Aust. J. Phys., 1982, **35**, 321–50

The Radio Properties of a Complete Sample of Bright Galaxies

J. I. Harnett

School of Physics, University of Sydney, Sydney, N.S.W. 2006.

Abstract

Results are given for the radio continuum properties of an optically complete sample of 294 bright galaxies, 147 of which have been detected. Data were obtained with the 408 MHz Molonglo Radio Telescope. The radio luminosity functions for all galaxies and for spiral galaxies alone are derived and the radio emission for different galaxy types is investigated. Spectral indices of 73 galaxies which had been detected at other frequencies were derived; the mean index of a reliable subsample is $\langle\alpha\rangle = -0\cdot71$.

1. Introduction

There have been many extensive surveys of continuum radio emission from bright galaxies. The earliest comprehensive survey of high sensitivity was that of Cameron (1971*a*, 1971*b*) using the Molonglo Cross Radio Telescope at 408 MHz. Cameron observed two optically complete samples south of $\delta = +18°$ and defined the radio luminosity function with reasonable statistics at radio powers of $\sim 10^{22}$ W Hz^{-1}. In the past decade the optical properties of galaxies have been revised so that the selection of an optically complete sample is more reliable. In addition, between 1970 and 1978 the sensitivity of the 408 MHz Molonglo Cross was improved by more than a magnitude, permitting more detections and more accurate measurements of weak radio emission. Before observations at 408 MHz with the Molonglo Cross ceased in 1978, a new survey was made to improve Cameron's results and provide the best possible data base for subsequent investigations at different frequencies. Well-observed sources in Cameron's catalogue were not re-observed, although they are included in the tabulated results. Altogether, 294 galaxies are listed, of which 147 have been detected; however, 28 of these detections are shown to be uncertain because of low signal-to-noise ratios, confusion or discordant positions.

A description of the new survey and tabulation of directly measured properties appears in Section 2. Section 3 re-evaluates the radio luminosity function and discusses the relationship between galaxy types and their optical and radio properties. Section 4 derives spectral indices of 73 galaxies from the present data and previously published surveys at other frequencies.

2. Observations

(*a*) Sample Selection

The selection criteria were identical with those of Cameron (1971*a*). Two groups of galaxies were chosen: those brighter than total corrected optical magnitude 11·0 and south of $\delta = +18°$; and those with photographic magnitudes less than 12·5 in the regions $b = -35°$ to $-60°$, $l = 100°$ to 220° and $b = +35°$ to $+60°$, $\delta \leqslant +18°$. Eight galaxies were excluded from the original sample and a further 33 not selected by Cameron were added. These changes resulted from considerable revisions of optical magnitudes (de Vaucouleurs *et al.* 1976; de Vaucouleurs 1977; de Vaucouleurs and Corwin 1977; de Vaucouleurs *et al.* 1977; de Vaucouleurs and Bollinger 1977*a*, 1977*b*, 1977*c*; de Vaucouleurs and Head 1978; de Vaucouleurs *et al.* 1981; and de Vaucouleurs, personal communication 1978).

The new survey includes:

(1) from Cameron's list 1, all detected galaxies with measured flux densities less than 500 mJy (1 Jy $\equiv 10^{-26}\,\mathrm{W\,m^{-2}\,Hz^{-1}}$) and all undetected galaxies except NGC 4293;

(2) from Cameron's list 2, all detected galaxies with measured flux densities less than $500/n^{\frac{1}{2}}$ mJy (where n is the number of transits observed), NGC 660 and all undetected galaxies;

(3) the 33 galaxies not previously observed.

Of 239 galaxies observed in this program, 92 were detected, 28 of these with some qualifications.

(*b*) *Calibration*

The survey was conducted in February, May and August 1978 using the Molonglo Radio Telescope at 408 MHz with a bandwidth of 2·5 MHz. The effective beamwidths were 2·86 arcmin in right ascension and 2·86 sec z arcmin in declination where z is the zenith angle.

Optical positions were taken initially from the 'Second Reference Catalogue of Bright Galaxies' (RC2) (de Vaucouleurs *et al.* 1976). However, where large discrepancies between optical and fitted radio positions occurred, new positional determinations were made using Palomar Sky Survey plates (PSS) and European Southern Observatory blue plates (ESOB). An x-y measuring machine was used to obtain positional accuracies ranging from 1 arcsec for compact images (Hunstead 1971, 1974) to about 30 arcsec for the most extended galaxies.

The pointing of the telescope and the flux density scales were calibrated by observing point sources with accurately known positions and flux densities. These were taken from Hunstead (1972). Known variable sources (McAdam 1978) were not used for the flux density calibrations. All flux densities are based on the absolute scale of Wyllie (1969*a*, 1969*b*).

There are many factors influencing the accuracy of these calibrations and individual observations. To provide useful estimates of positional and flux density errors, general terms which represent telescope pointing uncertainties, random noise and confusion have been adopted.

For point sources, the standard errors in observed positions are of the form

$$\sigma = \{a^2 + (b/Sn^{\frac{1}{2}})^2\}^{\frac{1}{2}}, \tag{1}$$

where S is the flux density in mJy and n is the number of transits observed. Empirical estimates of the constants a and b are tabulated below. Positions of extended sources (diameter $\gtrsim$ 3 arcmin) are less certain. A contour map of each transit of a galaxy was produced and mid points of the contours were used to derive a position with standard deviations of X in right ascension and $X \sec z$ in declination, where z is the zenith angle and X varies from ~ 6 arcsec for symmetric sources to ~ 10 arcsec for complex asymmetric sources. These errors were combined with the errors derived from equation (1).

Flux density uncertainties for unresolved sources are expressed as

$$\sigma_s = \{a^2 + (b/n^{\frac{1}{2}})^2 + (cS)^2\}^{\frac{1}{2}}, \qquad (2)$$

where n and S have the same meanings as before. For extended sources, fitting of the beamshape was inappropriate and integrated flux densities were computed. A further uncertainty of 5% was then included because of difficulties in estimating the flux density between the zero and first contour levels. The constants used for equations (1) and (2) are:

Parameter	a	b	c
Right ascension (s)	$0 \cdot 2 \sec \delta$	$100 \sec \delta$	—
Declination (″)	3	1500	—
Flux density (mJy)	11	15	0·04

(*c*) *Directly Measured Properties*

A detected radio source was regarded as being identified with a galaxy if the positional discrepancy was less than 1 arcmin or 2 kpc in projected distance, whichever was the larger. It is unlikely that any chance coincidences are included with these criteria; however, some real associations may have been rejected. These would be included among the 'confusing sources' in the Notes to Table 1 (see p. 342).

The results of the 1978 survey are shown in Table 1, together with results for those galaxies detected by Cameron (1971*a*, 1971*b*) in 1968–69 and not re-observed; these are indicated by an asterisk next to the flux density measurement. The columns are:

Column 1, line 1: NGC, IC or other identifying label. An asterisk indicates that the galaxy was not detected because of faulty observations or loss of data during computer analysis.

Column 2, line 1: Revised morphological type of de Vaucouleurs *et al.* (RC2).
line 2: Hubble morphological type (RC2).

Column 3, line 1: Optical right ascension in hours, minutes and seconds.
line 2: Radio right ascension and standard error in seconds of time.

Column 4, line 1: Optical declination in degrees, minutes and seconds.
line 2: Radio declination and standard error in seconds of arc.

Column 5, line 1: Distance in Mpc obtained, in order of preference, from
(1) de Vaucouleurs (personal communication 1981): 115 galaxies.
(2) de Vaucouleurs *et al.* (1981): 78 galaxies.
(3) de Vaucouleurs (1979*a*): 56 galaxies.
(4) de Vaucouleurs and Bollinger (1979) and the RC2: 30 galaxies.
(5) de Vaucouleurs (1979*b*): 2 galaxies.
(6) Sandage (1978), RC2 and de Vaucouleurs and Bollinger (1979): 9 galaxies.
A colon indicates either a large uncertainty in the distance or derivation of the distance from preliminary values of the modulus.

Table 1. **Optical and radio properties of galaxy sample**

N	Type	R.A.		Dec.		Dist. (Mpc)	MAG MABS	S (mJy) P*E18 (W/Hz)		RMAG RMABS		R408 -alpha		Note
7814	SA 2	00 00 41.4		15 52 00		12.5	10.93	< 45		> 14.9		>4.0		
	SAB						-19.5	< 837		>-15.6				
45	SA 8	00 11 31.8		-23 27 36		5.68	10.78	< 90		> 14.2		>3.4		S
	SDM						-18.0	< 336		>-14.6				
55	SB 9	00 12 24.0		-39 28 00		1.57	6.98	1300*		11.3		4.3		
	SBM	(EMISSION OVER OPTICAL EXTENT)					-18.9	3830		-14.6				
134	SX 4	00 27 54		-33 32		12.7:	10.43	398	27	12.6	.1	2.2		
	SBC	27 54.7	.5	31 01	9		-20.1	7690		-17.9				
157	SX 4	00 32 14.4		-08 40 18		12.1	10.75	544	33	12.2	.1	1.5		
	SBC	32 14.0	.4	40 10	9		-19.7	9500		-18.2		0.22	.39	
247	SX 7	00 44 39.6		-21 01 48		2.83	8.98	52	13	14.8	.3	5.8		
	SD	44 39.7	.9	01 13	16		-18.3	49.8		-12.5				
253	SX 5	00 45 07.8		-25 33 42		3.11	7.50	16200*		8.5		1.0		
	SC	45 06.1		33 34			-20.0	18800		-19.0		0.63	.07	
300	SA 7	00 52 31.8		-37 57 18		1.74	8.39	< 180		> 13.5		>5.1		N
	SD						-17.8	< 64.1		>-12.7				
0057-33	E3P	00 57 36		-33 58		0.12:	6.8*	< 100		> 14.1		>7.3		
	DE						-13.6	< 0.17		>- 6.3				
I1613	IX 10	01 02 13.2		01 51 00		0.7:	9.69	< 120		> 13.8		>4.1		
	IM						-14.5	< 6.91		>-10.4				
428	SX 9	01 10 21.7		00 42 53		10.0	11.55	85:	13	14.2	.2	2.7		
	SM	10 20.6	.6	43 21	12		-18.5	1020		-15.8				
474	LA	01 17 31.8		03 09 18		15.9:	11.74	< 95		> 14.1		>2.4		
	SO						-19.3	<2854		>-16.9				
488	SA 3	01 19 11.4		04 59 35		20.9	10.83	77	14	14.3	.1	3.5		
	SB	19 14.5	.7	05 00 16	16		-20.8	4020		-17.3		1.22	.38	
514	SX 5	01 21 24.6		12 39 30		21.1	12.15	133	17	13.7	.2	1.6		
	SC	21 25.9	.6	39 57	16		-19.5	7080		-17.9		1.41	.28	
524	LA	01 22 09.8		09 16 46		25.9	11.24	< 30		> 15.4		>4.1		
	SO						-20.8	<2410		>-16.7				

