of binary galaxies. The 279 galaxy pairs selected from the UGC are restricted to positive declinations and an apparent magnitude range between 12.0 and 14.5. These galaxy pairs are required to satisfy isolation criteria (eq. [1]) incorporating both apparent magnitude and angular separation parameters. The criteria are adopted in the attempt to ensure a fair representation of widely separated physical doubles.

The actual distribution of angular separations for the binary galaxies is reconstructed through an appropriate convolution of the observed distribution and the two probability functions based on a statistical analysis of the selection criteria (eq. [8]). A power-law regression on this distribution yields a slope of -0.5 and is supported by a χ^2 goodness of fit (eq. [10]). Additionally, the evidence suggests that the number of spurious pairs can be reasonably predicted and that a given spurious system can be eliminated on the basis of radial velocity measurements.

Neutral-hydrogen observations of the binary galaxies produce 21 cm profiles on 149 member galaxies (94 without observed optical redshifts), resulting in 44 galaxy pairs with H I data on both components.

Both optical and radio data are compiled on member galaxies (Tables 1, 2, and 3). Global properties based on the H I data, including total indicative mass and a mass-to-light ratio, are presented (Tables 4 and 5); these provide independent measurements to be compared with the results from a statistical study of the orbital parameters (Paper II).

It is not possible to include a comprehensive list of all those individuals who have made significant contributions to this project, if only because the memory is frail; it is equally difficult to express the depth of my gratitude. I especially thank my thesis adviser, Dr Yervant Terzian, for his guidance, encouragement, and support when those resources were most needed. In addition, Drs. Morton Roberts, Seth Shostak, Ed Salpeter, Jim Condon, Martin Harwit, and Dick Sramek provided me with many excellent discussions, and from them I have learned a great deal. My graduate studies were supported by a Danforth Fellowship and assistance from NRAO and NAIC. The National Astronomy and Ionosphere Center is operated by Cornell University under contract with the National Science Foundation.

APPENDIX A

Given a prospective binary galaxy with apparent magnitudes m_1 and m_2, the parameter $m_o(m_1, m_2)$ is an upper limit defining the magnitude range of those galaxies to be included in the requirements for isolation based on angular proximity. Assume for the moment that apparent magnitudes are reliable distance indicators (i.e., that all galaxies have the same luminosity), and let ΔD_o represent the radial distance out to which prospective doubles are isolated:

$$\Delta D_o = D(m_o) - D(m_f)\,, \quad \text{with } D(m_o)/D(m_f) = \text{dex}\,[(m_o - m_f)/5]\,, \tag{A1}$$

where $D(m_o)$ is the expected distance to galaxies with magnitude $m_o(m_1, m_2)$ and $D(m_f)$ is the expected distance to the faint member of the pair. Solving for $m_o(m_1, m_2)$, one obtains

$$m_o(m_1, m_2) = 5 \log \{\text{dex}\,(m_f/5)[1 + \Delta D_o/D(m_f)]\}\,. \tag{A2}$$

Now, assign ΔD_o the fixed value $\Delta D_o = D(15.0) - D(14.5)$, so that a prospective pair with a faint component magnitude $m_f = 14.5$ will be isolated with respect to those galaxies with $m \leq 15.0$. In order that this radial isolation parameter remain constant for all prospective pairs,

$$m_o(m_1, m_2) = 5 \log [\![\text{dex}(m_f/5)\{1 + [D(15.0) - D(14.5)]/D(m_f)\}]\!]$$
$$\sim 5 \log [\text{dex}\,(m_f/5) + 2.06 \times 10^2]\,, \tag{A3}$$

where m_f is the fainter of the two magnitudes.

APPENDIX B

The conversion of Zwicky magnitudes (Zwicky *et al.* 1960–1968) to the Holmberg system (Holmberg 1958) is based on a least-squares analysis of the 268 galaxies common to both studies. The series of regressions allows for systematic declination and angular diameter effects observed in the Zwicky data, with the declination effect apparently originating in the compilation of the Zwicky catalog along declination strips and the angular diameter effect arising out of the methods used in estimating magnitudes. The Holmberg photometric magnitudes are assumed to be free of error, and the individual coefficients are obtained in an order of decreasing importance.

The series of least-squares regressions for galaxies with angular diameter $a \leq 6\overset{'}{.}0$ is displayed in Figure 7. Similarly, Figure 8 shows the series of least-squares regressions for galaxies with angular diameter $a > 6\overset{'}{.}0$. In this case, the angular diameter effect is well within the scatter of the data and has not been removed.

