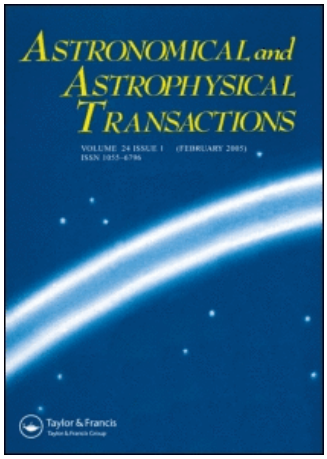

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"QUASAR" VERY LONG BASELINE NETWORK

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The dedicated "QUASAR" Very Long Baseline Network is presented. Principal Network characteristics are given.

KEY WORDS VLB Interferometry

"QUASAR" Very Long Baseline Network[1] is under construction in the Soviet Union. The "QUASAR" Network is composed of six radiotelescopes of 32 m diameter covering the USSR territory along both longitude ($\Delta\lambda = 128°$) and latitude ($\Delta\phi = 23°$) and linked with the Center of Operation in Leningrad via a geostationary satellite channel.

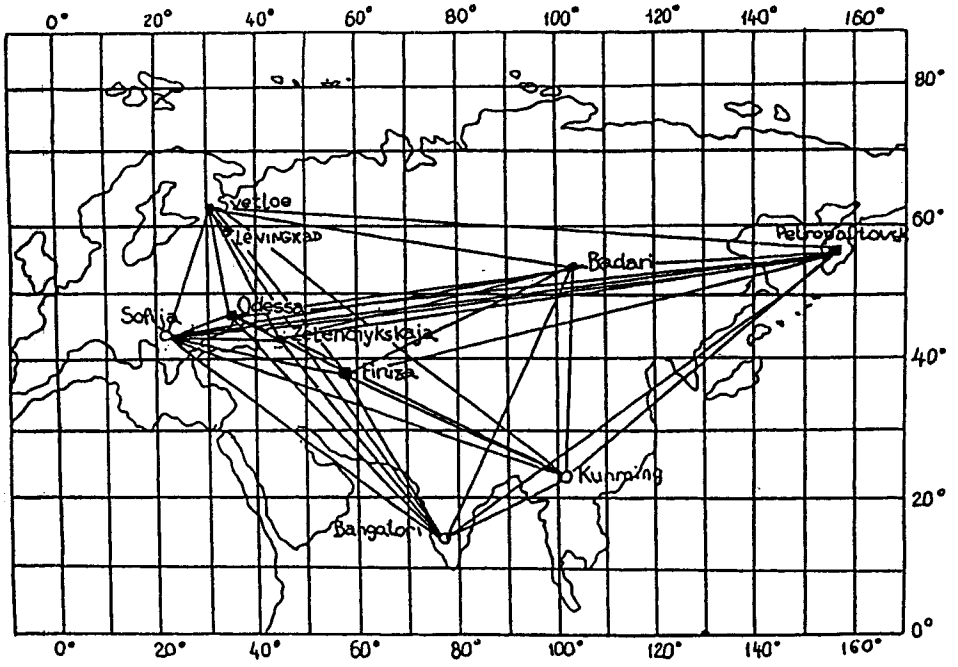

Figure 1 Configuration of the "QUASAR" Network stations. • will be operational in 1992; ● will be operational in 1993; ■ will be operational in 1994; ○ will be operational in 1995.

Table 1 "QUASAR" Network specification

1. Geometrical characteristics			
Network	Maximal baseline:	Longitude coverage:	Latitude coverage:
National	7380	128°	23°
International	7940	134°	48°

2. Antenna system		
Antenna for observations:	Number:	Diameter:
of radio sources	9	32 m
of navigation satellites transmitting signal	9	1.3 m
via geostationary satellite	10	
Far East, India, China, Center of Operation		12 m
other stations		4 m
Monitoring troposphere electrical characteristics	9	1.5 m
Control of RT-32 surface by radiohолography	2	0.5 m

3. Receiving system	
Radiometers for:	Wavelengths:
observations of radio sources	1.35; 3.5; 6; 13; 18/21 cm
observations of navigation satellites	19 cm
monitoring troposphere	1.5; 1 cm
control of RT-32 surface	2.5 cm

