

# CANDLES – Search for Neutrino-less Double Beta Decay of $^{48}\text{Ca}$ –

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CANDLES is the project to search for neutrino-less double beta decay ( $0\nu\beta\beta$ ) of  $^{48}\text{Ca}$ .

$0\nu\beta\beta$  is acquiring great interest

after the confirmation of neutrino oscillation

which demonstrated nonzero neutrino mass.

Measurement of  $0\nu\beta\beta$  provides a test for the Majorana nature of neutrinos and gives an absolute scale of the effective neutrino mass.

In order to search for  $0\nu\beta\beta$  of  $^{48}\text{Ca}$ ,

we proposed CANDLES system by using  $\text{CaF}_2$  scintillators.

The CANDLES system aims at a high sensitive measurement

by a characteristic detector system and  $^{48}\text{Ca}$  enrichment.

The system realizes a complete  $4\pi$  active shield

by immersion of the  $\text{CaF}_2$  scintillators in liquid scintillator.

The active shield leads to a low background condition for the measurement.

On the other hand,

$^{48}\text{Ca}$  enrichment is also effective for the high sensitive measurement,

because natural abundance of  $^{48}\text{Ca}$  is very low (0.19%).

We have studied  $^{48}\text{Ca}$  enrichment and succeeded

in obtaining enriched  $^{48}\text{Ca}$  although it is a small amount.

Now we have developed the CANDLES III system,

which contained 350 g of  $^{48}\text{Ca}$  without enrichment,

at the Kamioka underground laboratory.

Two improvements, a light-concentration system and a new DAQ system,

were installed for the CANDLES III system.

The light-concentration system improved a energy resolution

by increasing a PMT photo-coverage by 80%.

The new DAQ system, which is a dead time less system,

improved a rejection efficiency

for a characteristic background origin.

Now we checked detector performance

with the light-concentration system and the new DAQ system.

Here we will report the detector performance for background rejection,

and the expected sensitivity with the light-concentration system and the new DAQ system.

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