UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

OFFICE OF THE DEPUTY VICE-CHANCELLOR
RESEARCH AND POSTGRADUATE AFFAIRS

Referee report:

"Deep underwater muon and neutrino detector on Lake Baikal"

The Baikal Giant Volume Detector (GVD) is one of a global network of neutrino detection systems that will investigate violent inter-galactic processes, which result in emission of ultra-relativistic particles (most notably neutrinos) whose energies are far beyond the reach of earth bound laboratory experiments. Advances in gravitational wave astronomy and the advent of multi-messenger astronomy have given a major impetus for these large telescopes to make a substantial contribution in the analysis and interpretation of multi wavelength spectra emanating from processes such as the most recent kilo-Nova explosion. Furthermore, recent observation of high-energy diffuse astrophysical neutrino fluxes that were extracted from track-like and cascade-like events by IceCube, guarantees the detection of astrophysical neutrinos during the GVD's first years of operation due to the fact that GVD-I will have a detection volume for cascades of about 0.4 km^3, which is approximately the same as the fiducial volume of IceCube for this detection mode. Owing to its location, the Baikal detector will be in unique position to access a region of the Southern hemisphere which lies along the line of sight of the Milky way galactic centre where most high-intensity neutrino fluxes emerge from – thereby giving the Baikal array an added advantage among its peer observatories.

This long-range project is now entering a new phase following the design Study (2008–2010) and the Preparatory Phase (2011–2015). The Preparatory phase was concluded in 2015 with the deployment of a demonstration cluster "Dubna" cluster comprising 192 optical modules (OM). Data collected by the "Dubna" cluster was used for the reconstruction of angular distribution of atmospheric neutrinos and the selection of high-energy shower events that are candidates for extraterrestrial neutrinos. The current set-up of onsite data taking the system in lake Baikal consists of the two GVD clusters about 0.1 km^3 effective volume, with high angular and energy resolution for high-energy neutrino detection. The phase 1 of the GCD set up will run over the period 2017-2020 reaching 8 clusters, followed by a contiguous extension in the 2021- 2023 period to a total set of 14 clusters. Over this period the JINR group have developed extensive expertise and have played pivotal roles in some of the key aspects of this project.

This project promises to yield a rich harvest of results that will have an impact in our understanding of inter-stellar and intra-galactic processes.

I strongly recommend that JINR continues the full support of the Dubna team in the final preparations and later execution of this project, with highest priority.

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