4. Time-frequency system	
H-maser standard stability	10^{-14}–10^{-15}
Primary time synchronization via GLONASS	20 ns

5. Data transmission system	
"OFF-line"	tape-recorder, 144 MHz per each station
"ON-line"	satellite channel, 4.5 × 6 or 9.0 × 3 Mbit/s

6. Control and monitoring system	
Central site computer	CM-1425
Number of Network stations	15
"ON-line" system via satellite channel	64 kbit/s
Digital telephone line via satellite channel	64 kbit/s

7. Satellite	
Geostationary satellite "GORIZONT" with channels	
bandwidth	36 MHz
UP-frequency	14 GHz
DOWN-frequency	11 GHz

8. Processing system		
Correlator (MK-III format)	I step	II step
stations number	3	10
bandwidth per station	120 Mbit/s	144 Mbit/s
bus type	CAMAC	VME
input data	tape-recorder and satellite channels	

Table 1—(Continued)

Mainframe	VAX-6320 (cluster)
total RAM	128 Mb
disk memory	20 Gb
Workstations	VS-3100
Software	VAX/VMS; UNIX

9. Collocation

Laser ranging systems, gravimeters, seismic and meteodata stations.

Table 2 "QUASAR" Network putting into operation

Stations	*Putting into operation*
Svetloe Zelenchukskaya Badari	1992
Firuza	1993
Odessa Kamchatka	1994
Bangalore Kunming Sofia	1995

Table 3 Principal characteristics of "QUASAR" Network

Construction of coordinate reference system based on extragalactic radio-sources (after averaging)	0.1 mas
Construction of terrestrial reference system fixed by baselines of Network	1–3 cm
Spreading of terrestrial reference system on the Soviet Union territory	3–5 cm
Determination and monitoring Earth rotation parameters in radioastronomical system:	
—polar wobble	1–3 cm
—Universal Time	0.1 ms
with the time resolution better than	6^h
Time synchronization	0.1 ns
Source mapping	0.1 mas

Table 4 Approximate coordinates of "QUASAR" Network stations

Station	*Longitude*	*Latitude*
Svetloe	−30.14°	61.08°
Zelenchukskaya	−41.60°	43.88°
Badari	−104.24°	52.33°
Firuza	−58.24°	38.00°
Odessa	−30.30°	46.80°
Kamchatka	−158.00°	53.00°
Bangalore	−77.50°	13.00°
Kunming	−102.47°	25.02°
Sofia	−24.00°	42.00°

It is proposed to construct "QUASAR" stations abroad: in India (Bangalore), China (Kunming), and Bulgaria (near Sofia) ("QUASAR International"). In this configuration $\Delta\lambda = 134°$ and $\Delta\phi = 48°$ (see Figure 1).

The principal technical characteristics are summarized in Table 1. Table 2 presents the time schedule of putting Network into operation.

The Network will provide data for: precise determination of sky and terrestrial coordinate systems and their mutual orientation, obtaining precise ballistic information for spacecrafts during deep space mission, high resolution mapping cosmic radiosources. Principal Network characteristics related to these problems are given in Table 3.

Approximate coordinates of Network stations are given in Table 4. Table 5 gives a notion of the size and orientation of interferometer bases in equatorial coordinate system.

Table 5 Size and orientation of "QUASAR" Network bases in equatorial coordinate system

		Svetloe 1	*Badari* 2	*Zelench.* 3	*Firuza* 4	*Odessa* 5	*Kamchat.* 6	*Bangalore* 7	*Kunming* 8
2	θ	4256							
	p	534							
3	θ	1689	4456						
	p	1161	627						
4	θ	2724	3638	1455					
	p	1655	1121	494					
5	θ	1281	4983	911	2356				
	p	933	399	−228	−722				
6	θ	6227	3498	7180	6821	7368			
	p	488	−45	−672	−1167	−444			
7	θ	4708	3247	3670	2215	4562	6743		
	p	4147	3613	2986	2491	3214	3659		
8	θ	5665	1887	5354	4127	6083	4798	2627	
	p	2885	2351	1723	1229	1951	2396	−1262	
9	θ	1705	5603	1435	2887	624	7904	5103	6702
	p	1314	780	153	−341	381	825	−2833	−1570

θ—Equatorial projection (km), p—polar projection (km)
9—Network station near Sofia

