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ON THE INTERNATIONAL RADIO ASTRONOMY OBSERVATORY ON PLATEAU SUFFA

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ABSTRACT

We present the update information on the International Radio Astronomy Observatory Suffa project and describe the original design of new 70-m radiotelescope RT-70 for millimeter astronomy as well. Some oreographic, seeing and climatic features of Suffa are also given.

Now owing to impetuous development of VHF and UHF technology the millimeter astronomy is drowing as unique tool in the study of diverse forms of space matter interactions and its evolution. One can indicate the large group of astrophysical problems, solution of which is possible only using the millimeter range. Let's quote some of them as an example: the exploration of the interslellar medium's chemical and isotopic composition by means of radiospectroscopy;

- the study of dark clouds, starforming regions and protoplanets;

- the investigation of structure and dynamics of extragalactic objects by means of Earth-Space VLB radiointerferometry.

In the last decade a few new large millimeter radiotelescopes became operational in different countries (see e.g.Baars et al,1987). But these telescopes couldn't provide the prospects of millimeter astronomy and its future is connected with creation of biger diameter telescopes having high electrooptical features and installed in places with the good seeing parameters.

For this purpose the team under the lidership of academician N. S. Kardashev began the design of very large radiotelescope and the search of the place for its installation in late seventies (Kardashev, 1992; Kardashev et al, 1995). After the search over the decade and the careful exploration of southern regions of Transe-Caucas and Middle Asia the required place was chosen in Uzbekistan Republic (Hojaev,1995). It locates on plateau Suffa (h 2300m a.s.l.) in northern moutainside of Turkestan range on the territory of Zoomin National Park (Fig.1). The main climatic and seeing parameters of it are presented in Table 1.

The radiotelescope RT-70 (Fig.2) has classical two mirror scheme of Gregory. It allows to observe in prime as well as in secondary focuses. The shape of main mirror(4) is paraboloid with D=70m and F=21m, two removable elliptic contrreflectors(5): D=5m or D=3m. Nine spectral bands of telescope cover wavelength range 0.9~920 mm. The waveguide system of telescope will allow to change the observing wavelengths due to rapid replacing of receivers located at the Vertex cabin(7). Another main blocks of RT-70 shown in Fig.2 are mount(1), base of mirror system(2), truss frame(3) and building edifices(6). The main mirror truss frame construction envisages gomological character of weight

Table 1. The main features of climate and seeing on plateau Suffa

I. Clear sky (CS)	
1. Mean annual number of clear days and nights	110
2. Mean annual CS (%)	47
3. Max. % of CS(August)	78
4. Mean annual night CS (%)	58
5. Mean annual day CS (%)	38
II. Wind (W)	
1. W with velocity(V) (1m/s (%)	27
2. W with V (3m/s (%)	73
3. W with V (5m/s (%)	90
4. W with V)10m/s (%)	3
5. K= Vmax/Vmean (averaged)	1.5
6. Kmax	2.6
III.Temperature (T) [grad. C]	
1. Average Tmax (July)	21.0
2. Average Tmin (January)	-10.6
3. Average daily amlitude of T	8.5
IV.Precipitable water (PW) [mm]	
1. Mean annual PW	8.0
2. Average winter PW (no clouds)	3.6
3. Average summer PW (no clouds)	12.6
V.Average annual atmospheric transmission coefficients at zenith (ATC)	
ATC at 3.1 mm and 5.8 mm wavelengths	0.90 - 0.98
ATC at 1.36 mm wavelenghth	0.60

Note— Data on CS,W,T were obtained during decade, that of PW -during 5 years; data on ATC are from Kardashev(1992).

deformations, and automatic correction of distortions provides the maintenance of reflector surface necessary shape - principle of adaptive regulation. According to this principle the main mirror of the telescope will be consist of 1188 trapezium-shaped panels bonded with high precision adaptive system which is rigidly fastened on hard frame. The panels were made from previously surface-profiled plates using the special technology.

