Study of RCR Catalogue Radio Source Integral Spectra

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(Received February 21, 2018; Revised May 15, 2018)

We present the characteristics of the sources found on the averaged scans of the “Cold” experiment 1980–1999 surveys in the right-ascension interval $2^h < \text{RA} < 7^h$. Thereby, a refinement of the parameters of the RC catalog sources (RATAN Cold) for this interval is complete. To date, the RCR catalog (RATAN Cold Refined) covers the right-ascension interval $2^h < \text{RA} < 17^h$ and includes 830 sources. The spectra are built for them with the use of new data in the range of 70–230 MHz. The dependence between the spectral indices $\alpha_{0.5}$, $\alpha_{3.94}$ and integral flux density at the frequencies of 74 and 150 MHz, at 1.4, 3.94 and 4.85 GHz is discussed. We found that at 150 MHz in most sources the spectral index $\alpha_{0.5}$ gets steeper with increasing flux density. In general, the sources with flat spectra are weaker in terms of flux density than the sources with steep spectra, which especially differs at 150 MHz. We believe that this is due to the brightness of their extended components, which can be determined by the type of accretion and the neighborhood of the source.

1. INTRODUCTION

Within the “Cold” experiment [1–3] from 1980 to 2000, several surveys of the sky strip on the declination of the microquasar SS 433 ($\text{Dec}_{2000} = 4^\circ 59' \pm 20'$) performed at the RATAN-600 radio telescope. Based on the 1980–1981 observations, the RC catalog of radio sources (RATAN Cold) [4, 5] was published, including 1209 objects with the flux density higher than 5 mJy, detected at the frequency of 3.94 GHz. At such flux densities, practically all the sources found within the “Cold” experiment are galaxies with active nuclei (AGN, Active Galaxy Nucleus) and powerful sources in the radio range [6].

In AGN, synchrotron radiation in the radio range is produced by ultrarelativistic particles in the magnetic field. High-energy cosmic particles are accelerated in the jet that transports them from the active nucleus to the shock region, called the hot spot [7]. Then a beam of cosmic rays expands from the center of the shock region, forming extended components of radio emission [8].

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Synchrotron radiation in all the processes occurring in different structures of a radio source is usually described by a power function \( F(\nu) \propto \nu^\alpha \), where \( F(\nu) \) is the flux density at the \( \nu \) frequency. However, internal variations in the energy distribution of cosmic rays, the environment of the source, the processes taking place in the interstellar medium, spectral “aging” [9], caused by a faster de-excitation of high-energy particles, and also the relative brightness of various components, namely, of the core, jets, hot spots and extended components, play an important role in the formation of its integral radio spectrum [10]. An important issue in understanding the formation of a radio spectrum is an estimation of the contribution of physical components of the source to the total radiation in different frequency ranges and for different orders of radio luminosity.

Multifrequency studies of spectral characteristics of the “Cold” survey sources were repeatedly carried out, starting with the publication of the RC catalog [4, 5] itself in 1991–1993, followed by the studies of 1989–1996 by Bursova et al. [11–13] and of 2001–2006 by Soboleva et al. [14, 15]. The spectra of sources of the refined RC catalog, or the RCR (RATAN Cold Refined) [16], for the right-ascension interval \( 7^h < RA < 17^h \) were also investigated involving the VLSSr survey [17, 18], including the flux density estimates from the VLSSr and GB6 [19] survey maps.

With the advent of new surveys in the low-frequency spectral region in the range of 72–231 MHz, GLEAM [20] and TGSS [21] with the detection threshold of 50 mJy and angular resolution from \( 25'' \), it became possible to refine the spectra of the RCR sources, especially for that half of the catalog objects in which the flux data were known only at two frequencies, 1.4 and 3.94 GHz. For the interval of \( 2^h < RA < 7^h \) this was already done by Zhelenkova et al. [22]. Here we have carried out this task for the entire right-ascension interval of \( 7^h < RA < 17^h \).

2. RCR-SOURCES IN THE INTERVAL \( 2^H < RA < 7^H \) AT THE WAVELENGTH OF 7.6 CM

The study of Soboleva et al. [16], publishing the RCR catalog (RATAN Cold Refined), which includes sources from the interval of \( 07^h < RA < 17^h \), gives the characteristics of objects that are detected on the scans when they are processed by two methods that differ the way the background of the sky is determined on the averaged scans. Reduction of the sky background, as it is done in the fgr [23] package, used in the processing, consists of an iterative approximation to a certain background curve owing to a convolution with the weight function. Varying the size of the background calculation window, the number of iterations and the level, we can change the shape of the calculated curve. A rectangle was used as the weight function, i.e. the sliding averaging was performed. The first reduction method determined the background by a convolution with a window
of 80°, and in the second case, with a window of 20°.

Using two different ways of accounting for the sky background, as it turned out, allows to obtain more accurate results in determining the right ascension and flux density of the sources. This is also useful for a more complete source detection. So, for example, three quarters of the sources were identified in the records using both methods, while the fourth part of the sources was detected on the scans applying the first or the second method of sky background approximation.

The reduction results for the right-ascension range of \(02^h < RA < 07^h\), where the sky background is “smoothed” by the 20° window are published in the study of Zhelenkova et al. [22]. Here we give the right ascensions, integral flux densities, and the corresponding errors of determination of these variables for the list of sources found on the scans, “smoothed” by the window of 80°. Thereby, the refinement of the RC catalog object parameters for this interval of right ascensions is now complete.

When processing the observational data at the wavelength of 7.6 cm, we used standard reduction methods. The reduction procedure is described in detail in the study of Soboleva et al. [16]. The convolution of averaged scans was performed with the calculated beam pattern in its central section. Before the identification of objects, the background was reduced with the window of 80°. Next, the sources on the scans were identified using the gaussian analysis. The time referencing was done to the strong sources of the NVSS survey [24]. For each detected radio source its position on the scan \(RA\), antenna temperature \(T_a\) and the Half-Power Beam Width (HPBW) were determined. The integral flux density \(F\) was calculated using the formula: \(F = k_{eff} \times k_i \times T_a/k_{DN}\), where \(k_{eff}\) is a coefficient that takes into account the effective area of the antenna, \(k_i\) is a correction factor taking into account the difference of calibrations and a slight difference in the effective area of the antenna in the observational cycles, \(i\) is the number of the cycle, \(k_{DN}\) is a diagram coefficient indicating how much the response from the source is weakened when it is removed from the central section of the beam pattern. The \(k_i\) coefficient was determined from the sources with well-known spectra, its value lies in the range of 1.1–1.5 depending on the year of observations. The value of \(k_{eff}\) was equal to 3.5.

The diagram coefficient \(k_{DN}\) was calculated for each radio source with the allowance for a transverse offset of the feed horn along the focal line of the secondary mirror and the distance of the radio source along the vertical to the central section by the algorithms presented in the study of Majorova [25].

After determining the flux densities and right ascensions of the objects in each cycle of observations, the mean \(F\) and \(RA\) over all cycles were calculated with the corresponding errors.
2.1. Radio Source List

Soboleva et al. [16] published a summary of sources in the interval of \(07^h < RA < 17^h\) and listed the characteristics of the objects found on the scans, where the background of the sky is “smoothed” both by the window of \(80^s\), and \(20^s\). The difference in data reduction is called the first and the second methods, respectively. In this paper, we will adhere to the format of the table from [16] and to the already published characteristics of the sources [22], which are found on the scans, “smoothed” by the window of \(20^s\), and add the parameters of the sources, which are identified on the scans, where the background was determined using a filter with the window of \(80^s\).

The sources discovered by both the first and second methods in the interval \(2^h < RA < 7^h\) are presented in Table 1, where column (1) lists the source name, composed of the source coordinates \(RA_{2000}\) and \(Dec_{2000}\) from the NVSS [24] catalog. Columns (2) and (3) contain the right-ascension differences of the objects \(\Delta RA_1\) and \(\Delta RA_2\) with errors, where \(\Delta RA_1 = RA_{NVSS} - RA_1\) and \(\Delta RA_2 = RA_{NVSS} - RA_2\), \(RA_{NVSS}\) is the right ascension of the source according to the NVSS data. Columns (4) and (5) list the flux densities of the sources \(F_1\) and \(F_2\) in mJy with the inaccuracies (as the average over all the observational cycles). \(RA_1\) and \(F_1\), \(RA_2\) and \(F_2\) are respectively the right ascensions and flux densities, obtained during the processing of observational data by E. K. Majorova using the first method, and by N. S. Soboleva with A. V. Temirova using the second method (see Table 1 in [22]).

Columns (6) and (7) give the values of spectral indices \(\alpha_{3.94}\) and \(\alpha_{0.5}\) \((F_\nu \propto \nu^\alpha)\), which are determined at the frequencies of 3.94 and 0.5 GHz, respectively. The latter frequency was chosen by analogy with the study of Miley and De Breuck [26].

Column (8) “Morph” provides comments on the morphology of the sources, determined from the NVSS and TGSS survey maps, as well as the features of registration of sources by the RATAN-600 beam pattern:

- “d”, “m” is a source with two or more NVSS-components respectively;
- “b” is a blend, i.e. two or more sources are registered as one due to the shape and size of the telescope’s beam pattern;
- “R” is a blended source that can be resolved by software.

Column (9) “Flx” lists comments on the features of flux density measurements and variability. The last based on the literature or the simple condition \(F_{var} > 3\), where \(F_{var} = (F_{max} - F_{min})/\sqrt{err_{max}^2 + err_{min}^2}\):

- “V” is a variable, according to the literature, radio source, or “v”, suspected of variability [28];
– “F” – the source flux density in the FIRST survey is higher \( F_{\text{var}} > 3 \) than that in the NVSS, which is a sign of possible variability;
– “B” – there is a significant \( F_{\text{var}} > 3 \) flux density scatter at the frequencies of 3.94–5 GHz according to the catalog data;
– “E”, “e” – the estimates of the source flux density from the GB6 survey maps are brighter \( F_{\text{var}} > 3 \) or, respectively, weaker than ought to be from a comparison of the estimated flux density and the one measured at the frequency of 3.94 GHz;
– “s” (scattered) is a large spread of the flux density data at different frequencies;
– “#” – the flux density data is available only at the frequencies of 1.4 and 3.94 GHz;
– “1” – detected only in one cycle of “Cold” experiment.