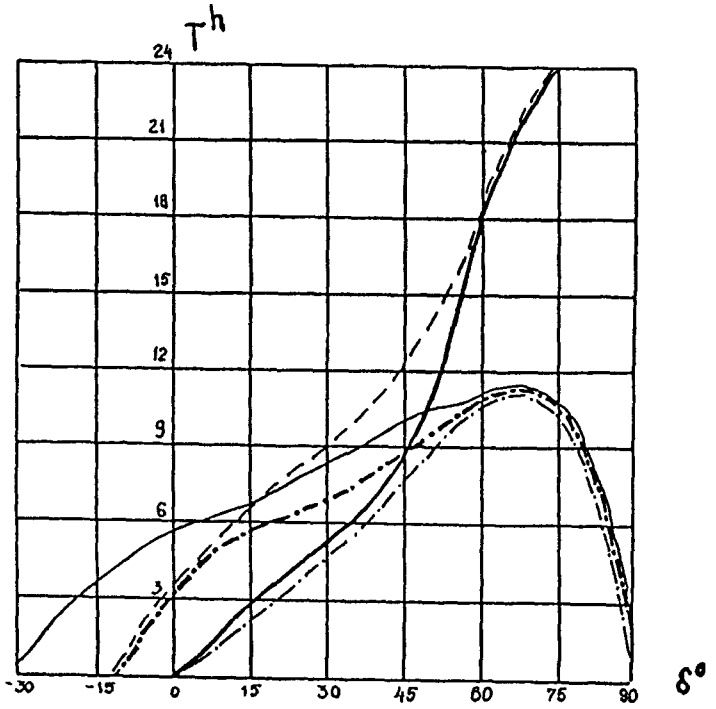

Figure 2 Duration of the sojourn of sources in the common field of vision of "QUASAR" Network as a function of declination. ——— Network of 6 stations: Svetloe, Zelenchukskaya, Badari, Firuza, Odessa, Kamchatka; — — — — Network of 5 stations: Svetloe, Zelenchukskaya, Badari, Firuza, Odessa; —·—·—·— Network of 9 stations: Svetloe, Zelenchukskaya, Badari, Firuza, Odessa, Kamchatka, Bangalore, Kunming, Sofia; —·—· Network of 8 stations: Svetloe, Zelenchukskaya, Badari, Firuza, Odessa, Bangalore, Kunming, Sofia; ——— Network of 4 stations: Zelenchukskaya, Firuza, Bangalore, Kunming.

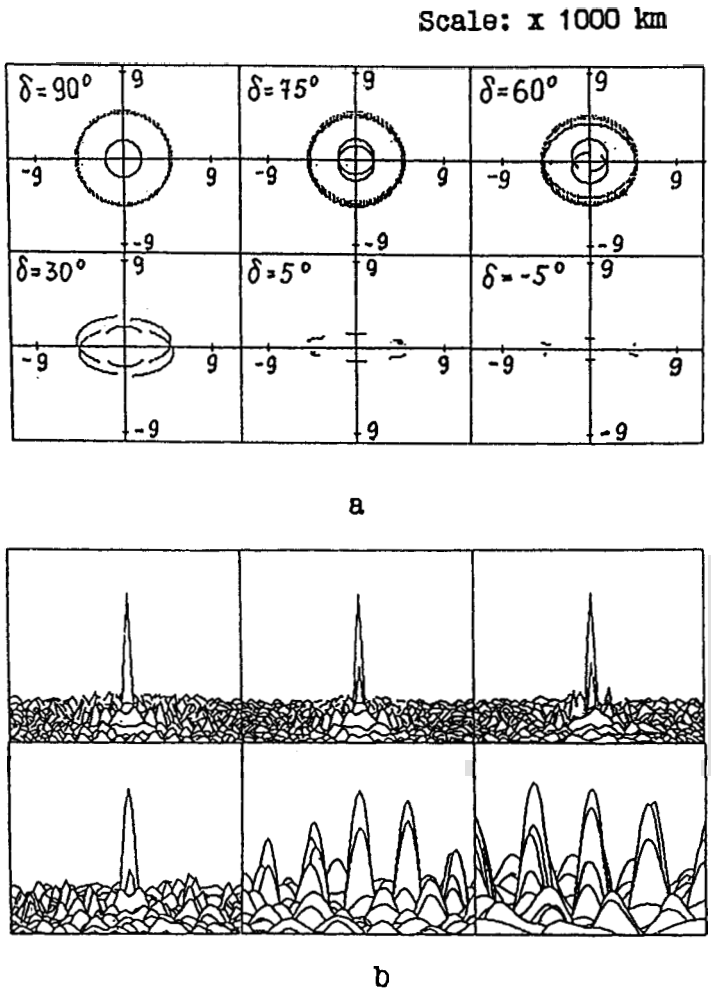

Figure 3 **Supersynthesis.** Network of 3 stations: Svetloe, Zelenchukskaya, Badari. a—UV-coverages; b—synthesised beams.