584	E4	01 28 50.7		-07 07 29		17.5	11.07	< 50		> 14.8		>3.7		
	E4						-20.1	<1830		>-16.4				
613	SB 4	01 31 58.8		-29 40 18		16.1	10.48	516	31	12.3	.1	1.8		
	SBBC	31 59.7	.5	40 33	8		-20.6	15900		-18.7		0.67	.10	
628	SA 5	01 34 00.6		15 31 36		8.24	9.50	162	18	13.5	.2	4.0		
	SC	33 59.9	.6	31 39	15		-20.1	1320		-16.1		0.62	.61	
660*	SB 1	01 40 21.0		13 23 18		10.0	10.52*							S
	SBA						-19.5							
720	E5	01 50 34.2		-13 59 06		17.4	10.92	< 40		> 15.0		>4.1		
	E5						-20.3	<1450		>-16.2				
772	SA 3	01 56 35.4		18 46 00		15.6	10.65	191	17	13.3	.1	2.7		
	SB	56 34.1	.5	46 20	13		-20.3	5580		-17.7		0.77	.32	
821	E6	02 05 40.8		10 45 30		18.2	11.51	< 30		> 15.4		>3.8		
	E6						-19.8	<1190		>-15.9				
864	SX 5	02 12 50.4		05 46 12		12.5	11.20	69	14	14.5	.2	3.3		
	SC	12 49.9	.8	46 26	17		-19.3	1280		-16.0		0.76	.18	
895	SA 6	02 19 06.4		-05 44 54		19.1	11.90	97:	16	14.1	.2	2.2		
	SCD	19 05.6	.8	45 29	15		-19.5	4250		-17.3				
908	SA 5	02 20 46.2		-21 27 42		12.1	10.40	500*		12.3		1.9		
	SC	20 46.1		27 46			-20.0	8800		-18.1		0.69	.07	
936	LB	02 25 04.8		-01 22 42		14.5	10.78	< 60		> 14.6		>3.8		
	SBO						-20.0	<1530		>-16.2				
1022	SB 1	02 36 04.1		-06 53 32		15.1	11.85	< 70		> 14.4		>2.6		C,P
	SBA						-19.0	<1900		>-16.5				
0237-34	E0	02 37 50.4		-34 44 24		0.25:	8.84	< 310		> 12.8		>4.0		N
	DE						-13.1	< 2.27		>- 9.2				
1042	SX 6	02 37 56.4		-08 38 48		13.6	11.16	< 50		> 14.8		>3.6		
	SCD						-19.5	<1110		>-15.9				
1052	E4	02 38 37.2		-08 28 06		13.8:	11.26	660*		12.0		0.7		P
	E4	38 36.4		28 07			-19.5	15000		-18.7		0.35	.20	
1055	SB 3	02 39 11.4		00 13 42		12.2	10.81	600*		12.1		1.3		
	SB	39 11.7		13 40			-19.6	10700		-18.3		0.74	.12	

Table 1 *(Continued)*

N	Type	R.A.		Dec.		Dist. (Mpc)	MAG MABS	S (mJy) P*E18 (W/Hz)		RMAG RMABS		R408 -alpha		Note
1068	SA 3	02 40 07.2		-00 13 30		7.87	9.21	11700*		8.9		-0.3		
	SB	40 07.0		13 32			-20.3	86700		-20.6		0.61	.03	
1073	SB 5	02 41 05.4		01 09 54		13.6	11.19	< 90		> 14.2		>3.0		C
	SB						-19.5	<1980		>-16.5				
1084	SA 5	02 43 31.8		-07 47 06		18.2	10.79	540*		12.2		1.4		P
	SC	43 31.3		47 31			-20.5	21400		-19.1		0.50	.01	
1087	SX 5	02 43 51.6		-00 42 30		11.4	11.13	349	23	12.7	.1	1.6		
	SC	43 52.7	.4	42 14	9		-19.2	5460		-17.6		0.88	.58	
1090	SB 4	02 44 00.6		-00 27 24		18.1	12.03	< 30		> 15.4		>3.3		
	SBBC						-19.3	<1180		>-15.9				
1097	SB 3	02 44 11.4		-30 29 06		11.2	9.87	900*		11.7		1.8		
	SBB	44 12.1		28 55			-20.4	13400		-18.5		0.66	.04	
0255-54	SB 7	02 55 06		-54 48			10.99	NOT OBSERVED						
	SBD													
1179	SX 6	03 00 21.0		-19 05 36		14.5	11.88	< 40		> 15.0		>3.2		
	SCD						-18.9	< 999		>-15.8				
1187	SB 5	03 00 24.0		-23 03 48		15.2	10.63	167	17	13.5	.1	2.9		
	SBC	00 24.0	.6	03 31	10		-20.3	4620		-17.4		0.64	.37	
1201	LA	03 01 57.6		-26 15 54		12.6:	11.25	< 30		> 15.4		>4.1		
	SO						-19.3	< 570		>-15.1				
1232	SX 5	03 07 30.0		-20 46 12		15.7:	10.19	78:	15	14.3	.2	4.1		
	SC	07 28.2	.8	45 53	14		-20.8	2300		-16.7				
1291	SBO	03 15 28.5		-41 17 23		8.91	9.19	< 100		> 14.0		>4.8		N
	SBO/A						-20.6	< 970		>-15.7				
1300	SB 4	03 17 25.2		-19 35 28		15.7	10.74	72:	16	14.4	.3	3.7		
	SBBC	17 22.6	1.0	35 32	17		-20.2	2120		-16.6				
1313	SB 7	03 17 39.0		-66 40 42		4.47	9.35	201	19	13.3	.1	4.0		
	SBD	17 44.8	1.3	40 19	11		-18.9	481		-15.0		0.06		
1302	SBO	03 17 42.6		-26 14 24		16.2	11.38*	< 30		> 15.4		>4.0		
	SBO/A						-19.7	< 944		>-15.7				

1309	SA 4	03 19 46.9		-15 34 49		20.0	11.68	181	18	13.4	.1	1.7		P
	SBC	19 47.5	.5	34 26	9		-19.8	8700		-18.1		0.36	.07	
1316	LX	03 20 46.8		-37 23 06		16.3	9.47	249000*		5.6		-3.9		
	SO	(03 20 47.6)		(-37 23 09)			-21.7	7910000		-25.5		0.65	.10	
1326	LB	03 22 01.2		-36 38 24		15.9:	11.02	129	17	13.8	.2	2.8		
	SBO	22 02.5	.8	38 42	12		-20.0	3900		-17.2				
1332	L	03 24 03.9		-21 30 32		14.7	10.84	< 60		> 14.6		>3.8		
	SO						-20.0	<1560		>-16.2				
1344	E5	03 26 18.0		-31 14 30		17.5	11.02	< 45		> 14.9		>3.9		
	E5						-20.2	<1640		>-16.3				
1350	SB 2	03 29 10.2		-33 47 54		20.0:	11.03	< 30		> 15.4		>4.4		
	SBAB						-20.5	<1440		>-16.1				
1353	SB 3	03 29 49.8		-20 59 12		24.2	11.72	< 30		> 15.4		>3.6		P
	SBB						-20.2	<2100		>-16.5				
1365	SB 3	03 31 42.0		-36 18 18		8.71	9.78	1300*		11.3		1.5		
	SBB	31 41.2		18 20			-19.9	11800		-18.4		0.71		
1371*	SX 1	03 32 52.8		-25 05 54		14.5	11.50*							
	SA						-19.3							
1380	LA	03 34 31.2		-35 08 24		15.9:	10.81	< 30		> 15.4		>4.6		
	SO						-20.2	< 907		>-15.6				
1385	SB 6	03 35 19.8		-24 39 54		17.7	11.30	340*		12.7		1.4		P
	SBCD	35 17.9		39 55			-19.9	12700		-18.5		0.46	.17	
1395	E2	03 36 19.2		-23 11 24		15.9:	10.85	< 40		> 15.0		>4.2		
	E2						-20.2	<1210		>-16.0				
1399	E1	03 36 34.8		-35 36 42		15.9:	10.60	1400*		11.2		0.6		N
	E1	36 34.5		36 34			-20.4	42400		-19.8				
1398	SB 2	03 36 45.3		-26 29 59		15.9	10.30	35:	15	15.2	.8	4.9		
	SBAB	36 45.1	2.0	30 23	32		-20.7	1060		-15.8				
1404	E1	03 36 57.1		-35 45 21		15.9:	11.00	< 100		> 14.1		>3.1		C,P
	E1						-20.0	<3020		>-16.9				
1400	LA	03 37 15.6		-18 50 54		15.9:	11.80	< 40		> 15.0		>3.2		P
	SO						-19.2	<1210		>-16.0				
1407	E0	03 37 57.0		-18 44 24		15.9:	10.85	280*		12.9		2.1		P
	E0	37 55.8		44 20			-20.5	8420		-18.1		0.77	.46	
1421	SX 4	03 40 09.0		-13 38 54		29.2	11.35	192	16	13.3	.1	2.0		P
	SBC	40 09.2	.4	38 46	8		-21.0	19600		-19.0		0.51	.13	

Table 1 (*Continued*)

N	Type	R.A.	Dec.	Dist. (Mpc)	MAG MABS	S (mJy) P*E18 (W/Hz)	RMAG RMABS	R408 -alpha	Note
1433	SB 1	03 40 27.0	-47 22 48	22.9	10.39	< 70	> 14.5	>4.1	
	SBA				-21.4	<4130	>-17.3		
1448	SA 6	03 42 52.8	-44 48 00	11.2	10.63	286 21	12.9 .1	2.3	
	SCD	42 52.7 .6	48 09 9		-19.6	4270	-17.3		
1518	SB 8	04 04 37.8	-21 18 42	15.1	11.80	< 30	> 15.4	>3.6	P
	SBDM				-19.1	< 818	>-15.5		
1532	SB 2	04 10 10.2	-33 00 06	19.5	10.98	105 15	14.0 .2	3.0	
	SBAB	10 07.9 .8	00 11 12		-20.5	4780	-17.5		
1549	E0+	04 14 39.0	-55 42 54	13.8:	10.54	< 40	> 15.0	>4.5	
	E0-1				-20.2	< 911	>-15.7		
1553	LA	04 15 05.4	-55 54 08	10.5:	10.09	< 50	> 14.8	>4.7	C
	S0				-20.0	< 660	>-15.3		
1559	SB 6	04 17 01.2	-62 54 18	17.4:	10.50	700*	12.0	1.5	
	SBCD	17 01.1	54 18		-20.8	25400	-19.2		
1566	SX 4	04 18 52.8	-55 03 24	6.79:	9.88	700*	12.0	2.1	
	SBC	18 52.6	03 56		-19.3	3860	-17.2	0.72	
1617	SB 1	04 30 33.0	-54 42 24	17.4:	10.77	< 50	> 14.8	>4.0	
	SBA				-20.4	<1810	>-16.4		
1637*	SX 5	04 38 57.6	-02 57 06	6.38	11.02				
	SC				-18.0				
1672	SB 3	04 44 55.2	-59 20 12	11.3	10.62	700*	12.0	1.4	
	SBB	44 53.8	20 01		-19.7	10700	-18.3	0.69 .13	
1744	SB 7	04 57 55.5	-26 05 40	8.13	11.26	< 45	> 15.0	>3.7	
	SBD				-18.3	< 359	>-14.7		
1792	SA 4	05 03 30.0	-38 02 42	10.0	10.40	600*	12.1	1.7	
	SBC	03 31.9	02 58		-19.7	7180	-17.9		
1808	SX 1	05 05 58.8	-37 34 42	7.6	10.24	1400*	11.2	1.0	
	SA	05 58.6	34 38		-19.2	9680	-18.2	0.74 .004	
1964	SX 3	05 31 14.4	-21 58 54	15.2	10.91	200 17	13.3 .1	2.4	
	SB	31 15.6 .5	58 32 9		-20.0	5540	-17.6	0.72 .09	

