

ZICOS –Neutrinoless double beta decay experiment using Zr-96 in organic liquid scintillator-

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A liquid scintillator containing a tetrakis (isopropyl acetoacetato) zirconium ($\text{Zr}(\text{iprac})_4$) has been developed for new project of neutrinoless double beta decay search using Zr-96 isotope, which is called ZICOS experiment. The liquid scintillator has 10 wt.% concentration of $\text{Zr}(\text{iprac})_4$, a light yield of $48.7 \pm 7.1\%$ for BC505, and an energy resolution of $4.1 \pm 0.6\%$ at 3.35 MeV assuming 40% photo coverage of the photomultiplier.

In order to investigate a half-life over 10 to the 26th years, which corresponds to neutrino mass below 0.1 eV, we have to use a ton scale of Zr-96 isotope, and have to remove background events such as Tl-208 , which come from the surface of inner balloon as observed by KamLAND-Zen, over one order magnitude. For this purpose, we have developed new technique to use Cherenkov light in order to distinguish the signal and backgrounds using their characteristic hit pattern of photomultiplier, and then have got a method which has ability of 93% background reduction even though remaining 80% of double beta decay signal in study of the Monte Carlo simulation. In this case, we need to separate Cherenkov light and Scintillation light even for a few MeV electron. Using difference of the light emission mechanism, we could also identify the shapes of time profile for Cherenkov light and Scintillation light with FADC data.

Here we will report recent results of our measurement and the conceptual design of ZICOS detector from the study.

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