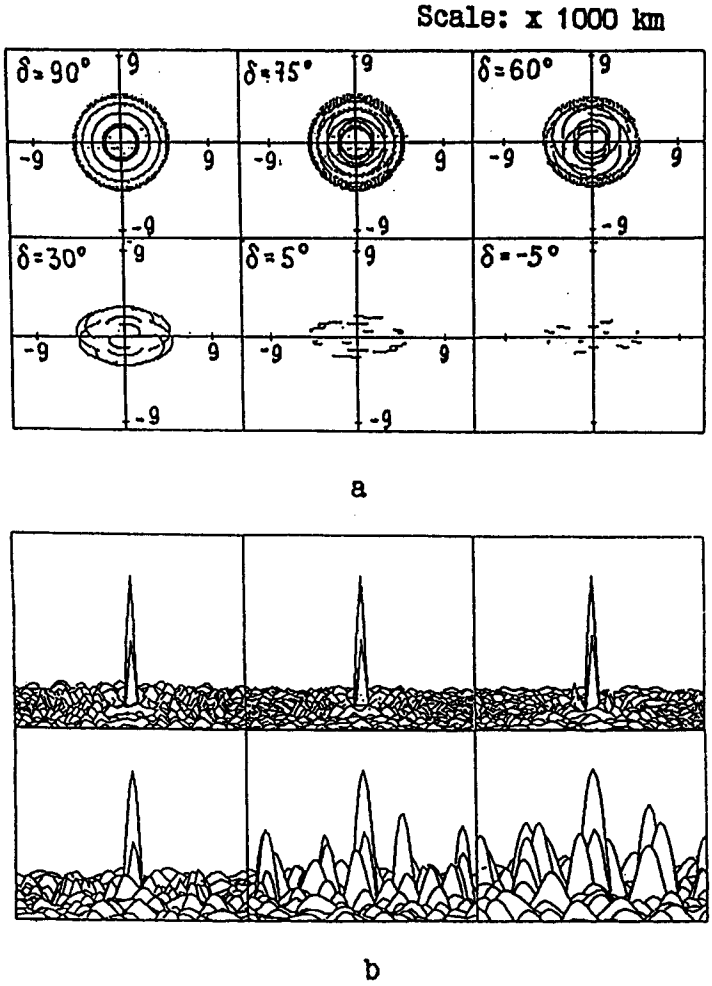

Figure 4 Supersynthesis. Network of 4 stations: Svetloe, Zelenchukskaya, Badari, Firuza. a—UV-coverages; b—synthesised beams.

