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Stereoscopic Cherenkov telescope system SHALON ALATOO

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Abstract. The creation of SHALON ALATOO Observatory of P.N.Lebedev Physical Institute RAS comes to the end.

SHALON Observatory created by for search and investigations of the galactic and extragalactic sources, where it is possible the accelerations of protons and nuclei, theirs interactions with the environment and the generations of the gamma-quanta with energies >1 TeV is operating more than seven years in mountains Alatoo (3338 m above sea level). The creation of stereo pair of two gamma-telescopes SHALON-l and SHALON-2 (Fig. 1-4), located on a distance of 260 m, is at the final stage and synchronous observations began March 2001. The observations of Cherenkov light will essentially improve distinction of gamma-quanta on a background of cosmic rays, down to the analysis of individual events.

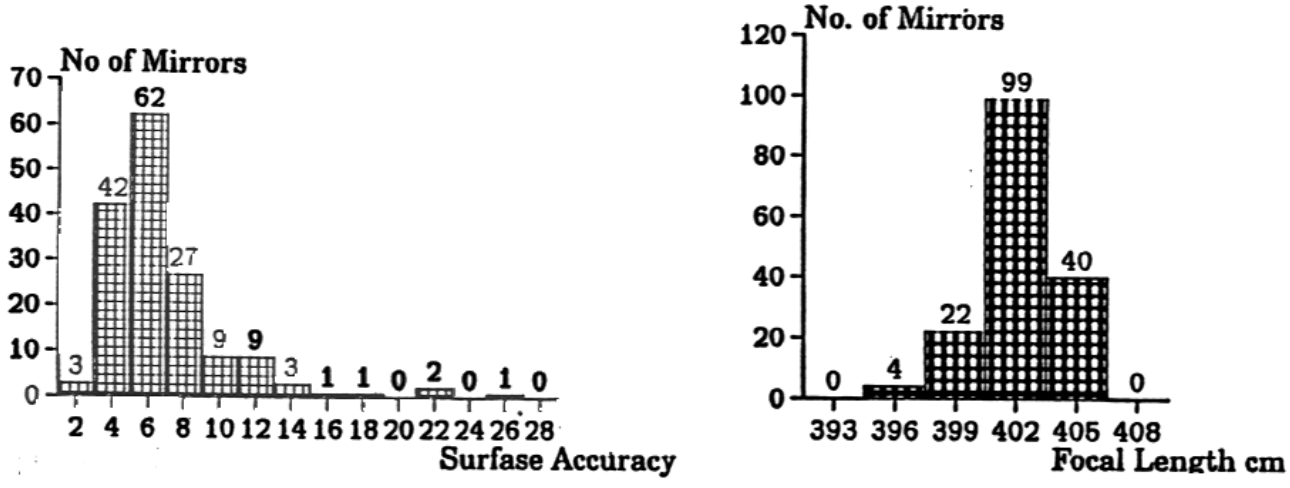
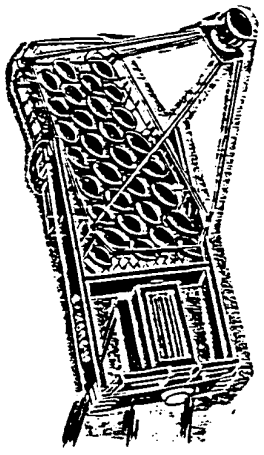
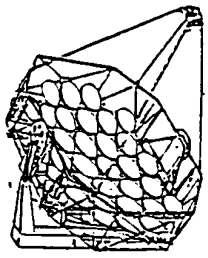


Fig 1. *Surface Accuracy of 161 Mirrors (λ = 500 nm) and focal length Distribution of 161* Mirrors



SHALON

260 m



The second telescope SHALON from the first one now constructed at the distance of 260 m

The mirror telescope SHALON with mirror area 11 m^2 and 144 light detectors with total angle of observations 8° is constructed