Column (10) “Sp.” lists the types and features of the radio spectra:

– “l” is the spectrum where the flux density \( F \) dependence on \( \nu \) is described by a power function \( F \propto \nu^\alpha \) and is approximated on the logarithmic scale by a straight line (S-spectrum);
– “+” and “-” – the spectrum at higher frequencies gets flatter (C+) or steeper (C-), respectively;
– “h” (hill) – the complex spectrum is formed by imposing a power-law spectrum on a spectrum with self-absorption at the frequencies from 0.1 to 12 GHz. In this case the spectral index \( \alpha_{0.5} \) was determined from the spectrum built from the data up to 1 GHz, while \( \alpha_{3.94} \) – from 1 GHz and higher;
– “g”, “p” – is the spectrum with a maximum in the range of GHz or MHz, respectively;
– “G” – is a well-known source of GPS (GigaHertz Peak Spectrum);
– “u” (upturn) – there is a minimum in the spectrum, followed by growth at the frequencies above 5 GHz.

We recall that the altitude of observations for the RATAN-600 antenna in the surveys was chosen by the visible coordinates of the SS 433 object from the beginning of the “Cold” experiment in 1980 and was retained in the subsequent cycles, i.e. the investigated strip of the sky was slightly offset in the declination from cycle to cycle. Thus, some sources could be registered only in one survey [29]. This refers to 065848.74+045522.0. All the other sources in the published list were found in at least two cycles of the “Cold” experiment.

A total of 256 sources were identified in the right-ascension interval \( 2^h < RA < 7^h \). Of these, 68% are found using two methods and 32% – applying the first or the second method.
3. SPECTRAL CHARACTERISTICS OF RCR SOURCES

In the literature, publications on the multifrequency studies of the spectra of radio sources are not so common. As an example, one can cite one of the first papers of Laing and Peacock [30], and then: Ker et al. [31], Mahony et al. [32], Whittam et al. [33], Calistro Riviera et al. [34].

Laing and Peacock [33] found in the 178–2700 MHz frequency range the dependence of the shape of the radio source spectra on luminosity. More powerful sources have a flatter spectrum, while weaker sources reveal a steepening of the spectrum at low frequencies.

Whittam et al. [33] noted the enhancement of the flux for radio galaxies at high frequencies (15.7 GHz) and suggested that this could be due to the nuclei of the FRI-type sources that become dominant in this range.

Investigations of a sample of radio galaxies from the LOFAR deep survey in the range from 150 MHz (the limit of 120–150μJy) and up to 1.4 GHz (28μJy) have shown that the steepening at low frequencies, observed for faint AGNs can be explained by the domination of radio source components with a steep spectrum, although the contribution of components with a flat spectrum becomes more significant at high frequencies, making the spectral index more flat [34]. Due to a rather high uncertainty in the flux density estimation owing to different angular resolutions in the surveys and methods of source detection, this result may be rather ambiguous for AGNs since they are extended sources.

The spectral characteristics of the sources that were detected in the “Cold” experiment surveys have been repeatedly determined both from the multifrequency observations conducted at the
The scattering diagram for the spectral indices and integral flux density at the frequency of 3.94 GHz $F_{3.94}$ for the RC catalog radio sources: (a) for 304 objects from [4, 5] and (b) for 396 sources from [13]. The values for the sources are shown in the figures by gray circles. Each list was divided into the bins based on the flux density. The median value of the spectral index and the flux density of each bin is shown on the plot with a black square. The dashed line describes the linear regression.

Figure 2. The scattering diagram for the spectral indices and integral flux density at the frequency of 3.94 GHz $F_{3.94}$ for the RC catalog radio sources: (a) for 304 objects from [4, 5] and (b) for 396 sources from [13]. The values for the sources are shown in the figures by gray circles. Each list was divided into the bins based on the flux density. The median value of the spectral index and the flux density of each bin is shown on the plot with a black square. The dashed line describes the linear regression.

RATAN-600, and with the involvement of data from well-known catalogs.

The sensitivity limit of the “Cold” experiment surveys in 1980–1981 was significantly better than the ones of all the catalogs available then. Therefore, in the RC catalog publication [4, 5] the spectral indices in the frequency range of 365–3940 MHz were determined only for one fourth of the sources. Rather bright sources made it into this sample. The median values of the flux density and spectral index for it amounted to $F_{3.94} = 82$ mJy and $\alpha = -0.82$, respectively. Figure 1a presents a histogram with the distribution of spectral indices from the materials of the papers [4, 5].

In one of the first publications on the spectral characteristics of RC sources [11], the data was mainly obtained from the multi-frequency observations at the RATAN-600. The spectra were constructed for one third of the 840 objects from the first list of the RC catalog [4]. In 70% of them, the spectra turned out to be steep with an average spectral index of $\alpha = -0.87$.

In the studies of Bursov et al. [12, 13] the spectra for 529 (44%) RC sources in the range of 970–3940 MHz were mainly determined from the observations at the RATAN-600 radio telescope. Most of them are bright enough objects ($F_{3.94} > 35$ mJy) with steep spectra at the median values of $F_{3.94} = 69$ mJy and $\alpha = -0.85$. There is an insignificant number of sources (3%) with inverse spectra ($\alpha \geq 0.1$). Figure 1b presents a histogram with the distribution of indices for the sources from [13].

We have divided the sources for which the spectral indices are determined in the papers [4, 5, 13] into groups by the flux density, taking as the unit of measurement the noise error of $\sigma = 3.5$ mJy as the average of the root-mean-square noise errors from the 1980–1994 surveys [16]. The first bin
included the sources with $F \leq 10.5 \text{ mJy}$ at the frequency of 3.94 GHz, i.e. weaker than $3\sigma$. The boundaries of the following bins were chosen to be 17.5, 35, 70, 105, 140, 210, 280, 700 and over 700 mJy or $5\sigma$, $10\sigma$, $20\sigma$, $30\sigma$, $40\sigma$, $60\sigma$, $80\sigma$, $200\sigma$ and over $200\sigma$, respectively. Then we slightly changed the division for an even more homogeneous distribution of sources into groups, so that in each of them there would be enough sources for the statistics. As a result, the upper boundaries of bins were as follows: 15, 25, 35, 50, 70, 100, 150, 250 and more than 250 mJy.

Figure 2 shows a scattering diagram for the spectral indices and integral flux density $F_{3.94}$ from the data of [4, 5] (Fig. 2a) and [13] (Fig. 2b). The values for the sources are shown by gray circles, the median value of the spectral index and the flux density of each bin – by a black square, the regression line from these values – by a dashed line. Both in the first (Fig. 2a) and in the second case (Fig. 2b) rather bright sources, discovered within the “Cold” experiment at 3.94 GHz reveal a tendency to the flattening of the spectra with increasing flux density.

In the works of Soboleva et al. [15, 16] the NVSS catalog was used to determine the two-frequency indices $\alpha_{1.4}^{3.94}$ at 1.4 and 3.94 GHz (the wavelength of 20 and 7.6 cm, respectively) in RC sources, including weak objects ($F_{3.94} < 35$ mJy). In the $10'$-wide band extending for about $16^h$ in the right ascension, 95% of the RC catalog objects were identified with the NVSS sources. It was found that with increasing flux density at the wavelength of 7.6 cm, spectral indices of the sources become more steep.

According to the data obtained over 1987–2000, for the “Cold” strip extending for $11^h$ over the right ascension, about 600 sources were detected [16], which were identified with the NVSS. The average value of the two-frequency spectral index $\alpha_{3.94}^{1.4}$ for them was $-0.44$. A half of these sources proved to have a standard power spectrum, while in 30% of objects the spectrum becomes steeper with increasing frequency. The flattening of the two-frequency spectral index $\alpha_{3.94}^{1.4}$ is observed at weaker flux densities, as it was also noted in [15], which may be due to a decrease in the proportion of FRII-type sources.

3.1. Spectral Indices of RCR Sources and New Data

With the advent of more flux density-sensitive TGSS and GLEAM surveys, it became possible to refine the spectra of bright sources in the low frequency range, and also to more confidently determine the spectra of a half of the RCR sources for which the data on the flux density were available only at 1.4 and 3.94 GHz.

To construct the source spectra, we used the mean values from the integral flux densities obtained
Figure 3. The distribution of spectral indices of 830 RCR catalog sources for the right ascension interval $(2^h < R.A. < 17^h)$ at the frequencies of 0.5 GHz (a) and 3.94 GHz (b). The gray bars denote spectral indices determined from the spectra constructed invoking the data from the GLEAM and TGSS surveys, the black broken line – without these data.

by two methods at 3.94 GHz, the VLSSr, GLEAM, TGSS, TXS [35], NVSS, FIRST and GB6 survey data, as well as the information from the CATS [36, 37], Vizier [38] and NED databases.

Now there are 13% of the objects whose flux densities are known at two frequencies. They are not available in the VLSSr, GLEAM, TGSS and GB6 catalogs, since their flux is weaker than the detection threshold of reliably identified sources adopted in the catalogs. For a number of such sources at the visual control, a noticeable brightening was revealed on the maps. To construct their spectra, we engaged the flux density estimates based on the VLSSr (74 MHz), TGSS (150 MHz) and GB6 (4.85 GHz) survey radio maps, sometimes also using the GLEAM (the band of 70–231 MHz). These estimates are performed using the Aladin functions [39, 40]. To work with the tables, we used the TOPCAT [41] software application.

Applying the software package spg [23] the approximation of spectra was done by the polynomials of the first or second degree, and spectral indices $\alpha_{3.94}$ and $\alpha_{0.5}$ were calculated at the frequencies of 3.94 and 0.5 GHz, respectively, for the list sources.

