

A CATALOGUE OF LINEAR POLARIZATION OF RADIO SOURCESH. TABARA ⁽¹⁾ and M. INOUE ⁽²⁾ (*)⁽¹⁾ Faculty of Education, Utsunomiya University, Mine 350, Utsunomiya 320, Japan⁽²⁾ Department of Physics, Nagoya University, Chikusa-ku, Nagoya 464, Japan*Received May 28, 1979*

Summary. — This catalogue is a compilation of all the data of linear polarization of radio sources published prior to December 1978. The catalogue contains 7225 data for 1510 radio sources. Polarization parameters derived from the data are also tabulated with other physical parameters.

Key words : Linear polarization — Radio source — Rotation measure — Depolarization.

1. **Introduction.** — Measurements of linear polarization from radio sources have been extensively made at various wavelengths, but the data are inconveniently scattered over a great number of publications.

It is necessary to combine all these data to calculate the rotation measure and depolarization of radio sources, which are important for the investigation of the physical condition in the radio sources and of the space between the sources and the observers (e.g. Gardner and Whiteoak, 1963; Sofue *et al.*, 1968; Kronberg *et al.*, 1972; and Morris and Tabara, 1973).

Entries in the catalogue are 1510 radio sources containing the data published prior to December 1978. All of the quoted values with occasional negative numbers for the position angle of polarization are taken from the original references. The result of the analysis of these data will be presented elsewhere.

2. **The data of linear polarization.** — The observational results of linear polarization of radio sources are listed in table I. The sources are listed in order of increasing right ascension.

Column 1 : source name.

Column 2 : the wavelength in cm. In the case of radio sources resolved in two or three components, the data for the individual components are also listed after the data of the integrated polarization. The symbols W, E, N, S, and C at the head of the column denote the west, east, north, south, and central component, respectively.

Column 3 : the percentage polarization (P) and its error (ΔP).

Column 4 : the position angle of polarization (PA) and its error (ΔPA).

Column 5 : notes on the references. See the corresponding number in the note to table I next to table II.

Some observations of the linear polarization are monitors of the time variation. In these cases the data are given by averaging over the whole period and are denoted by an asterisk in column 5 of table I. Table II lists the sources which show apparently time variation in the linear polarization. Columns 1 and 2 show the source name and another well-known name. Column 3 gives the monitored wavelengths at which the source is recognized to be obviously variable. Column 4 gives note on the references that is the same as the column 5 of table I.

3. **Source characteristics.** — The radio and optical characteristics of the radio sources listed in table I are given in table III. To determine the polarization parameter, we have used the data in table I except for the data published prior to 1964 and reference 27 on the ground that some of the data have large or systematic errors.

Column 1 : source name.

Columns 2-5 : alternate source name.

Columns 6, 7 : the radio position for epoch 1950, but in a few case with an asterisk, the optical position.

Columns 8, 9 : the galactic coordinates of the sources.

Columns 10, 11 : the source identification and optical magnitude. The source with an asterisk is variable in magnitude.

QSO : quasi stellar object

GAL : galaxy

SNR : supernova remnant

HII : H II region.

Column 12 : redshift.

Column 13 : radio flux densities in Jy ($= 10^{-26} \text{ W Hz}^{-1} \text{ m}^{-2}$) at 6 cm. The sources with an asterisk is variable.

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Columns 14-16 : the values of rotation measure (RM) and its error in rad/m^2 , the intrinsic position angle (IPA) and its error in degrees, and the grade of these values. The RM and IPA are defined as

$$\phi(\lambda) = RM\lambda^2 + IPA ,$$

where $\phi(\lambda)$ is the position angle at the wavelength λ (Gardner and Whiteoak, 1963). The method of calculation of RM is given in the next section.

Columns 17, 18 : the maximum degree of polarization and the depolarization wavelength in cm at which the percentage polarization drops to half its maximum value (e.g. Kronberg *et al.*, 1972). The values are estimated graphically.

Columns 19-22 : notes on the references corresponding to the radio position, optical identification and optical magnitude, redshift, and radio flux density. See the note to table III.

4. Calculation of rotation measure. — For the calculation of RM , the sources with position angle observed at more than distinctly two wavelengths between 6 and 31 cm were selected. The calculation was performed by a weighted least-squares fit to a straight line. The weighting factor of PA was the square of its error ΔPA . For sources without data of ΔPA , we estimated ΔPA using P and ΔP by the following formula,

$$\Delta PA = (\tan^{-1} \Delta P/P)/2 .$$

The fitting was made for all possible choices of $\pm n \times 180$ degrees ambiguities ($n = 0, \pm 1, \pm 2, \dots$) of PA .