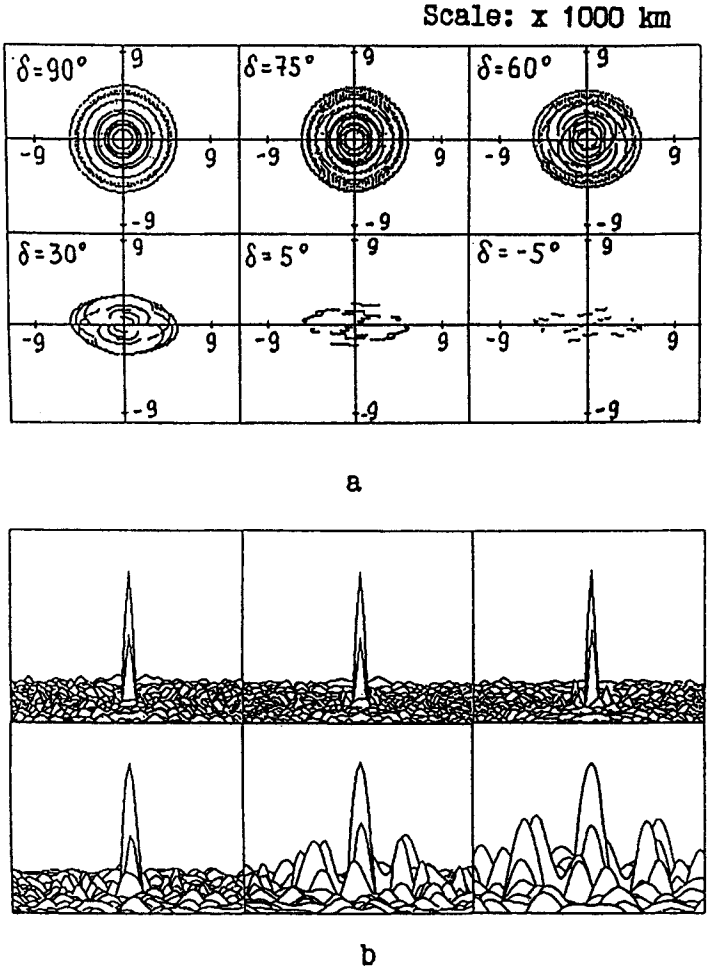

Figure 5 Supersynthesis. Network of 5 stations: Svetloe, Zelenchukskaya, Badari, Firuza, Odessa. a—UV-coverages; b—synthesised beams.

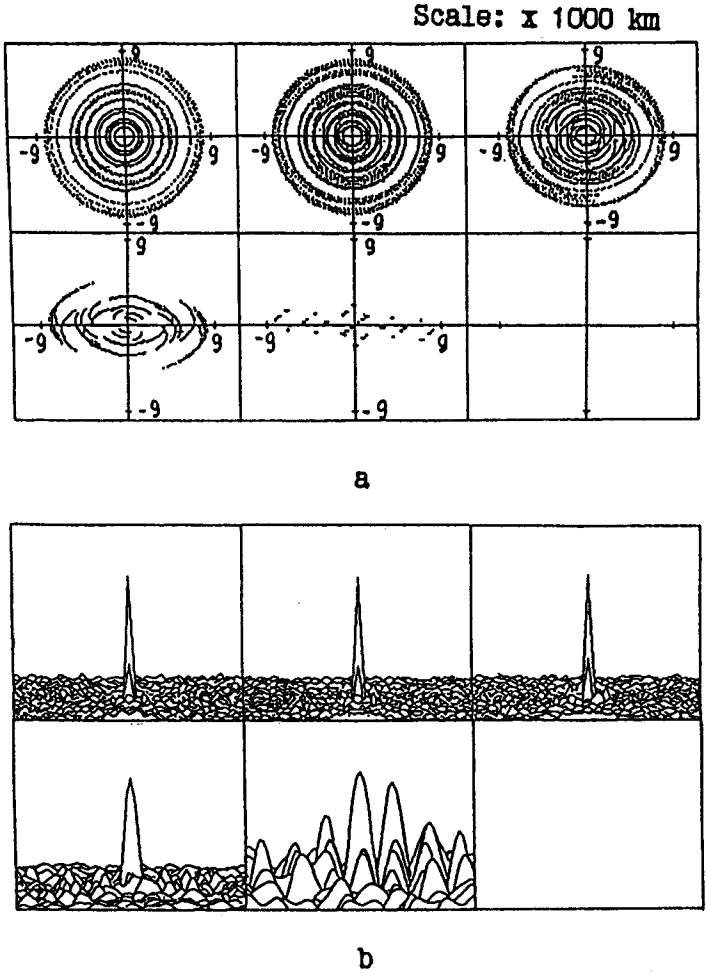

Figure 6 Supersynthesis. Network of 6 stations: Svetloe, Zelenchukskaya, Badari, Firuza, Odessa, Kamchatka. a—UV-coverages; b—synthesised beams.

