SHORT COMMUNICATIONS

OBSERVATIONS OF 11 RADIO SOURCES NEAR 55 MHz*

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A recent investigation of radio sources in the northern hemisphere was made by Kellermann (1966). He attempted to explain some of the characteristics of the sources that were observed to have curved spectra. In order to make a similar investigation possible for sources in the southern hemisphere, more observations especially at low frequencies are needed. Recently surveys have been published at 153 MHz (Hamilton and Haynes 1967) and between 40 and 120 MHz (Haynes and Hamilton 1968). Continuing these observations, we report here on measurements of 11 radio sources made at the Australian National Radio Astronomy Observatory, Parkes, N.S.W., in January 1968.

A total power receiver tuned from 50 to 70 MHz was used. The bandwidth was 1 MHz and the receiver noise temperature was 630°K. The feed was a broad band helix mounted at the focus of the 210 ft telescope. The helix, with diameter 20 in. and length 8 ft, consisted of two coaxial windings in the same sense with pitch angles of 35°. The two windings were fed 180° out of phase and matching from 300 Ω to a 70 Ω cable was achieved with a broad band transformer. The feed was sensitive to waves with right-hand circular polarization.

The spectrum of the source Hydra A (PKS 0915−11) as given by Conway, Kellermann, and Long (1963) was used as the reference spectrum for all the observations. This source was used to calibrate a temperature saturated noise diode which was used as a secondary standard. The noise diode was coupled to the receiver with a directional coupler. Repeated scans of Hydra A showed that the beamwidth of the telescope near 55 MHz is close to 6°.

The sources to be observed were selected with the following criteria.

(1) The source is sufficiently strong to permit reliable measurements.

(2) No nearby strong sources exist to produce confusion.

(3) The galactic background radiation in the vicinity of the source is low.

Of the sources measured, five were known to have curved spectra.

Below 100 MHz observations of sources are hindered by the presence of man-made interference, and during the present observations only three channels were found to be sufficiently clear to permit reliable measurements. These were centred at 54·2, 59·2, and 67·4 MHz and were generally clear between 0000 and 1000 hr local time.

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Table 1

SOURCE MEASUREMENTS

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
PKS Catalogue Number	Position (1950·0) R.A. h m s	Dec. ° ′	Present Results (f.u.) $S_{54\cdot2}$	$S_{59\cdot2}$	$S_{67\cdot4}$	Previous Observations (f.u.) $S_{85\cdot5}$	S_{153}	S_{408}	S_{1410}	Freq.	S	Remarks
0320−37	03 20 42	−37 25·0	1022	—	985	950	474	249	—	42·7 46·3 58·0	1255 1532 1309	NGC1316, Fornax A
0859−25	08 59 37	−25 44·2	—	44·2	—	54	51	16·4	5·8	—	—	
1226+02	12 26 34	+02 19·1	338·6	377·8	—	167	(150)	55·1	41·2	99·2	134	3C273
1302−49	13 02 32	−49 12·1	—	19·2	—	20	—	14·0	7·4	—	—	NGC4945
1355−41	13 55 56	−41 38·0	—	64·2	—	35·0	22·0	13·2	4·6	—	—	
1459−41	14 59 11	−41 54·3	—	76·0	—	55·0	32·9	17·4	4·7	87·0 105·2	60·9 40·7	Extended
1648+05	16 48 42	+05 04·5	—	—	1050	890	424	161	46·0	98·0 113·0	695·6 627·0	3C348
1814−63	18 14 49	−63 46·9	—	76·0	—	71·0	—	34	14·2	94·0 108 113·2	74·6 80·0 86·4	
1932−46	19 32 20	−46 28·2	284·7	—	—	141	(157)	39	13·4	89 116 97	136 112 124	Polarized Extended E–W
2152−69	21 52 58	−69 55·8	—	355·0	—	253	—	80	32	89·0 99 112·5	218·7 198 160·7	
2356−61	23 56 24	−61 11·7	364·0	—	—	296·0	—	66	23·7	84·0 99 115	254·8 208 165·0	