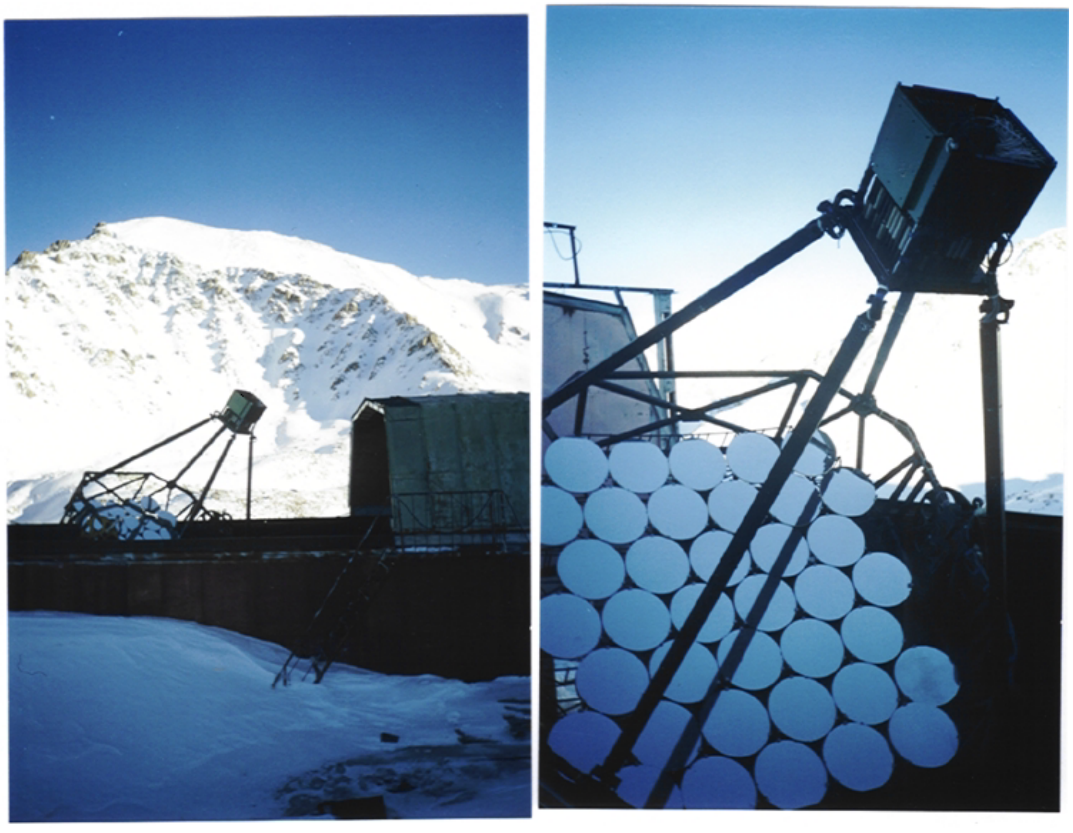
Characteristics of the SHALON Gamma-Telescope

1. The size of spherical mirror 11.2m^2
2. A mirror of such size is composed of several mirror 60 cm, number 38
3. The mirror radius of curvature is 8.5 m
4. The angle of the mirror's turn azimuthal: 0^o-360^o zenith: 0^o -110^o
5. Distance between the mirror's and the light receptors F=0.47*R=4.1 m
6. The number of photomultypliers 144 (12x12) angle for every pixels 0.6^o
7. SHALON-1 - azimuthal, SHALON-2 - equatorial
8. Full angle >8^o

Fig.2. *The SHALON ALATOO Observatory.*

The way of methodical perfection of search and observation of the galactic and extragalactic sources of gamma - quanta with energy > 10^{12} eV chosen in Lebedev uses wide distribution (> 300m^2) of cherenkov light of the electrons cascade, generated by primary gamma – quantum in the Earth atmosphere. It allows to observe sources of gamma -quanta with intensity of >$10^{-12}cm^{-2}sec^{-1}$. The observation complexity of such sources is aggravated in many orders by a large isotropic background of cosmic rays.

