

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

Referee report

The measurements of Cosmic Rays (CRs) energy spectrum, its 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 CRs have been accelerated up to energy $E \sim Z \cdot 10^{15}$ eV in the processes of the supernova explosion. The "knee" energy range $10^{15} - 10^{17}$ eV is a crucial one for understanding of the CRs origin, acceleration and propagation in our Galaxy and also in a transition region from the galactic to extragalactic CRs. High energy gamma-astronomy particularly allows a direct investigation of the supernova explosion processes.

At the energies above 10 TeV, the rapidly decreasing CRs 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) and a net of non-imaging optical detectors named TAIGA-HiSCORE (High Sensitivity Cosmic Origin Explorer). These detectors will cover up to several square kilometers of the taiga area. The detection sensitivity for local sources of the 5 km² observatory in the energy range of 30 – 200 TeV is expected to be 10^{-13} erg cm⁻² sec⁻¹ for 500 h of observations which is comparable with planned sensitivity of the main gamma-ray astronomy projects in this energy range.

The data taking with two complementary detectors will allow considerably suppress the background from charged CRs. It will be a large area device for a relatively low price.

The full responsibility of the JINR in this project is the IACT's mechanics and focusing mirrors manufacturing. Additionally the JINR group activities include the Monte-Carlo simulations of the common HiSCORE and IACT telescopes operation as well as participation in the data taking and in the program development for the off-line analysis of TAIGA combined data.

With the TAIGA observatory, the interesting scientific program supported by the RSF grant can be realized. This program includes: (1) searches for Galactic Pevatrons, (2) the new hybrid approach for study of CRs mass composition in the "knee" region ($10^{14} - 10^{16}$ eV), (3) study of CRs anisotropy in the energy region 100 – 1000 TeV.

The first two IACTs were designed, fabricated at JINR and begun successfully data taking in the Tunka area together with the HiSCORE detectors.

The gamma astronomy in comparison with the neutrino astronomy is the new domain of the JINR scientific activities. The goals of them are the same: investigations of the CRs acceleration mechanisms in the SN explosion. So, the data obtained in the both studies will be complementary.

It is important to stress that TAIGA is the International experiment of more than 80 authors from the 14 scientific groups of the different countries including groups of the JINR and its member-states.

I recommend approving continuation of this project with the first priority.

Prof. Savin I.A.