

MICROSEISMIC VARIATIONS MONITORING USING SMALL APERTURE SEISMIC ARRAY “MIKHNEVO”

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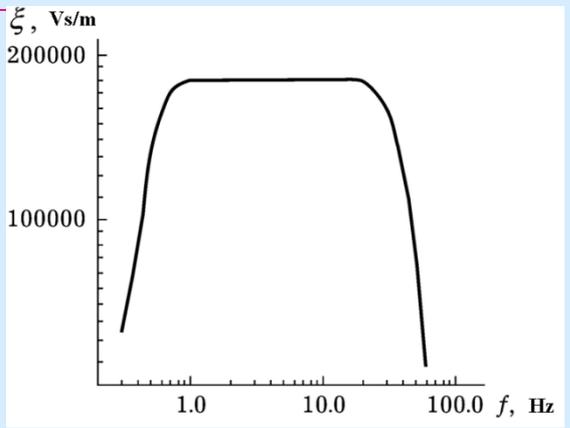
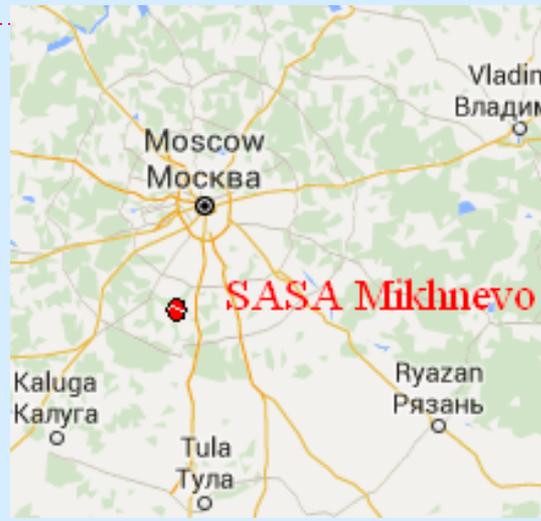
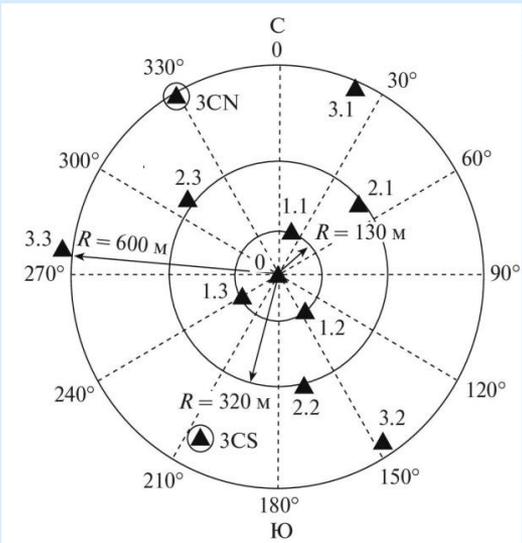
Targets

- ▶ Astrophysic's researches link search for dark matter to the registration of the superenergy of cosmic rays using well known methods based on the Cherenkov–Vavilov effect, a method of observing atmosphere fluorescence and method of reception of radio waves. But the use of sensitive detectors requires reducing the influence of background noise to a low level. The impulses caused by cosmic rays, require to be distinguished from various nature noise. **Low-frequency oscillations of seismic** and industrial origin always present. To define the signal in the background noise level we need to get data free from seismic noise.
- ▶ **Seismo-ionospheric interaction before earthquakes**

Gufeld et al. 1990; Belyaev et al., 2010; Nesterov, 2013; Ryakhovskiy, 2014; Zolotov, 2015; Karpov et al., 2013; Ryu et al., 2014, 2016; Hayakawa & Kopytenko, 2012; Sorokin & Hayakawa, 2013; Oyama et al., 2015, 2016; Reddy & Seemala, 2015; Devi et al., 2013; Liu et al., 2013 etc.