Let us compare the way how the distribution of spectral indices of the sources found in the “Cold” surveys varied as the new data appeared in the other frequency ranges.

In their publication, Soboleva et al. [14] engaged the VLSS and GB6 surveys for constructing the spectra of the RCR catalog sources. New low frequency GLEAM and TGSS surveys were used at the next iteration for the construction of spectra of RCR-sources from the interval of $2^h < R.A. < 7^h$ [22]. Continuing it here, we present the results for all the RCR sources from the interval of $2^h < R.A. < 17^h$ and compare the spectral indices computed from the spectra, where the
GLEAM and TGSS survey data were used in the approximation (further referred to as “new” here), and the indices obtained without the GLEAM and TGSS data (“old”).

Figure 3 presents the distributions of spectral indices of 830 RCR-sources at the frequencies of 0.5 and 3.94 GHz. The “new” spectral indices are shown by gray bars, and the “old” ones – by the broken black line. The histograms reveal a noticeable difference for the “old” and “new” indices, which can be associated with the refinement of radio spectra for those sources whose flux data had previously been only known at two frequencies, and the spectrum was usually approximated by a straight line. Thus, the number of spectra that are best approximated by a straight line (the S-spectra)\(^1\) decreased from 73% (“old” spectral indices) to 35% (“new” spectral indices).

Dividing the sources into groups with ultra steep (USS, Ultra Steep Spectrum; \(\alpha \leq -1.0\)), steep (SS, Steep Spectrum; \(-1.0 < \alpha \leq -0.5\)), flat (FS, Flat Spectrum; \(-0.5 < \alpha \leq 0.1\)) and inverted (IS, Inverted Spectrum; \(0.1 < \alpha\)) spectra, we have obtained the following composition at the frequency of 0.5 GHz (Fig. 3a) with the median value of the spectral index for each group: USS – 2%, \(\alpha = -1.02\); SS – 68%, \(\alpha = -0.74\); FS – 21%, \(\alpha = -0.32\); IS – 9%, \(\alpha = 0.38\), and at the frequency of 3.94 GHz (Fig. 3b): USS – 14%, \(\alpha = -1.12\); SS – 52%, \(\alpha = -0.77\); FS – 24%, \(\alpha = -0.28\); IS – 10%, \(\alpha = 0.42\).

The statistics for other types of spectra has also changed with the addition of GLEAM and TGSS survey data. In 10% of the sources, the maximum of the spectrum falls on the frequencies of 0.1–12 GHz. Such spectra are observed in CSS (Compact Steep Spectrum), GPS (Gigahertz Peak Spectrum), HFP (High Frequency Peaker). Seven objects from them are included in the published lists of such sources. And still 3% of sources have a maximum in the spectrum, but the spectrum has yet a more complex shape. It is formed by imposing a power-law spectrum at low frequencies onto a spectrum with self-absorption at the frequencies of 0.5–12 GHz. Sources with such a radio spectrum are indicated in Table 1 with the symbol “l”. In our list there are 3% of sources with upturn-spectra, where the spectra reveal a minimum, followed by a growth at the frequencies from several gigahertz.

### 3.2. Spectral Indices and Flux Density

Samples which are complete with regards to the flux density of radio sources can include different populations of objects, depending on which frequency and with what limit of flux density they are obtained, since due to different redshifts of objects, the contributions to the integral observable

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\(^1\) We compared the spectral indices at 0.5 and 3.94 GHz.
Figure 4. The distribution of two-frequency spectral indices for RCR catalog sources. The diagram (a) shows in gray the indices at the frequencies of 74–150 MHz ($\alpha_{74-150}$), the black broken line – the indices at the frequencies of 150–1420 MHz ($\alpha_{150-1420}$); (b) the two-frequency indices $\alpha_{150-1420}$ and $\alpha_{1420-3940}$; (c) $\alpha_{1420-3940}$ and $\alpha_{3940-4850}$; (d) $\alpha_{1420-3940}$ and $\alpha_{1420-4850}$.

spectrum come from various physical components of the source (see [31], Fig. 2). If the source is observed not along the axis of the jet, then at low frequencies synchrotron radiation from extended components shall dominate. At the frequencies above several gigahertz, the contribution to radiation from the nucleus becomes significant. If the sampling is performed at 100–300 MHz, then up to large redshifts ($4 \leq z \leq 6$) the radio emission will still be registered from the extended components, which allows to directly compare the characteristics. If the sampling is done at the frequency of 1 GHz or higher, then the sources with a significant contribution of the nucleus, which are oriented so that the jet is directed along the line of sight, would more preferentially get into the sample, and the more often, the greater their redshift. Note that most of the sources known at $z > 4$ are compact and often reveal a bent or a peaked spectrum, what indicates the youth of the source or a certain activity, related with the merger of galaxies. Since our sample is produced at the frequency of about 4 GHz, then it should have a significant share of sources with a substantial contribution of the nucleus into
Let us consider at the histograms (Fig. 4) the way the distributions of two-frequency spectral indices for the RCR-sources vary in the frequency range from 74 MHz to 4.85 GHz. Each diagram in Figure 4 presents two histograms with the distribution of two-frequency indices: for lower frequencies the histogram is represented by the gray bars, and for higher frequencies – with a black broken line. The most compact distribution of indices was obtained for a two-frequency spectral index $\alpha_{1.4}^{0.15}$, and the largest scatter – for $\alpha_{4.85}^{3.94}$.

Comparing these diagrams we may assume variations in the contribution of different physical components of a radio source into the integral spectrum. Thus, at 74–150 MHz synchrotron self-absorption in the shock region is most likely at work. For the frequency range of 0.15–1.4 GHz, the main contribution is provided by the synchrotron radiation of extended components, while the physical conditions in them are apparently quite close. At the frequencies of 1.4–3.94 GHz, the radiation of the nucleus is added, and at the frequencies of 3.94–4.85 GHz its contribution becomes more significant. On top of this, we have to account both for the different power of the sources and their evolutionary stage – the initial phase, where the jet starts to break through the environment, and then a formed jet, where its infeed by the nucleus still carries on, and the relic phase, where the infeed of the jet has already ceased.

To determine the possible relationship between the spectral index and the integral flux density, which was indicated in [15, 16] for the RC-catalog sources, we have considered various combinations of spectral indices and flux densities at different frequencies for 830 RCR-catalog sources (Fig. 5). On the diagrams, linear regression across all the points for the sources with steep spectra, SS ($\alpha \leq -0.5$) is described by the upper gray dashed line, and for the sources with flat spectra, FS, ($\alpha > -0.5$) – by the bottom dashed line. Note that the SS-sources account for 70%, if we apply $\alpha_{0.5}$ for the division into groups, and 66%, if we use $\alpha_{3.94}$.

There is a larger concentration of sources with steep spectra in a certain area of the diagram in all figures as compared to the sources with flat spectra, which can indicate close physical conditions in the extended components, the radiation of which dominates in the sources with steep spectra.

We determined the Pearson correlation coefficients $r$ for the pairs “decimal logarithm of the integral flux density–spectral index”. We considered the combinations between $\alpha_{0.5}$ and the flux densities at the frequencies of 150 MHz, 1.4, 3.94 and 4.85 GHz and, respectively, for $\alpha_{3.94}$ both for the sources with steep and flat spectra. The correlation coefficient for the pair $\alpha_{0.5}$ and $F_{150MHz}$ (Fig. 5a) for the sources with steep spectra amounted to $r = -0.42$, while for sources with flat spectra is was equal to $r = -0.50$. Here, as the flux density increases, the radio spectrum gets steeper. For the
Figure 5. The diagram of scattering of spectral indices at the frequencies of 0.5 GHz (a, b), 3.94 GHz (c, d) and the flux density at the frequencies of 150 MHz (a), 1.4 (b), 3.94 (c) and 4.85 GHz (d) for 830 sources of the RCR catalog. The upper dashed line is a regression line over all points for the sources with steep spectra \((\alpha \leq -0.5)\), bottom dashed line is for the sources with flat spectra.

other pairs of parameters, the correlation coefficients proved to be from 0.2 and smaller. Thus, for \(\alpha_{0.5}\) and \(F_{1.4\text{GHz}}\) (Fig. 5b) \(r\) amounts to –0.22, and –0.09 for the sources with steep and flat spectra, respectively; for \(\alpha_{3.94}\) and \(F_{3.94\text{GHz}}\) (Fig. 5c) \(r = -0.14\), and \(r = -0.15\); for \(\alpha_{3.94}\) and \(F_{4.85\text{GHz}}\) (Fig. 5d) \(r = -0.12\), and \(r = -0.13\).

We also compared the distribution of integral flux densities for these two groups of sources. Figures 6a and 6b present the histograms with the distribution of \(F_{150\text{MHz}}\) and \(F_{1.4\text{GHz}}\), where the separation into the SS (gray bars) and FS-groups (black line) is produced by \(\alpha_{0.5}\), and Figs. 6c and 6d represent the histograms with the distribution of \(F_{3.94\text{GHz}}\) and \(F_{4.85\text{GHz}}\) with a division into the SS and FS-sources by \(\alpha_{3.94}\). In general, the FS-sources are weaker in terms of the flux density than the SS-sources. It is interesting that in Figs. 6c and 6d both the maxima of histograms (about 20 mJy), and the type of distributions approximately coincide for the SS and FS groups.

At the frequency of 1.4 GHz, the maximum (Fig. 6b) for the SS-sources is shifted relative to the
Figure 6. The distribution of the integral flux density for the sources with steep and flat spectra: grouping by $\alpha_{0.5}$ for 150 MHz (a) and 1.4 GHz (b); grouping by $\alpha_{3.94}$ for 3.94 GHz (c) and 4.85 GHz (d). The gray bars denote the sources with steep spectra, the black line describes the sources with flat spectra.

maximum for the FS-sources and is located at 40–50 mJy. A significant difference in the position of the distribution maximum $F_{150MHz}$ between the SS and FS-sources is noticeable at 150 MHz. We believe that this is due to a different brightness of the extended components in SS and FS-sources, while at the frequencies of 3.94–4.85 GHz, prevailed by the contribution from the nuclear part, there is no such noticeable difference.