The range of RM search was less than 200 rad/m^2 except at low galactic latitudes ($\cot |b| < 2$), where the range was extended to $100 \cot |b| \text{ rad/m}^2$ in consideration of the contribution of our galactic disk. Goodness of fit was tested by the chi-square (χ^2) method and the values of RM and IPA in table III are given in the case that the integral probability $P(\chi^2, \nu)$ is the highest, where $\nu = N - 2$ is the number of degree of freedom left after fitting N data points to the two parameters of RM and IPA . As shown in column 16 of table III, sources are classified into three grades according to their integral probability $P(\chi^2, \nu)$. Let P_1 and P_2 be the probabilities for the maximum and the second maximum values of $P(\chi^2, \nu)$. Sources of grade *A* have $P_1/P_2 \geq 10$ and $P_1 \geq 20\%$, and that of grade *B* the same but $1\% \leq P_1 < 20\%$. The remainder, e.g. $1\% < P_1$ or $P_1/P_2 < 10$ are more ambiguous in the value of RM than that of grade *A* and *B*, and we give no mark in column 16 of table III.

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TABLE III (continued).

NAME	PKS	3C	4C	ALT. NAME	R.A.	DEC.	(L, B)	DT	MAG	Z	S(6)	PH	PA	G	P(MAX)	DEP	NOTES					
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	
2315-182	2315-18				23 15 09.7	-18 16 36	30.4 +88.2	GAL	19.0		0.60							133	231	407		
2315-639	2315-639				23 15 36.5	-43 34 10	346.0 +84.7				0.48							113	228	430		
2315-012	2315-01		01.74		23 15 43.7	01 12 36	80.6 -55.4	GAL	20.0		0.28							158	221	423		
2315-122	2315-12				23 15 46.0	-12 12 46	62.5 +82.0	GAL	19.0		0.49							116	212	408		
2315-167	2315-16				23 15 37.13	-16 42 04.3	54.0 +85.6				0.25							117	217	407		
2315-340	2315-340				23 15 39.1	-34 05 45	8.9 -84.4	850	18.5		0.50							128	212	408		
2314-038	2314-03	459.0	03.57		23 14 02.51	03 48 55.0	83.0 +51.3	GAL	17.5	0.2199	1.56	-64.8	2.0	7	6	3.5	35	106	208	301	401	
2314-388	2314-38		39.73		23 15 25.19	39 34 09.5	104.1 -19.5	GAL	20		0.40							110	202	419		
2314-349	2315-408		37.69		23 15 25.9	-40 44 30	352.1 +84.6	850	17.5		0.36							127	207	408		
2314-423	2314-423				23 16 24.0	-42 23 20	348.4 +65.9				0.54							127	207	408		
2317-372	2317-372				23 17 10.9	-37 13 09	0.3 +84.3				0.35							137	207	408		
2317-277	2317-27				23 17 14.9	-27 44 27	76.7 +89.7	GAL	17.5		1.24	9.8	1.1	90	1	15	221	132	231	407		
2318-079	2318-07				23 18 07.6	07 37 12	87.9 +88.4	GAL	12.8	0.0119	0.21	-10.4	2.2	36	4	12	221	142	233	303	407	
2318-164	2318-16				23 18 24.85	-16 20 21.9	55.4 +86.5				0.40							117	207	407		
2318-235	2318-23	460.0	23.58		23 18 58.7	23 30 31	97.7 +34.4	GAL	18.5	0.2440	0.34	-74.9	7.4	108	12	8	3	221	139	208	301	401
2319-550	2319-55		27.30		23 19 14.76	-55 01 55.1	327.3 -57.9	850	18.0		0.45	23.5	4.1	144	6	9	17	117	210	408		
2319-272	2319-27				23 19 31.98	27 16 15.1	99.7 -31.5				1.07							170	207	404		
2320-079	2319-07			DA 599	23 20 03.90	07 55 33.8	88.5 +84.6	850	17.5	2.090	0.71							106	209	310	408	
2321-985	2321-98	461.0		CAS A	23 21 12.46	58 32 45	111.7 -24.1	SMR		910	320.0	3.6	177	7	1			141	208	420		
2322-040	2322-04				23 22	-04	77.6 -58.7				0.44							127	207	408		
2322-811	2322-81				23 22 21.4	-81 08 09	349.7 +81.5				0.39							134	208	407		
2322-572	2322-57				23 22 21.5	-57 12 55	324.2 -56.5				0.37							105	233	303	407	
2322-123	2322-12				23 22 43.69	-12 23 57.3	62.3 +86.9				0.36							106	207	407		
2322-052	2322-05		-05.96		23 22 44.77	-05 14 05.7	74.3 -59.8	GAL	18.5	0.0823	0.37							106	207	407		
