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

Referee report

In the widely adopted view, the Galactic component of charged CR is accelerated in shock fronts at the boundaries of expanding shells of Supernova Remnants (SNR) in the interstellar medium. There are two possible CR acceleration mechanisms: leptonic and hadronic ones. There is ambiguity to resolve them but it is resolved at higher energies, where the inverse Compton process of the lepton mechanism of the CR acceleration becomes inefficient. Thus, a gamma-ray spectrum reaching up to few 100 TeV would represent an unambiguous signature for hadron mechanism acceleration. In order to understand the production of CR in our Galaxy, the cosmic accelerators need to be identified over the full energy range usually attributed to the Galactic CRs. The corresponding Galactic gamma-ray and neutrino signals can be expected to span the energy range from the MeV/GeV range up to several 100 TeV. While the detection of galactic CR neutrinos is a difficult and expensive task for IceCube, ANTARES and BAIKAL neutrino experiments, high energy gamma astronomy is much cheaper.

The full scale gamma-ray Observatory TAIGA will include a network of 500 wide field of view timing Cherenkov light detectors, named TAIGA-HiSCORE (High Sensitivity Cosmic Origin Explorer) and up to 16 IACTs with shower image analysis, covering an area of 5 km^2, and the muon detectors with a total sensitive area of 2000 m^2, distributed over an area of ~5 km^2. The combination a few complementary methods of gamma-ray measurements allows building a device with large area for a relatively low price. The advantage of IACT telescopes combined with a wide-angle timing array is the possibility to use the image information about the EAS characteristics (core position, direction, energy) for a separation of the CR events from the gamma events that can be better reconstructed by the timing array than by a single IACT. This allows, even for a distance between the IACTs of up to 600 m, to maintain a level of gamma-hadron rejection ~0.01 of showers induced by charged CRs at the energy of 100 TeV.

It will be possible to study cosmic gammas of the PeV energies of the bright galactic gamma-ray sources and to measure the energy spectrum of the brightest extragalactic sources like a radiation from the Mkr421 active galactic nucleus.

It is important that a number of TAIGA different detectors (HiSCORE, IACT, muon chambers) is planned in increase step by step that will increase its scientific potential.

The JINR group has obtained the valuable experience of the IACT design, production and successful hybrid operation in Tunka area with HiSCORE detectors.

The JINR group is a strong one it includes 17 scientists and engineers including the young people for the data analysis to provide the present and future level of JINR activity in this important domain of science. A ratio of the project financial request and its scientific program is quite reasonable.

I am recommend to approve of this project realization in JINR with the first priority.

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