Comparing the diagrams in Fig. 5 and 6, we may suggest that the sources with steep and flat spectra refer to different types of objects, where the energy physics of the jets is determined by various types of accretion. To test this assumption, we would have to at least engage the optical range data for the classification of parent galaxies of radio sources.
4. CONCLUSION

A strip of the sky covered by the surveys of the “Cold” experiment over 1980–1999, by the brightest sources, and the sweep by the right ascension is $15^h$, which gives the area (with the subtraction of $2^m$ calibrations) of about $150^\circ$. Weak sources ($F_{3.94} \leq 17.5 \text{ mJy}$, 30%) are registered in the $10'$-strip, then the area of the survey amounts to $40^\circ$. Accordingly, for the sources brighter than 17.5 mJy and weaker than 35 mJy (30%) this is $20'$ and $68^\circ$, for the sources brighter than 35 mJy and weaker than 70 mJy (20%) – $25'$ and $96^\circ$. The $20'$ strip captures about three quarters of the total number of objects of the RCR catalog, or slightly more than 600 sources, which coincides with the number of sources in [16].

We completed the reduction of a region of the survey strip in the right-ascension interval $2^h < \text{R.A.} < 7^h$ and obtained a list of sources and their characteristics from the averaged scans, where the sky background was determined being “smoothed” by the $80^s$ window. Now the RCR catalog presents sources from the right-ascension interval $2^h < \text{R.A.} < 17^h$, where for each radio source identified by two methods described above, its position on the scan (RA) and the integral flux density ($F$) at the frequency of 3.94 GHz are determined.

For each of the objects of the RCR-catalog, radio spectra and spectral indices at 0.5 and 3.94 GHz are calculated, and also the two-frequency spectral indices at 74 and 150 MHz, 1.4, 3.94 and 4.85 GHz. To construct the spectra we have engaged all the known information on the integral flux densities at different frequencies, available from the CATS, Vizier and NED databases, as well as the estimated values of flux densities obtained from the VLSSr, GLEAM, TGSS and GB6 survey maps. First of all, these estimated values were useful constructing the spectra of the sources that have data on the flux densities only at two frequencies: 3.94 GHz (RCR) and 1.4 GHz (NVSS). These are mostly the sources with flux densities of less than 30 mJy. About 80% of them have flat spectra ($\alpha > -0.5$).

According to the results of Soboleva et al. [15, 16] in RC sources, divided by the flux density at 3.94 GHz into four groups: 5–10 mJy, 10–20 mJy, 20–30 mJy and brighter than 30 mJy, the median value of the two-frequency spectral index $\alpha_{3.94}^{1.4}$ amounted to -0.09, -0.22, -0.45 and -0.65, respectively. For the RCR catalog in the same source groups, the median values $\alpha_{3.94}^{1.4}$ were respectively as follows: -0.21, -0.41, -0.51 and -0.61. The tendency of the spectral index flattening at weaker flux densities for the new determinations of $F_{3.94}$ over the more extensive observational material of the 1980–1999 surveys has as well persisted. This may be related with a decrease in the share of FRII-type sources [42].
We have considered the same six types of integral radio spectra as it was done by Soboleva et al. [14]: \( S, C^-, C^+ \), the spectra with a maximum (MPS, GPS, HFP) and with a minimum (upturn) at the frequencies of 2–5 GHz, as well as the spectra of a more complex shape (hill). It turned out that when adding the GLEAM and TGSS data, the number of spectra approximated by a straight line decreased from 73\% to 35\%, the number of \( C^- \)-spectra increased from 19\% to 29\%, and \( C^+ \) – from 2\% to 23\%, the number of sources with spectra, having a maximum – from 4\% to 10\%, and finally, the number of sources with upturn-spectra increased approximately from 0.01\% to 3\%.

These variations are related to the observational selection. To account for it, classifying the sources from our list based on the radio spectrum we are clearly lacking the data on the flux density in the high-frequency region from 5 GHz and above.

To determine the possible relationship between the spectral index and integral flux density, we calculated the correlation coefficients for different combinations of spectral indices and flux densities at different frequencies. A noticeable correlation was detected between \( \alpha_{0.5} \) and \( F_{150\,MHz} \) (Fig. 5a) both for the sources with steep spectra, and for the sources with flat spectra. While the flux density increases, the radio spectrum gets steeper. However, at other frequencies, the correlation between the integral flux density and spectral index is absent.

In general, FS-sources are weaker in terms of flux density than the SS-sources. This difference is especially noticeable at the frequency of 150 MHz. We believe that this is linked with a different brightness of extended components in the SS and FS-sources, while at the frequencies of 3.94–4.85 GHz, where the contribution from the nuclear part prevails, there is no such noticeable difference. We may suggest that the sources with steep and flat spectra belong to different types of objects with various jet energies, what can be determined by different types of accretion. However, the environment and the evolutionary stage of the radio source can also have an effect. To test this assumption, we would have to attract data of other ranges for the classification of parent galaxies and the radio sources themselves.

For a complete analysis of the spectra of objects in the deep decimeter sky surveys (TGSS, NVSS, FIRST), the sensitivity on the centimeter waves should be one to two orders of magnitude higher than that in the decimeter surveys, i.e. not worse than dozens of micro-Jansky. Such a sensitivity in the centimeter range has so far been realized only on very small areas of the sky. For this reason, the “Cold” experiment survey data obtained over 1980–2000 still remain relevant.
ACKNOWLEDGMENTS

The study was carried out with the partial support of the RFBR grant No. 17-07-01367. The work was accomplished with the support of the Ministry of Education and Science Of the Russian Federation (state contract 14.518.11.7054). The research made use of the means of access to the Vizier catalogs, the SIMBAD database (CDS, Strasbourg, France), as well as the NASA/IPAC Extragalactic Database (NED), supported by the JPL of the California Institute of Technology under the contract with NASA.

The authors express their deep gratitude to the referee for the comments that significantly improved the text of the article.