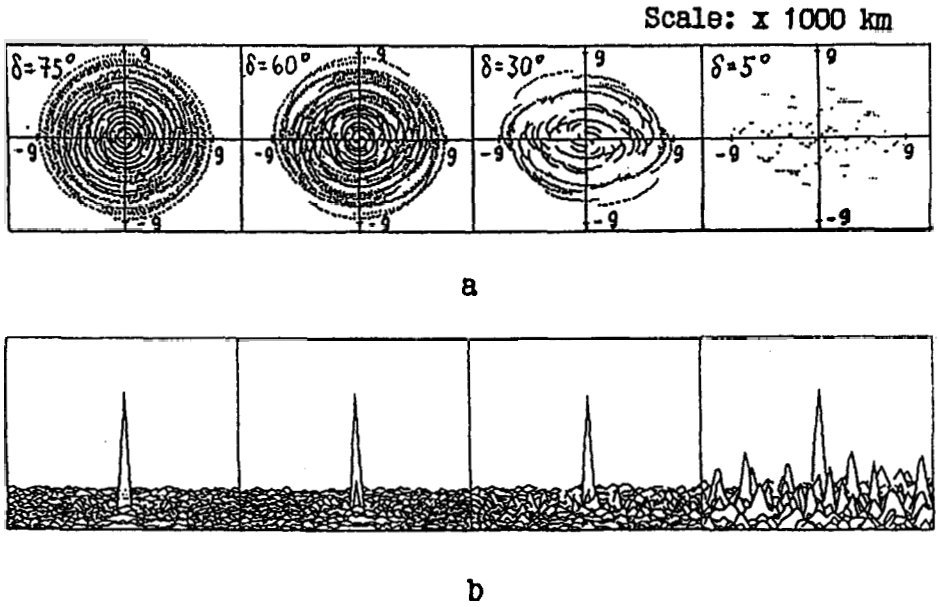

Figure 7 Supersynthesis. Network of 9 stations: Svetloe, Zelenchukskaya, Badari, Firuza, Odessa, Kamchatka, Bangalore, Kunming, Sofia. a—UV-coverages; b—synthesised beams.

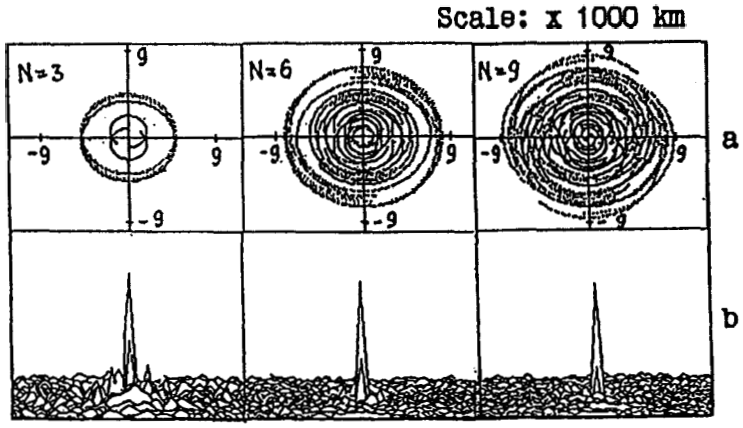

Figure 8 Supersynthesis. a—UV-coverages for different number of Network stations; b—synthesised beams (source declination 60°).