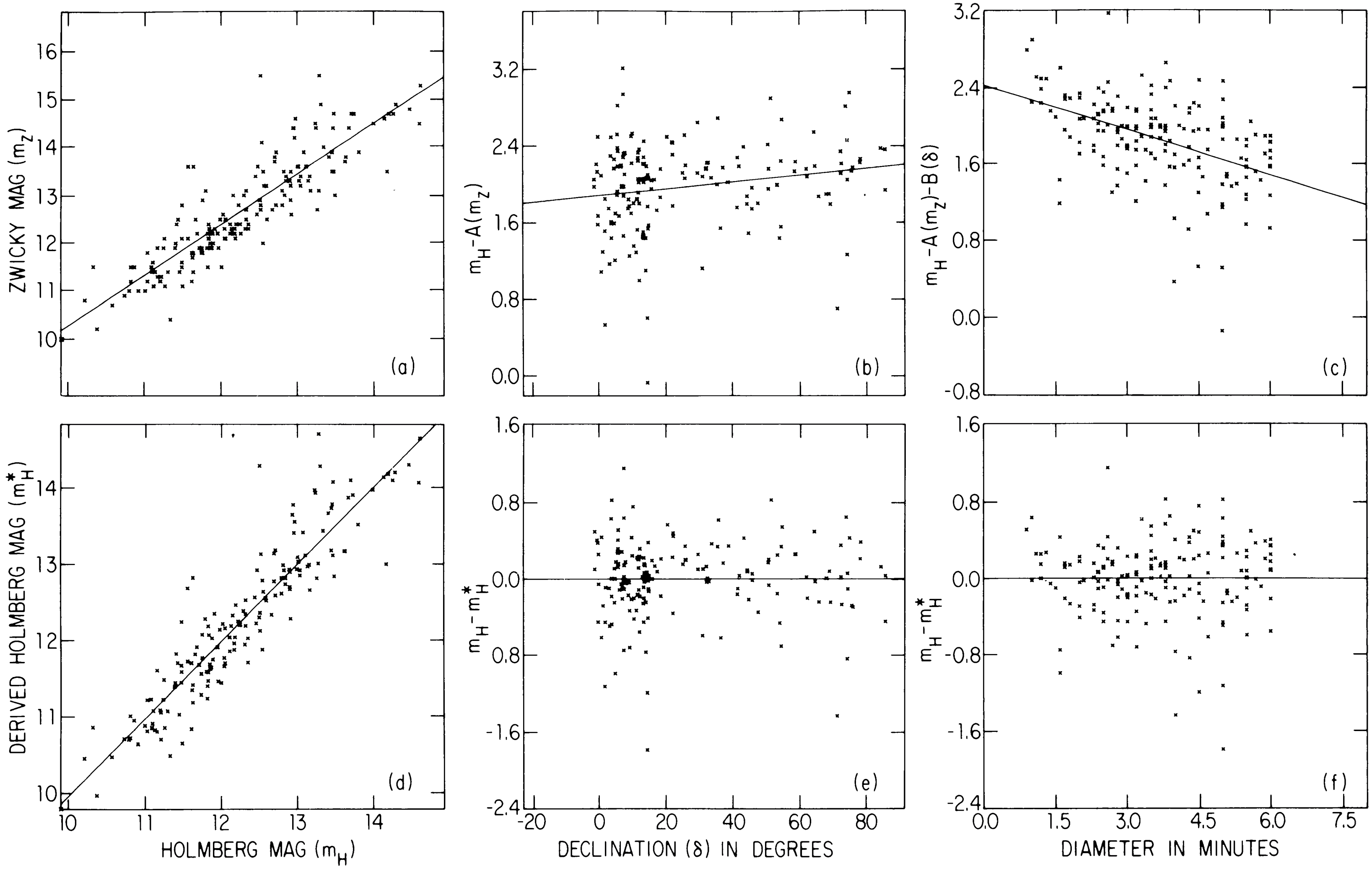

FIG. 7.—Conversion of Zwicky magnitudes to the Holmberg system using the 167 galaxies common to both studies with angular diameters $a \leq 6'.0$, based on a series of least-squares regressions. (*a*) The first-order fit; (*b*) the observed declination and (*c*) angular diameter effects present in the Zwicky data. Also shown is the success with which the conversion reproduces (*d*) the Holmberg system and corrects for (*e*) the systematic declination and (*f*) angular diameter dependence.

