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Low Frequency (327 MHz) VLBI Survey: First Results

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Abstract. In this paper we report the first results of the 327 MHz VLBI survey which has been carried out in the last two years to select potential candidate sources for the future SVLBI missions and to search for directions of small scattering-"holes" in the interstellar scattering medium. During the three VLBI sessions conducted so far, we observed about 80 sources. Preliminary data analyzed from the first part of the survey shows that at least 17 out of 50 sources have compact components with a size smaller than 30 mas.

The source sample was selected from the list of compact extragalactic radio sources which have been targets of recent VLBI surveys at L-band (Polatidis et al. 1995) and S/X-band VLBI astrometry programs (Johnston et al. 1995). The major limitations for the selection of sources for this low-frequency survey were defined by scattering effects in propagation mediums and by the baseline sensitivity of an interferometer. In order to minimize interstellar and interplanetary scattering, the choice of SVLBI targets was limited by the sources lying primarily at high-galactic latitudes and in the galactic anti-center direction ($| b | > 10^\circ$ and $280^\circ > l > 100^\circ$, accordingly), and we observed these sources at elongations $> 60^\circ$. The minimal flux density of sources which can be detected with an interferometer consisting of a 10 m space (Radioastron) and 70 m ground-based radio telescopes, with the observing frequency band (4 MHz) and integration time (15 min) will be about 0.3 Jy. The sample of 79 sources selected to be observed at first three parts of this survey includes 19 Low Frequency Variable and 15 Compact Steep Spectrum radio sources. Most of the sources in our sample have not been observed with VLBI at 327 MHz.

Observations and Results

Our goal was to detect the compact components rather than produce radio images. In order to observe as many sources as possible in a short time, we observed most of the sources in two-three 15-minute scans during the session separated in hour angle. To calibrate our measurements of the scattering effects, we included a few pulsars and a few radio sources at different Sun elongations. These "calibration" sources have been observed in every session.

Three observing sessions have been carried out so far, in Dec.1994, Feb.1995 (both MKII) and Oct.1995 (MKIIIE). All data were correlated at the JPL BlockII correlator. From the 52 radio sources observed in the first session, which was carried out with the VLBA, only 6 showed a signal-to-noise ratio more than 6 after fringe fitting. Nevertheless, we decided to proceed and create the rough images of all correlated sources, again with the understanding that these preliminary images, compared with VLBI data at other frequencies, will help us to select the sources for future more detailed studies. From the analysis of these images, we found that at least 17 sources have compact components smaller than 30 mas (see Table). Comparison with higher frequency VLBI maps show for some sources certain inconsistencies which can be due to poor UV coverage in our experiment. We currently are carrying out a more extensive analysis of scattering effects in our data. Our further plans include an expansion of the survey to observe sources with Southern declinations (down to -35 deg) and to make detailed 327 MHz VLBA studies of sources which showed evidence of compact structures in the first parts of survey.

Source	(1)	(2)	(3)	(4)	(5)
0016+731	120.6	10.73	0.6	0.3	33x15
3C 84	150.6	-13.26	42.8	1.8	41x28
0716+714	144.0	28.02	1.6	0.26	37x14
3C 179	148.0	28.42	7.7	0.15,0.35	78x18,28x18,103,-86.7
0917+624	152.2	40.94	1.3	0.33	21x16
0945+408	181.0	50.28	3.8	0.28,0.68	32x16,31x18,63,-93
M82	141.4	40.57	13.3	< 0.02,1.01	43x20,40x14,86,56.4
3C 249.1	130.4	38.55	7.9	0.38	41x21
3C 263	134.2	49.74	9.6	0.81	22x14
3C 309.1	110.0	42.10	21	2.21	42x23
NGC6251	115.8	31.20	5.0	0.13,0.16	46x15,44x15,129,73.5
1642+690	100.7	36.62	1.9	0.24	40x34
3C 371	100.1	29.17	4.9	0.56	44x23
1823+568	85.7	26.08	3.2	0.2,0.19	41x16,40x15,159,46.9
2021+614	96.1	13.78	0.9	0.36,0.37	50x49,50x48,85,-26,8
2311+469	106.2	-12.47	4.9	0.44,0.42	53x36,45x36,152,65.6
2342+821	120.6	19.88	10.1	1.71	49x21

Notes: 1: Galactic Longitude; 2: Galactic Latitude; 3: Total Flux Density (Jy); 4: Image Integrated Flux (comp1, comp2 - Jy); 5: Estimated Size and Structure (comp1, comp2, distance - mas, PA - deg).

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References

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