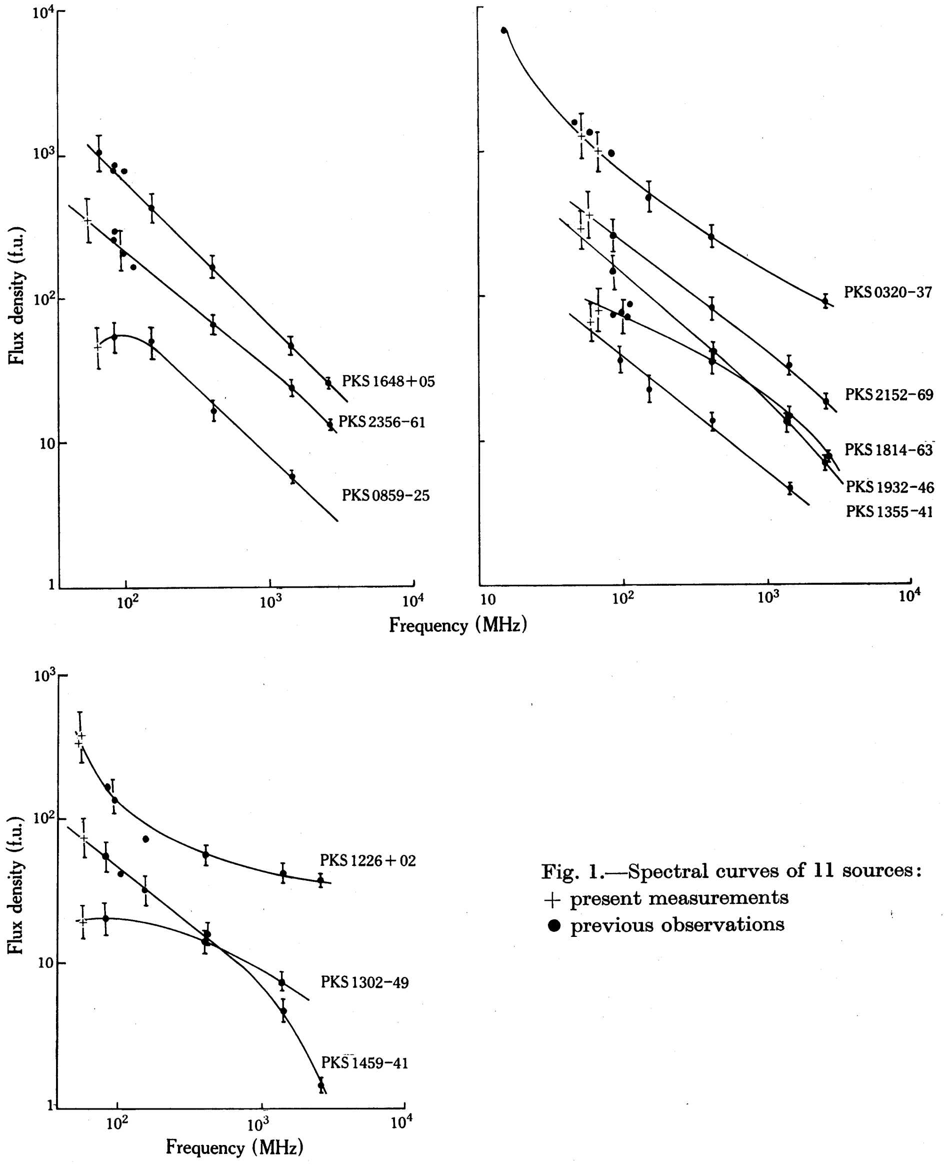

Fig. 1.—Spectral curves of 11 sources:
+ present measurements
● previous observations

The results of the source measurements are given in Table 1, together with observations of other workers. Notes on the table are as follows.

Column 1. Parkes catalogue number.

Columns 2 and 3. Right ascension and declination (1950·0).

Columns 4, 5, and 6. Present observations of flux density at 54·2, 59·2, and 67·4 MHz.

Column 7. Flux density at 85·5 MHz from Mills, Slee, and Hill (1958).

Column 8. Flux density at 153 MHz from Hamilton and Haynes (1967).

Columns 9 and 10. Flux densities at 408 and 1410 MHz from the Parkes catalogue (Bolton, Gardner, and Mackey 1964; Day *et al.* 1966; Shimmins *et al.* 1966).

Columns 11 and 12. Flux densities at various frequencies between 40 and 120 MHz from Haynes and Hamilton (1968).

Column 13. Remarks.

The accuracy of the measurements is affected by: (1) errors in calibrating the noise diode secondary standard, (2) errors due to neighbouring sources within the telescope beam, and (3) errors due to faint transmitting stations within the passband of the receiver. Of these factors (2) was largely eliminated by selecting suitable sources, and repeated scans permitted the rejection of records affected by interference (3). The flux densities given are thought to be accurate to within 12% $\pm 3\cdot 8$ f.u.

Figure 1 gives the observed spectra for the 11 sources measured. In all, 8 of the 11 sources appear to have curved spectra. Following the convention of Bolton, Gardner, and Mackey (1964) for classifying spectra, sources PKS 1226+02 and PKS 0320−37 have negative curvature spectra while 6 sources show positive curvature spectra. The source PKS 0859−25 seems to have a spectrum that implies a single source in which the synchrotron radiation is being affected by self absorption. The source PKS 1302−49 has a spectrum that is not characteristic of a single absorption mechanism affecting the synchrotron emission spectrum but may result from a cutoff in the high energy electron spectrum combined with absorption at lower frequencies. Three sources PKS 1459−41, PKS 1814−63, and PKS 1932−46 show a steepening of their spectra at high frequencies, suggesting a cutoff in the high energy electron spectrum.

This programme of low frequency source measurements is being continued.

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