2207	SX 4	06 14 14.4		-21 21 12		19.6	10.81	1200*		11.4		0.6		
	SBC	14 14.2		21 14			-20.7	55100		-20.1		0.88	.05	
2217	LB	06 19 40.0		-27 12 29		15.9:	10.94	69	14	14.5	.2	3.6		
	SB0	19 37.8	.9	12 27	15		-20.1	2070		-16.5				
2223	SX 3	06 22 30.0		-22 48 36		16.4	11.52	187:	17	13.4	.1	1.9		
	SB	22 28.6	.5	48 15	9		-19.6	6000		-17.7				
2427	SX 8	07 35 02.0		-47 31 31		9.04	11.24	< 70		> 14.4		>3.2		C
	SDM						-18.5	< 684		>-15.4				
2442/3	SB 3	07 36 33.0		-69 25 00		14.4	10.41	900*		11.7		1.3		
	SBB	36 32.1		25 06			-20.4	22300		-19.1				
2525	SB 5	08 03 15.6		-11 17 06		12.7	11.48	86	14	14.2	.2	2.7		
	SBC	03 15.9	.7	17 02	13		-19.0	1650		-16.3				
2613	SA 3	08 31 10.8		-22 48 00		15.7	10.13	111	14	13.9	.2	3.8		
	SB	31 12.4	.6	48 22	10		-20.9	3270		-17.1				
2775*	SA 2	09 07 40.8		07 14 30		9.6	10.85							
	SAB						-19.1							
2784	LA	09 10 06.0		-23 57 54		10.5:	10.68	< 30		> 15.4		>4.7		
	S0						-19.4	< 396		>-14.7				
2835	SB 5	09 15 36.9		-22 08 37		10.5:	10.37	133	16	13.7	.2	3.3		
	SBC	15 38.1	.6	08 14	11		-19.7	1740		-16.4				
2967	SA 5	09 39 29.9		00 33 53		15.9	12.01	259:	20	13.0	.1	1.0		
	SC	39 27.8	.5	34 30	10		-19.0	7830		-18.0				
2974	E4	09 40 01.8		-03 28 06		17.9	11.46	< 250		> 13.1		>1.6		
	E4						-19.8	<9540		>-18.2				
2997	SX 5	09 43 27.6		-30 57 36		7.41	9.74	700*		12.0		2.3		S
	SC	43 29.2		57 26			-19.6	4600		-17.4				
3059	SB 4	09 49 39.0		-73 41 12		9.55	10.80	600*		12.1		1.3		
	SBBC	49 33.1		41 16			-19.1	6550		-17.8				
3109	SB 9	10 00 46.8		-25 54 48		2.00	9.53	< 100		> 14.0		>4.5		N
	SBM						-17.0	< 47.2		>-12.5				
3115	L	10 02 44.4		-07 28 30		6.43	9.65	< 70		> 14.4		>4.8		
	S0						-19.4	< 331		>-14.6				
3136	E4	10 04 31.2		-67 08 00		14.1	10.08	< 30		> 15.4		>5.3		
	E4						-20.7	< 717		>-15.4				
1005+12	E3	10 05 46.2		12 33 12			10.61	< 250		> 13.1		>2.5		C
	E3													

Table 1 (*Continued*)

N	Type	R.A.		Dec.		Dist. (Mpc)	MAG MABS	S (mJy) P*E18 (W/Hz)		RMAG RMABS		R408 -alpha		Note
3145	SB 4	10 07 43.2		-12 11 18		28.2	11.88	98	15	14.1	.2	2.2		
	SBBC	07 44.2	.7	11 38	13		-20.4	9310		-18.2				
3166	SX 0	10 11 09.6		03 40 30		12.0	11.07	123	17	13.8	.2	2.7		
	SO/A	11 09.1	.7	39 51	15		-19.3	2130		-16.6		0.73	.14	
3169	SA 1	10 11 37.8		03 43 12		10.5	10.93	183	18	13.4	.1	2.5		
	SAP	11 39.1	.5	43 01	12		-19.2	2420		-16.7		0.51	.20	
3223	SA 3	10 19 19.8		-34 00 48		10.2	11.13	< 30		> 15.4		>4.3		
	SB						-18.9	< 376		>-14.6				
3239	IB 9	10 22 23.4		17 24 48		7.9:	11.31*	< 60		> 14.6		>3.3		
	IBM						-18.2	< 448		>-14.9				
3256	P	10 25 42.0		-43 38 54		25.9	11.03	1450*		11.2		0.2		
	SBB	25 42.8		38 40			-21.0	117000		-20.9		0.61	.04	
3261	SB 3	10 26 53.3		-44 24 02		22.8	12.16*	232	18	13.1	.1	0.9		
	SBB	26 53.7	.6	23 43	9		-19.6	14400		-18.7				
3338	SA 5	10 39 28.8		14 00 36		15.0	11.02	41:	14	15.0	.5	4.0		
	SC	39 28.4	1.3	00 48	34		-19.9	1100		-15.9				
3346	SB 6	10 40 59.4		15 08 06		18.8	12.18*	< 30		> 15.4		>3.2		P
	SBCD						-19.2	<1270		>-16.0				
3351*	SB 3	10 41 19.2		11 58 06		8.24	10.22							
	SBB						-19.4							
3367*	SB 5	10 43 55.8		14 00 48		27.9	11.85							S,P
	SBC						-20.4							
3368	SX 2	10 44 08.6		12 05 02		7.9:	9.80	< 190		> 13.4		>3.6		
	SAB						-19.7	<1420		>-16.1				
3370	SA 5	10 44 23.4		17 32 18		17.6	11.94	189	23	13.4	.2	1.5		P
	SC	44 22.4	.6	32 55	11		-19.3	7020		-17.8		1.22	.14	
3377	E5	10 45 03.0		14 15 00		8.7:	10.87	< 40		> 15.0		>4.2		
	E5						-18.8	< 362		>-14.7				
3379	E1	10 45 11.4		12 50 48		9.1	10.00	< 45		> 14.9		>4.9		
	E1						-19.8	< 446		>-14.9				

3384	LB	10 45 38.4		12 53 42		9.1	10.64	< 30		> 15.4		>4.8		
	SB0						-19.2	< 297		>-14.4				
3389	SA 5	10 45 49.8		12 47 54		16.9	12.06	79	16	14.3	.3	2.2		P
	SC	45 49.6	.7	47 59	13		-19.1	2700		-16.8		0.63	.17	
3412	LB	10 48 15.0		13 40 30		7.68	11.15	< 40		> 15.0		>3.9		
	SB0						-18.3	< 282		>-14.4				
3423	SA 6	10 48 38.4		06 06 18		13.8	11.34	87:	13	14.2	.2	2.9		S
	SCD	48 39.1	.6	06 27	14		-19.4	1980		-16.5				
3489	LX	10 57 40.8		14 10 12		7.2	10.87	< 30		> 15.4		>4.5		
	S0						-18.4	< 186		>-13.9				
3511	SA 5	11 00 57.0		-22 49 00		10.2	11.01	192	19	13.3	.2	2.3		
	SC	00 57.1	.6	48 58	10		-19.1	2400		-16.8				
3521	SX 4	11 03 15.6		00 14 12		8.43	9.56	2600*		10.5		0.9		
	SBC	03 18.4		13 25			-20.3	22100		-19.1		0.98	.12	
3557	E3	11 07 36.0		-37 15 54		19.1:	10.91	1500*		11.1		0.2		
	E3	07 35.0		16 02			-20.5	65500		-20.3		0.68	.01	
3585	E7	11 10 49.8		-26 28 48		12.0	10.79	< 60		> 14.6		>3.8		P
	E7						-19.6	<1030		>-15.8				
3593	SA 0	11 12 00.0		13 05 24		6.9	11.24	194	17	13.3	.1	2.1		
	S0/A	11 59.1	.5	06 16	12		-18.0	1110		-15.9				
3596	SX 5	11 12 28.8		15 03 36		15.4	11.42	62:	14	14.6	.3	3.2		
	SC	12 29.4	.9	03 20	24		-19.5	1750		-16.3				
3607	LA	11 14 16.8		18 19 42		18.2	10.76	< 30		> 15.4		>4.6		
	S0						-20.5	<1190		>-15.9				
3608*	E2	11 14 21.0		18 25 36		20.0	11.70							
	E2						-19.8							
3621	SA 7	11 15 50.4		-32 32 24		5.75	9.51	500*		12.3		2.8		
	SD	15 51.7		32 47			-19.3	1980		-16.5		0.67		
3623	SX 1	11 16 18.6		13 21 54		7.2:	9.66	< 55		> 14.7		>5.0		
	SA						-19.6	< 343		>-14.6				
3626	LA	11 17 26.4		18 37 48		14.5:	11.41	< 30		> 15.4		>4.0		
	S0						-19.4	< 755		>-15.4				
3627	SX 3	11 17 38.4		13 15 48		6.85	9.30	700*		11.9		2.6		
	SB	17 37.8		15 40			-19.9	3930		-17.3		0.54	.17	
3628	S 3	11 17 39.6		13 52 06		7.91:	9.63	900*		11.7		2.1		
	SB	17 39.2		52 15			-20.0	6740		-17.8		0.49	.12	

Table 1 *(Continued)*

N	Type	R.A.		Dec.		Dist. (Mpc)	MAG MABS	S (mJy) P*E18 (W/Hz)		RMAG RMABS		R408 -alpha		Note
3640	E3	11 18 32.4		03 30 36		13.2:	11.01	125:	17	13.8	.2	2.8		
	E3	18 35.3	.7	30 18	26		-19.6	2610		-16.8				
3672	SA 5	11 22 30.6		-09 31 12		18.2	11.23	163	16	13.5	.1	2.3		
	SC	22 30.5	.5	31 17	10		-20.1	6460		-17.8				
3686	SB 4	11 25 07.3		17 30 00		14.3	11.76	35:	14	15.2	.6	3.5		S
	SBBC	25 06.9	1.6	30 42	43		-19.0	859		-15.6				
3705	SX 2	11 27 32.0		09 33 10		11.7	11.77*	46	14	14.9	.4	3.1		
	SAB	27 22.6	1.2	34 04	28		-18.5	753		-15.4		0.72	.35	
3810	SA 5	11 38 24.0		11 44 54		12.5	11.06	340*		12.7		1.6		
	SC	38 21.8		47 47			-19.4	6330		-17.8		0.91	.25	
3887	SB 4	11 44 32.4		-16 34 38		16.0	11.25	68	13	14.5	.2	3.3		
	SBBC	44 32.1	.7	34 21	13		-19.8	2080		-16.5				
3923	E4	11 48 30.0		-28 31 42		15.9	10.79	< 35		> 15.2		>4.4		P
	E4-5						-20.2	<1060		>-15.8				
3962	E1	11 52 06.6		-13 41 48		16.0	11.27	< 30		> 15.4		>4.1		S
	E1						-19.8	< 919		>-15.6				
3976	SX 3	11 53 23.4		07 01 42		23.6	11.74	< 50		> 14.8		>3.1		C
	SB						-20.1	<3320		>-17.1				
4027	SB 8	11 56 56.4		-18 59 24		8.91:	11.30	210	16	13.2	.1	1.9		P
	SBDM	56 56.8	.4	59 02	8		-18.5	2000		-16.6				
4030	SA 4	11 57 49.8		-00 49 24		16.0	10.76	330*		12.7		1.9		
	SBC	57 49.6		48 36			-20.3	10100		-18.3		0.69		
4038/9	P	11 59 19.2		-18 35 06		13.2:	10.21	1300*		11.3		1.1		
	IM	59 19.8		35 38			-20.4	27100		-19.3		0.88	.09	
4050	SB 2	12 00 20.4		-16 05 36		28.3	12.25*	< 30		> 15.4		>3.1		
	SBAB						-20.0	<2880		>-16.9				
4116	SB 8	12 05 03.6		02 58 12		12.9	12.01	< 40		> 15.0		>3.0		
	SBDM						-18.5	< 794		>-15.5				
4123*	SB 5	12 05 37.8		03 09 24		12.0	11.53							S
	SBC						-18.9							

