

# Future of Super-Kamiokande and Hyper-Kamiokande

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Super-Kamiokande(SK) discovered neutrino oscillations of atmospheric neutrinos and solar neutrinos. Also,  $\theta_{13}$  was discovered by the T2K experiment. The future operation of SK will improve accuracy of oscillation parameter measurements. Especially, mass hierarchy in atmospheric neutrinos, spectrum upturn due to the solar matter effect in solar neutrino measurement, and the comparison of T2K  $\theta_{13}$  with reactor  $\theta_{13}$  measurements (which gives possible hints of non-maximal  $\theta_{23}$  and CP phase) are interesting subjects of the future SK. In addition, a program for low energy anti-neutrino physics, called GADZOOKS!, has been proposed and intensive R&D studies have been performed. By dissolving 0.1% gadolinium to SK, anti-electron-neutrinos can be detected by delayed gamma ray emission from neutron capture. GADZOOKS! will observe supernova relic neutrinos, and improve angular resolution for supernova burst neutrinos. The finite  $\theta_{13}$  enables us to measure CP phase by comparing neutrino oscillations of  $\nu_{\mu} \rightarrow \nu_e$  and  $\bar{\nu}_{\mu} \rightarrow \bar{\nu}_e$ . For this purpose, a larger far detector volume is necessary. Hyper-Kamiokande(HK) will have 25 times larger fiducial volume size than SK. HK has a wide coverage for the CP phase measurement. Because of the large detector volume, HK has quite high sensitivities for mass hierarchy and  $\theta_{23}$  octant in atmospheric neutrinos, proton decay, and supernova neutrinos. In this talk, future programs of SK and physics potential of HK are discussed.

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