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| NVSS         | $\Delta RA_1 \pm \sigma$ | $\Delta RA_2 \pm \sigma$ | $F_1 \pm \sigma$ | $F_2 \pm \sigma$ | $\alpha_{3.4}$ | $\alpha_{0.5}$ | Mrph | Flx | Sp. |
|--------------|--------------------------|--------------------------|-----------------|-----------------|----------------|----------------|------|-----|-----|
| 020421.77+050130.3 | -0.09±0.65              | 10.6±2.0                |                  | 0.65±0.44       | #              | +u             |      |     |     |
| 020638.77+044807.2 | 0.03±0.76                | 3.10                    | 37.0±4.0        | 43.8            | -0.73±0.73    | -              |      |     |     |
| 020651.70+044828.6 | 2.07±1.76                | 31.5±6.0                | -0.20±0.06      | E               | -              |               |      |     |     |
| 020704.61+050110.4 | -0.02±0.25               | 0.16±0.27               | 10.2±2.0        | 10.0±2.0        | -1.30±0.61    | -              |      |     |     |
| 020801.88+050033.3 | 0.05±0.30                | 0.20±0.36               | 8.2±2.0         | 18.3±7.5        | -0.15±0.08    | #              |      |     |     |
| 020912.54+050051.7 | -0.21±0.20               | 0.24±0.11               | 30.8±2.1        | 32.3±2.3        | -1.14±0.84    | -              |      |     |     |
| 020921.70+050142.7 | 0.10±0.35                | 0.13±0.13               | 15.1±3.0        | 17.4±3.0        | -0.98±0.83    | -              |      |     |     |
| 020931.16+045535.0 | -0.13±0.31               | 0.98±0.46               | 16.6±2.1        | 16.1±2.0        | -0.78±0.78    | l              |      |     |     |
| 021336.47+051819.2 | 2.92                     | 134.2±3.0               | -0.86±0.86      | l               |               |               |      |     |     |
| 021449.84+050409.7 | -0.06±0.35               | 0.42±0.30               | 26.7±2.7        | 31.6±3.0        | -0.72±0.72    | l              |      |     |     |
| 021906.86+050354.1 | 0.72±0.25                | 0.71±0.33               | 20.2±2.1        | 14.5±1.5        | -0.39±0.48    | +              |      |     |     |
| 022019.20+045226.1 | 2.13±1.05                | 32.3±3.5                | -0.36±0.69      | bR F            | h              |               |      |     |     |
| 022032.66+050243.6 | -0.06±0.28               | 0.29±0.14               | 52.5±3.7        | 60.7±4.0        | -0.94±0.72    | -              |      |     |     |
| 022046.45+050439.2 | 0.04±1.00                | 0.59±0.30               | 14.7±4.0        | 15.6±5.0        | -1.27±0.04    | -p             |      |     |     |
| 022141.42+044349.3 | 3.12±0.88                | 151.0±62.0              | -0.83±0.83      | B               | l              |               |      |     |     |
| 022218.69+050343.8 | -0.08±0.44               | -1.22±0.18              | 18.2±3.0        | 26.8            | -1.14±0.90    | bR             |      |     |     |
| 022220.25+050010.3 | 1.48±0.44                | 1.04±0.18               | 4.5±1.5         | -1.06±0.70      | -bR            |               |      |     |     |
| 022416.53+045842.8 | -1.81±0.49               | 13.6±3.0                | mR              |                 |               |               |      |     |     |
| 022419.41+045657.3 | 0.00±0.07                | 0.60±0.49               | 15.4±3.0        | 19.0±3.0        | 0.12±0.66     | +              |      |     |     |
| 022509.74+050837.4 | 1.10±0.73                | 2.11±0.05               | 45.0±2.7        | 54.0±7.0        | -1.17±0.90    | B              | -     |     |     |
| 022528.41+045316.2 | -0.10±0.17               | 0.76±0.94               | 20.2±2.0        | 33.7±2.0        | -1.08±0.60    | -              |      |     |     |
| 022619.89+044631.5 | 0.29±0.30                | 0.58±1.65               | 76.8±25.0       | 54.0±14.0       | -0.94±0.74    | -              |      |     |     |
| 022621.32+045233.4 | -0.29±1.23               | 24.2±4.0                | 0.05±0.05       | l               |               |               |      |     |     |
| 022836.14+045619.2 | 1.50±0.05                | 0.54±0.87               | 14.8±2.0        | 17.0±1.0        | -1.15±0.41    | -p             |      |     |     |
| 022929.95+045318.0 | 3.29±0.30               | 1.14±0.63               | 19.2±2.0        | 29.6±3.0        | -1.18±0.83    | -              |      |     |     |
| 023126.85+045846.4 | 0.06±0.55               | -0.18±0.33              | 12.3±2.5        | 13.8±3.0        | -0.85±0.85    | l              |      |     |     |
| 023155.98+050234.4 | -0.10±0.57               | 0.14±0.32               | 17.0±4.0        | 18.0±2.0        | -0.74±0.51    | v              | -     |     |     |
| 023331.40+044909.3 | 0.33±1.61                | 35.7±7.0                | -0.82±0.82      | E               | l              |               |      |     |     |
| 023407.16+044642.7 | -0.69±0.80               | 1.69±0.34               | 173.3±17.7      | 271.0±56.0      | -0.23±0.59    | s -G           |      |     |     |
| 023546.15+045111.4 | -0.36±0.43               | 27.5±3.5                | -0.77±0.63      | -               |               |               |      |     |     |
| 023840.05+045516.8 | -0.10±0.50               | 0.23±0.34               | 45.5±6.6        | 48.9±5.0        | -0.79±0.78    | bR             | l     |     |     |
| 023840.80+045752.3 | 0.65±0.50                | 12.5±2.0                | -0.45±0.79      | bR              | +              |               |      |     |     |
| (1)          | (2)          | (3)     | (4)     | (5)     | (6)     | (7) | (8) | (9) | (10) |
|-------------|-------------|---------|---------|---------|---------|-----|-----|-----|------|
| 023950.49+050042.9 | -0.02±0.08 | 0.11±0.11 | 9.8±4.5 | 19.6±7.0 | -1.42 | -0.60 | s  | -p  |
| 024309.09+045634.3 | -0.11±0.50 | 0.00±0.54 | 17.6±4.0 | 16.3±3.5 | -0.70 | -0.55 | -  | -   |
| 024322.22+045804.2 | -0.21±0.57 | -0.02±0.74 | 10.0±2.0 | 12.7±1.0 | -0.05 | -0.84 | +u | -u  |
| 024430.44+044445.8 | 0.72±1.70 | 59.2±1.0  | -0.64 | -0.64 | E  | 1   |     |     |
| 024754.12+045414.2 | 0.39±0.51 | 18.4±3.5  | 0.31  | -0.44 | #  | +u  |     |     |
| 024816.44+045345.0 | 1.02±0.70 | 0.53±0.68 | 24.4±12.0 | 26.5±12.0 | -0.76 | -0.76 | 1  |     |
| 024939.93+044028.8 | -0.40±0.40 | 1.48±3.33 | 139.3±35.0 | 133.0±22.0 | -0.96 | -0.68 | -  | -   |
| 025239.26+045840.3 | -0.14±0.30 | 0.67±0.16 | 23.9±2.6 | 31.0±2.6 | -0.67 | -0.44 | F  | -   |
| 025253.93+050226.0 | -0.07±0.47 | 0.13±0.24 | 16.6±3.0 | 21.8±3.0 | -0.62 | -0.62 | l  |     |
| 025311.49+050032.2 | 0.68±0.25 | 0.30±0.40 | 8.7±1.5 | 10.3±2.5 | -0.29 | -0.29 | #  | 1   |
| 025421.04+045723.9 | -0.30±0.31 | 0.55±0.18 | 15.4±1.5 | 17.3±2.0 | -0.70 | -0.64 | E  | -   |
| 025630.90+050221.1 | -0.06±0.53 | 0.22±0.26 | 16.0±2.5 | 25.5±2.0 | -1.00 | -0.71 | -  |     |
| 025647.96+050041.4 | 0.77±0.32 | 1.31±0.48 | 9.7±2.0 | 8.5±2.0 | -0.23 | -0.62 | h  |     |
| 025831.38+045309.0 | 1.18±1.66 | 29.5±7.0  | -0.72 | -0.72 | 1   |     |     |     |
| 025856.77+050410.4 | 0.96±0.36 | 0.89±0.17 | 14.8±2.0 | 18.9±2.0 | -0.89 | -0.78 | -  |     |
| 030256.65+045521.1 | 0.21±0.25 | 0.61±0.35 | 45.6±4.0 | 58.1   | -1.05 | -0.94 | -  |     |
| 030321.00+050143.5 | -0.16±0.42 | 0.21±0.46 | 12.8±3.0 | 14.8±1.0 | -0.56 | -0.56 | F  | 1   |
| 030357.72+050240.7 | -0.17±0.30 | 1.39±0.66 | 10.5±1.5 | 12.0±2.0 | 0.04  | -0.71 | +  |     |
| 030456.91+045640.4 | -0.34±0.81 | 12.5±2.0  | 0.29  | 0.29  | #  | 1   |     |     |
| 030546.02+045243.3 | -0.17±1.12 | 1.92±1.25 | 39.5±3.5 | 26.4±12.0 | -0.75 | -0.75 | 1  |     |
| 030626.32+045137.2 | 0.62±0.38 | 0.84±0.71 | 41.9±16.0 | 37.8±6.0 | -0.81 | -0.78 | -  |     |
| 030656.53+045710.3 | 0.11±0.20 | 0.53±0.14 | 50.3±5.0 | 53.8±8.0 | -0.98 | -0.66 | -  |     |
| 030726.37+045517.5 | -2.94±1.30 | 15.8±2.0  | -0.97 | -0.97 | 1   |     |     |     |
| 030733.90+045304.6 | 2.42±1.30 | 23.5±2.0  | 0.08  | -0.49 | E  | +   |     |     |
| 030810.14+050226.7 | 2.50±0.06 | -0.01±0.32 | 9.4±2.0 | 12.1±2.0 | 0.37  | -0.71 | F# | +   |
| 030833.98+045409.2 | 1.42±0.35 | 2.29±0.75 | 30.4±4.0 | 34.4±2.0 | -0.83 | -0.58 | F  | -   |
| 031114.39+050314.6 | -0.75±1.11 | -0.09±0.30 | 26.5±3.0 | 26.3±2.0 | -0.81 | -0.81 | l  |     |
| 031124.23+050742.7 | 0.72±0.91 | -0.36 | 25.6±3.0 | 29.2   | -0.71 | -0.57 | -  |     |
| 031147.96+050802.4 | 0.17±0.65 | 1.45±0.31 | 97.9±16.0 | 100.1±16.0 | -1.40 | -1.06 | F  | -   |
| 031321.84+050452.1 | 0.10±0.30 | 0.51±0.41 | 17.5±2.0 | 16.9±4.0 | -0.97 | -0.97 | 1  |     |
| 031347.01+044724.5 | 1.11±0.70 | 3.31±3.40 | 52.3±10.0 | 45.1±4.0 | 0.91  | 0.91  | l  |     |
| 031532.21+050721.0 | 1.65±0.47 | 0.22±1.00 | 31.7±6.5 | 40.4±6.5 | -0.78 | -0.78 | d  | 1   |
| 031705.35+045838.2 | -0.27±0.54 | -0.07±0.07 | 11.3±2.6 | 13.2±1.0 | -0.07 | -0.07 | #  | 1   |
| 031736.52+045545.0 | 2.42±0.20 | 1.61±0.78 | 13.8±2.0 | 14.9±2.0 | -0.15 | -0.25 | +  |     |
| (1)          | (2)          | (3)          | (4)          | (5)          | (6)          | (7)          | (8)          | (9)          | (10)  |
|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------|
| 031752.52    | 0.22±0.67    | 0.82±0.20    | 19.8±3.0     | 22.5±4.0     | 0.65±0.51    | #            | +u           |             |        |
| 031841.77    | -0.19±0.36   | -0.50±0.55   | 200.3±19.0   | 188.0±24.0   | -1.07±-0.93  | db           | B            | -           |        |
| 031844.85    | 1.91±0.76    | 1.47±0.67    | 44.2±4.5     | 47.9±7.0     | -0.80±-0.51  | F            | -            |             |        |
| 031858.07    | -0.02±0.30   | -0.03±0.11   | 53.3±4.0     | 58.8±5.0     | -0.33±-0.92  | F            | h            |             |        |
| 031903.22    | 0.08±0.65    | -0.49±0.04   | 24.1±3.0     | 30.0±5.0     | -1.08±-1.18  | #            | -p           |             |        |
| 031926.47    | 0.36±0.41    | 1.36±0.42    | 79.8±5.0     | 96.7±7.5     | -0.73±-0.66  | F            | -            |             |        |
| 032125.00    | -0.19±0.38   | 0.28±0.13    | 15.7±3.0     | 14.0±3.0     | -1.25±-0.50  | F            | -p           |             |        |
| 032314.72    | 0.21±1.30    | 1.02±0.71    | 117.4±11.0   | 143.1±18.0   | -0.07±-0.81  | F            | h            |             |        |
| 032407.34    | -0.41±0.48   | -0.02±0.46   | 126.7±22.0   | 141.5±25.0   | -1.08±-0.94  | -            |             |             |        |
| 032456.18    | 2.16±1.08    | 1.65±1.18    | 86.2±8.7     | 88.1±12.0    | -1.25±-0.17  | F            | -p           |             |        |
| 032506.09    | 0.26±0.60    | 1.76         | 11.6±2.0     | 14.3         | 1.48±-0.25   | #            | +u           |             |        |
| 032640.58    | 0.36±0.34    | 23.4±10.0    | -0.44±-0.62  | bR           | +            |             |             |             |        |
| 032642.23    | 0.23±0.34    | 0.98±0.98    | 27.7±11.0    | 51.4±8.5     | -0.78±-0.78  | bR           | l            |             |        |
| 032724.74    | 0.82±0.43    |             | 11.5±2.0     | -0.39±-0.79  | +            |             |             |             |        |
| 032825.57    | 0.42±0.43    |             | 23.1±1.0     | 50.3±6.0     | -0.73±-0.86  | dB           | +            |             |        |
| 032826.67    | 1.52±0.43    | 1.24±0.81    | 23.1±1.0     | -0.80±-0.93  | dB           | +            |             |             |        |
| 032910.98    | -0.01±0.21   | 0.47±0.22    | 22.1±5.0     | 26.9±2.0     | 0.02±-0.81   | bR           | E            | h            |        |
| 032911.02    | 0.45±0.30    |             | 8.9±1.0      | -0.13±0.32   | bR           | #            | -p           |             |        |
| 032917.08    | 0.12±0.25    | -0.04±0.10   | 15.1±2.0     | 13.6±3.0     | -0.79±-0.79  | l            |             |             |        |
| 032935.83    | 0.79±0.23    | 0.25±1.17    | 13.8±2.0     | 11.6±3.0     | 0.46±0.46    | #            | l            |             |        |
| 033226.75    | 0.02±0.33    | 0.62±0.06    | 29.1±6.0     | 23.5±5.0     | 1.53±-0.03   | v            | +u           |             |        |
| 033510.40    | 0.05±0.15    | 0.45±0.08    | 47.3±3.0     | 44.7±2.0     | -0.98±-0.09  | F            | -p           |             |        |
| 033524.20    | 0.13±0.49    | 0.33±0.11    | 12.1±2.0     | 11.5±2.0     | 0.17±0.17    | #            | l            |             |        |
| 033613.25    | 0.55±0.64    | 0.57±0.22    | 7.0±2.0      | 8.9±2.0      | -0.72±-0.72  | B            | l            |             |        |
| 033726.24    | 0.04±0.23    | 0.65±0.64    | 19.8±2.0     | 24.0±5.0     | -0.98±-0.66  | bR           | -            |             |        |
| 033726.67    | 0.29±0.66    |             | 87.3±11.0    | -1.00±-0.79  | bR           | F            | -            |             |        |
| 033750.84    | 0.84±0.15    | 0.00±0.84    | 9.8±1.0      | 12.1±1.0     | -0.77±-0.77  | l            |             |             |        |
| 033901.60    | 0.51542.4    | 2.49±0.21    | 70.0±7.0     | -0.79±-0.79  | l            |             |             |             |        |
| 033959.59    | 0.71±0.12    | 0.77±0.18    | 12.1±1.5     | 12.8±2.0     | 0.04±0.04    | #            | l            |             |        |
| 034024.79    | 0.01±0.15    | 0.07±0.23    | 21.1±2.0     | 22.0±2.0     | 0.12±0.12    | s            | l            |             |        |
| 034041.76    | 1.36±0.28    | -0.52±0.73   | 11.2±2.0     | 13.5±5.0     | -0.04±-0.45  | b            | +            |             |        |
| 034109.80    | 1.45±0.32    | 0.86±0.61    | 60.4±6.0     | 56.9±7.0     | -0.97±-0.86  | -            |             |             |        |
| 034151.93    | 0.49±0.25    | -2.01±3.03   | 8.5±1.0      | 9.0±1.0      | -0.54±-0.30  | -            |             |             |        |
| 034231.79    | 4.14±0.58    | 2.16±1.62    | 53.7±6.0     | 70.8±2.0     | -0.72±-0.60  | F            | -            |             |        |
Table 1. (Continue)