I 764	SA 5	12 07 39.0		-29 27 30		10.1	12.35*	< 50		> 14.8		>2.5		
	SC						-17.7	< 609		>-15.2				
4179	L	12 10 18.6		01 37 42		12.3	11.35	< 50		> 14.8		>3.5		
	SO						-19.1	< 905		>-15.6				
4192	SX 2	12 11 15.6		15 10 48		11.5	10.35	230	19	13.1	.1	2.7		
	SAB	11 14.3	.5	11 08	12		-20.0	3640		-17.2				
4216	SX 3	12 13 21.4		13 25 46		14.6	10.32	< 90		> 14.2		>3.9		C
	SB						-20.5	<2320		>-16.7				
4254	SA 5	12 16 17.4		14 41 42		12.8	10.20	1800*		10.9		0.7		
	SC	16 15.6		42 13			-20.3	35100		-19.6		1.14	.19	
4261	E2	12 16 50.4		06 06 06		26.3	11.09	35300*		7.7		-3.4		
	E2-3	(LARGE DOUBLE)					-21.0	2920000		-24.4		0.73	.06	
4273	SB 5	12 17 22.8		05 37 18		19.9	12.04	< 50		> 14.8		>2.8		P
	SBC						-19.4	<2360		>-16.7				
4281	L	12 17 48.6		05 39 54		31.6:	11.78	< 30		> 15.4		>3.6		P
	SO						-20.7	<3580		>-17.1				
4303	SX 4	12 19 21.6		04 45 06		12.9	9.94	1200*		11.4		1.5		S
	SBC	19 22.0		45 27			-20.6	24000		-19.2		1.01	.12	
4321	SX 4	12 20 22.8		16 06 00		12.1	9.88	700*		11.9		2.0		
	SBC	20 23.4		06 04			-20.5	12300		-18.5		0.99	.18	
4365	E3	12 21 55.6		07 35 37		14.5	10.29	< 90		> 14.2		>3.9		C
	E3						-20.5	<2250		>-16.6				
4374	E1	12 22 31.2		13 09 48		14.5	10.06	12200*		8.8		-1.3		
	E1	22 32.5		09 38			-20.7	307000		-22.0		0.62	.02	
4378	SA 1	12 22 45.0		05 12 06		30.8	12.28*	< 30		> 15.4		>3.1		
	SA						-20.2	<3400		>-17.0				
4382	LA	12 22 52.4		18 28 00		11.0:	9.81	73:	16	14.4	.3	4.6		
	SO	22 50.4	1.0	28 33	27		-20.4	1060		-15.8				
4406	E3	12 23 39.6		13 13 24		11.5:	9.89	< 150		> 13.6		>3.7		
	E3						-20.4	<2420		>-16.7				
4429	L	12 24 54.0		11 23 06		12.6:	10.74	< 45		> 14.9		>4.2		
	SO						-19.8	< 855		>-15.6				
4438	SA 0	12 25 13.8		13 17 06		7.94:	10.45	700*		11.9		1.5		
	SO/A	-		-			-19.1	5280		-17.6		1.08	.14	
4442	LB	12 25 31.8		10 04 42		14.5:	11.04	< 60		> 14.6		>3.6		
	SBO						-19.8	<1510		>-16.2				

Table 1 *(Continued)*

N	Type	R.A.		Dec.		Dist. (Mpc)	MAG MABS	S (mJy) P*E18 (W/Hz)		RMAG RMABS		R408 -alpha		Note
4450	SA 2	12 25 58.2		17 21 42		11.5:	10.61	< 70		> 14.4		>3.8		
	SAB						-19.7	<1110		>-15.9				
4457*	SX 0	12 26 25.8		03 50 48		6.46	11.38							
	S0/A						-17.7							
4472	E2	12 27 14.4		08 16 42		11.5	9.09	700*		11.9		2.8		
	E2	27 11.7		16 43			-21.2	11000		-18.4		0.73	.20	
4473*	E5	12 27 17.4		13 42 19		12.0:	10.85							
	E5						-19.5							
4486	E+0	12 28 17.4		12 40 06		14.5:	9.35	580000*		4.6		-4.8		
	E0-1	28 17.6		40 22			-21.5	14500000		-26.2		0.77	.03	
4487	SX 6	12 28 29.4		-07 46 42		11.2	11.34	< 40		> 15.0		>3.7		
	SCD						-18.9	< 602		>-15.2				
4496A	SB 9	12 29 06.6		04 12 54		9.73	11.43	103	15	14.0	.2	2.6		
	SBM	29 07.8	.6	13 08	14		-18.5	1170		-15.9				
4501	SA 3	12 29 27.6		14 14 42		15.0	9.86	1200*		11.3		1.4		
	SB	-		-			-21.0	32300		-19.6		1.22	.07	
4504	SA 6	12 29 42.4		-07 17 14		13.1	11.59	41:	19	15.0	.7	3.4		
	SCD	29 41.1	2.2	16 39	42		-19.0	837		-15.6				
4517	SA 6	12 30 12.0		00 23 18		7.48	10.41	< 250		> 13.0		>2.6		
	SCD						-19.0	<1670		>-16.4				
4526	LX	12 31 30.6		07 58 30		15.9:	10.21	< 75		> 14.4		>4.2		C
	S0						-20.8	<2170		>-16.6				
4527	SX 4	12 31 35.4		02 55 42		11.8	10.77	539	33	12.2	.1	1.4		
	SBC	31 34.6	.4	55 55	10		-19.6	8980		-18.2		0.78	.08	
4532	IB 9	12 31 46.8		06 44 42		8.51	11.75	290*		12.9		1.2		P
	IBM	31 46.7		44 24			-17.9	2510		-16.8				
4535	SX 5	12 31 48.0		06 28 36		9.68	10.22	209	19	13.3	.1	3.1		
	SC	31 49.6	.5	28 41	12		-19.7	2340		-16.6		0.88	.44	
4536	SX 4	12 31 54.0		02 27 42		9.55	10.54	800*		11.8		1.3		
	SBC	31 52.4		27 33			-19.4	8730		-18.1		1.04	.15	

4546	LB	12 32 55.2		-03 31 06		33.1	11.09	< 30		> 15.4		>4.3		
	SBO						-21.5	<3930		>-17.2				
4548	SB 3	12 32 55.2		14 46 24		10.5	10.71	NOT OBSERVED						
	SBB						-19.4							
4552*	E0	12 33 08.5		12 49 50		15.1	10.60							
	E0						-20.3							
4569	SX 2	12 34 19.3		13 26 20		6.9	9.82	454	29	12.4	.1	2.6		C
	SAB	34 18.3	.5	25 26	11		-19.4	2590		-16.8				
4570	L	12 34 21.0		07 31 24		11.5	11.27	< 40		> 15.0		>3.8		
	S0						-19.0	< 633		>-15.3				
4579	SX 3	12 35 12.0		12 05 36		14.5	10.28	500*		12.3		2.0		
	SB	35 11.9		04 52			-20.5	12500		-18.5		0.83	.14	
4592	SA 8	12 36 44.4		-00 15 24		11.3	12.16*	< 50		> 14.8		>2.6		
	SDM						-18.1	< 767		>-15.5				
4593*	SB 3	12 37 04.8		-05 04 12		21.0	11.39							S
	SBB						-20.2							
4594	SA 1	12 37 23.8		-11 20 51		9.77	8.76	107	16	14.0	.2	5.2		
	SA	37 21.2	.7	20 35	14		-21.2	1220		-16.0		0.06	.40	
4602*	SX 4	12 38 01.8		-04 51 30		22.7	11.78							
	SBC						-20.0							
4621	E5	12 39 31.2		11 55 12		12.6	10.60	< 45		> 14.9		>4.3		
	E5						-19.9	< 855		>-15.6				
4632	SA 5	12 39 58.2		00 11 24		19.2	11.77	63:	16	14.6	.3	2.8		P
	SC	39 59.8	.9	11 31	16		-19.6	2790		-16.8				
4636	E0	12 40 17.4		02 57 42		11.5	10.27	222	20	13.2	.1	2.9		
	E0-1	40 16.5	.5	57 57	11		-20.0	3500		-17.1		0.70	.39	
4643	SBO	12 40 47.4		02 15 06		15.9:	11.25	< 100		> 14.1		>2.8		
	SBO/A						-19.8	<3020		>-16.9				
4649	E2	12 41 09.3		11 49 37		15.1	9.61	41:	19	15.0	.7	5.4		
	E2	41 07.3	2.2	50 10	55		-21.3	1120		-15.9				
4651	SA 5	12 41 12.6		16 40 06		19.2	11.03	NOT OBSERVED						
	SC						-20.4							
4658	SB 4	12 42 02.4		-09 48 42		22.1	12.74*	93	18	14.1	.3	1.4		P
	SBBC	42 02.7	.8	48 31	13		-19.0	5430		-17.6				
4665	SBO	12 42 27.0		03 19 48		15.1	11.43*	< 30		> 15.4		>3.9		
	SBO/A						-19.5	< 818		>-15.5				

