Tunka Advanced Instrument for cosmic ray physics and Gamma Astronomy (TAIGA)

The measurements of Cosmic Ray (CR) spectrum, composition and anisotropy in the wide energy interval are of fundamental importance for the astroparticle physics study. According to existent theoretical understanding, the charged galactic CR have to be accelerated up to energy $E \sim Z \cdot 10^{15}$ eV in the processes of the supernova explosion at the end of the star evolution. The "knee" energy range 10^{15} - 10^{17} eV is a crucial region for understanding CR origin, acceleration and propagation in our Galaxy and it is also the transition region from galactic to extragalactic CRs.

Beyond 10 TeV, the rapidly decreasing CR fluxes require a large effective detector area. The gamma-ray observatory TAIGA which is under construction in the Tunka Valley, combines several Imaging Atmospheric Cherenkov Telescopes (IACT) with a net of non-imaging optical detectors named TAIGA-HiSCORE (High Sensitivity Cosmic Origin Explorer). This allows to extend the area of the device up to several square kilometers and to considerably suppress the background from charged CR. The combination of two complementary methods of gamma-ray and CR separation allows building a device with large area for a relatively low price. TAIGA is the first detector of this kind. JINR full responsibility is the IACT's mechanics manufacturing. Besides JINR group activity is the Monte-Carlo simulation of common operation of HiSCORE and IACT telescope to find the most efficient arrangement. Another activity is the development of the new program for off-line analysis of TAIGA combined data.

The detection sensitivity for local sources of a 5 km^2 observatory in the energy range of 30 – 200 TeV is expected to be 10^{-13} erg cm^{-2} sec^{-1} for 500 h of observation or 10 detected events which is comparable with planned sensitivity of the main gamma-ray astronomy projects in this energy range.

With the TAIGA observatory it would be possible a serious scientific program. The most interesting are: (1) search for Galactic Pevatrons, (2) apply the new hybrid approach for study of CR mass composition in the “knee” region (10^{14} -10^{16} eV), (3) study of CR anisotropy in the energy region 100 – 3000 TeV.

The first IACT telescope was designed, fabricated at JINR and begun the successfully data taken in Tunka aria in the hybrid mode together with the HiSCORE detectors. The gamma-astronomy is the new domain of the JINR scientific activity. The scientific aims of the gamma and neutrino astronomy are very similar – the investigation of the mechanisms of the CR acceleration in the SN explosion – so the data obtained with the study will add one to another.

It important to stress that TAIGA experiment is fulfilled by the strong collaboration consists of more than 70 authors from the 13 scientific groups of the different countries including JINR member-states.

I would recommend to approve of this project continuation with the first priority.

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