The technique and engineering decision of task of small gamma - quanta with energy > 10^{12} eV fluxes observing on a background of the cosmic rays, in one thousand time greater based on the high angular resolution of the gamma - quantum arrival direction (~0.1^o) of working telescope SHALON-1 and process of cascades development distinction, generated in the gamma - quanta and particles of cosmic rays. The distinctions in development of the elections cascade on an atmosphere depth are used now for statistical discrimination of primary gamma - quanta at a background of protons and nuclei of cosmic rays at the analysis of experimental data received by a telescope SHALON-1. The installation of a gamma - telescope SHALON-2 at distance of 260m (Fig. 4) from a telescope SHALON-1 creates a stereopair of two telescopes recording the cherenkov radiation of the same shower from different distance from its axis. The observation of cherenkov light will essentially improve distinction of gamma - quanta on a background of cosmic rays, down to the analysis of individual events.



SHALON -1

SHALON –2

Fig. 3. *High altitude mountain SHALON-ALATOO obervatory*

Lebedev Institute presented results from SHALON-1 air Cherenkov telescope with an energy threshold of about 0.8 TeV. Markarian 421, Markarian 501 and Seyfert AGN NGC1275, Quazars AGN 3c454,3 and 1739+522, as well as Cygnus X-3, Geminga, Tych Brahe and the Crab have been stadied (see references and papers in this 27ICRC).

Starting observing by the of the second telescope SHALON-2 will allow 1) to use stereo observation of cherenkov radiation of an extensive air: showers developing at a direction of a researched source of gamma - quanta with energy 1-50 TeV, for more reliable distinction of showers from gamma - quanta on the large background of showers generated by isotropic flux of protons and nuclei of cosmic rays; 2) it is more reliable to establish temporary changes of a flux of gamma - quanta from, so-called, variable gamma - quanta sources; 3) considerably to increase time of search of new sources at independent observation by two telescopes.

With commissioning developed and constructed in Physical Institute SHALON-2 should register: Synchronously with SHALON-1 cascades from a prospective source on the common area of the review. The direction of arrival of gamma - quantum in both telescopes should coincide with a direction on a prospective source with accuracy ~ 0.1°; The distribution of cherenkov light on matrixes of both telescopes should correspond to the electron-phtoncascade from gamma - quantum of the certain energy and height of a maximum of the cascade (see papers in this 27 ICRC).

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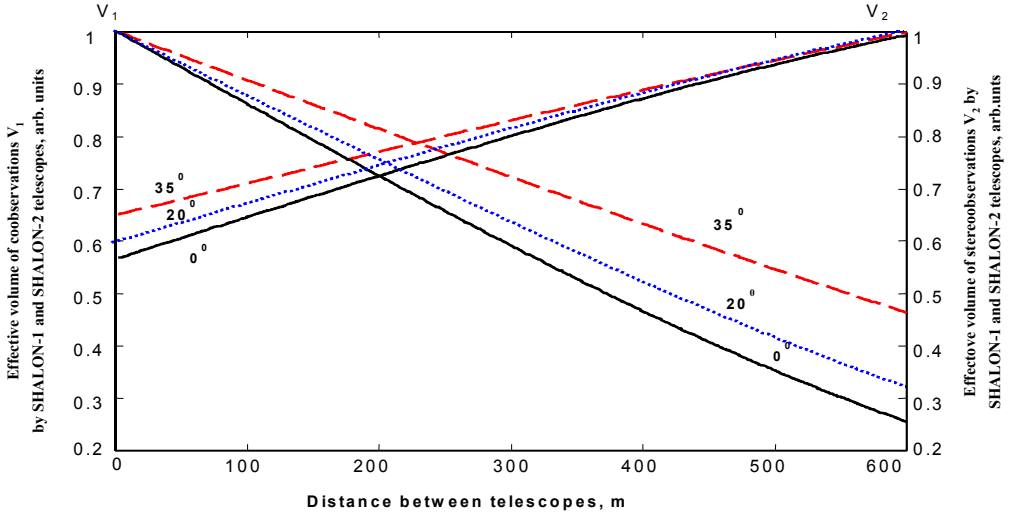

Fig. 4. *Effective volume of coobservations V_1 and stereoobservations V_2 by SHALON-1 and SHALON-2 telescopes in dependence of distance between them* (for zenith angles of 0°-35°).