SASA "Mikhnevo" was established in 2004



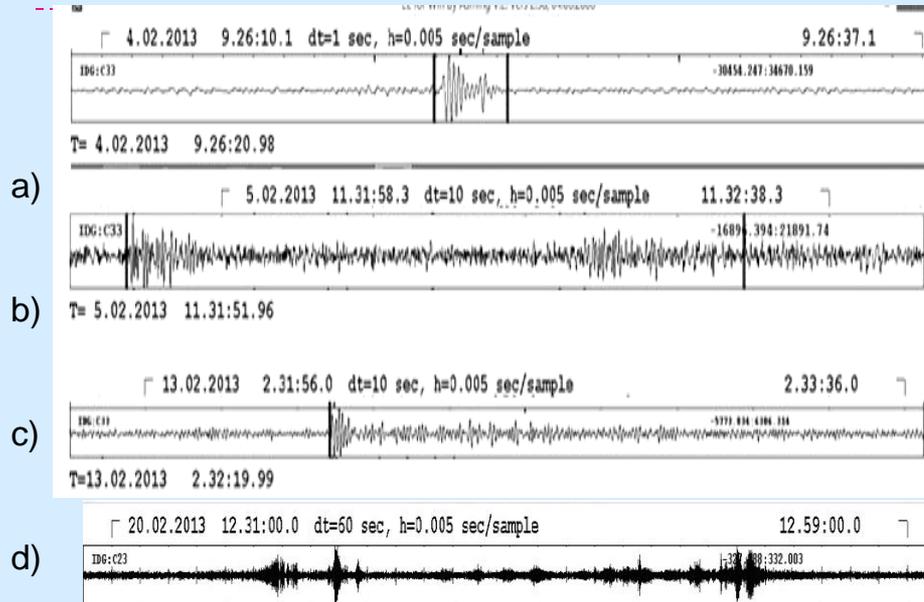
Configuration SASA "Mikhnevo" represents three concentric circles. Annually SASA registers a large number (over 500 events) of different nature signals. Man-made seismic events from mineral deposits exploration are most common. SASA allows isolate very weak signals and thus significantly increases the number of detectable events.

high sampling rate (200 Hz) and wide frequency ranges of the recorded oscillations 0.5-40 Hz

Multichannel processing allows the SASA to ensure the sensitivity of the observations for the sources of seismic events with magnitudes $M > 2.5$ on a distance of 280-300 km with magnitudes $M > 1.5$ - at distances up to 90 km; for weak events with magnitudes $M > -0.5$ at distances up to 5 km." International code of SASA is MHVAR/ Coordinates are $54.96^\circ, 37.77^\circ$.



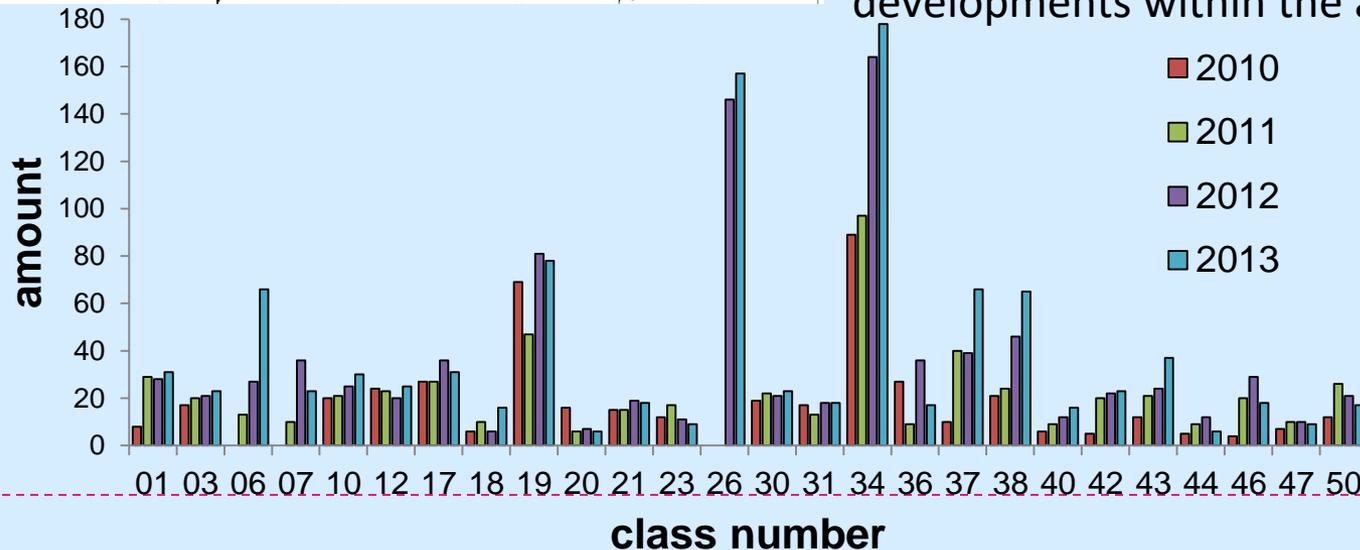
Seismograms digitized and packed in CSS format