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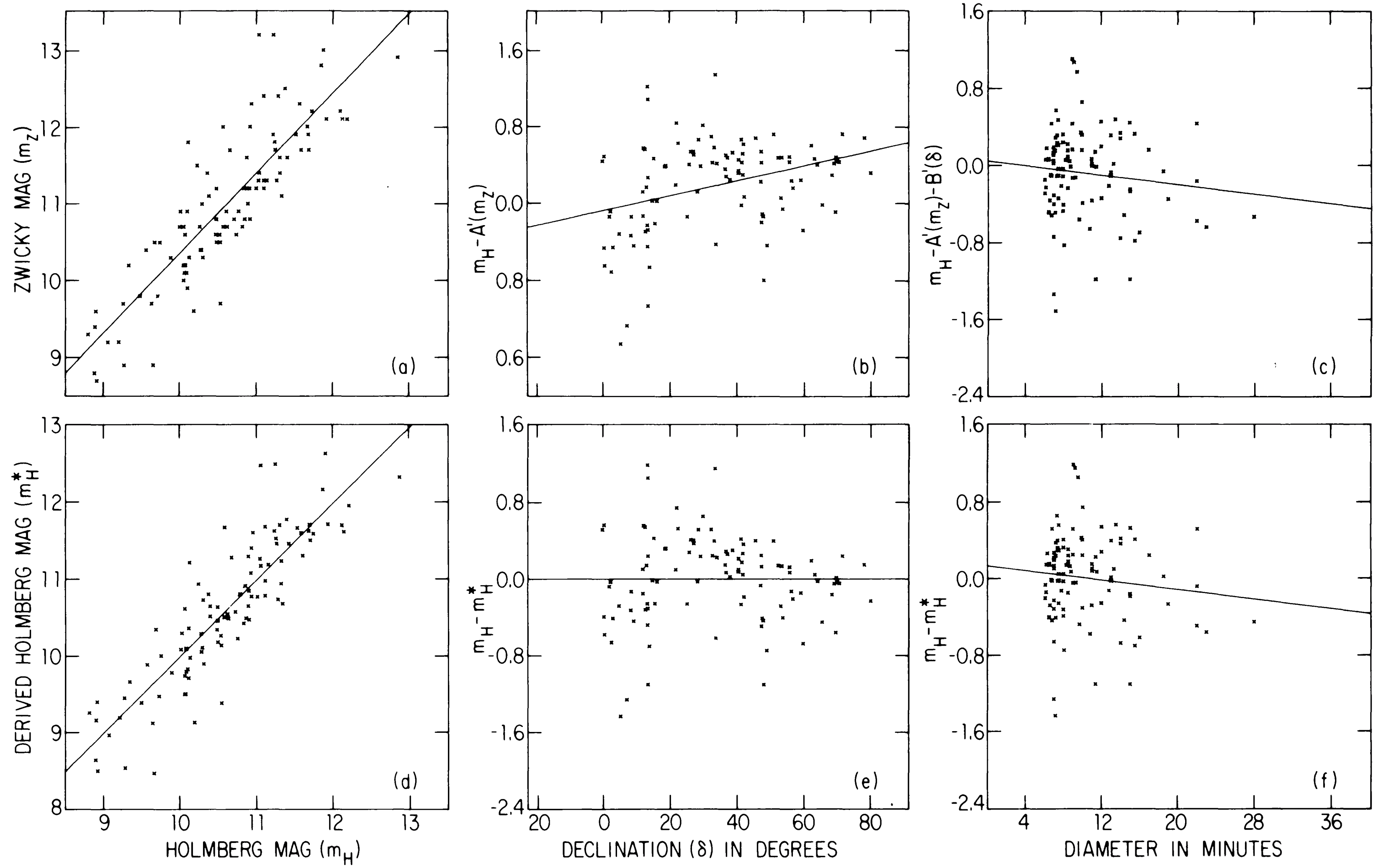

FIG. 8.—Conversion of Zwicky magnitudes to the Holmberg system using the 101 galaxies common to both studies with angular diameters $a > 6'.0$, based on a series of least-squares regressions. (*a*) The first-order fit; (*b*) the observed declination and (*c*) angular diameter effects present in the Zwicky data. Also shown is the success with which the conversion reproduces (*d*) the Holmberg system and corrects for (*e*) the systematic declination and (*f*) angular diameter dependence. (In this case, the diameter effect is well within the scatter of the data and has not been removed.)

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