| (1)       | (2)       | (3)       | (4)       | (5)       | (6)       | (7)       | (8)       | (9)       | (10)  |
|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-------|
| 034243.15+044527.5 | -0.18     | 82.6      | -0.67     | -0.67     | E       | l       |
| 034329.99+045750.3 | -0.01±0.26 | 0.21±0.23 | 1097.5±50.0 | 1133.1 | -0.97 | -0.83 | V       | -       |
| 034554.43+045729.5 | 0.33±0.41 | -0.44±0.70 | 12.9±2.0 | 15.3±1.0 | -0.39 | -0.60 | h       |         |
| 034628.75+045545.5 | 0.07±0.25 | -0.03±0.76 | 14.2±2.0 | 17.3     | -0.28 | -1.30 | d       | h       |
| 034656.76+045653.8 | -0.10±0.01 | 12.3±3.0 | -0.21 | -0.36 | +       |
| 034824.81+045421.7 | 0.10±0.61 | 0.82±0.54 | 25.6±5.0 | 24.3±3.0 | -0.46 | -0.46 | F       | l       |
| 034828.10+050151.6 | 1.03      | 12.3±2.0 | -0.52 | -1.05 | h       |
| 034901.48+051038.4 | 0.32±0.50 | 0.12±0.69 | 55.1±8.0 | 66.1±10.0 | -0.76 | -0.76 | B       | l       |
| 034931.08+050042.4 | -0.28±0.36 | -0.09±0.33 | 22.3±4.0 | 25.0±1.0 | -0.67 | -0.67 | l       |         |
| 034940.30+045731.2 | -0.10±0.10 | 0.03±0.36 | 12.8±4.5 | 15.8±4.0 | -0.02 | -0.02 | F       | l       |
| 035054.23+050620.9 | 1.09±0.70 | 0.41±0.28 | 430.9±30.0 | 399.4±27.0 | -0.70 | 0.15 b | B       | -p      |
| 035203.68+044612.0 | -1.38±0.74 | 59.9±8.0 | -0.84 | -0.31 | -p      |
| 035208.14+045128.5 | 0.05±0.20 | 2.92      | 40.3±7.0 | 35.6±5.0 | -0.83 | -0.83 | l       |         |
| 035303.88+050431.1 | 1.52±0.22 | 2.14±0.33 | 28.6±6.5 | 32.5±1.5 | -0.15 | -0.37 | +       |         |
| 035424.14+044107.3 | -0.86±1.10 | 0.53±1.04 | 193.0±35.0 | 190.4±8.0 | -0.13 | -0.43 | B       | h       |
| 035454.40+050250.2 | -0.25±0.15 | -0.41     | 13.8±2.0 | 21.1     | -0.97 | -0.81 | -       |         |
| 035515.52+045703.1 | 1.15±0.56 | 9.2±2.0   | 0.70     | -0.70 | #       | l       |
| 035602.18+045602.8 | 0.54±0.15 | 0.88      | 11.7±2.0 | 15.8     | -0.76 | -0.76 | l       |         |
| 035659.95+045947.7 | -0.82±0.21 | 9.1±1.5   | -0.10 | -0.69 | +       |         |
| 035815.51+045449.1 | 2.31±0.05 | 12.5±4.0  | 0.55     | -0.76 | +u      |
| 040311.59+045929.0 | 0.35±0.05 | 0.37±0.93 | 9.1±2.0 | 8.2±3.0 | 0.35 | 0.35 | #       | l       |
| 040332.04+045817.3 | -0.07±0.45 | 0.42±0.22 | 45.3±6.0 | 45.8±6.0 | -0.75 | 0.23 | -p      |
| 040404.37+045839.5 | 0.12±0.05 | 0.57      | 11.0±2.0 | 10.4±2.0 | 0.13 | -0.51 | s       | +       |
| 040424.21+050633.6 | -2.19±0.47 | -1.29±0.03 | 20.6±3.0 | 43.6±2.0 | -0.82 | -0.82 b | l       |
| 040427.26+050207.2 | -0.04±0.50 | 0.97      | 30.5±4.0 | 39.4±2.0 | -0.79 | -0.79 | l       |         |
| 040626.84+044753.2 | 1.56±1.10 | -1.82±4.50 | 54.4±10.0 | 61.4±10.0 | -0.92 | -0.92 | l       |         |
| 041034.32+045540.3 | 1.19±0.61 | 12.6±4.0  | -0.08 | -0.33 | +       |
| 041319.72+045839.7 | -0.33±0.56 | 0.18±0.17 | 23.4±3.0 | 25.2±3.0 | -0.35 | -0.73 | E       | h       |
| 041330.97+045247.7 | -1.28±0.12 | -1.21±0.67 | 27.2±2.0 | 31.7±3.0 | -0.60 | -0.60 | l       |         |
| 041510.24+050144.4 | 1.32±0.56 | 10.9±4.0  | -0.64 | -0.76 | +       |
| 041752.68+044404.8 | 1.38±0.45 | -5.30     | 59.7±7.0 | 66.7±15.0 | -0.17 | -0.91 b | h       |
| 042003.08+045101.9 | -0.62±0.44 | 0.54±0.29 | 36.6±6.0 | 41.8±6.0 | -0.45 | -0.45 | l       |         |
| 042154.98+050230.5 | 0.57±0.28 | 0.26±0.23 | 19.1±2.0 | 17.8±2.0 | -0.20 | -0.55 | B       | h       |
| 042333.58+045451.3 | 0.58±0.37 | 1.21±0.32 | 20.4±5.0 | 20.1±5.0 | -0.69 | -0.69 | l       |         |
Table 1. (Continue)