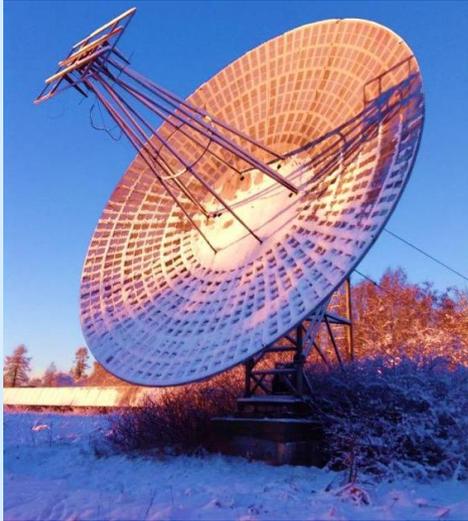
For signals with low signal-to-noise ratio even resolution of the antenna is insufficient to uniquely identify the source.

For this purpose, all known sources are numbered and digitized.

Registration of weak seismic events ($M < 3.5$) at regional distances allowed to collect representative statistics for plotting the frequency and consequently to estimate the main parameters of technological developments within the areas.



Possible implementation



This could be useful:

- in Russia, in the area of Elbrus; on Neutrino Observatory Boksansky Institute for Nuclear Research
 - Russian-American SAGE project.
 - Collaboration Borexino. // Phys. Rev. Lett. 107, 141302. - 2011. - DOI: 10.1103 / PhysRevLett.107.141302. - ArXiv: 1104.1816.
- Project ANTARES antares.in2p3.fr/



Telescopes twin Keck I and Keck II Observatory, Mauna Kea (Hawaii, USA) [www.astronews.ru/]

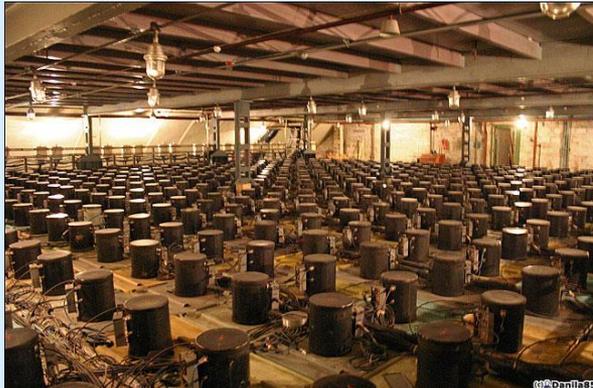
Neutrino astronomy - the branch of astronomy that studies the neutrino radiation from extraterrestrial sources to obtain information about the ongoing processes in the space.



As an object of the interferometer could be used terrestrial radio telescopes in Russia Bear Lakes, Kalyazin, and others.

"Radioastron" project - a ground tracking station, implemented in Pushchino (ASC FIAN) [www.federalspace.ru/319].