Table 1 *(Continued)*

N	Type	R.A.		Dec.		Dist. (Mpc)	MAG MABS	S (mJy) P*E18 (W/Hz)		RMAG RMABS		R408 -alpha		Note
4666	SX 5	12 42 34.8		-00 11 12		18.3	10.98	730*		11.9		0.9		
	SC	42 34.5		11 05			-20.3	29200		-19.4		0.52	.08	
4684	LB	12 44 43.3		-02 27 13		18.8	12.27*	< 50		> 14.8		>2.5		S,P
	SBO						-19.1	<2110		>-16.6				
4697*	E6	12 46 00.6		-05 31 42		10.0:	9.96							
	E6						-20.0							
4696	E1	12 46 03.0		-41 02 18		31.6	11.22	12000*		8.8		-2.4		
	E1	46 03.1		02 22			-21.3	1440000		-23.7				
4699	SX 3	12 46 26.4		-08 23 36		14.1	10.15	52:	16	14.8	.4	4.6		S
	SB	46 27.0	1.3	23 14	24		-20.6	1240		-16.0				
4713	SX 7	12 47 25.2		05 35 00		10.3	11.88	116	16	13.9	.2	2.0		P
	SD	47 25.8	.5	34 47	10		-18.2	1470		-16.2		0.70	.11	
4731*	SB 6	12 48 25.8		-06 07 18		8.17	11.14							
	SBCD						-18.4							
4742	E4	12 49 12.0		-10 11 00		11.7	11.85	< 40		> 15.0		>3.2		P
	E4						-18.5	< 654		>-15.3				
4753	IO	12 49 48.0		-00 55 42		11.4	10.40	< 30		> 15.4		>5.0		
	IO						-19.9	< 465		>-14.9				
4762	LB	12 50 25.4		11 30 09		9.1:	10.68	< 68		> 14.5		>3.8		
	SBO						-19.1	< 675		>-15.3				
4772	SA 1	12 50 55.9		02 26 21		12.6	12.40*	< 50		> 14.8		>2.4		P
	SA						-18.1	< 950		>-15.7				
4775	SA 7	12 51 10.8		-06 21 12		12.2	11.49	79	18	14.3	.3	2.8		P
	SD	51 09.4	.9	21 27	15		-18.9	1410		-16.1				
4781*	SB 7	12 51 46.8		-10 15 54		11.6	11.26							
	SBD						-19.1							
4818	SX 2	12 54 12.6		-08 15 12		9.9	11.89*	72	15	14.4	.3	2.5		
	SAB	54 12.6	.8	15 30	16		-18.1	844		-15.6				
4845	SA 2	12 55 28.1		01 50 48		14.5	12.17*	193	19	13.3	.1	1.1		S
	SAB	55 27.4	.5	51 37	12		-18.6	4830		-17.5		0.98	.25	

4856	SB0	12 56 42.0		-14 46 18		14.1:	10.89	< 30		> 15.4		>4.5		
	SB0/A						-19.9	< 717		>-15.4				
4900	SB 5	12 58 06.0		02 46 08		16.4	11.84	72	18	14.4	.3	2.6		P
	SBC	58 07.0	.9	46 31	16		-19.2	2310		-16.7		0.46	.18	
4902	SB 3	12 58 21.7		-14 14 41		30.3	11.56	207	19	13.3	.1	1.7		
	SBB	58 23.3	.5	15 14	10		-20.9	22800		-19.1				
4941	SX 2	13 01 37.5		-05 16 58		9.20	11.59	< 40		> 15.0		>3.5		
	SAB						-18.2	< 405		>-14.8				
4939*	SA 4	13 01 37.8		-10 04 24		15.9:	11.56*							
	SBC						-19.4							
4945	SB 6	13 02 31.8		-49 12 00		3.89:	8.25	12600*		8.8		0.6,		
	SBCD	02 33.1		11 53			-19.7	22800		-19.2		0.46	.05	
4958	LB	13 03 12.0		-07 45 06		15.2	10.96	< 30		> 15.4		>4.4		
	SB0						-19.9	< 829		>-15.5				
4976	E4	13 05 42.0		-49 14 30		11.4	10.48	< 40		> 15.0		>4.6		
	E4						-19.9	< 622		>-15.4				
4981	SX 4	13 06 13.2		-06 30 48		19.1	11.52	< 80		> 14.3		>2.8		P
	SBC						-19.9	<3470		>-17.1				
4984	LX	13 06 18.4		-15 14 58		11.0	11.84*	90	16	14.1	.3	2.3		P
	S0	06 17.7	.7	14 25	12		-18.3	1300		-16.1		0.47	.21	
4995	SX 3	13 07 04.2		-07 34 00		15.6	11.54	< 60		> 14.6		>3.1		P
	SB						-19.4	<1750		>-16.4				
5018	E3	13 10 19.8		-19 15 12		31.3	11.49	< 30		> 15.4		>3.9		P
	E3						-21.0	<3520		>-17.1				
5044*	E0	13 12 43.8		-16 07 18		25.0	11.88*							P
	E0						-20.4							
5054	SA 4	13 14 18.0		-16 22 18		14.5	11.04	164	17	13.5	.1	2.5		
	SBC	14 17.4	.5	22 22	10		-19.8	4100		-17.3		0.42	.18	
5061	E0	13 15 20.4		-26 34 24		19.7	11.61*	< 60		> 14.6		>3.0		P
	E0						-19.9	<2790		>-16.9				
5068	SX 6	13 16 16.8		-20 46 36		5.55	10.21	< 165		> 13.6		>3.3		
	SCD						-18.5	< 607		>-15.1				
5085	SA 5	13 17 34.2		-24 10 42		15.1	11.94*	74:	18	14.4	.3	2.4		S
	SC	17 31.8	1.0	10 51	16		-19.0	2010		-16.5				
5084	L	13 17 34.3		-21 33 54		15.4	11.97*	41:	15	15.0	.5	3.0		S
	S0	17 35.6	1.7	33 44	28		-19.0	1160		-15.9				

Table 1 *(Continued)*

N	Type	R.A.		Dec.		Dist. (Mpc)	MAG MABS	S (mJy) P*E18 (W/Hz)		RMAG RMABS		R408 -alpha		Note
5087	LA	13 17 42.6		-20 20 54		16.4	11.67	56:	18	14.7	.4	3.0		P
	SO	17 41.1	1.2	20 37	20		-19.4	1800		-16.4				
5102	LA	13 19 07.2		-36 22 06		2.7	9.81	< 195		> 13.4		>3.6		
	SO						-17.3	< 170		>-13.8				
5128	L	13 22 31.8		-42 45 30		3.28	7.27	2740000*		3.0		-4.3		
	SO	CENTAURUS A					-20.2	3530000		-24.6				
5161	SA 5	13 26 24.0		-32 54 54		9.55	11.34	65	14	14.5	.3	3.2		
	SC	26 23.1	.9	54 50	14		-18.6	709		-15.4				
5170	SA 5	13 27 07.2		-17 42 24		14.0	11.97*	< 30		> 15.4		>3.4		S
	SC						-18.8	< 704		>-15.3				
5236	SX 5	13 34 10.2		-29 36 48		4.21	7.84	6200*		9.6		1.8		
	SC	34 10.5		36 26			-20.3	13200		-18.5		0.92	.09	
5248	SX 4	13 35 03.0		09 08 30		9.95	10.36	700*		11.9		1.5		
	SBC	35 03.2		09 39			-19.6	8290		-18.1		1.25	.16	
5247	SA 4	13 35 20.6		-17 37 49		15.6	10.80	168	16	13.5	.1	2.7		
	SBC	35 20.8	.5	37 07	10		-20.2	4870		-17.5				
5253	IO	13 37 05.4		-31 23 24		2.16	10.44	128	16	13.8	.1	3.4		
	IO	37 05.5	.7	23 14	11		-16.2	71.5		-13.0				
5266	LA	13 39 54		-47 56		29.2	12.25*	< 40		> 15.0		>2.8		
	SO						-20.1	<4080		>-17.2				
5300*	SX 5	13 45 44.4		04 11 54		16.2	11.93*							
	SC						-19.1							
5334	SB 5	13 50 20.4		-00 52 06		8.79	11.90*	< 30		> 15.4		>3.5		
	SBC						-17.8	< 277		>-14.3				
5363*	IO	13 53 36.6		05 30 00		14.8	10.80							
	IO						-20.1							
5364	SA 4	13 53 41.4		05 15 36		10.7	10.70	66:	14	14.5	.3	3.8		
	SBC	53 39.7	.9	15 29	20		-19.5	907		-15.7				
5427	SA 5	14 00 48.6		-05 47 30		26.7	11.79	250	17	13.1	.1	1.3		P
	SC	00 50.4	.4	47 44	8		-20.3	21300		-19.0				

5468	SX 6	14 03 57.6		-05 12 48		19.1	11.96	< 40		> 15.0		>3.0		P
	SCD						-19.4	<1750		>-16.4				
5483	SA 5	14 07 19.2		-43 05 12		16.9	11.46	< 60		> 14.6		>3.1		
	SC						-19.7	<2050		>-16.5				
1409-65*	SA 3	14 09 18		-65 06		2.56	8.62							
	SB						-18.4							
5530	SA 4	14 15 18.0		-43 09 42		11.9	11.19	50:	16	14.8	.4	3.6		S
	SBC	15 17.4	1.8	09 12	23		-19.2	841		-15.6				
5566	SB 2	14 17 49.3		04 09 51		15.2	10.81	< 50		> 14.8		>4.0		C
	SBAB						-20.1	<1380		>-16.1				
5576	E3	14 18 32.4		03 29 54		14.5	11.47	< 50		> 14.8		>3.3		
	E3						-19.3	<1260		>-16.0				
5584	SX 6	14 19 50.2		-00 09 39		13.6	11.60	< 40		> 14.8		>3.2		
	SCD						-19.1	< 879		>-15.9				
5643	SX 5	14 29 28.2		-43 57 12		7.55	10.12	600*		12.1		2.0		
	SC	29 28.6		57 06			-19.3	4090		-17.3				
5669	SX 6	14 30 17.5		10 06 40		11.8	11.65	< 30		> 15.4		>3.7		
	SCD						-18.7	< 500		>-15.0				
5668	SA 7	14 30 54.0		04 40 12		18.7	11.84	31:	14	15.3	.7	3.5		S
	SD	30 52.5	1.7	40 17	38		-19.5	1300		-16.1				
5701	SB0	14 36 41.4		05 34 48		15.1:	11.93*	< 40		> 15.0		>3.1		
	SB0/A						-19.0	<1090		>-15.9				
5713	SX 4	14 37 37.8		-00 04 30		16.6:	11.66	358	24	12.7	.1	1.0		P
	SBC	37 37.6	.4	04 31	8		-19.4	11800		-18.4		0.57	.10	
5728	SX 1	14 39 36.6		-17 02 24		28.2	12.39*	138	15	13.7	.1	1.3		P
	SA	39 37.2	.5	02 26	9		-19.9	13200		-18.6		0.26	.58	
5746	SX 3	14 42 23.3		02 09 56		19.1:	10.72	< 90		> 14.2		>3.5		C
	SB						-20.7	<3790		>-17.2				
5775	SB 5	14 51 27.0		03 44 48		15.6	11.49	520*		12.3		0.8		
	SBC	51 25.3		45 16			-19.5	15200		-18.7		0.72	.05	
5792	SB 3	14 55 48.0		-00 53 24		14.3	11.05	152:	20	13.6	.2	2.5		
	SBB	55 46.5	.7	53 13	15		-19.7	3730		-17.2				
5813	E1	14 58 39.0		01 53 54		15.1:	11.30	< 50		> 14.8		>3.5		
	E1						-19.6	<1360		>-16.1				
5838	LA	15 02 54.0		02 17 36		17.4	11.37	< 40		> 15.0		>3.7		
	S0						-19.8	<1440		>-16.2				