The position of each panel in the paraboloid coordinate system will be defined by means of measuring device, data of which later would be utilized for calculations of the deformation field with consecutive correction of reflector surface using the special drives (Shanin, 1996). The reflector surface rms accuracy will be 0.05mm. Preliminary shaping of main mirror will be made using radio-holography method has been pioneered by Bennet et al (1976). For this the millimeter

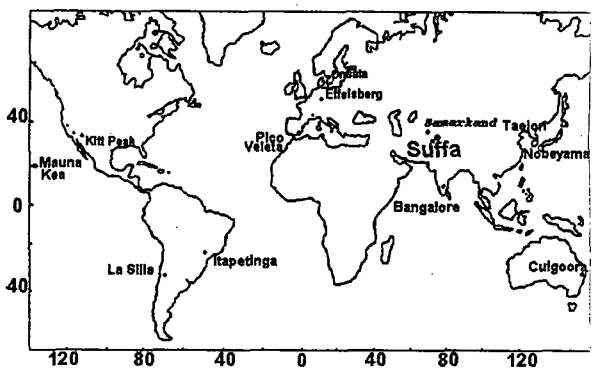

Fig. 1.— Distribution of the major millimeter telescopes in the world

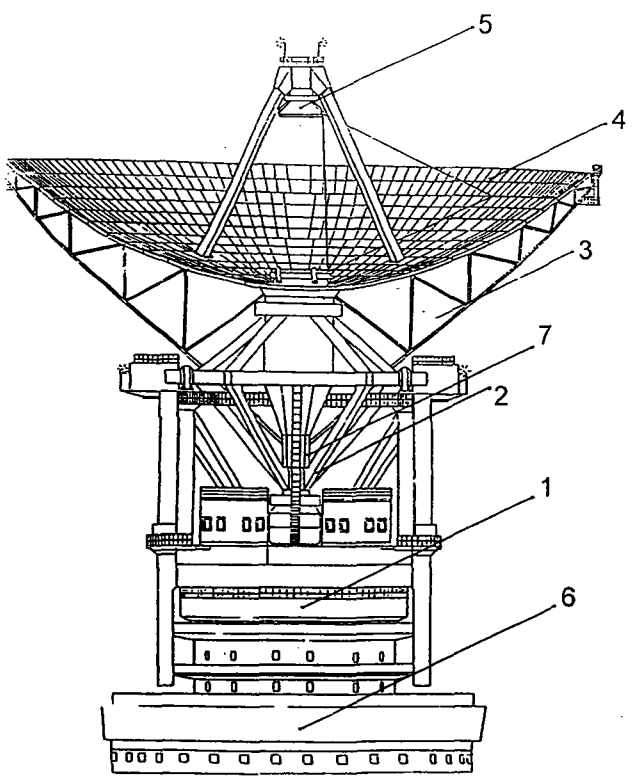

Fig. 2.— Cross session of RT-70 radiotelescope

wave transmitter will be installed on Shau Kartau peak (h~4029m, d=10km) of Turkestan range and high quality basic aerial-on the contrreflector's rigel. Further one can derive composite purposefulness diagramm of antenna in distant zone by measuring of amplitude-phase distribution in the telescope aperture and restore reflector suface shape distribution as regards an ideal paraboloid by Fourier Transformation. RT-70 will be also equiped by turn angle sensors with accuracy not less than 0.3 arcsec and precise pointing system using optical and autocollimating laser devices.

Given project is realized in conformity with Pact on Intensification of Economic Integration between Uzbekistan Republic and Russian Federation (Art.9) dated March 2 1994 and Agreement between Governments of Uzbekistan and Russia on Creation of International Radioastronomical Observatory on Plateau Suffa signed on July 27 1996. The Agreement is open to joining of other States.

At present the RT-70 main units and auxiliary structures are assembling on plateau Suffa, completed part of which is about 45of the work.

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