2323-435	2323-43			OZ 438	23 23 18.37	43 30 28.9	107.0 -14.4	GAL	18.3		1.01							116	222	424		
2323-407	2323-40				23 23 21.69	-40 43 48.0	350.2 +84.0	GAL	19.5		1.00	28.8	7.7	138	12	19	14	117	207	408		
2324-023	2324-02				23 24 20.34	-02 18 47.6	80.4 -57.8	GAL	18.9		1.11	-27.2	6.5	44	11	5	221	113	228	407		
2324-269	2323-26	463	27.52		*23 23 28.5	26 59 26	101.0 -32.0	850	17.5	0.875	-88.3	2.4	88	8	5-9	12	150	209	310	401		
2325-293	2325-29		29.68	CTD 141	*23 25 42.30	29 20 38.3	102.1 -29.9	850	17.3	1.015	0.53	-72.5	1.8	45	5	6	10	150	209	310	401	
2325-151	2325-15				23 25 55.3	-15 10 49	61.1 +67.2	850	20		0.76							133	207	407		
2326-477	2326-47				23 26 33.6	-47 44 52	335.7 +84.1	850	16.0	1.299	2.064	24.2	4.3	119	6	5	221	134	209	310	408	
2326-002	2326-00				23 26 36.0	-52 12 18	332.0 +82.3	850	19.0		0.75							134	210	408		
2328-107	2328-10		10.73		23 28 08.92	10 43 44.9	93.1 +87.1	850	18.1	1.489	0.90	91.1	11.7	160	19	6	20	106	209	310	401	
2329-182	2329-18				23 29 03.0	-18 13 29	40.0 +84.4				1.03							133	207	407		
2329-384	2329-38				23 29 18.9	-38 28 22	354.3 -70.0	850	17.0	1.195	0.47							127	209	310	408	
2329-296	2329-29		29.69		23 29 31.63	29 40 15.1	103.1 +29.8	GAL	19.8		0.24							110	202	419		
2331-417	2331-41				23 31 49.37	-41 42 02.5	345.8 +86.7				1.45	33.0	9.1	155	14	3-5	11	117	213	408		
2332-469	2332-46				23 32 20.4	-46 34 04	314.3 +84.8				0.75	29.1	3.4	89	5	8	221	130	408			
2333-528	2333-52				23 33 29.1	-52 52 36	526.7 +80.9				1.154							134	210	408		
2335-027	2335-02				23 35 23.24	-02 47 35.7	84.2 -59.7	850	19.3	1.072	0.63							113	228	407		
2335-021	2335-02	03.59			23 35 22.5	-02 47 35.7	84.2 -59.7	850	19.3		0.61							113	214	407		
2335-267	2335-26	465.0	26.64		23 35 37.5	26 44 38	103.5 -33.1	GAL	13.29	0.0293	2.80	100.6	6.9	23	12	4-5	13	149	208	301	401	
2337-334	2337-33				23 37 17.4	-33 24 28	71.2 +73.4				1.56							128	208	408		
2337-220	2337-22	466	22.63		23 37 51.79	22 04 17.0	102.1 -37.6				0.69							106	207	407		
2338-132	2337-13		13.88		23 38 00.94	13 16 22.3	97.8 +85.8				0.32							106	207	407		
2338-047	2338-04		04.81		23 38 24.62	04 16 28.0	92.0 +54.1	850	19.5		0.45	6.5	4.3	148	3	6	14	105	201	407		
2338-146	2338-14				23 38 34.85	-14 37 29.8	62.8 -70.5				0.43	-9.1	0.3	39	0	4	2-3	117	207	407		
2338-365	2338-36				23 38 37.29	-38 32 46.3	319.6 -56.5				0.94	0.3	7.0	88	11	4	20	117	207	407		
2339-353	2339-35				23 39 08.8	-35 23 04	0.4 -73.1				0.46							127	207	408		
2340-036	2340-03				*23 40 22.5	-03 40 20	85.4 +61.2	850	17.0	0.894	0.35							150	209	310		
2344-092	2344-09	09.74			23 44 03.95	08 14 05.9	97.5 -50.1	850	15.976	0.672	1.384	0.7	1.3	143	4	4-5	349	106	209	310	408	
2345-167	2345-16				23 45 27.493	-16 47 52.779	62.5 +71.9	850	18.0	0.4005	4.138	-19.5	12.8	30	14	3	221	101	209	310	401	
2345-184	2345-18	467	18.71		23 45 37.10	18 27 21.3	102.8 +81.7	GAL	19.5	0.651	0.45	-54.5	0.2	113	0	7	15	106	216	302	407	
2346-004	2346-00				23 46 08.1	00 27 10	112.9 +10.9				0.35							141	207	407		
2347-026	2347-02		-02.90		23 47 51.50	-02 41 23.7	89.8 +61.3				0.45							113	207	407		
2348-643	2348-64	468.1			23 48 27.30	64 23 37.2	116.5 2.4				0.87	-93.9	5.7	151	10	1-5	20	153	203	401		
2348-014	2348-01		-01.41		23 49 22.48	-01 25 56.5	91.7 +80.4				0.62							156	233	303	407	
2351-006	2351-00				23 51 35.36	-00 34 28.9	93.4 +39.9	850	19.0	0.463	0.48							113	209	310	408	
2352-495	2352-49			DA 611	23 52 37.784	49 33 26.78	113.7 -12.0	GAL	19	1.												