Table 1 *(Continued)*

N	Type	R.A.		Dec.		Dist. (Mpc)	MAG MABS	S (mJy) P*E18 (W/Hz)		RMAG RMABS		R408 -alpha		Note
5846	E0	15 03 56.4		01 47 48		15.9	10.84	45:	14	14.9	.4	4.1		
	E0-1	03 56.9	1.2	48 01	26		-20.2	1360		-16.1				
5850*	SB 3	15 04 35.4		01 44 12		25.0	11.34							
	SBB						-20.6							
5861*	SX 5	15 06 33.0		-11 08 00		18.7	11.77							P
	SC						-19.6							
5885	SX 5	15 12 21.6		-09 54 00		9.95	11.96*	34:	14	15.2	.6	3.2		
	SC	12 21.1	1.6	53 55	29		-18.0	403		-14.8				
5921	SB 4	15 19 27.4		05 14 53		9.59	11.07	< 50		> 14.8		>3.7		C
	SBBC						-18.8	< 550		>-15.1				
5962	SA 5	15 34 14.4		16 46 24		25.1	11.69	184	18	13.4	.1	1.7		P
	SC	34 14.5	.5	46 43	9		-20.3	13900		-18.6		0.63	.07	
5970	SB 5	15 36 08.4		12 21 00		21.0	11.73	123	18	13.8	.2	2.1		P
	SBC	36 06.6	.6	20 41	11		-19.9	6480		-17.8		1.32	.33	
6215	SA 5	16 46 48.0		-58 54 18		9.08	9.97	800*		11.8		1.8		P
	SC	46 45.0		54 18			-19.8	7890		-18.0				
6221	SB 5	16 48 25.2		-59 08 00		9.59	9.73	800*		11.8		2.1		
	SBC	48 26.5		08 06			-20.2	8800		-18.1				
6300	SB 3	17 12 18.6		-62 45 54		8.63	9.87	219	19	13.2	.1	3.3		
	SBB	12 19.8	1.1	46 19	10		-19.8	1950		-16.5				
6384	SX 4	17 29 58.8		07 05 43		13.6	10.50	77	16	14.3	.3	3.8		
	SBC	29 58.7	.9	06 28	21		-20.2	1690		-16.4		0.52	.49	
I4662	IB 10	17 42 12.0		-64 37 18		2.5	10.79	62:	16	14.6	.3	3.8		P
	IM	42 13.9	2.0	37 29	16		-16.2	46.4		-12.4				
6684	LB	18 44 03.0		-65 13 54		8.06	10.69	< 50		> 14.8		>4.1		S
	SBO						-18.8	< 389		>-14.8				
6744	SX 4	19 05 01.8		-63 56 18		4.37	8.54	< 425		> 12.5		>4.0		
	SBC						-19.7	< 969		>-15.7				
6753	SA 3	19 07 12.0		-57 08 00		27.8	11.13	600*		12.1		1.0		P
	SB	07 11.6		07 54			-21.0	55500		-20.1				

6814	SX 4	19 39 55.2		-10 26 36		21.5	11.08	104	14	14.0	.2	2.9		
	SBC	39 56.0	.6	26 37	12		-20.6	5740		-17.7				
6822	IB 9	19 42 07.2		-14 55 42		1.49	8.49	< 130		> 13.8		>5.3		N
	IM						-17.4	< 33.9		>-12.1				
7090	SB 5	21 32 59.0		-54 46 51		6.34	10.61	< 80		> 14.3		>3.7		C
	SBC						-18.4	< 385		>-14.7				
7184	SB5	21 59 53.4		-21 03 18		23.2	11.33	90:	19	14.2	.2	2.9		
	SBC	59 56.4	1.1	03 01	19		-20.5	5860		-17.6				
7205*	SA 4	22 05 06		-57 40		14.5	11.06							
	SBC						-19.7							
7213	SA 1	22 06 12.0		-47 25 00		17.5	11.08	< 90		> 14.2		>3.1		C,P
	SA						-20.1	<3300		>-17.0				
I5201	SB 6	22 18 18		-46 19		8.05	10.99	< 105		> 14.0		>3.0		
	SBCD						-18.5	< 809		>-15.5				
7410	SB 1	22 52 10.8		-39 55 42		16.7	10.78	< 80		> 14.3		>3.5		S
	SBA						-20.3	<2670		>-16.8				
I5267	LA	22 54 22.4		-43 39 44		17.2	11.02	< 30		> 15.4		>4.3		
	SO						-20.1	<1060		>-15.7				
I1459	E3	22 54 22.8		-36 43 48		16.7	10.70	508	32	12.3	.1	1.6		
	E3	54 22.9	.5	43 43	8		-20.4	16900		-18.8				
7424	SX 6	22 54 28.4		-41 20 18		9.08	10.69	< 55		> 14.8		>4.1		
	SCD						-19.1	< 525		>-15.0				
7552	SB 2	23 13 25.2		-42 51 30		16.7	11.04	600*		12.1		1.1		
	SBAB	13 24.1		51 44			-20.1	20000		-19.0		0.83	.19	
7582	SB 2	23 15 38.4		-42 38 42		14.9	10.95	637	39	12.0	.1	1.1		
	SBAB	15 39.0	.6	38 33	8		-19.9	16800		-18.9				
7606	SA 3	23 16 29.4		-08 45 36		22.6	11.04	< 60		> 14.6		>3.6		
	SB						-20.7	<3660		>-17.2				
I5332	SA 7	23 31 48.0		-36 22 41			10.92	< 80		> 14.3		>3.4		
	SD													
7793	SA 8	23 55 15.6		-32 52 06		2.96	9.30	107	15	14.0	.1	4.7		
	SDM	55 17.6	.7	51 50	11		-18.1	112		-13.4				
2359-15	IB 9	23 59 24.0		-15 44 36			10.66	NOT OBSERVED						
	IM													

Notes to Table 1

Confused sources

Galaxies are listed in RA order with confusing sources and their flux densities *S* in mJy

NGC 1022	02 36 04·1	−06 53 32	*S*	NGC 4365	12 21 55·6	07 35 37	*S*
source	02 36 11·0	−06 54 48	122	source	12 21 59·0	07 34 03	66
NGC 1073	02 41 05·4	01 09 54		NGC 4526	12 31 30·6	07 58 30	
source	02 41 22·5	01 09 53	130	source	12 31 55·8	07 58 48	66
NGC 1404	03 36 57·1	−35 45 21		NGC 4569	12 34 19·3	13 26 20	
source	03 36 51·5	−35 44 56	232	source	12 34 06·4	13 15 19	1450
NGC 1553	04 15 05·4	−55 54 08		NGC 5566	14 17 49·3	04 09 51	
source	04 14 58·8	−55 52 19	249	source	14 17 43·6	04 08 26	163
NGC 2427	07 35 02·0	−47 31 31		NGC 5746	14 42 23·3	02 09 56	
source	07 35 20·5	−47 36 01	593	source	14 42 25·9	02 13 06	139
1005+12	10 05 46·2	12 33 12		NGC 5921	15 19 27·4	05 14 53	
source	10 05 33·0	12 27 08	180	source	15 19 24·2	05 15 47	93
NGC 3976	11 53 23·4	07 01 42		NGC 7090	21 32 59·0	−54 46 51	
source	11 53 13·3	07 01 19	157	source	21 32 50·5	−54 46 25	112
NGC 4216	12 13 21·4	13 25 46		NGC 7213	22 06 12·0	−47 25 00	
source	12 13 16·5	13 22 33	80	source	22 06 07·4	−47 24 26	209
source	12 13 24·4	13 27 07	67				

Other galaxies

NGC 300: A nearby galaxy with diameter 19·5 arcmin. There is a 730 mJy source at 00 51 41·9, −38 02 48 (Large *et al.* 1981). Nucleus has a flux density of less than 30 mJy.

0237−34: (Fornax). This nearby dwarf galaxy has a diameter of 20·0 arcmin. The radio observations did not include the whole region.

NGC 1291: The diameter of this galaxy is 11·0 arcmin. There is a point source of ~600 mJy at 03 15 19·0, −41 21 37.

NGC 1399: There is a nearby strong source which is probably unassociated with NGC 1399, at 03 36 51·7, −35 32 29 (Schilizzi and McAdam 1975).

NGC 3109: The diameter of this close galaxy is 10·7 arcmin. The nucleus has a flux density <40 mJy.

NGC 6822: A nearby galaxy of diameter 11·0 arcmin. A point source of ~500 mJy is at 19 42 22·5, −14 59 17.

Column 6, line 1: Optical magnitude (MAG) in the B_T^o system where available, obtained from
(1) de Vaucouleurs *et al.* (1981): 89 galaxies.
(2) de Vaucouleurs (1979*a*): 31 galaxies.
(3) de Vaucouleurs (personal communication 1978): 105 galaxies.
(4) B_T^o in RC2: 38 galaxies.
(5) m_c, the revised and corrected magnitude on the Harvard scale: 28 galaxies.
(6) Cameron (1971*a*): 3 galaxies.
The m_c magnitudes and those taken from Cameron are shown with an asterisk.

line 2: The absolute optical magnitude, MABS.

Column 7, line 1: The 408 MHz flux density *S* (in mJy) and the standard error where available. An asterisk indicates that the data are from

Cameron (1971*a*). A colon indicates an uncertain association and an upper limit shows that the galaxy was not detected.

line 2: The radio luminosity P in $\mathrm{W\,Hz^{-1}} \times 10^{18}$.

Column 8, line 1: The radio magnitude m_{408} (RMAG) defined by $m_{408} = -53 \cdot 45 - 2 \cdot 5 \log S_{408}$ and standard error.

line 2: The absolute radio magnitude RMABS.

Column 9, line 1: The radio index $R_{408} = m_{408} - B_{\mathrm{T}}^{\mathrm{o}}$ (R408 = RMAG − MAG).

line 2: The radio spectral index and standard error as explained in Section 4.

Column 10, line 1: *Notes*: The code letters are as follows: C, a confusing source was detected in the neighbourhood (details are given in Notes to Table 1, p. 342; N, see Notes to Table 1; P, sources which are unresolved ($\lesssim 3$ arcmin diameter); S, sidelobe interference hindered measurements of flux density and position.

3. Analysis of Data and Results

(*a*) *Radio luminosity function*

Complete samples of galaxies are necessary for the derivation of the radio luminosity function. The V_0/V_{m} method was used to test completeness (Hummel 1981, and references therein); the mean value of V_0/V_{m} should be $0 \cdot 5$ and each value between 0 and 1 should have equal probability of occurring. For the group of galaxies in Cameron's list 1, we have $\langle V_0/V_{\mathrm{m}} \rangle = 0 \cdot 49 \pm 0 \cdot 02$, when the limiting magnitude is $B_{\mathrm{T}}^{\mathrm{o}} = 11 \cdot 0$.

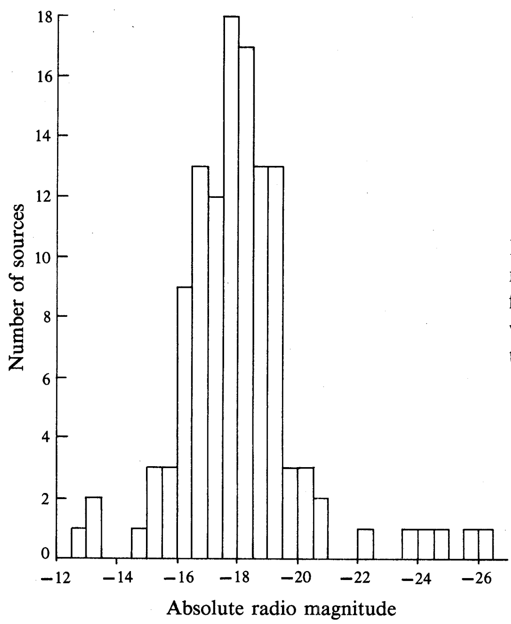

Fig. 1. Distribution of absolute radio magnitudes at 408 MHz for all detected galaxies. The weakest source is NGC 247 (Sd), the strongest NGC 4486 (E+0).