| (1)       | (2)       | (3)       | (4)       | (5)       | (6)       | (7)       | (8)       | (9)       | (10)  |
|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-------|
| 042545.15 + 045028.3 | 1.30±2.50 | 24.9±3.0  | -0.49     | -0.49     | 1         |
| 042619.18 + 045025.7 | -0.21 ±0.79 | 0.40±0.40 | 432.5±54.0 | 434.4±54.0 | -1.12    | -0.75    | -         |
| 042636.60 + 051818.0 | 7.60      | 375.0±   | -0.23     | 0.18      | B        | -p       | -         |
| 042747.61 + 045708.9 | -0.18 ±0.44 | 0.46±0.20 | 645.9±65.0 | 642.7±73.0 | -0.26    | -0.26    | V         | 1      |
| 043311.04 + 052115.4 | 3.89±0.90  | 0.83±1.65 | 1333.2±120.0 | 1878.0±200.0 | -0.13    | -0.89    | m         | V      |
| 043551.33 + 045612.6 | 0.95±0.63  | 1.43      | 13.2±3.0  | 10.4±3.0  | -0.86    | -0.86    | 1         |
| 043558.30 + 045723.9 | 0.30±0.25  | 1.36      | 13.2±2.0  | 9.2±2.0   | -0.28    | 0.09     | #         | p      |
| 043611.99 + 050127.0 | -0.51 ±0.55 | 0.31±0.38 | 12.3±2.0  | 13.3±2.0  | -0.66    | -0.66    | 1         |
| 043629.74 + 050034.9 | -0.08 ±0.83 | 0.18±0.56 | 13.1±3.0  | 16.2±3.0  | -0.30    | -0.30    | 1         |
| 043722.65 + 050529.6 | -3.38±1.38 | 25.0±3.0  | -0.64     | -0.64     | 1        |
| 043732.83 + 045139.0 | 3.77      | 11.0±3.0  | -1.39     | -1.10     | -         |
| 043848.16 + 044936.2 | -0.21±0.74 |          |          |          |          |          | +         |
| 044014.54 + 050002.9 | 0.20±1.20  | 1.12±0.17 | 14.1±2.0  | 15.3±1.0  | 0.01     | -0.83    | +u        |
| 044136.20 + 045403.4 | 1.00±0.10  | 1.12±0.05 | 19.8±4.0  | 19.9±5.0  | -1.23    | 0.74     | -         |
| 044448.48 + 044848.7 | -3.14      |          |          |          |          |          |          |
| 044447.89 + 050126.8 | 0.08±0.35  | 0.32±0.18 | 58.2±6.0  | 64.6±5.0  | -1.09    | -0.95    | -         |
| 044455.22 + 045659.7 | -0.06±0.48 | -0.05±0.61 | 20.0±3.0  | 22.0±7.0  | 0.93     | 0.08     | #         | +u    |
| 044924.30 + 045844.5 | 0.21±0.33  | 0.89±0.23 | 10.7±2.0  | 11.7±2.0  | -1.08    | -0.73    | -         |
| 044935.43 + 050102.3 | 0.29±1.03  | 1.62±0.15 | 13.9±2.0  | 11.9±2.0  | -0.59    | -0.59    | 1         |
| 045000.72 + 051254.9 | 0.03±2.60  | 2.14      | 36.5±3.0  | 33.2±5.0  | -0.60    | -0.60    | 1         |
| 045110.15 + 045054.8 | -0.57±0.30 | 0.08±0.57 | 41.5±4.0  | 38.3±14.0 | -0.72    | -0.57    | d         | E      |
| 045113.48 + 043751.2 | 2.37      | 30.6      | -0.88     | -0.58     | s        | -         |
| 045151.26 + 050134.7 | -0.52±0.55 | 1.61      | 9.3±2.0   | 9.1±3.0   | -0.74    | -0.74    | 1         |
| 045322.45 + 051052.6 | 1.29±0.65  | -0.33     | 64.8±12.0 | 57.2±8.0  | -0.09    | 0.79     | -g        |
| 045503.78 + 045302.0 | 0.61±0.27  | 0.56±0.35 | 30.9±5.0  | 35.3±7.0  | -1.06    | -0.93    | -         |
| 045544.48 + 045051.9 | 0.47±0.62  | 1.26±0.54 | 37.0±5.0  | 32.8±4.0  | -0.53    | -0.53    | 1         |
| 045754.69 + 045354.3 | 0.49±0.39  | 0.93±0.28 | 87.8±5.5  | 75.7±7.5  | -0.98    | -0.86    | -         |
| 045815.27 + 050410.4 | -0.01±0.60 | 0.43±0.38 | 73.6±5.0  | 71.3±7.0  | -1.17    | -0.94    | -         |
| 045905.59 + 045609.8 | -0.24±0.26 | -0.18±0.24 | 85.7±8.0  | 99.8±8.0  | -0.91    | -0.81    | db        | -      |
| 050011.77 + 045838.8 | 0.51±0.53  | 11.2±2.5  | -0.53     | -0.53     | 1        |
| 050026.57 + 050433.2 | 0.88±0.70  | 21.5±2.7  | -1.23     | -0.69     | -        |
| 050043.12 + 051155.8 | -2.30±0.20 | 55.1±7.0  | 0.23      | -0.51     | hu       |
| 050523.20 + 045942.8 | -0.26±0.25 | 0.51±0.12 | 872.0±70.0 | 1000.0±63.0 | -0.06    | -0.55    | V         | h      |
| 050625.10 + 050819.7 | 1.01±1.06  | 2.02±0.59 | 75.2±12.0 | 66.4±6.0  | -0.83    | -0.67    | v         | -      |
| (1)  | (2)  | (3)     | (4)     | (5)     | (6)     | (7)     | (8)     | (9)     | (10) |
|------|------|---------|---------|---------|---------|---------|---------|---------|------|
| 050649.14| 045101.7 | 0.47±0.25 | 0.40±1.33 | 28.9±4.0 | 29.6±9.0 | -0.23 | -1.03 | h      |
| 050709.01| 045520.0 | -0.20±0.32 | 0.33±0.01 | 32.3±3.0 | 33.8±3.0 | -0.88 | -0.81 | -      |
| 050825.45| 045155.4 | -1.94±0.25 | 0.82     | 22.2±2.0 | 29.6     | -0.90 | -0.90 | l      |
| 051006.04| 045910.0 | -0.28±0.18 | 1.18±0.30 | 11.9±2.0 | 11.7±2.0 | -0.21 | -0.50 | +      |
| 051018.00| 045952.7 | -0.07±0.37 | -0.47±2.25| 11.7±2.0 | 12.9±1.0 | -0.17 | 0.09  | #      |
| 051106.30| 045854.5 | -0.37±0.23 | 0.55±0.34 | 15.6±1.6 | 15.2±1.0 | -0.76 | -0.76 | l      |
| 051219.39| 045610.8 | 0.82±0.39 | 0.49±0.83 | 13.8±2.0 | 17.5±2.0 | 0.10  | -0.44 | +      |
| 051343.45| 045854.7 | -0.18±0.12 | -0.85±0.09| 31.4±4.0 | 33.8±5.0 | -1.51 | -0.02 | bR     |
| 051344.36| 050347.3 | 0.41±0.15 | 14.3±3.0 | 13.1±5.0 | -1.10 | -0.49 | bR     |
| 051359.03| 050235.7 | -0.19±0.24 | -0.11±0.48| 23.9±2.5 | 22.0±2.0 | -1.45 | 1.67  | E#     |
| 051539.19| 045947.5 | -0.05±0.20 | 0.26±0.43 | 9.3±1.0 | 9.0±1.0 | -0.35 | -0.35 | l      |
| 051711.68| 050032.6 | -0.13±0.34 | 0.28±0.13 | 38.1±3.0 | 44.0±4.0 | 0.45  | -0.50 | s      |
| 051909.69| 050520.3 | -0.02±0.11 | 0.49±0.26 | 22.4±2.0 | 31.0±7.0 | -0.72 | -0.72 | l      |
| 051923.70| 045900.4 | -0.83±0.15 | 8.0±1.5 | 8.0±1.5 | 0.28  | -0.49 | #      |
| 052035.50| 045401.7 | 0.36±0.37 | 0.82±0.38 | 28.4±3.0 | 33.0±4.0 | -0.46 | -0.82 | B      |
| 052055.49| 050654.7 | 2.00±0.31 | 1.77±0.75 | 48.5±6.0 | 46.0±4.0 | -0.95 | -0.78 |      |
| 052117.03| 050728.8 | 0.15±0.20 | -0.36±0.67| 67.0±7.0 | 80.0±12.0| -0.92 | 0.37  | B      |
| 052241.76| 045304.3 | 1.05±0.73 | -0.09±1.10| 24.2±3.0 | 21.0±5.0 | -0.26 | -0.84 | h      |
| 052326.80| 045918.6 | -0.40±0.15 | 0.50±0.25 | 11.0±2.0 | 16.0±3.0 | -0.82 | 0.23  | #      |
| 052331.28| 050844.2 | 1.15±0.81 | 66.0±24.0| 1.06  | -0.87 |      |
| 052333.28| 045827.7 | -0.41±0.74 | 0.84 | 17.9±3.0 | 19.0±5.0 | -0.84 | -0.60 |      |
| 052431.59| 050736.6 | 1.09±1.00 | 39.0±5.0 | 0.81  | -0.81 | E     |
| 052502.08| 045432.7 | 0.08±0.27 | 0.70±0.26 | 81.7±8.0 | 85.0±9.0 | -0.83 | -0.73 |      |
| 052719.63| 050153.9 | 0.21±0.37 | 1.93±0.25 | 35.8±3.0 | 41.0±3.0 | -0.89 | -0.64 |      |
| 052801.46| 045750.1 | -0.34±0.23 | 0.32±0.06 | 42.1±3.0 | 46.0±1.0 | -0.56 | -0.56 | l      |
| 053207.80| 050243.6 | 0.60±0.10 | 0.31±0.30 | 18.1±2.0 | 18.0±3.0 | -0.69 | -0.69 | d      |
| 053435.41| 050342.5 | 0.18±0.38 | 0.22±0.23 | 228.0±20.0| 240.0±21.0| -1.09 | -0.87 |      |
| 053603.93| 050600.6 | 0.68±0.14 | 1.46±0.95 | 23.8±5.0 | 29.0±5.0 | -0.94 | -0.94 | l      |
| 053816.21| 045239.5 | 1.04±0.93 | 2.91±0.45 | 25.8±5.0 | 27.0±4.0 | -0.17 | -0.58 | h      |
| 053849.53| 050411.5 | -1.22±0.10 | -0.66±0.48| 23.9±2.5 | 30.0±4.0 | -0.81 | -0.81 | dR     |
| 053851.42| 050309.7 | 0.67±1.15 | 11.1±2.0 | 58.0±5.0 | 58.0±5.0 | -0.55 | -0.19 | s      |
| 053957.88| 045359.5 | 0.22±0.10 | 0.80±0.33 | 20.9±4.5 | 33.0±5.0 | -0.84 | -0.84 | l      |
| 054118.70| 050900.2 | 1.07±1.05 | 1.77±0.45 | 87.3±8.5 | 100.0±20.0| -1.02 | -0.86 |      |
| 054246.21| 045419.6 | 0.15±0.29 | 0.51±0.18 | 58.4±5.0 | 58.0±5.0 | -0.55 | -0.19 | s      |
| (1)        | (2)        | (3)        | (4)        | (5)        | (6)        | (7)        | (8)        | (9)        | (10)       |
|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| 054405.13  | +045906.4  | 0.65±0.24  | 1.66±0.34  | 11.4±2.0   | 14.0±1.0   | -0.20      | -0.64      | +          |
| 054555.90  | +045943.6  | -0.06±0.27 | 0.75       | 14.8±2.0   | 12.0       | -1.25      | -0.56      | s          | -p         |
| 054948.75  | +045246.4  | -0.13±0.76 | 1.09±1.00  | 20.4±4.0   | 32.0±9.0   | -0.52      | -0.65      | +          |
| 055256.16  | +044725.3  | 1.62±1.07  | 2.99±0.48  | 82.3±18.0  | 94.0±2.0   | -1.09      | -0.72      | d          | -          |
| 055313.77  | +045549.6  | -0.02±0.67 | 0.44±0.31  | 35.7±4.0   | 42.0±5.0   | -1.16      | -0.13      | s          | -p         |
| 055652.59  | +050937.2  | 0.55±1.50  | 1.15±1.50  | 49.1±8.0   | 46.0±6.0   | -1.20      | -0.54      | -p         |
| 055902.37  | +045304.8  | 0.12±2.14  | 0.83±1.40  | 20.7±2.0   | 28.0±2.0   | -0.77      | -0.66      | -          |
| 055936.84  | +045800.8  | -0.53±0.15 | 0.26±0.02  | 14.7±2.0   | 16.0±2.0   | -1.17      | -0.95      | -          |
| 060033.87  | +045601.1  | 0.04±1.24  | 11.6±2.0   | 11.0       | 0.08      | -0.92      | +          |
| 060404.70  | +045657.4  | 0.28±0.10  | -0.92      | 9.6±2.5    | 12.0±2.5   | -0.87      | -0.32      | d          | #          | -p         |
| 060428.72  | +045958.8  | 0.14±0.40  | 0.58±0.77  | 8.4±2.0    | 12.0±3.0   | -0.87      | -0.61      | -          |
| 060537.91  | +050020.5  | -1.49±0.35 | 11.0       | 0.42      | -0.67      | +u         |
| 060612.31  | +045743.1  | 0.00±0.27  | 0.21±0.40  | 21.2±4.0   | 22.0±3.0   | -0.53      | -0.53      | v          | l          |
| 060659.73  | +050659.2  | 1.64±0.34  | 1.43±0.40  | 53.7±11.0  | 46.0±9.0   | -0.81      | -0.71      | d          | v          | -          |
| 060715.71  | +045818.9  | 0.08±0.62  | -0.53±0.33 | 10.3±2.0   | 9.0±3.0    | -0.74      | -0.74      | l          |
| 060829.14  | +050115.3  | 0.54±0.22  | 0.98±0.16  | 13.6±3.0   | 15.0±4.5   | -0.85      | -0.57      | d          | -          |
| 060947.02  | +045927.9  | -0.09±0.14 | 0.02±0.22  | 10.9±2.0   | 11.0±2.0   | -1.26      | -0.92      | -          |
| 061003.66  | +045354.1  | 0.40±0.40  | 0.55       | 18.1±4.0   | 14.0±3.0   | -0.84      | -0.87      | v          | -          |
| 061028.84  | +050025.8  | 0.74±0.47  | 0.33±0.43  | 11.4±2.0   | 16.0±2.0   | -0.91      | -0.75      | -          |
| 061048.06  | +050504.4  | 0.18       |           |           | 15.0±3.0   | -0.23      | -0.77      | +          |
| 061217.47  | +045636.7  | 0.27±0.10  |           | 16.0±7.0   | 1.03      | 0.15       | #          | +u         |
| 061553.63  | +045650.9  | 0.65±0.90  |           | 13.0±4.0   | -1.26      | -0.79      | -          |
| 061627.92  | +045312.0  | 1.44±0.50  |           | 15.0±3.0   | -0.06      | -0.48      | +          |
| 061756.20  | +045824.9  | -0.41      |           | 7.0±3.0    | 0.60      | -0.18      | #          | +u         |
| 061823.59  | +050700.1  | 1.72       |           | 33.0±7.0   | -0.07      | -0.48      | +          |
| 061900.21  | +050630.8  | 0.55±0.60  | 0.91±0.13  | 321.0±39.0 | 299.0±27.0 | -0.81      | 0.04       | b          | v          | -p         |
| 061909.63  | +045400.1  | 0.25±0.32  | 0.76±0.37  | 32.5±5.0   | 47.0±1.0   | 0.52       | -0.66      | b          | +u         |
| 061943.49  | +045748.3  | 0.67±0.55  | 0.63       | 11.3±3.0   | 12.0±5.0   | -0.80      | -0.80      | l          |
| 062128.52  | +045852.2  | -0.21±0.10 |           | 23.1±7.0   | 37.0±5.0   | 0.20       | -0.70      | bR         | v          | #          | -p         |
| 062130.07  | +045258.2  | 1.34±0.10  |           | 41.6±5.0   |           | -0.72      | -0.58      | bR         | s          | -          |
| 062152.90  | +043834.4  | 4.65±0.28  | 1.06±1.00  | 361.6±20.0 | 392.0±33.0 | -1.01      | -0.80      | -          |
| 062157.68  | +045606.8  | 0.13±0.28  | 0.31±0.14  | 45.0±5.0   | 61.0±11.0  | -0.79      | -0.55      | s          | -          |
| 062207.41  | +045651.1  | -0.06±0.24 | -0.07±0.15 | 35.4±5.0   | 25.0±4.0   | -0.90      | -0.65      | v          | -          |
| 062310.75  | +050410.0  | -1.67±0.27 | -1.86±0.14 | 64.4±21.0  | 65.0±11.0  | -0.74      | -0.74      | m          | v          | l          |
Table 1. (Continue)