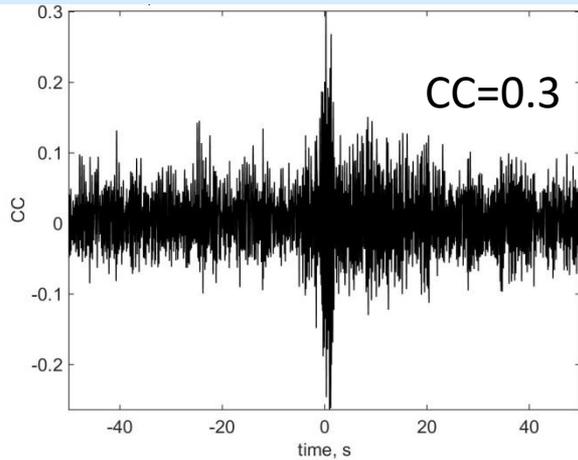
Project "Radioastron" - the use of a radio telescope at the highly elliptical orbit allows you to get an interferometer which observation time is comparable with the period of treatment, and the interferometer base length - from an orbit diameter.



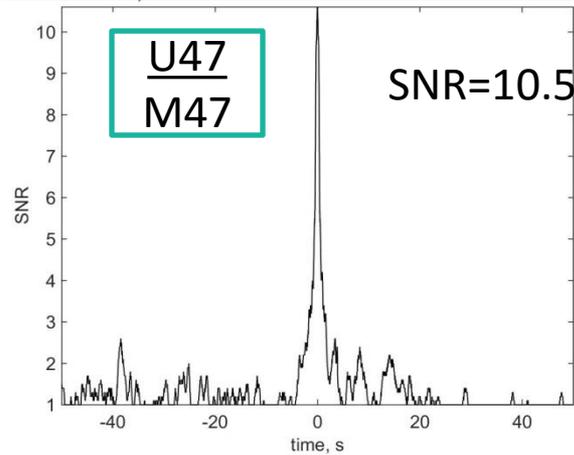
► The pattern seismic master event development technique provides the opportunity to increase the efficiency of the detectors of cosmic rays.



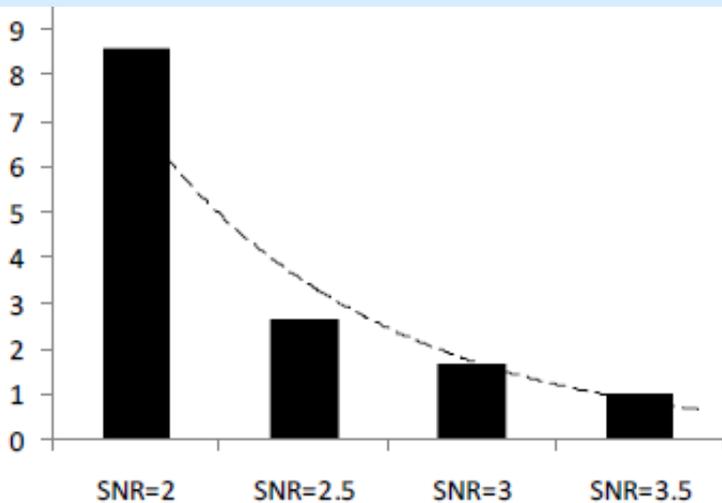
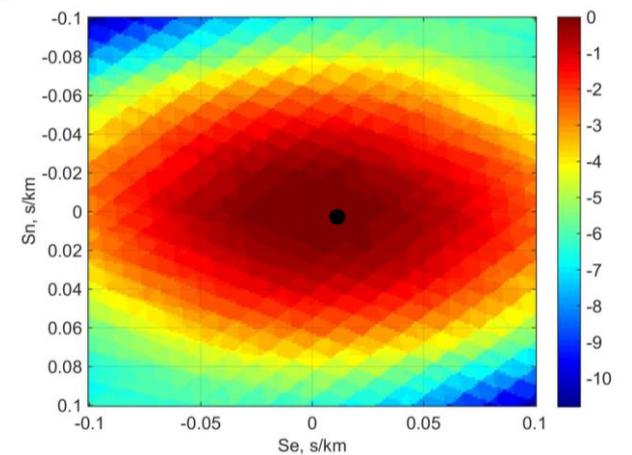
Crosscorrelation trace



SNR=STA/LTA



f-k analysis



Earth is a great theatre, where each tragedy is played in various names

Voltaire