Although Cameron selected his second group of galaxies to a limiting photographic magnitude of $12 \cdot 5$, it was complete to $B_{\mathrm{T}}^{\mathrm{o}} = 12 \cdot 0$, with $\langle V_0/V_{\mathrm{m}} \rangle = 0 \cdot 52 \pm 0 \cdot 02$. For $B_{\mathrm{T}}^{\mathrm{o}} = 12 \cdot 5$, we have $\langle V_0/V_{\mathrm{m}} \rangle = 0 \cdot 35 \pm 0 \cdot 02$; the low value is reasonable as the original selection was made from the 'Reference Catalogue of Bright Galaxies' (de

Vaucouleurs and de Vaucouleurs 1964) which is known to become incomplete at $\sim B(\mathrm{o}) = 12\cdot5$ (Crane 1977). Also, the RC2, which together with further work (de Vaucouleurs, personal communication 1978), was used to update the sample, becomes appreciably incomplete at $B_T^{\mathrm{o}} = 12\cdot0$. Using the derived limiting magnitudes, we excluded eight galaxies: one from list 1 ($B_T^{\mathrm{o}} > 11\cdot0$) and seven from list 2 ($B_T^{\mathrm{o}} = 12\cdot0$).

The distribution of absolute radio magnitudes at 408 MHz is presented in Fig. 1. The most luminous sources are the radio galaxies measured by Cameron, whereas NGC 247 (Sd), NGC 5253 (I0) and NGC 7793 (Sdm) detected in 1978 are the faintest. The radio power of Cameron's weakest source NGC 5885 was $1\cdot4\times10^{20}\,\mathrm{W\,Hz^{-1}}$. The lower limit has now been reduced to $5\cdot0\times10^{19}\,\mathrm{W\,Hz^{-1}}$ (NGC 247), with the majority of galaxies grouped around $10^{22}\,\mathrm{W\,Hz^{-1}}$.

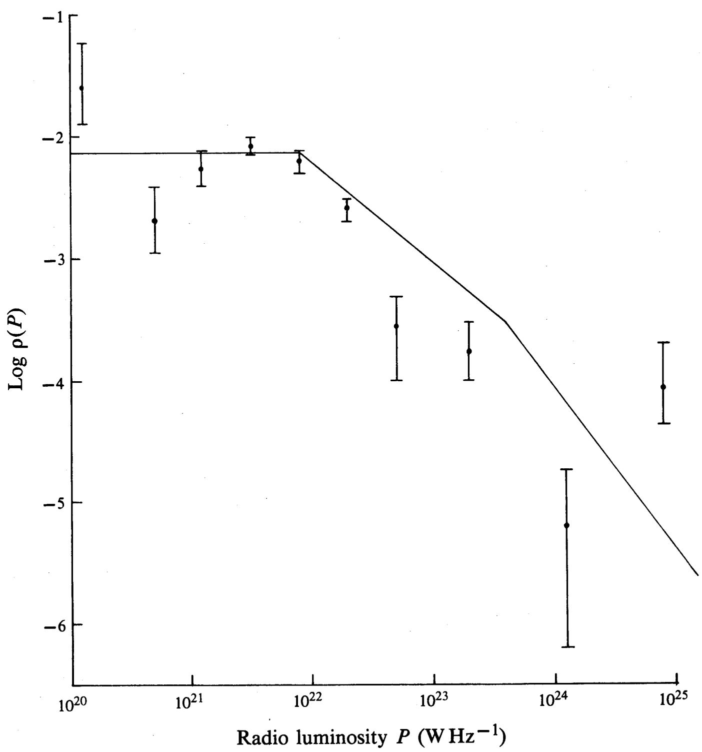

Fig. 2. Radio luminosity function $\rho(P)$ for all detected galaxies in unit magnitude steps. The standard piecewise linear fit is from Robertson (1978).

Many authors such as Colla *et al.* (1975), Auriemma *et al.* (1977), Feretti and Giovannini (1980) and Hummel (1981) have used the bivariate form of the radio luminosity function. Because of the correlation between radio and optical magnitudes (cf. Fig. 4) and the poor statistics of presently available radio luminosity functions, there is little additional information contained in the bivariate form. Therefore Fig. 2 presents the radio luminosity function for all detected galaxies in unit magnitude steps, calculated essentially as described by Cameron (1971*b*). These calculations take into account the different limiting magnitudes of the two groups of galaxies. The standard piecewise form of the radio luminosity function was calculated by Robertson

(1978) using the derivation of Fomalont *et al.* (1974) and data from von Hoerner (1973). As a result of the improved data, the errors and scatter are less than in Cameron's original curve, but the agreement is close. Fanti *et al.* (1973) investigated the radio luminosity function for a complete sample of northern spiral galaxies with the 408 MHz Bologna Radio Telescope. Fig. 3 presents their results adjusted by a factor of 1·10 (Fanti *et al.* 1981) to the Wyllie (1969*a*, 1969*b*) scale, along with the Molonglo data; again the agreement is good.

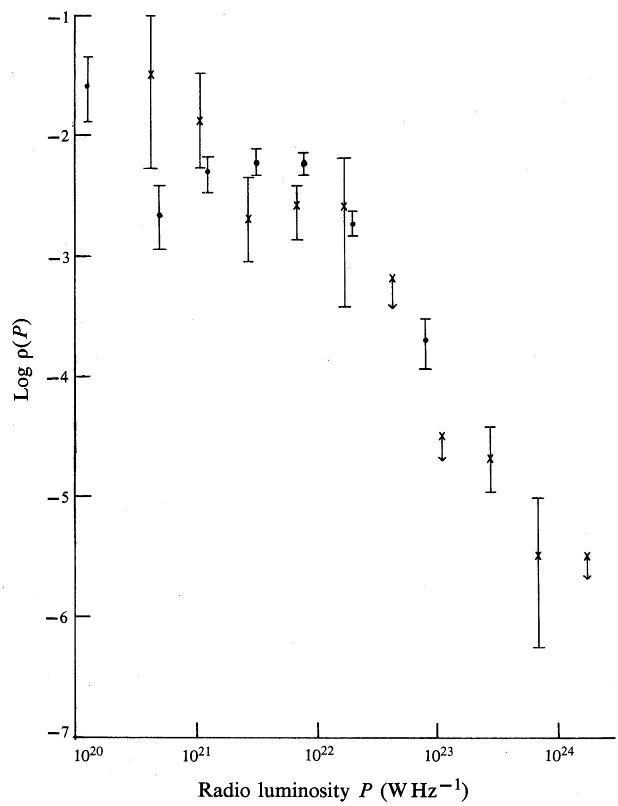

Fig. 3. Radio luminosity function $\rho(P)$ for spiral galaxies plotted for data from this paper (dots) and from the Bologna group of Fanti *et al.* (1973) (crosses).

Error bars were calculated on the basis of the number of galaxies observed, assuming Poisson statistics. For a large number n of detected galaxies, the error is $\pm n^{\frac{1}{2}}$, whereas for $n < 4$ the Poisson tables are used to obtain 1σ values. The same method was used to estimate errors for the Bologna data. For bins containing small numbers of galaxies, the interval size is extended to two magnitudes.

(*b*) *Correlation between radio and optical properties*

Radio index and galaxy types. Previous surveys (Cameron 1971*a*; Hummel 1981) have compared radio observations of galaxies with their optical properties and different classification schemes, for example, Hubble and DDO types. In these surveys, as in the present one, no more than half the galaxies were detected, making direct intercomparisons between galaxy types impossible. This means that indirect statistical methods are necessary. Whereas Hummel (1981) used fractional luminosity functions for his analysis, the present paper uses a calculated detection probability for each galaxy based on its optical magnitude, following the method of Cameron (1971*a*). The sum of the detection probabilities may then be compared with the number of detections for different classification schemes.

The method relies on the assumption of a model for the relationship between radio and optical luminosity. The exact form of the model is not critical for relative comparisons; in this case it is based on the detected spiral galaxies because they form the most complete and best defined group. Their mean radio emission is stronger than the mean of the whole sample, and therefore the calculated number of 'expected' detections in general exceeds the actual number of detections.

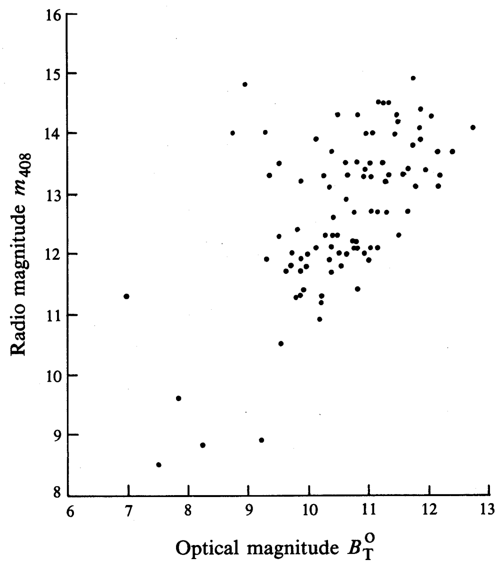

Fig. 4. Radio magnitude m_{408} plotted against optical magnitude B_T^o for all detected spiral galaxies from Sa to Sm.

Least squares analysis of the radio and optical magnitudes of 96 detected spiral galaxies verified a linear relationship with the regression equation

$$m_{408} = 4\cdot 65 + 0\cdot 76\, B_T^o$$
$$\pm 1\cdot 06 \pm 0\cdot 10\,. \qquad (3)$$

The correlation coefficient is 0·7 and there is a vertical r.m.s. scatter of $1^m\cdot 0$. The results are also presented graphically in Fig. 4. The departure of the slope from the expected value of 1·0 is probably the result of selection effects caused by the sensitivity limit of the telescope.

The galaxies were grouped according to the revised Hubble/de Vaucouleurs type, the DDO (van den Bergh) classification, the Byurakan nuclear type and the Yerkes

(Morgan) type. Only the Hubble/de Vaucouleurs classification scheme is complete for the sample and gives meaningful results. Table 2 compares the number of galaxies detected with those 'expected'. Equation (3) has been used to define the model and a gaussian distribution for the scatter in m_{408} is assumed. Fig. 5 shows a plot of radio index R_{408} for detected galaxies against galaxy type. These results together establish that the radio emission of intermediate type spirals is well described by equation (3). In contrast, ellipticals and lenticulars combine a low average detectability with a high dispersion in radio index. Apparently their radio emission is normally low unless they display the activity of 'radio galaxies'. The SO galaxies are the least detectable; they share the normal low emission of ellipticals, but in the present sample there are no examples of radio galaxies.

Table 2. Comparison of detected galaxies with 'expected' detections

	E	L	S0	S1	S2	S3	S4	S5	S6	S7	S8	S9	I
Total detected	14	8	3	4	9	22	28	37	7	6	2	3	4
Uncertain	3	3	0	0	1	3	4	8	3	1	0	1	1
Expected	40·8	34·7	9·1	12·1	15·4	31·4	30·9	42·9	16·1	10·0	5·7	3·8	6·2
Ratio A (%)[A]	27	14	33	33	52	61	78	68	25	50	35	53	65
Ratio B (%)[B]	34	23	33	33	58	70	91	86	43	60	35	79	65

[A] Ratio A is the number of well-detected galaxies, excluding uncertainties, divided by the expected number of detections.
[B] Ratio B is the number of detections, including uncertainties, divided by the expected number of detections.