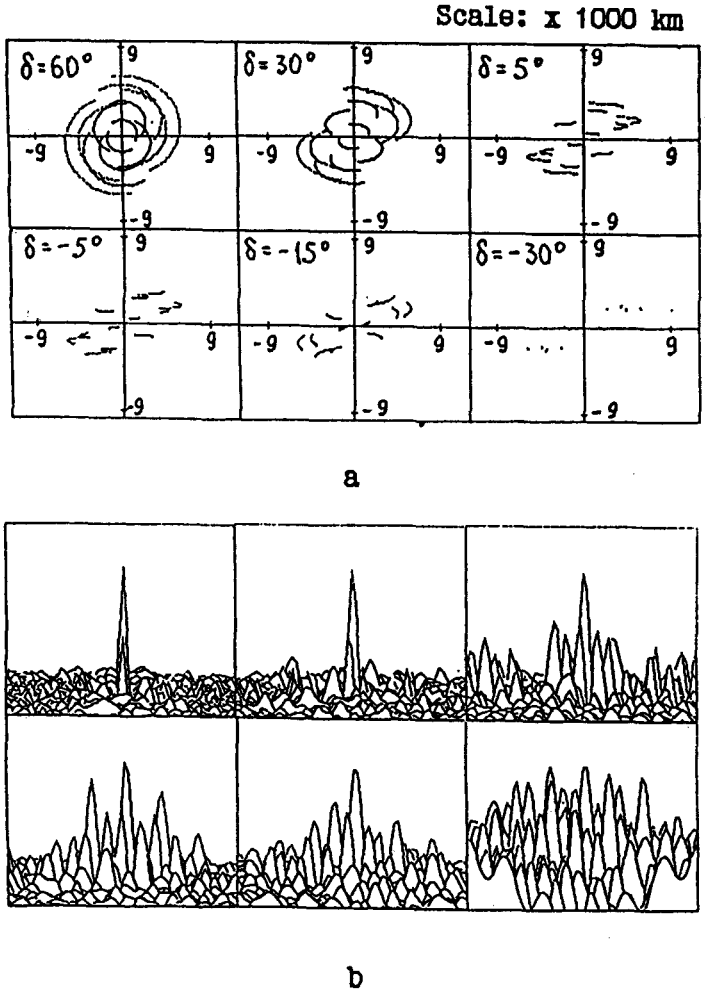

Figure 9 Supersynthesis. Network of 4 stations: Zelenchukskaya, Firuza, Bangalore, Kunming. a—UV-coverages; b—synthesised beams.

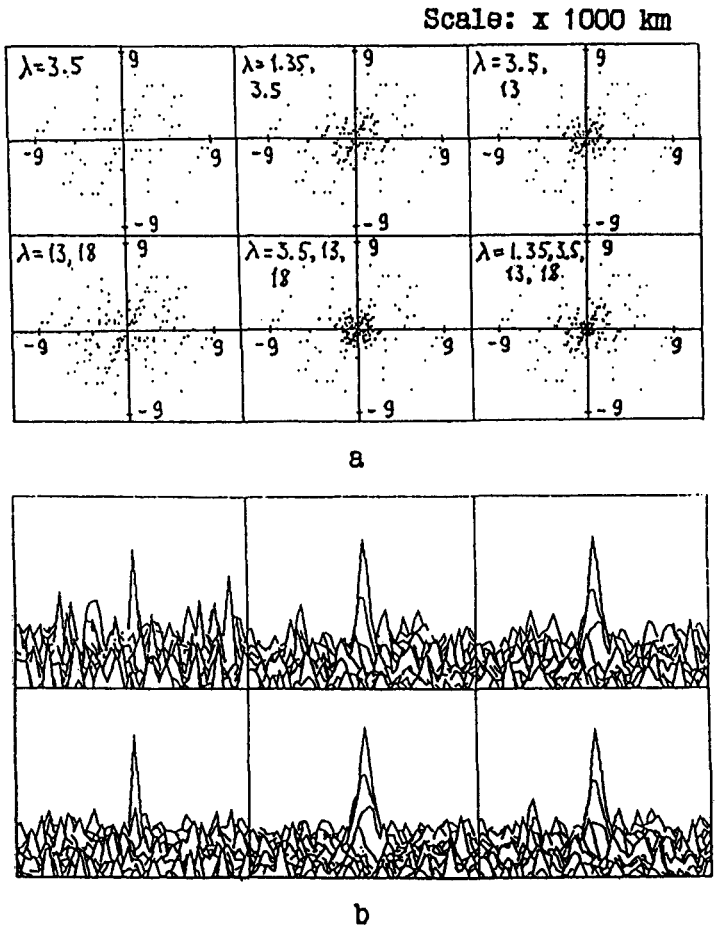

Figure 10 Instantaneous multifrequency synthesis. Network of 9 stations: Svetloe, Zelenchukskaya, Badari, Firuza, Odessa, Kamchatka, Bangalore, Kunming, Sofia. $\delta = 60°$, $H = 6^h$. a—UV-coverages; b—synthesised beams.

The duration of the sojourn of sources in the common field of vision of "QUASAR" and "QUASAR-International" Networks as a function of declination is shown in Figure 2.

UV-planes and synthesised "dirty" beams related to Image sypersynthesis (using Earth rotation) are presented in Figures 3–9.

For investigating fast variable source structures, mapping under instantaneous synthesis conditions is of great interest. Figure 10 outlines the possibilities of "QUASAR-International" Network for solving this problem.

Reference

1. Finkelstein, A. M. *et al.* Dedicated VLBI-Network "QUASAR". *Proceedings IAU Symp.*, **141,** Leningrad, Oct., 1989.