|      | (1)             | (2)     | (3)     | (4)     | (5)     | (6)     | (7)     | (8)     | (9)     | (10)   |
|------|-----------------|---------|---------|---------|---------|---------|---------|---------|---------|--------|
| 062325.66+045624.1 | 0.02±0.11 | 0.34±0.25 | 11.3±2.0 | 12.0±2.0 | -0.37 | -0.06 | #       | -       |
| 062418.85+045701.8 | 0.02±0.37 | 0.48±0.23 | 159.0±10.0 | 165.0±30.0 | -0.99 | -0.73 | -       | -       |
| 062450.96+050350.0 | 1.24±0.50 | 0.35±0.38 | 22.0±3.0  | 22.0±4.0  | -1.05 | -0.69 | -       | -       |
| 062549.27+045648.2 | 0.81±0.30 | 28.0±9.0  | 11.3±2.0 | 12.0±2.0 | -0.37 | -0.06 | #       | -       |
| 062741.83+045803.9 | 0.18±0.37 | 0.28     | 25.1±3.0 | 52.0±   | -0.98 | -0.82 | v       | -       |
| 063605.69+043240.5 | 1.59±0.15 | 477.3±40.0 |         |         | -0.79 | -0.79 | 1       |         |
| 063759.26+045505.5 | 0.71±0.73 | 0.22±0.67 | 15.1±2.0 | 18.0±2.0 | 0.77  | 0.40  | #       | +       |
| 063826.31+045246.6 | -0.03±0.70 | -0.13±0.94 | 19.7±3.5 | 27.0±4.5 | -0.79 | -0.79 | 1       |         |
| 063929.62+045937.0 | 0.51±0.38 | -0.02±0.27 | 12.4±3.0 | 17.0±4.0 | -0.26 | -0.57 | v       | +       |
| 064054.67+050550.3 | -0.62±0.34 | 0.67±0.01 | 38.9±5.0 | 36.0±4.0 | -0.44 | -0.78 | +       |         |
| 064116.31+044748.5 | 0.28±0.51 | 0.99±0.71 | 61.5±6.0 | 59.0±18.0 | -1.22 | -0.66 | -       |         |
| 064415.38+050641.5 | 0.33±0.71 | 1.23±0.40 | 112.0±20.0 | 119.0±5.0 | -0.93 | -0.83 | -       |         |
| 064753.44+050456.5 |         |         |         |         | 24.0±3.0 | -0.15 | 1.18 | E#      | +u      |
| 065110.86+045356.1 | 0.81±0.73 | 0.00     | 12.2±2.0 | 17.0±6.0 | 0.21  | -0.63 | +       |         |
| 065327.45+050319.2 | 0.10±0.53 | 45.5±6.0  |         |         | -0.90 | 0.03  | d       | -p      |
| 065327.47+050851.6 | 0.12±0.53 | 0.24±0.46 | 151.0±15.0 | 149.0±16.0 | -0.48 | -0.35 | bR      | B       |         |
| 065529.90+045510.9 | 0.13±0.38 | 0.29±0.23 | 42.8±4.0 | 48.0±6.0 | -0.03 | -0.03 | s       | l       |
| 065848.74+045522.0 | 0.71±0.55 | 25.1±1.0  |         |         | 0.25  | -1.00 | bR      | v1      | +u      |
| 065850.15+050206.7 | -0.11±0.73 | 1.10±0.71 | 41.0±18.0 | 40.0±7.0 | 0.00  | 0.00  | bR      | v       | l       |
| 065929.43+045603.8 | 0.29±0.30 | -0.94±0.92 | 13.5±4.0 | 13.0±2.0 | 0.28  | 0.28  | v#      | l       |