Distribution of radio index. The distribution of radio index for all galaxies, detected, uncertain and undetected, is shown in Fig. 6. For this complete sample the mean radio index is greater than $2^m \cdot 8$. The active radio galaxies are responsible for the low index tail to the distribution; if these are excluded, the mean radio index is greater than $3^m \cdot 0$. If undetected galaxies are also excluded, the mean radio index of the 'normal' detected galaxies is $2^m \cdot 4$ with an r.m.s. scatter of $1^m \cdot 1$. This lower value is a result of observational selection because of the radio detection limit.

4. Spectral Indices

The spectral indices and standard errors of 73 detected galaxies are listed in Table 1. In conjunction with the 408 MHz data, the surveys of Pfleiderer (1977), Dressel and Condon (1978), Pfleiderer *et al.* (1980), Hummel (1980) and the Parkes and MSH Catalogues summarized in Bolton *et al.* (1979) were used to obtain data for the following frequencies: 80, 85, 1400, 1415, 2380, 2700 and 5000 MHz. Data were initially fitted to a power law $S = \kappa\nu^{\alpha}$, where S is the radio flux density and ν the frequency. The regression coefficient was less than 0·8 for eight cases, so these were rejected. In most cases it was not clear whether the poor fit was caused by confusion and resolution errors or real departure of the spectrum from a power law.

For further analysis a subsample of 50 galaxies was selected, the criteria being that errors in flux density measurements were available and the standard error in the spectral index was $\leqslant 0 \cdot 2$. Fig. 7 indicates the distribution of spectral indices for the subsample and the other galaxies. The distribution is compact, and for the subsample

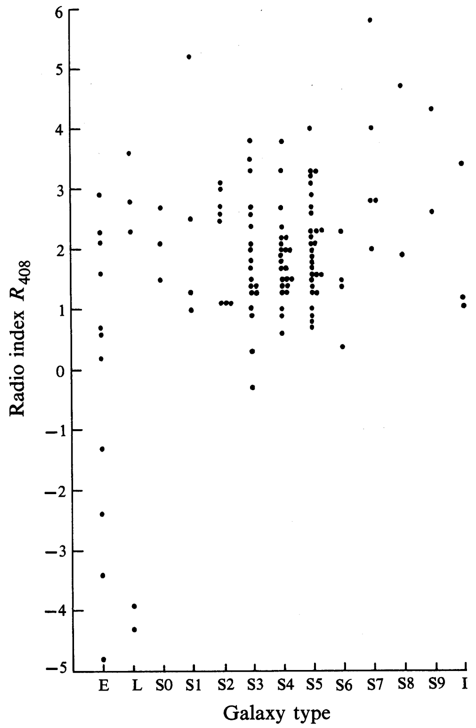

Fig. 5. Radio index R_{408} plotted against galaxy type in the Hubble/de Vaucouleurs classification scheme.

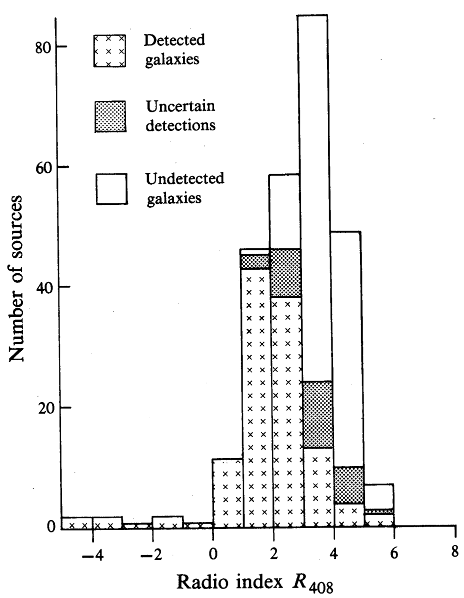

Fig. 6. Distribution of radio index for all galaxies, detected, uncertain and undetected.

the mean index $\langle\alpha\rangle$ is $-0{\cdot}71$ with a dispersion of $0{\cdot}23$. After deconvolution, the dispersion is $0{\cdot}19$. Analysis of the data for 45 spiral galaxies resulted in $\langle\alpha\rangle = -0{\cdot}72$ and a dispersion of $0{\cdot}24$ which, after deconvolution, was $0{\cdot}19$.

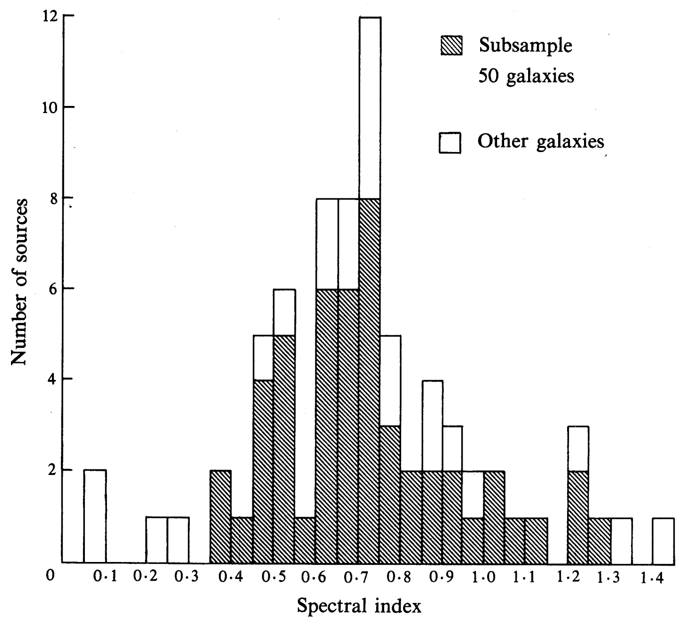

Fig. 7. Distribution of spectral index $|\alpha|$ for detected galaxies. Those with spectral indices less than $0{\cdot}1$ are NGC 1313 and NGC 4594.

Acknowledgments

I thank my supervisor, Professor B. Y. Mills, for his advice during the preparation of this work, Dr W. B. McAdam for his assistance and Professor G. de Vaucouleurs for making available unpublished data. I am indebted to J. Volaric who made the majority of the observations as part of an honours project and M. Calabretta and P. White who also provided observational and calibration material.

The Molonglo Radio Telescope is supported by the Australian Research Grants Committee, the Sydney University Research Grants Committee and the Science Foundation for Physics within the University of Sydney. I acknowledge the receipt of a Commonwealth Postgraduate Research Award.

References

Auriemma, C., *et al.* (1977). *Astron. Astrophys.* **57**, 41.
Bolton, J. G., Wright, A. E., and Savage, A. (1979). *Aust. J. Phys. Astrophys. Suppl.* No. 46.
Cameron, M. J. (1971*a*). *Mon. Not. R. Astron. Soc.* **152**, 403.
Cameron, M. J. (1971*b*). *Mon. Not. R. Astron. Soc.* **152**, 429.
Colla, G., *et al.* (1975). *Astron. Astrophys.* **38**, 209.
Crane, P. C. (1977). Thesis, Massachusetts Institute of Technology.
de Vaucouleurs, G. (1977). *Astrophys. J. Suppl. Ser.* **33**, 211.
de Vaucouleurs, G. (1979*a*). *Astrophys. J.* **227**, 729.
de Vaucouleurs, G. (1979*b*). *Astron. J.* **84**, 1270.
de Vaucouleurs, G., and Bollinger, G. (1977*a*). *Astrophys. J. Suppl. Ser.* **33**, 241.

de Vaucouleurs, G., and Bollinger, G. (1977*b*). *Astrophys. J. Suppl. Ser.* **33**, 247.
de Vaucouleurs, G., and Bollinger, G. (1977*c*). *Astrophys. J. Suppl. Ser.* **34**, 469.
de Vaucouleurs, G., and Bollinger, G. (1979). *Astrophys. J.* **233**, 433.
de Vaucouleurs, G., and Corwin, H. G. (1977). *Astrophys. J. Suppl. Ser.* **33**, 219.
de Vaucouleurs, G., Corwin, H. G., and Bollinger, G. (1977). *Astrophys. J. Suppl. Ser.* **33**, 229.
de Vaucouleurs, G., and de Vaucouleurs, A. (1964). 'Reference Catalogue of Bright Galaxies' (Univ. Texas Press).
de Vaucouleurs, G., de Vaucouleurs, A., and Corwin, H. G. (1976). 'Second Reference Catalogue of Bright Galaxies' (Univ. Texas Press).
de Vaucouleurs, G., and Head, C. (1978). *Astrophys. J. Suppl. Ser.* **36**, 439.
de Vaucouleurs, G., Peters, W. L., Bottinelli, L., Gouguenheim, L., and Paturel, G. (1981). *Astrophys. J.* **248**, 408.
Dressel, L. L., and Condon, J. J. (1978). *Astrophys. J. Suppl. Ser.* **36**, 53.
Fanti, C., Ficarra, A., Gregorini, L., Mantovani, F., and Olori, M. C. (1981). *Astron. Astrophys.* **97**, 251.
Fanti, R., Gioia, I., Lari, C., Lequeux, J., and Lucas, R. (1973). *Astron. Astrophys.* **24**, 69.
Feretti, L., and Giovannini, G. (1980). *Astron. Astrophys.* **92**, 296.
Fomalont, E. B., Bridle, A. H., and Davis, M. M. (1974). *Astron. Astrophys.* **36**, 273.
Hummel, E. (1980). *Astron. Astrophys. Suppl. Ser.* **41**, 151.
Hummel, E. (1981). *Astron. Astrophys.* **93**, 93.
Hunstead, R. W. (1971). *Mon. Not. R. Astron. Soc.* **152**, 277.
Hunstead, R. W. (1972). *Mon. Not. R. Astron. Soc.* **157**, 367.
Hunstead, R. W. (1974). *In* 'New Problems in Astrometry', I.A.U. Symp. No. 61, 1973 (Eds W. Gliese *et al.*), p. 175 (Reidel: Dordrecht).
Large, M. I., Mills, B. Y., Little, A. G., Crawford, D. F., and Sutton, J. M. (1981). *Mon. Not. R. Astron. Soc.* **194**, 693 (Microfiche No. MN194/1).
McAdam, W. B. (1978). *Proc. Astron. Soc. Aust.* **3**, 283.
Pfleiderer, J. (1977). *Astron. Astrophys. Suppl. Ser.* **28**, 313.
Pfleiderer, J., Durst, C., and Gebler, K. (1980). *Mon. Not. R. Astron. Soc.* **192**, 635 (and Microfiche MN192/1).
Robertson, J. G. (1978). *Mon. Not. R. Astron. Soc.* **182**, 617.
Sandage, A. (1978). *Astron. J.* **83**, 904.
Schilizzi, R. T., and McAdam, W. B. (1975). *Mem. R. Astron. Soc.* **79**, 1.
von Hoerner, S. (1973). *Astrophys. J.* **186**, 741.
Wyllie, D. V. (1969*a*). *Mon. Not. R. Astron. Soc.* **142**, 229.
Wyllie, D. V. (1969*b*). *Proc. Astron. Soc. Aust.* **1**, 234.

Manuscript received 1 December 1981, accepted 15 March 1982